

SECTION 1

URBAN STRATEGIES

ACCELERATING URBAN TRANSITION: AN APPROACH TO GREENING THE BUILT ENVIRONMENT

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ABSTRACT

The Bologna Adaptation Plan, recently adopted by the City authorities to address the way the city of tomorrow will coop with climate change effects, suggests some effective measures to mitigate and reduce the impacts of urban heat island [UHI] and heat waves. Among the suggested actions, the greening of in-between spaces of the dense built environment and the introduction of new green surfaces (roof and facades) seem to offer interesting perspectives. The paper describes a research activity run by the Department of Architecture and the Municipality of Bologna to investigate how to define the best arrangement of greening with the aim to optimize the impact on outdoor comfort conditions. After analysing UHI, the related parameters and the mitigation effect produced by green surfaces, some demo sites were assumed as test bed to simulate different green layout. Models and simulations were performed using ENVIMET, a software recognized in the scientific literature as one of the most used tool at urban scale. Once boundary conditions were modelled and all the main features of the sites were properly modelled, simulations were run in order to compare different scenarios coming from a number of architectural, economical and practical constraints. The results are then compared with other factors, related to the social aspects, the use of the spaces, the perception of the sites, etc. Two demo sites were investigated in two of the densest parts of the city of Bologna and one in the historic city center was definitely implemented as a temporary initiative coupling the environmental challenge with the opportunity to socially reshape a fragment of old city. This micro-intervention represents the first experimental phase to strengthen the urban transition of the historic city center in the perspective to realize no-disruptive transformations of the open public spaces, improving the users' wellbeing and comfort.

Keywords: urban transition, regeneration, greening actions, sustainable design, thermal comfort.

1 INTRODUCTION

The city of Bologna is facing some important changing related both to ongoing regeneration processes and to relevant mobility plans that will contribute in reshaping the consolidated urban fabric in the next decade. With the aim to provide a common framework and address all the projects toward a coherent and feasible vision, the Municipality recently adopted the *Bologna Adaptation Plan*, a document including some real local measures to make the city more resilient and capable to meet the climate change challenges. The Plan is the main outcome of a LIFE+ project named BLUE AP (Bologna Local Urban Environment Adaptation Plan for a Resilient City) [1], that was led by the Public Authorities to increase the reaction capacity of the city after several extreme events and conditions were experienced in the past decade.

The BLUE AP planning and testing actions were collected into guidelines for the Adaptation Plan definition with the ambition to be easily replicated to other medium-size Italian cities. Bologna represents a pilot-city in this field being the first city in Italy to adopt a plan for facing climate changes with a dedicated, specific and creative tool. The process, involving citizens and key stakeholders, defined six main pillars on which the Plan is based:

1. including adaptation measures in the City's Building Code - with aim to envisage clear and explicit incentives for adapting the built environment to more efficient management solutions of climate change effects;



2. defining guidelines for improving infrastructural reactions during extreme meteorological events;
3. launching a greening campaign for outdoor comfort conditions for mitigation solutions in case of extreme conditions;
4. improving the rainwater harvesting capacity and transform paved surfaces to increase draining and diminishing flooding risks;
5. including measures for collecting rainwater in order to reduce water shortage in case of extreme conditions;
6. raising awareness about the risks associated with climate change and promote insurance schemes, by informing companies and citizens..

According to this framework a cooperation between the Municipality of Bologna and the University of Bologna - Department of Architecture was established to investigate possible solutions for urban and building regeneration taking into account the Adaptation Plan paradigms and to accelerate greening actions especially in quite consolidated and dense contexts. This paper presents the methodology approach adopted, the simulation and application of some solutions in the urban context.

2 STATE OF THE ART AND BACKGROUND

The relation between the structure of the cities and the effects of urban heat island [UHI] is a quite well investigated issue by the scientific community [2]–[4], while the outcomes and the impacts of potential mitigation or adaptation actions are still under discussion. Thus, the Technology Research Unit of the Department of Architecture (UNIBO) approached the request to accelerate greening actions to support urban transition with a very practical way: accepting the most relevant and consolidated assumption and selecting the most interesting locations where simulations and tests should be conducted in order to obtain a feedback about the proposed solutions. According to Asimakopoulou et al. [5], UHI is assumed as a climatic phenomenon where urban areas have higher air temperature than their rural surroundings as a result of anthropogenic modifications of land surfaces, pattern of urban fabric, building arrangement, significant energy use and its consequent generation of waste heat. This phenomenon behaves as a dome of stagnant warm air with a steady but weaker horizontal gradient of increasing temperature towards the heavily built-up areas of cities [6]. According to Oke [7], and Oke et al. [8] the different and combined causes contributing to UHI and more generally to uncomfortable environmental conditions can be grouped as follows [9]:

- anthropogenic heat including lighting, cooling and heating buildings which warm the urban atmosphere by conduction, convection, and radiation, influencing the energy balance in function of latitude and season of the year;
- air pollution, due to transportation and emissions, which influences the urban net all-wave radiation;
- surface waterproofing, referring to the predominance of impermeable surface especially for paved streets and public spaces which contributes to creating an evaporation deficit in the city;
- thermal properties of fabric, referring to the heat capacity, and consequently thermal inertia, of construction materials which absorb and retain more solar radiation than do rural soils and vegetation;
- surface geometry and buildings arrangement which influence wind speeds and urban radiation budget.



A number of studies investigated the main factors influencing the urban microclimate and their impacts on buildings energy demand according to different levels of complexity as well as on the outdoor conditions [10], [11]. Bologna Adaptation Plan suggests the introduction of new green surfaces replacing existing paved areas, creating new green roofs and façades and thus a preliminary analysis of the potential deriving impacts was performed by the research team. A specific branch of the scientific literature is dedicated to deepen the effects of green surfaces in the built environment as a measure to reduce the discomfort and with the aim to achieve significant benefits. A number of studies and tests demonstrates that the air temperature in the immediate surroundings of a green surface is approximately equal to the open air one or, during the hottest days, higher of just 2–3 degrees [12]–[14], while a traditional roof or paved surface temperature can accumulate an amount of heat able to increase their superficial temperature of 30–40 degrees [15]–[17].

A greening strategy requires, however, to carefully consider some implications from a technical and managerial point of view: the choice and the installation of vegetation requires specific agro-technical competencies in order to select the proper species according to the conditions and the scope especially in the case of a green roof (and some differences occur in the case the roof covers an underground car park or a six storey building) ; a green surface has contained initial costs but requires constant maintenance activities that must be adequately planned and provided; the influence of vegetation both on the key climatic parameters and on the end users has to properly investigated in order to maximize the potential benefits. Vegetation usually ensures the variation of relative humidity, the absorption of fine dust, the conditioning of the air-motions, the increasing of oxygen concentration, the temperature control, etc. The physiological activities of vegetation impacting on the built environment conditions are summarized in Table 1.

Table 1: Vegetation physiological activities and related benefits (source: Giacomello, E., Copertura a verde e risorsa idrica. Implicazioni tecnologiche e benefici per l'ambiente urbano, Franco Angeli, Milan, 2012).

physiological activity:	Phototropism	
	leaves assume the best favourable configuration to intercept solar radiation ensuring the processes of photosynthesis.	
Effects on the built environment	Deriving benefits	
Orienting perpendicularly to the light direction, leaves intercept solar radiation before it reaches the ground or the building surfaces. The foliage represents a mobile shielding layer, able to self-adjust according to the sun orientation.	Reduction of impacting solar radiation	
	Containment of surface temperatures	
	Reduction of the external surface emissivity at high wavelength (and therefore reduction of radiant mean temperature)	
physiological activity:	Photosynthesis	
	Plants use solar radiation to convert water and carbon dioxide in their nourishment (carbohydrates)	
Effects on the built environment	Deriving benefits	
Part of the incident solar radiation is captured by plants to trigger the synthesis processes of carbohydrates while reducing the solar radiation conferred to the surface in the background.	Reduction of mean radiant temperature	
	Absorption of carbon dioxide (carbon fixation)	
	Production of oxygen (photolysis)	
physiological activity:	Transpiration	
	plants release water into the atmosphere in the form of vapour	
Effects on the built environment	Deriving benefits	
The transition from liquid to vapor of water is obtained dispersing solar radiation	Reduction of mean radiant temperature	
	Ventilation and air movements around greened soil	

The main benefits expected by adopting a greening strategy are therefore a reduction of the temperature in the space in-between buildings, due to the low emissivity that contrast the increasing air temperature values in the built environment, with positive mitigation impact in case of heat waves, an influence on the relative humidity that contributes in creating more comfortable conditions and a delay in conferring rainwater to collectors in case of extreme rainfall [18]. Nonetheless an increasing of the green surfaces has also positive effects in terms of social impacts on the citizen perception and use of the involved sites.

3 DESIGN APPROACH AND SIMULATION MODELS

The importance of considering the climate and micro-climate condition of the space in-between the buildings emerged from the very beginning as one of the key aspect to include in the design approach for maximizing the potential impacts of greening solutions.

The research team focused on an intermediate scale between the city and the building: the district level was assumed as a preferential investigation field to explore how to greening solutions may positive influence the surroundings both reducing energy demand for cooling buildings and increasing quality and comfort condition of outdoor spaces [19]–[21].

Among the several areas where the Public Authorities is planning or implementing regeneration and transition actions, two sites were selected in the two densest portions of the urban fabric: the first one (Site 1) belongs to the Bolognina neighbourhood, in the north side of Bologna narrowing the railway central station, and the second one (Site 2) is located in the very center of the historic city. Fig. 1 shows the location of the two investigated sites in the city map.

3.1 Site 1 description

Most buildings of Bolognina dates back to the 50s and the 60s when the district was re-erected after the bombing of WWII and belongs to a social housing initiative. The urban fabric follows a regular rectangular grid according to a layout based on inner courtyards that were originally intended as green spaces but are actually used as car park.

A comprehensive regeneration project has been promoted focusing both on cost-effective design solution for retrofitting the buildings and on defining suitable options to re-arrange the outdoor spaces.

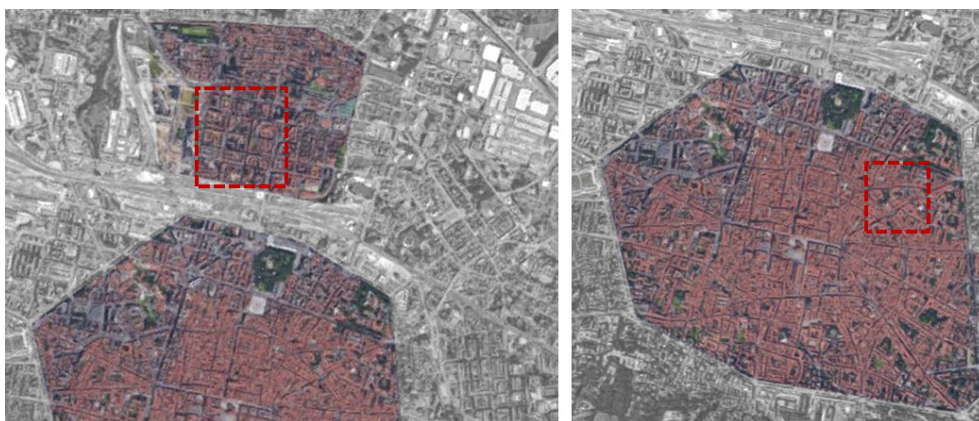


Figure 1: The Bologna map with highlighted the investigated sites. (a) Site 1; (b) Site 2.



Figure 2: Site 1 location in Bolognina District.

A specific block representing the typical situation was selected to develop some simulations and design options within the activities of Ma Sustainable Design Studio at the Department of Architecture. The block is clearly divided in two main spaces by a building, North-South oriented, and the study focused on the North-West corner and courtyard. Fig. 2 provides a more detailed locations of the site.

3.2 Site 2 description

The city center represents the densest urban fabric of Bologna and the selected area, Piazza Scaravilli, is a courtyard confined on three sides by university buildings and on the fourth is separated from via Zamboni by a portico. The place is part of the main university of Bologna headquarter and at the same time is very closed to most of the cultural institutions of the city. However, the site, currently used as a parking area, suffers both of uncomfortable climate conditions due to the huge amount of paved surfaces and of social conflicts related to a misuse of the public spaces in the district. For this reason, the site and the whole area are part of broader regeneration project under the framework of ROCK (Regeneration and Optimization of Cultural heritage in creative and Knowledge cities) project, financed by the EU Horizon 2020 research and innovation programme under grant agreement No 730280. Within this framework, the study aims to analyse/simulate the site conditions to prepare a socio-climatic experiment, useful to test mitigation and regenerative actions to be implemented under the project auspices and goals. Fig. 3 provides a more detailed locations of the site.



Figure 3: Site 2 location in the historic city center: piazza Scaravilli.

3.3 Assumptions and simulations

Despite the microclimate condition represents only a part of a wider strategy to regenerate the district, outdoor comfort captured the team attention with reference to the correlation between the adoption of greening solutions and potential mitigation impact.

Comfort conditions of outdoor spaces depends on a huge number of inter-related factors dealing with the main geometrical and material features of the built environment, thus one of the main goal of the study was to provide a simplified method to visualize the conditions of a specific site before and after interventions. ENVI-met [22] simulation software was adopted for this purpose: it is a quite well known and diffuse tool used at urban scale that has been widely explored in the scientific literature [23]. ENVI-met is a three-dimensional microclimate model designed to simulate the surface-plant-air interactions in a urban environment with a typical resolution of 0.5 to 10 meters spatial grid and 10 sec frame time. ENVI-met is a prognostic model based on the fundamental laws of fluid-dynamics and thermo-dynamics. ENVI-met enables to manage the main variables (air-temperature, wind-speed, relative humidity, etc.) and comfort Predicted Mean Vote index [PMV] [24], for creating isolines representations strictly connected to the site features.

The deriving outdoor maps provide a quite effective image of the impacts on the site allowing an easier decision-making process about design choices and options.

In the case of Site 1 a completely new courtyard layout was designed and the impacts of the proposed solutions on outdoor conditions were simulated before and after in order to evaluate the impacts and consider possible variations. Fig. 4 compares the courtyard layouts, while Figs 5, 6 and 7 offer some examples of the obtained outputs.

The deriving results are specific Outdoor-Microclimate-Maps indicated that there was a quite limited air-temperature variation in Site 1 while as Fig. 5 shows maximum wind speed value in the plot varies from 7.66 m/s to 9.70 m/s meaning the proposed layout facilitate natural ventilation and reduces still air zones (in blue). As Fig. 6 shows, relative humidity minimum (nearly 29%) and maximum (nearly 45%) values variations are quite limited while comfort conditions evaluated using PMV index seems to be positively influenced in the re-shaped

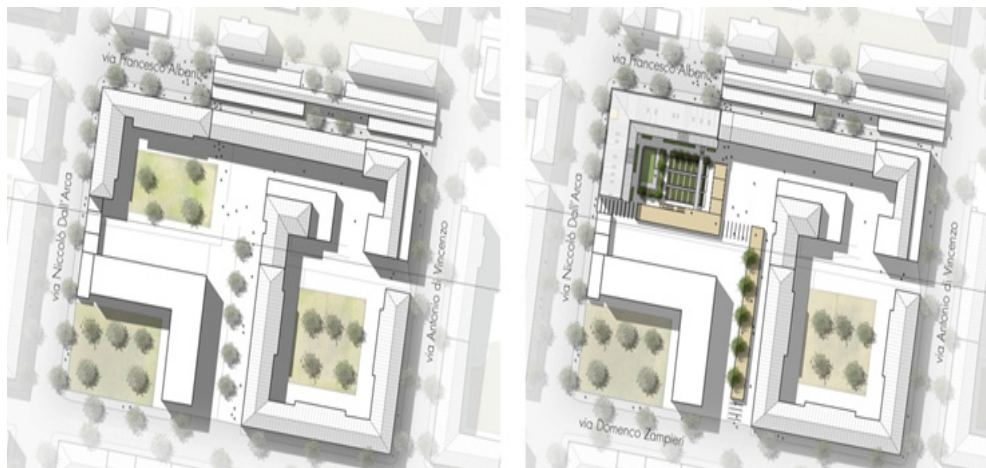


Figure 4: The current and the re-designed courtyard layout.

north-west corner especially if compared with the residual portions. The same approach and simulation methodology was adopted on site 2 to evaluate how some design option should influence comfort condition starting from the assumption to provide a temporary re-arrangement of Piazza Scaravilli that replaces the current car park function with a green space for collective use. Simulation addressed the arrangement of green areas and this initial design brief was then translated into a concrete action.

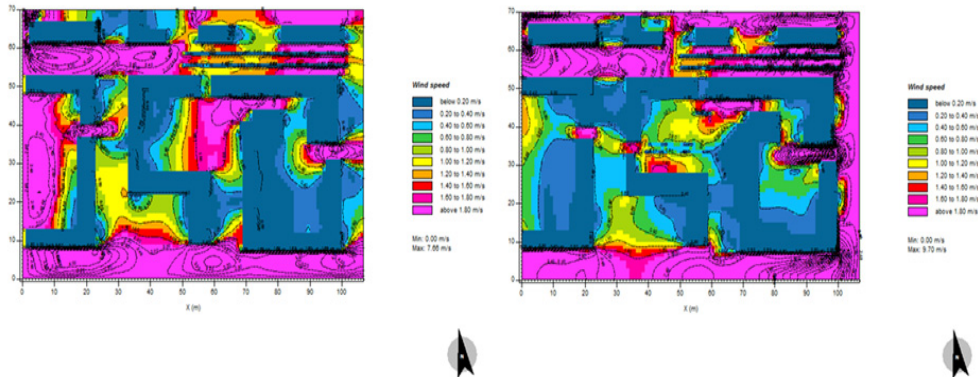


Figure 5: Wind speed according to the current and the re-designed courtyard layout.

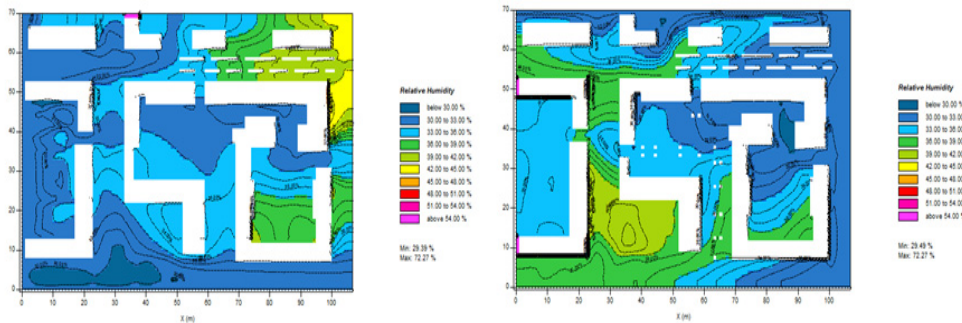


Figure 6: Relative humidity according to current and the re-designed courtyard layout.

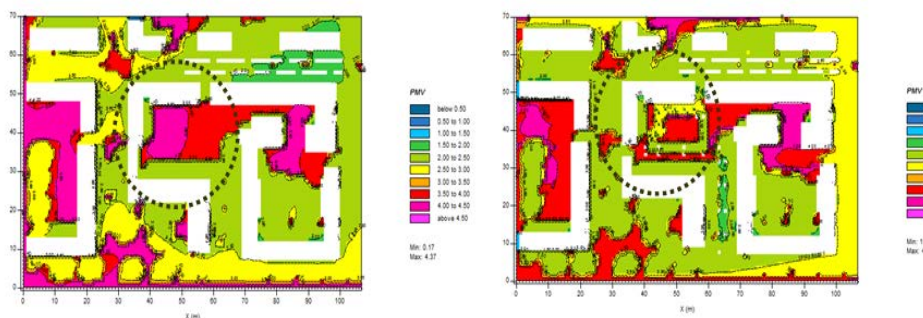


Figure 7: PMV according to current and the re-designed courtyard layout.

4 MICRO-INTERVENTION: SOCIAL AND CLIMATIC ASPECTS

The deployment of a socio-climatic experiment is based on the introduction of a social and technological infrastructure to increase the resilience of the whole area with the aim to promote the transition with micro-design solutions at urban scale: punctual or micro-actions to trigger physical changes, but also to modify the perception and the relations between the communities that populate the place. This focus on open urban spaces is supported by a well-defined regulatory framework in the City of Bologna: a) the Residential Climate Adaptation Plan for the definition of pilot actions to promote an active stakeholder participation in accelerating the climate mitigation strategy and related initiatives; b) the Rules for the Care and Regeneration of Municipalities of Bologna, issued to coordinate and link a set of ongoing actions and projects through the active collaboration of local actors and entrepreneurs.

In the case of Scaravilli Square, the micro-intervention and installations were concentrated on the two sides of the square, leaving the surrounding porticos and the central passage free (for emergency transit). In terms of social impact, the action is aimed to involve both the residents and the students that enjoy the spaces of the university area in different and often conflicting ways. The project has been co-designed by students and city associations and activists, producing a participatory realization and a model of management based on cooperation. The adopted work methodology follows the ROCK research process and is translated into a co-design pilot workshop for Design and Architecture students at University of Bologna. During this pilot, some of the engagement models that will be implemented during the demonstration phase of the European project were tested, exploring the potential for mitigation of the urban environment, the possible implications on microclimate and interactions with the sustainable use and development of the territory, to stimulate accessibility, inclusion and sense of belonging to the place by inhabitants and students. The pilot envisaged a greening action placing some temporary wooden tanks to host vegetation combined with wooden decks operating as stages, passages or seats (see Fig. 8). The used materials were thought to be durable according to their temporary lifespan, easily replaceable, clean and maintainable: the idea is to realize a dynamic garden, to foster biodiversity and sociality. The proposed adaptive reuse of Scaravilli Square has not only environmental purposes (improvement of outdoor comfort; urban heat island mitigation; reduction of CO₂ emissions), but also the aim to enable the quality of life of neighbourhood residents, by providing them with spaces for collective and multifunctional use (outdoor events, socialization spaces, temporary markets).

The idea is therefore to combine temporary and permanent transformations, in a perspective of sustainability and resilience as “potential for creating opportunities for new actions aimed at innovation and development” [25]. The great potential is to configure these spaces as places to activate the construction of resilient communities able to react creatively to changes [26]. The social experiment is aimed to support spontaneous forms of co-management and care of this space, based on low cost investment and high investment of design, testing environmentally sustainable construction technologies, materials and techniques that allow people to experience patterns of use before making permanent changes. Depending on the success of the action (monitored for two seasons), the progressive transformation of the square will enable a new model for public/semi-public space management that could be replicated in other neighbourhoods of Bologna.





Figure 8: Views (a) and (b) of the dynamic garden in Scaravilli square elaborated during the co-design workshop.



Figure 9: The co-construction phase realized with students and citizens associations.

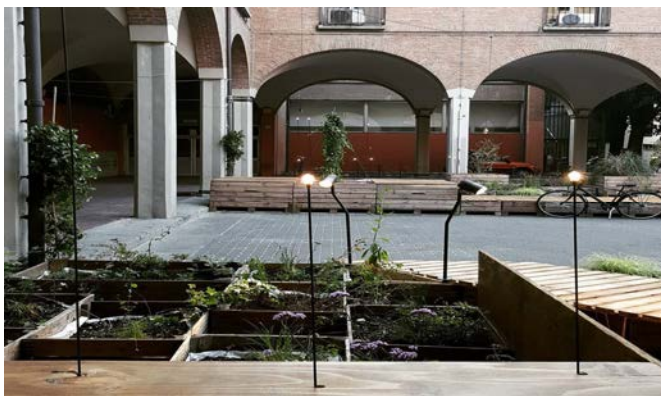


Figure 10: The final layout of the square, completed of light equipment sponsored by Viabizzuno.



Figure 11: Night time in Scaravilli Square.

5 CONCLUSIONS

Open spaces represents the public service that most categories of citizens use daily with none demographic socio-economic discrimination of users. This is a common ground where people carry out the functional and leisure activities that characterized a community. The impact generated by open space involves the perception of quality of life and physical and psychological well-being of people, providing a place dedicated to social interaction and contact with the built and natural environment.

The transformation process that starts in those places foresees a regeneration not only physical-environmental but also socio-economic pursuing a wider transition strategy, recreating urban quality, accessibility and permeability. The choice of referring to micro-urban design seems particularly effective because it is sustainable in a period of shortage of public resources that traditionally finance interventions on the open space of the city.

The purpose of these interventions is to contribute to the improvement of the environmental, functional and aesthetic aspects of the city, having a positive impact on the real estate value of the entire areas in which they are incorporated and at the same time to create an ecosystem of actors implementing and managing the transformation, both in historical centers and in peripheral contexts.

The ultimate goal of the presented approach is to define a replicable and scalable model that supports the regeneration of very dense neighbourhoods starting from their open spaces. Transformation activities foresee the active involvement of citizens, associations, students, creative communities and private bodies in the co-production, safeguard and management of new elements and equipment. The analyzed areas have a great potential for replication in the context of Bologna city. Acting primarily on the public space is a possible strategy for transferring the concepts of “active citizenship”, sustainable development, climatic risk, between local communities, starting from microscale interventions that will produce significant impacts on different spheres of urban, social, environmental quality. The actions envisaged have a high degree of scalability, combining temporary and permanent transformations, testing on the field not only the solutions more closely related to the specific context of intervention but, at the same time, checking their acceptance by resident communities, progressively promoting the re-appropriation and re-invention of public space.

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THE CITY OF OSTRAVA (CZECH REPUBLIC): A SUSTAINABILITY ASSESSMENT BASED ON VITALITY

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ABSTRACT

The largest post-industrial agglomeration in the Czech Republic is the Ostrava-Karviná settlement region covering the southern part of the Upper Silesian Coal Basin. The polycentric model of settlement, which is the consequence of mining and its accompanying phenomena (colonization, contamination, undermining, transport), comprises several medium-sized cities and one regional metropolis - Ostrava. Ostrava is a dominant regional centre which integrates economic and financial, intellectual and educational, cultural and social, as well as administrative functions. All of these functions need to be continuously formulated and formed, but, in particular, they must flexibly react to the current situation. Therefore, it is necessary to do not only short-term, but also long-term planning led by a leading idea (vision, theme) to achieve the most effective model of an urban and regional unit. The transformation which Ostrava has been undergoing since the 1990s means that the city is being transformed substantially from both the social-economic and urbanistic point of view. It is appropriate to solve the problems connected with the changes systematically, not to take only the current state into consideration, but to focus also on the long-term orientation of the settlement and the entire agglomeration. Finding an optimum solution, or a “motive” which would unite ideas for the effective development, transformation and forming of the city is a demanding process, but quite essential for the agglomeration to survive.

Keywords: ostrava, post-industrial city, urbanism, sustainability, vitality.

1 INTRODUCTION

The oldest preserved settlement in the area of today's Ostrava was on the Landek hill above the confluence of the Odra and the Ostravice. Archaeological findings prove that a settlement was there as early as the Old Stone Age, as well as incidental use of the black coal from the emerging coal beds as a fuel. The Holasice fort was built on Landek in the 8th century and a stone Premyslide castle in the 13th century. The oldest written documents state the existence of Polish (today's Silesian) Ostrava in 1229 and Moravská Ostrava in 1267 (which was granted city status in the following decade). In the Middle Ages and a large period of the Modern Times, Moravská Ostrava was only a small mercantile town on the trade route between the important regional centres of Opava and Těšín. A substantial change in this paradigm was made by the discovery of coal (officially recorded in 1763) and the subsequent commencement of its regular mining in 1787 [1].

Coal mining was followed by the construction of Vítkovice Ironworks, a railway line (North Ferdinand's Railway) and a rapid growth of the agglomeration. In the period before the establishment of the ironworks, the population of Moravská Ostrava was about 1,750; in 1910, it was as many as 36,000 and just before the reduction in mining in the 1990s the population culminated at 321,000. In his book *Cities and People* (GIROUARD, 1985) Mark Girouard puts in contrast the cities of Babel and Jerusalem types, where Babel is a metaphor of large, rich and sinful cities, “prostitutes, mothers of fornication and ugliness of the Earth”¹, and by Jerusalem he designates ideal and well-ordered cities.



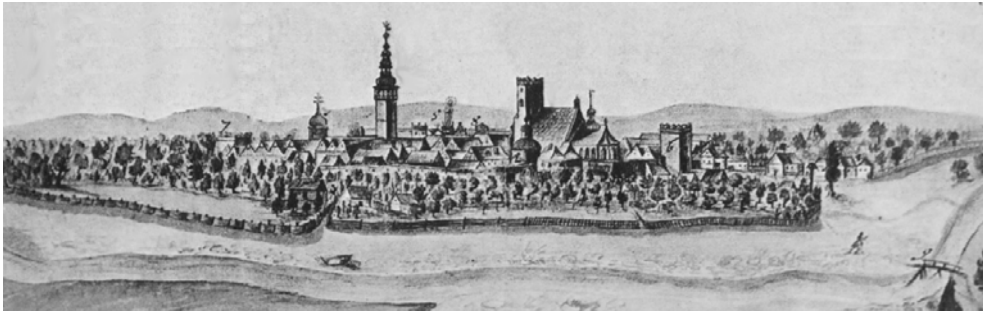


Figure 1: Moravská Ostrava in 1728. (Source: Archives of the City of Ostrava.)

In this context, Babel is an absolutely apt designation for Ostrava (“Moravian Klondike”) and its history in the past two centuries. An unrestrained growth, haphazard plunder of natural resources, contamination of water, earth and air in striving for profits, mixing of Czech, German and Polish ethnic influences in the 19th century, coexistence of enthusiastic builders, political prisoners, gold-diggers, as well as real criminals in building the heavy industry in the 1950s. All of these are integral aspects of Ostrava and its present identity.

When we think of a common city, we see streets, houses, a park here and there. When we see Ostrava, then we first see only sandstones, mudstones and coal beds. It is a mass of rock, a huge sandwich of seventy coal cycles. Flames blaze like over a black kerosene lamp and heavy machines move over these. Only then can one see people and their homes, taprooms and shops. Ostrava is charged with energy, a city like a dragon and rock eater absorbing coal and creating flames in accord with red and black colours ... A crisis comes periodically and cuts the dragon's heads off. Dweeb the Dragon then regenerates somewhere in the corner for years as a lizard that has lost his tail. In between, people drink, gamble and, from what people elsewhere would consider a chronic form of hopelessness, they create a special freedom of rough cheeriness. Happily, no similar city – a well-built, provocative, dancing black woman with one poked out, pink eye – does not exist in this country. One Ostrava is enough, for both beauty and despair [2].



Figure 2: Ostrava in 1905. (Source: Archives of the City of Ostrava.)

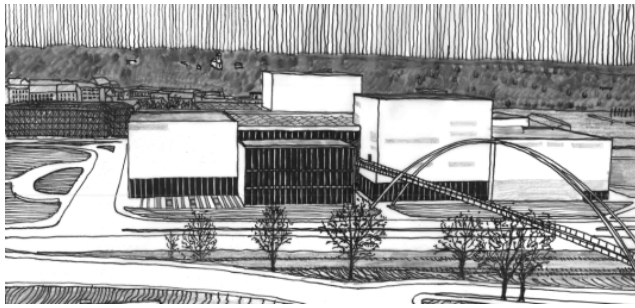


Figure 3: Panorama of Ostrava in 2017 – Shopping mall Nová Karolina. (*Drawing: M. Nedvěd.*)

The city was not prepared sufficiently for this change, though it could have been predicted that it would happen. This is proven by the dismal situation of brown fields, socially excluded localities, the languishing urban structure of the city and the spreading development with houses stretching over the city outskirts. Such a situation has arisen in which it is necessary to cope with not only the social-economic issue, but also the urbanistic one. Post-industrial localities gape with emptiness and languish or they are grasped in an unsuitable way. Individual urban units of which the city is composed were not able to unite in the coal boom period and it is still apparent at sight and feeling that they will not manage it in the near future. The public space framework is mushy, unreadable. It seems as if the interventions in the urban structure were not controlled.

But what will further happen with Ostrava? The city layout conception often changes, goals are not clear, unemployment grows, people migrate, the social composition changes, the settlement structure is fragmented and often not grasped or grasped badly. And processes are taking place in the city. They take place continuously. And these processes make cities living organisms. The processes take place naturally, the city creators try to guide them, which is their role for that matter. However, how much guidance is really necessary? This research deals with methods of how to guide the city according to natural processes dependent on cultural and historical factors. Will to live, vital forces, cultural and historical significance are sought. Because this is the way of finding places with a vitality potential. It is appropriate to put energy in such spaces and to support their development.

2 SUSTAINABILITY RESEARCH METHODOLOGY BASED ON VITALITY

2.1 City structure and borders

Ostrava comprises twenty-three municipal districts. Historically, the development of individual districts was different, which, in some cases, can be recognized from the urban structure even today. The historical core of the city is situated in the districts of Moravská Ostrava and Přívoz from where it spread to Vítkovice (ironworks and workers' settlement) and Mariánské Hory in the urban establishment of which also Camillo Sitte participated (as well as in Přívoz and now extinct Hrušov). Slezská (formerly Polská) Ostrava, most affected by coal mining and its remnants (heaps, shafts, settlements) became part of big Ostrava as late as 1939. The heavy industry from Vítkovice most expanded to Bartovice. Large housing estates Poruba and Ostrava-Jih were built after the Second World War and they were established in diametrically opposite ways – the block development of Poruba versus the

modernistic housing estate structure of Ostrava-Jih. This conglomerate connects several smaller municipal districts with many caesuras made up of fields, meadows and alluvial forests and it surrounds a ring of satellites of rural or suburban character.

The borders of individual municipal districts usually do not correspond to the borders of the urbanized city structure. Finding these borders is important. It is only the determination of the borders of the urbanized city structure that shows where the city is situated, where the country and where the others are situated.

2.2 System

In this research was necessary to find, name, define and apply the System using which the current processes taking place in the city could be assessed. The result was called – Sustainability Assessment System Based on Vitality. In order to effectively use the System, it was necessary to specify where the current borders of the city were (not administrative, but actual borders). These bordered municipal districts were then the subject of research. The first rating factor was the symbolic structure framework and the other rating factor for the research was vitality or, in other words, “appetite for life” (measured by many criteria: realty prices, occupancy of apartments, transportation, parking, civic amenities). It is these figures - borders, vital spaces, symbolic structure framework - that are the basis for creating the Sustainability Assessment System.

2.2.1 Symbolic structure framework

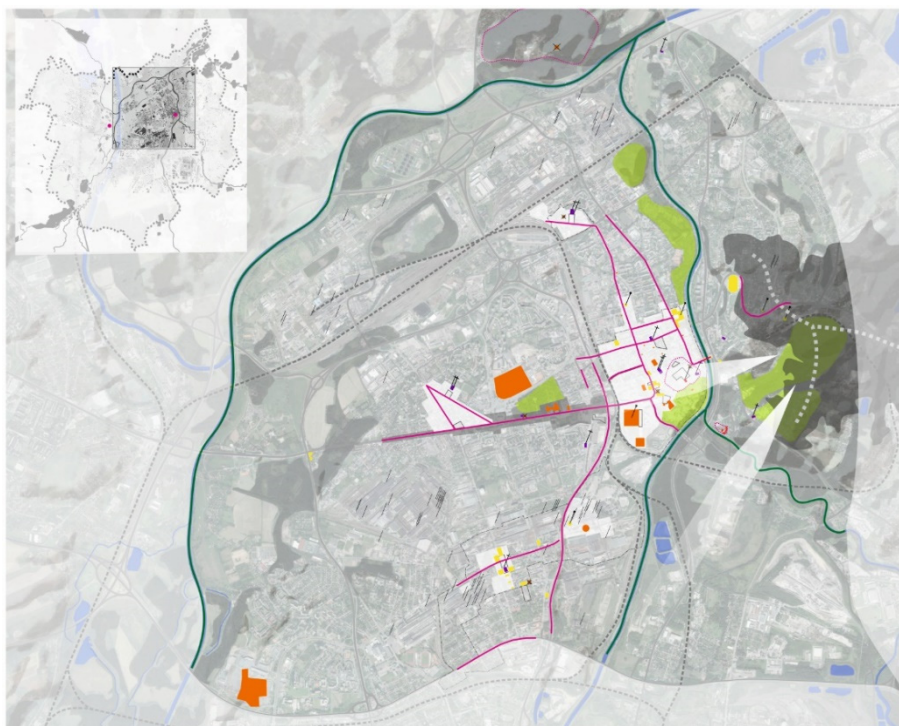


Figure 4: Symbolic structure framework in the centre of Ostrava. (Author: M. Mlčochová.)

Finding the so-called symbolic structure framework relies on evaluation of municipal districts, spaces, places or buildings in relation to what their influence is for creating the cultural network in the city. They are simply elements with significant historical, social, cultural, economic or symbolic values. A number of elements fall into several categories with which they, however, strengthen their significant position in the city. However, unlike other major cities, Ostrava has a sparse and unstable symbolic structure framework. This is no wonder: before finding coal and spreading industrial activities, it was a mere cluster of several villages or small urban structures. Much was built during the industrial revolution, but now that we face industrial decline and its consequences, we stand before the question of what to do with the redundant post-industrial structure. The cultural expression of the industrial period has the same significance and value as the expression of any other period. The industrial period accented work and manufacture because society was focused on it. Life materialization and the application of rational discoveries spread quickly and reflected the current state of mind; therefore, it undoubtedly falls to our heritage.

The symbolic structure framework is constructed from buildings and spaces. Buildings and spaces are divided into natural and cultural ones. Both natural and cultural spaces can be of dot, line or area type. Natural and cultural buildings can be solitaire or group ones.

Buildings and spaces are rated by their significance – historical, cultural, social and symbolic.

Both buildings and spaces can be rated according to the table and the corresponding significance for the city can be assigned to them. With this initial rating, it is possible to obtain a comprehensive overview of ratings of specific buildings and spaces of the city. The rating can be burdened by the subjective view of the evaluator.

Examples:

Landek: The historically most significant area in Ostrava, Landek hill (a spatial natural and generally cultural element, historically and culturally significant – see Fig. 6) is situated to the north at the confluence of the Odra and the Ostravice, on an elevated spot in the area where the Odra flows towards Poland from the confluence through a narrow neck, at the place where the Bohemian Massif ends. Mammoth hunters lived there and were the first ones who used black coal as a fuel. The Venus of Petřkovice was found there. Landek is rightfully considered the birthplace of the local settlement.

Moravská Ostrava: Another historically significant and a city-creating, purely cultural space is then the core of Moravská Ostrava (general cultural space, historically and culturally significant). The settlement was created there near the ford across the Ostravice. Historically, the urban space developed in dependence on social conditions in the city. It has been preserved as the Centre of Ostrava in the inhabitants' minds up to today.

From the historical and cultural points of view, these two spaces are the most substantial for the symbolic structure framework. Their significance for the city is indisputable, which is also the reason why the symbolic structure framework should be stabilized there.

Others:

Buildings which also have a historical and also cultural importance can include, for example, churches, houses of prayer, town halls, and theatres. Spaces with a historical and/or cultural significance, generally cultural, are, for example, squares. Line cultural spaces are, for example, streets, promenades, boulevards, city avenues. Embankments then fall into line cultural and/or natural spaces. General natural spaces are parks and significant natural units.

In its substance, each building or space is unique. The reason why it is necessary to assess individual spaces and elements is that we could find those among the unique buildings and spaces that really create the symbolic structure framework and have the potential to stabilize it and contribute to its systematic development.

2.3 Vitality

Vitality or appetite for life is the second rating factor in the Sustainability Assessment System. Vitality assessment is dependent on data obtained from demographic analyses, as well as on the rate of subjectivity put in the assessment.

Vitality in this passage means a determination of spaces where “something happens”.

Spaces where vitality is concentrated can be considered suitable for regeneration, stabilization or development. Finding corridors between these spaces is of equal importance, because their isolation could become a problematic factor. Monitoring of the vitality of spaces and their concentration is very substantial for the development of the city. Therefore, it was vitality that was determined as one of the rating factors on which the Sustainability Assessment System is fundamentally dependent.

Vitality monitoring is the way with which it is possible to find spaces which inhabitants like or dislike to live in, spaces which inhabitants only pass through, spaces which, though in the city, have little in common with city-creating.

Vitality seeking: Nature - natural elements, forests, greenery, bio-corridors, rivers and the spaces surrounding them - it is possible to state with certainty that vitality is in all of these places. It is appropriate to determine and protect these spaces and to allow that they can be passed through.

The density of population, migration balance, the largest concentrations of population and the distribution of the number of flats - this data give an image of the city inhabitants.

Villages, suburbs - the manner of the last few decades, when inhabitants move to the outskirts of the city and thus these municipal districts become more and more vital at the expense of vitality in the inner districts of the city.

Roma settlements - also their vitality is very high; from the view of inhabitants they are often problematic localities, but it should be realized that it is the Roma community that uses public space most.

Students and young people - vitality is usually high where students concentrate. And there the hope for the city is being born - young blood which has the potential to be the future permanent population.

Popularity of city localities - this is a subjective factor, but significantly showing how vitality is seen by the city's inhabitants themselves.

2.3.1 Sustainability assessment system

As such, the assessment of vitality in the city would not have a sufficiently predicative function on which spaces should be stabilized and developed. The determination of buildings and spaces of the symbolic structure framework would also undertake only an informative function. However, if both rating factors are used simultaneously, it is possible to assess the spaces using this Sustainability Assessment System very effectively. The larger the vitality and the stronger the symbolic structure framework, the better position the space has within the whole.

2.4 Results

Borders of urbanized structures were determined in the fragmented structure of the city of Ostrava. Vitality was analyzed and the symbolic structure framework was defined in these spaces. These factors allowed us to rate the city from the view of the Sustainability Assessment System. The rating matrix (Fig. 8) is divided into six parts. The vitality and

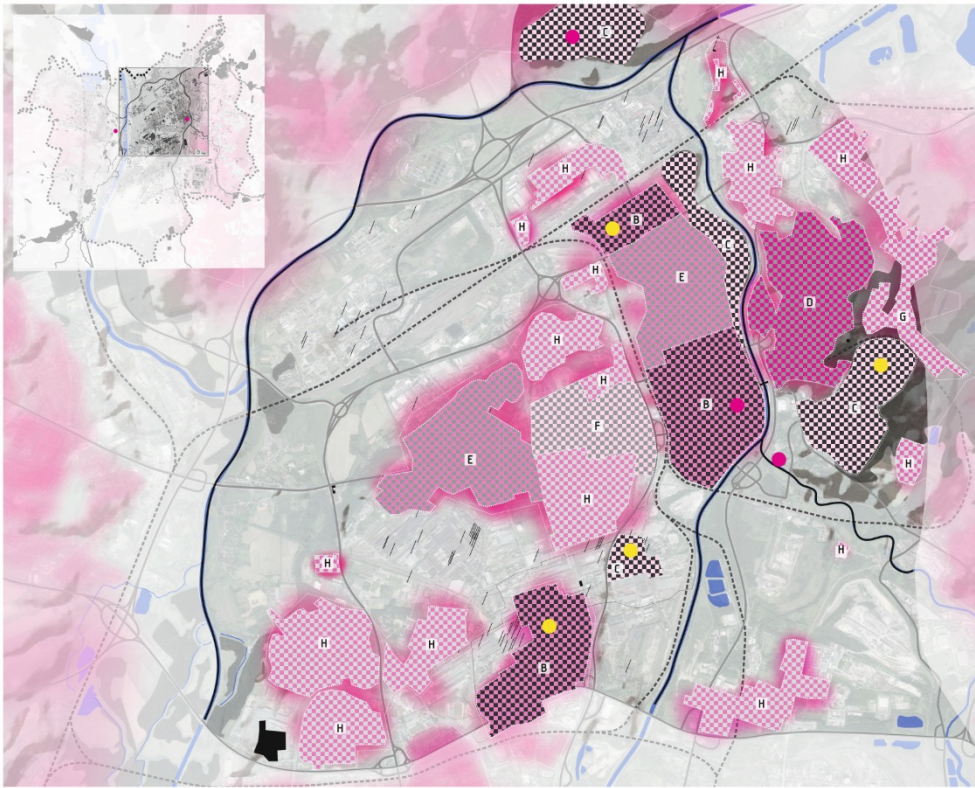


Figure 5: Sustainability Assessment System in the centre of Ostrava. (Author: M. Mlčochová.)

symbolic structure axes are divided into levels - weak, medium, strong. Thanks to the System's matrix it is thus possible to find spaces which are sustainable best – those which should be stabilized and developed, those in which it is useful to invest in and not let them languish. Spaces which are sustainable badly - it is not useful to invest an abundance of energy in them and to keep them alive by force, against natural processes taking place in them and also spaces which are in the middle of the matrix - in these it is necessary to determine their strengths and to further strengthen them so that in the future they could move to that part of the matrix with strong potential.

Example: To be able to connect the three largest urban units of Ostrava (Moravsko-Slezská Ostrava, Vítkovice with Ostrava-Jih and Ostrava-Poruba), it would be necessary to define (build up, grasp) spaces with an area larger than 15 km², which - to achieve a sustainable density of population - would mean bringing there at least another 200,000 people who would help make the fragmented development denser and who would contribute with their taxes to the city operation. The distance between Poruba and Hulváky is over 2 kilometres. Poruba was built as Nová Ostrava, i.e. an independent city. It has appeared in this way to today and it is a functional urbanistic unit without the need of direct connection by an urbanistic framework with the rest of the city (specifically with Hulváky). The space that separates Moravská Ostrava from Vítkovice is also extremely vast. In the widest point, it is 1.5 km and

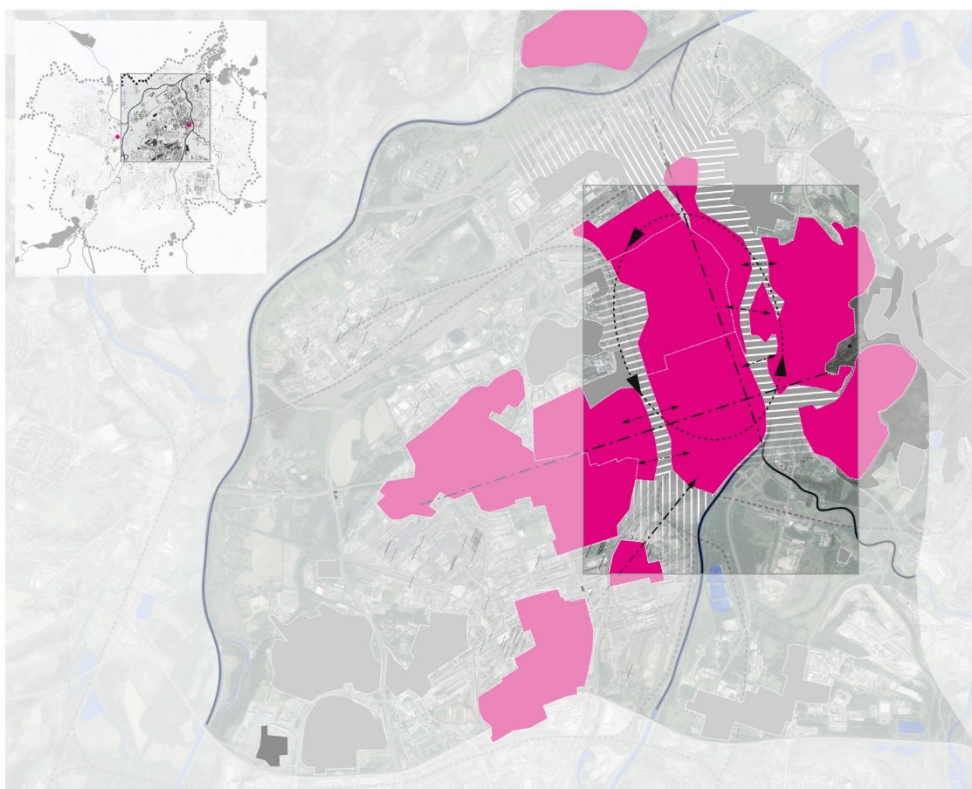


Figure 6: Results of Sustainability Assessment System in the centre of Ostrava. (Author: *M. Mlčochová.*)

is damaged by industrial activities (contamination, brownfields). Within the Sustainability Assessment System, investments in this space do not appear to be useful, conversely, they are shown to be investments against the natural life in the city, even in spite of the fact that much more energy is put there than, for example, in spaces which are potentially much more natural and suitable for stabilization - for example, in the space along the railway line dividing Moravská Ostrava into two territorial units, or in the space along the Ostravice which is the dividing element between Moravská Ostrava and Slezská Ostrava. The benefit of determination using the Sustainability Assessment System is exactly in assessing such disputable urban spaces.

3 CONCLUSION

Today's Ostrava is situated on an area of 214 km²; it is suffering from a rapid loss of job positions, negative migration and, despite stagnation of the heavy industry, also from the most polluted air in the country. The islands of settlements of urban type are divided there by long distances (forests, factories, strange areas of no man's land) and to cover them increases the intensity of motor traffic and thus also pollution. The present average density of population in Ostrava is 1,384 per square kilometre - just to compare; the density of population in Prague (Czech Capital City) is 2,600 per square kilometre. This means that 1,216 more people contribute with their taxes to the maintenance of one square kilometre of

Prague infrastructure (in addition, with an income 42% higher on average). With the bloated structure of four-lane roads and multilevel intersections, which are popular in Ostrava planners mentally stuck in the 1970s, a relatively quality and dense network of mass urban transportation, the need to provide lighting everywhere and at least elementary security, this situation is unsustainable in the long term. (Data source: Czech Statistical Office, Population, Housing and Flat Census 2011.)

What are then the possible variants of the future development?

3.1 Fragmentation

Ostrava is already fragmented, but still it makes up one political and administrative unit (city). However, some of the municipal districts realize the unsustainability of the current state and the fact how they lose money on redistribution of the income on taxes of its inhabitants for the entire city. For instance, the municipal district of Poruba considers what would bring to it if it broke away from the Statutory City of Ostrava. As a relatively compact city with a developed infrastructure, a university (VŠB-TU) and a population of 70,000 with (in relation to Ostrava) slightly above-average incomes, it probably suffers from the non-homogenous conglomerate making up the rest of the city and it would improve its financial position by becoming independent. If, when breaking away, it united with Svinov, it would also gain a significant traffic junction and would become a sustainable city with relatively clean air (the west limit of the agglomeration), a lot of greenery, as well as recreational opportunities. For future trouble-free functioning, it would have to invest in a new town hall and to build cultural institutions (libraries, galleries, theatres, cinemas), but basically it would gain a lot by becoming independent.

Poruba would be probably followed by rural (Pustkovec, Plesná, Krásné Pole, Petřkovice, Hošťálkovice,...) or suburban (Polanka nad Odrou) satellites which can function without problems as independent municipalities.

However, the division would have a serious impact on the economically weaker municipal districts of Ostrava-Jih, Mariánské Hory and Hulváky, Slezská Ostrava and probably also on the historical core alone - Moravská Ostrava and Přívoz. These districts with socially excluded localities would probably suffer from decline, social tension and the growth of (already today high) criminality. If politicians resisted the temptation of financing various rescue packages aimed at social peace (which would disappear ineffectively in black holes and on the accounts of local mafia bosses), these localities (or their unsustainable parts) would gradually become depopulated and would remain to nature.

If Ostrava does not find sufficient force and energy for its further sustainable existence, such a curative process is perhaps the best possible solution.

3.2 New coal

On the contrary, in the European cities that are best rated in relation to the quality of life, sustainability and competitiveness (e.g. Vienna, Zurich, Stockholm, Copenhagen, etc.), 80-85% of job positions are made up of the tertiary (business, services) or quaternary (science and research) economic sector [3].

Relatively low costs of living, genius loci, the presence of a university and research institutes (nanotechnology centre, Anselm and Salomon supercomputers, etc.) or the advantageous position in the middle of Europe with good transport services could potentially attract companies dealing with information technologies, development centres or administrative headquarters with low and middle managements of large international



companies. This market segment could then be a new “coal” - a fuel and energy for the city to survive. Dozens of other, less qualified job positions are related to it, which could help solve unemployment in the region. However, it will not come to the city on its own, nor can it be attracted by primitive incentives such as an industrial zone or a new motorway slip road, which apply to heavy industry. The idea of former mayor Kajnar that thousands of highly qualified and well-paid IT specialists or researchers will arrive in Ostrava every year after building a science and technology park with a growing capacity of thousands of workplaces a year is naive³. Well-educated, cultivated people who can work anywhere in the world will not voluntarily choose Ostrava to live if they do not have their quality cultural, social and sport enjoyments, good educational institutions for children, functioning services and opportunities of rest and short-term recreation in the city or in its close surroundings. Yet, the city still relentlessly resists investments in culture and quality, which is partly understandable - to justify hundred-million investments in a concert hall or library in a poor region with a high unemployment rate requires great political courage and the ability to persuade voters that such projects make sense and have the same or better economic return than building industrial zones for production lines and unskilled workers.

4 RECOMMENDATIONS FOR OSTRAVA

In 2010, an initiative of young architects and urban designers of Ostrava (Průša, Vysloužil, Kotek in cooperation with Department of architecture on Faculty of Civil Engineering in Ostrava) was established; they came with a project called Revitalized Ostrava and defined a sort of Decalogue for the city:

01/ Clear vision. The city is a living organism which needs to be well fed and looked after. To do this, it is necessary to have a clear procedure for such care and the way of fulfilling it. Therefore, a vision should be adopted defining a specific orientation of the development of the city, its structure and determination of rules which define this development for 50 to 100 years. The vision must be generally known and, in its substance, comprehensible.

02/ Turning the city towards itself. Gradual steps leading to stop the city from stretching to the surrounding landscape and orientating the development inside the city. In this way, concentrated, integral and variegated housing with a more effective transport service and accessibility will be created.

03/ Interconnecting. A new structure and the related life are slowly growing on the connecting lines of important and busy places (concentration of activities, historical and cultural centres, urban mass transportation junctions, parks, and the like) which are the main focuses of the urban structure.

04/ Multiplicity of functions. Targeted mingling of different functions – housing, services, administration, culture and recreation, results in keeping life in the city for 24 hours a day. By stopping certain places from depopulating it is possible to efficiently prevent creating unmaintained and unsafe places or even ghettos.

05/ Increasing the density of population. By filling the vacant and unmaintained spaces with buildings the patchy urban structure will gradually be filled up. Quality urban structure ensures a consistent separation of public and private spaces. A decrease in spaces administered by the city will result in increasing their quality and, conversely, determination and extension of private spaces will allow their users to make better use of them. A denser urban structure contains more variegated services and activities and it allows using roads and networks more effectively.

06/ Quality public spaces. A quality public space (a square, park or street), in particular, has the size adequate to its significance, it is clearly determined and well-arranged. It can be

then built with appropriate care, easily maintained and guarded. People like to get together and they feel fine in such space.

07/ City for people. When building roads and pavements the principle should be that pedestrians move at one level - on the ground - in the urban parterre. This should prevent creating obstacles (barriers), easy movement of people about the city should be assured without unnecessary and unpleasant underpasses and bridges and the related easy accessibility from various places.

08/ Elimination of barriers and black holes. A barrier means an obstacle dividing a territory and interrupting the live flow in it. A black hole is a place which sucks energy and potential out of its surroundings. It attacks the living organism of the city like a malignant tumour. Lifeless, non-cultural, economically weak and socially unstable areas appear around the barriers and black holes. It is necessary to stop building new barriers and to specifically solve the existing ones. This means, in particular, finding the way of their positive involvement into the urban structure. In the case of black holes, it is necessary to reveal the reasons why they have occurred, to reduce them and also to avoid them in the future.

09/ City house. A city house has various contents and is busy 24 hours a day. Shopping spaces and services are situated on the ground floor, on the floors above there are usually offices and the top floors are always intended for living. Functions and activities thus mingle in the very basic structural unit of the city - in the house. City houses are arranged into closed blocks where the quiet inner yards are sufficiently separated from busy streets. Localities with city houses are busy all day long and thus they are safe.

10/ Conversions rather than demolitions means the conversion and revitalization of existing buildings, not only of industrial heritage, and their use for new purposes. In the case of unused buildings their new use should be preferred to structurally easier demolitions. There will be fewer incomplete investment goals and the face and memory of the city will be richer. This, however, need not always mean a return to the original form.

ACKNOWLEDGEMENTS

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URBAN ROADS AND SOCIAL METABOLISM: A SUSTAINABLE DEVELOPMENT STRATEGY FOR SAN JUAN, PUERTO RICO

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ABSTRACT

The present work explores the relationship between an urban road with both, socio-metabolic processes and natural systems patterns. The premise is that roads have a decisive impact on energy, material flows and connectivity between biological structures. Therefore, urban metabolism - Social and natural processes measured out of energy use, material flows and land use - becomes the appropriate instrument to assess and analyze the functionality of the different components operating in artificial and natural systems. The case study traces the metabolic behaviors that result from the cross of Juan Ponce de León Avenue through the water system composed by the estuary of Martín Peña and Río Piedras River. A theoretical framework based on social equity, economy, and ecology is being applied in data collection and analysis. Parametric methodologies and GIS information are used to describe the structural and functional properties of both natural and urban systems. The collected data enable the understanding that the simultaneous loss of energy efficiency and land-use efficiency from the mid-20th century to the present affects the resilience of the area. Consequently, this exploration demonstrates the importance of urban metabolism in maintaining the ecological quality of natural systems. As a result, it proposes an urban metabolism strategy to develop more sustainable urban schemes for the systems composed of urban roads and natural ecosystems. The organized complexity of the water system, necessary to host biodiversity and fundamental ecological processes, cannot be guaranteed if the urban metabolism is not taken into account.

Keywords: urban metabolism, urban roads, resilience, urban sustainability.

1 INTRODUCTION

The cultural landscapes have been imprinting its traces on a palimpsest that reminiscent of different times in which human activity has shaped the environment. In this palimpsest, the streets have left their indelible mark. The problem that concerns this work lies in the purpose of these traces. Accordingly, with the fundamental aim of connecting and facilitating displacement, other functions of the street linked to natural and social processes occurring in the city should be recognized. In this sense, are developed four key themes. The first theme is presented a historical view of the street, highlighting its role in the urban metabolism. The second theme addresses the change in the relationship between street and urban metabolism from the industrial revolution due to the creation of new materials, the intensity of vehicular use and the growth of the city. The third theme sketches the importance of the vehicular routes in the model of urban development of San Juan, a pattern that can be recognized similar in different Latin American cities and the industrialized world in general. The fourth theme presents the case study and finally is presented a proposal that exposes the opportunities of the street to become a concatenator of the metabolic processes in a case study: Juan Ponce de León Avenue in the city of San Juan in Puerto Rico.

2 STREETS AND URBAN METABOLISM

The urban metabolism has its origin in recognition of the limits that impose the natural and social resources to the industrial models of making the city. Fisher-Kowalski [1], defines it



as a process composed of biophysical inputs and outputs summarized in the materials and energy that are extracted from the environment and are treated (ingested) by society. Some of these materials are accumulated as a socioeconomic stock while another part is thrown into the environment in the form of waste or polluting emissions. Beyond the accounting of raw materials, manufacturing, waste, and energy, urban metabolism should understand as a social practice. Therefore, there is a visible and quantifiable part that manifested in material and energy flows beside an immaterial part determined by the institutions and the ensuing symbolic and social systems. Both parts, material and immaterial, determine each other [2]. Thus, each society shapes its urban metabolism regarding the relationships establishes with its environment.

Organic-based pre-industrial cities teach that the street was an essential part of the urban metabolism configuration. So, the artificial basins defined by the layout of the streets concerning the system of fountains and channels work as an orchestrated machinery that contributed to feeding the orchards of the urban periphery.

Fig. 1 below shows an orchard feeding a pond that collects runoff water from areas of higher elevation in Brañas del Sar, Santiago de Compostela. Next, to this image, Fig. 2 shows the layout of the Castillo del Morro's floor, its configuration reflects the intended gesture of water collection, integrating aesthetics and functions values.

The hydrological system determined for a long time the scheme for spatial organization of houses, cultivation areas, morphology, and plot of streets, in general terms, the relationship between the city and its surroundings. The preponderance of water in the design of the city is why this has always been the most quantitatively significant flow of those circulate through its metabolism. Consequently, the street, in the pre-industrial city, the concatenator. It was not, as at present, strictly a means of displacement.

The slopes were oriented to lead the runoff to the orchards in the agricultural fields that bordered the city and fed with the fertility of the organic material carried by the water and deposited there. The level of permeability modified with the intention that was having concerning the water. Thus, the street worked, in some cases, as a channel, to lead the water toward the orchards or cisterns, in other cases worked as a permeable surface that by absorption allowed the reduction of the runoff. The street was part of an articulated urban design and natural processes; on the one hand, its benefits were taken advantage of, such as irrigation and water storage, and on the other, phenomena such as torrential rains were reduced. For organically based societies - those that still survive -, the primary resources for its subsistence come from a biosphere management that must ensure maintenance and



Figure 1: Water Management. Brañas del Sar Santiago de Compestela.



Figure 2: Layout of Castillo del Morro's floor. San Juan, Puerto Rico.

reproduction. The balance in relationships to the environment not only allows the meeting needs but also represent a guarantee of survival. These societies depend on its surroundings, so, the closure of metabolic cycles should be a condition.

Therefore, the lessons of these societies, allow us to recognize that is important to recover some kindness of the street. This reading can contribute to responding to the challenges of the present city and advanced towards sustainable future.

3 THE DEVELOPMENT PROCESS OF THE CITY LINKED TO THE STREETS AND THE IMPACTS ON URBAN METABOLISM

For pre-industrial or organic-based society, the resource management was the basis of its survival, more not for industrial-based society, which can become independent of the fertility of its soils because the resources are obtained from distant lands. The discovery of new ways of achieving energy on a larger scale has generated great changes in the relationship between human habitat and natural processes. Industrial system has progressed in a type of knowledge and technology appropriate to a society independent of the organic basis. The new model considered energy and material flow as inputs and not as part of processes that require a continuous regeneration. This unlinking between natural and social processes was possible because of the accessibility to fossil fuels as energy, a source capable of providing work and energy.

Organic technical systems must have nutrient recycling strategies, the closure of material cycles and the waste returns to the environment to ensure future resources. Nothing similar occurs to an industrial system: the availability of the resource in the mines does not depend on the return to waste to it. On the contrary, waste is a nuisance that distorts the efficiency of the industrial system, therefore should be removed as soon as possible. The productive value of the waste was shattered with linear metabolism, in which the materials are extracted from the earth's crust, are transformed into usefulness products by the industrial processes to meet social needs, are consumed, and, consequently, degraded and discharged into the environment. So, this mineral-based industrial technical system is a waste production system. As a result, has led a cut with natural processes that cause the deterioration of the environment that supports life on earth.

This linear metabolism that characterizes the current urban model has transformed the landscape faster than any other process of any another time of history. New materials allowed the rapid infrastructures construction. The asphalt enables the extension of the road network by all the confine, and with this, increase the use of private vehicle use, access to a significant percentage of the population.

Linear metabolism also made it possible to create new types of roads other than the street. The change in the intensity of vehicular use resulted in new needs for faster movement, which were covered by the expressway, in which the relationship between persons and environment changed completely. The fragment produced by these roads to the landscape is very evident. However, it is not the only fragment, these roads also affect the sociocultural level, as ancestral customs. There were a lot of ancient grazing routes, linked to a cultural landscape, that has been modified or eliminated.

Something different happens to the arteries or main streets of the city, defined as those that connect and distribute the vehicles between the various areas. These roads allow a different relationship between the public space, the urban elements, and the pedestrian. The main street gives entry to the city and connects with the secondary streets. Goes through commercial, cultural, and institutional areas, and leads to public spaces. The speed of its routes allows the driver to observe the buildings and its urban identity elements, and form a sketched of the city, unlike the expressway, which, even if it passes through the downtown, does not allow its recognition.

These qualities of the main street are an opportunity to make use of the unifying potential given by its functional pre-eminence and relationship with the city and concatenate it with the processes of urban metabolism. The main street, currently covered by waterproof tarmac and a usually collapsed sewerage system, could resume the channeling role of the metabolic flows and make them visible.

The visibility of natural processes, such as the cycles of water and raw materials, contributes to generating links between people and the natural environment. This links translates into practice pointed to maintaining and preserving the health and the the environmental productivity.

4 BRIEF HISTORICAL REVIEW OF THE URBAN DEVELOPMENT OF THE CITY OF SAN JUAN AND ITS ROAD SYSTEM

An analysis of San Juan urban development is fundamental to understand the relevance to its road system in relationship to the city model. The low density and the dispersed pattern of the residential areas stand out as a relevant feature. The pre-eminence of the metropolitan area, where more than half of the population of the island lives, have most of the services concentrated.

However, this was not always the case. Initially, the inhabitants of San Juan settled on the islet, whose strategic location motivated the construction of walls, fortresses, and the establishment of administrative headquarters.

It could be recognized significant reminiscences of an urban design linked to natural processes in Old San Juan. Even though cisterns are currently in disuse, there are a lot with different capacities. The antic houses collected the water through the roofs and canals of the central patios. Larger buildings such as the castles El Morro and San Cristóbal, or the barracks of Ballajá, also integrated into its design and configuration the management of this vital resource. Their patios through its impervious surfaces, slope orientation, and channel systems led the water toward huge cisterns. According to the United States Department of National Parks, the cisterns of the two castles could hold nearly one million



gallons of water, about half of the annual rainfall of San Juan. This amount of water being able to supply all San Juan in the case of drought [3]. The cobbled street of Old City allows permeability and contribute to reducing the runoff. All these considerations related to the natural processes were lost with the rapid growth linked to industrialization.

At the end of the 19th century, the city began to move outside the walls. Overpopulation caused wealthy families who had summer houses in different areas such as Miramar or Condado to settle there. Another important factor of urban expansion was the tramway, which facilitated the tour of the whole island and formed a circuit that led to an urban growth linked to its route, which also connects with other cities developed in the 18th century, such as Rio Piedras and Bayamón. Fig. 3 below shows the railway circuit of the Island, which corresponds to the occupation of the territory shown in Fig. 4.



Figure 3: Railway circuit of the Island. (Source: Rodney, 1925.)

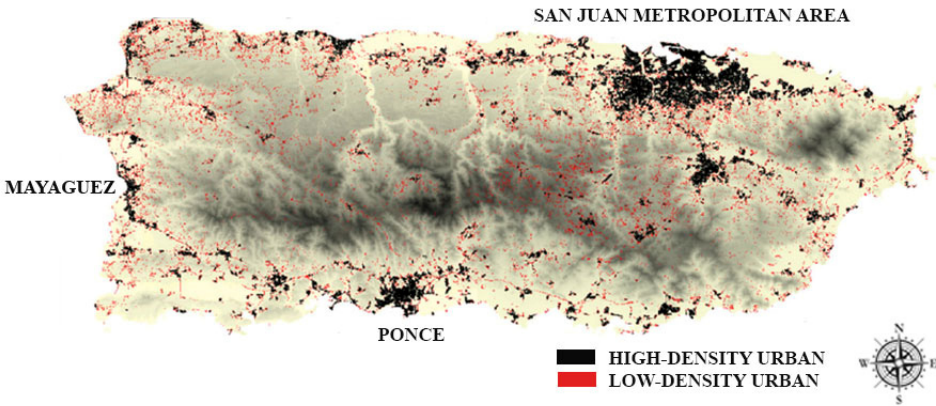


Figure 4: Development Pattern of Puerto Rico: High density (Black) and Low density (Red). (Source: Martinuzzi, Gould and Ramos, 2007.)



These road networks facilitated that San Juan grew from poles with different functions. These poles are the north-south axis formed by the sectors of Old San Juan, Santurce, Hato Rey and Río Piedras; The urban center of Bayamón; The cities of Carolina, Guaynabo, and Trujillo Alto [6]. This growth of nuclei modified its pattern of the 1940s when the island incorporated the dispersed model of the United States, which promoted the suburb linked to a green image concerning nature, contrary to the reality due to the long occupation of the soil [7]. In the 1950s and 1960s, a sense of economic prosperity generated fostered foreign investment. The population has risen sharply from the 1970s. This growth slowed, in 2000 to start a downward trend, which is still declining [1].

The car played a significant role in the urban development process. In 1930 the population moved into collective transport. Accordingly, the private vehicle was limited to the families of high income. In 2015, registered 661 motor vehicles per 1000 people. [8] This statistics places Puerto Rico in one of the countries with the highest number of vehicles per person. The environmental consequences of the excessive car use are evident in various senses: CO2 emissions, social inequity, economic impact, and a decrease in urban environmental quality.

As in the rest of the Latin American countries, Puerto Rico adopted not only the dispersed urban model but also the American way of life, which promotes an idea of development linked to the high consumption and relaxed lifestyle that promises, among other things, the car. With the car as the primary means of transport, urban sprawl has no physical limits. However, the residential areas isolated from urban centers, but dependent on its dynamics impoverish the quality of life of its inhabitants, who do not enjoy the best of the countryside because its landscape has been modified by moving away from the crops and greenery.

The population shift from central urban areas into suburbs, characteristic of western cities motivated by the promise of a substantial increase in income and quality of life. San Juan suffered the same process, but with the difference that many of the poor who moved to the periphery remained poor. The urban planning of the island in general, and of the metropolitan area, is characterized by cities and towns surrounded by dispersing urban expansion [5].

This urban model led to the construction of an extensive road network that responds almost exclusively to car journeys. In the metropolitan area, the short stretches with bike-lines are recent, and the pedestrianization is difficult due to the disconnection of the sidewalk, the lack of shade, and unsafely crossings.

The road system of San Juan, not only does not respond to the pedestrian, but it also does not answer to the natural processes that inevitably affect the city. From its relationship to the water, the San Juan road system can be read as a waterproof tissue that covers the pavement from the highest to the lowest of the faint topography areas. This tissue alters the runoff and increases the risk of flooding. Consequently, the streets are overflowing, and, in some cases, buildings are affected. The most vulnerable areas are near the sea, lakes, and rivers, but there are also other sectors of the city affected due not to have adequate drainage. This situation could be different to a route planning relating to the qualities of climate, soil, and topography.

This situation is because the street is conceived only as a connector that must provide a surface of displacement for the car, not as an urban element that can canalize social and natural processes, through which could flow and be in a harmonious way circumstances that in the present collide and hinder.

5 CASE STUDY

Juan Ponce de León Avenue has features of urban archetype: The great street marked by the signs of a history that glorify its trace and that connects multiple sectors of the city, such as



Alcalá Street in Madrid, The Seventh of Bogotá, or the Avenue of the Insurgents in México City.

Juan Ponce de León Avenue was drawn in a rudimentary way before the Spanish Conquest, then it was widened during the colonization and was called “Central Road”, is the main connector of the capital with the Island. For centuries circulated by this way people and goods that served as support for the development of the capital and the country regarded as the backbone of the city. As a dirt road to the 16th century, it has been subject to several transformations. Known as Avenida Juan Ponce de Leon in the year 1913.

This Avenue covering a total of 11.49 kilometers longed to begin in the Plaza Colón in Old San Juan as a continuation of the Fortaleza Street, the main artery of the islet. Runs northeastern - southeast through the Santurce neighborhood, which includes differentiated urban areas. Portions of the road pass-through business, financial, and commercial district of Hato Rey called Golden Mile and ended in the district of Río Piedras, functional focus where there is the most important University Campus of the country. Predominate in this avenue institutional, cultural, educational, emblematic, and commercial buildings, as well as cultural activities and community and training centers. Highlights its pass over two natural water systems that are Martín Peña Channel and Río Piedras, estuaries of high ecological value. The junction with these natural systems, as well as the crossing with important streets, represent a potential to configure a broader system, in which this avenue would have a role that could respond to aimed for a more circular urban metabolism.

This approaching is related to a growing concern for the protection of diversity has given rise in Puerto Rico to consideration of the most effective means for maintaining and improving biological habitat.

Currently, Juan Ponce de León Avenue and the City of San Juan in general, are characterized by linear metabolism that expresses on impervious pavements, a sewer system that generate pollution and impact on water quality of local water bodies, and lack of waste management.

There is a disconnection between the inhabitants and the natural processes that increase due to the lack of public spaces, which are important to promote the community involvement with the environment. San Juan presents a variety of squares, parks and public spaces, the problem is that they are far away from the activity centers. To this adds up problems that affect the continuity, image, and security of the avenue, such as deteriorated buildings or underutilized spaces along the way, which difficult its perception as public space. The intrinsic qualities of this Avenue cry out to come to light, the goal of this work is to its rescue and honour.

6 PROPOSAL

Based on the recognition of the potential of the Juan Ponce de León Avenue, is proposed an urban metabolism transformation strategy for the city of San Juan. What is seeking is to reclaim the role that had once this great street, but raising the challenge to the current sustainable demand from its main scopes, namely, social, environmental, and economic. Below are explained the proposal foundations.

Social field: In the public space is constructed the idea of the city, is a place where can be measured out encounter, tolerance, citizenship performance and urban environmental quality. How to pose (Borja and Muxi [9]), is one in which the society becomes visible. Is associative and relational, facilitates the integration and participation. This proposal aims at setting up this avenue as a backbone and seeks in this regard prioritize the pedestrianization to increase its usefulness as a social space. As well as articulate and give continuity to squares, parks,



commercial, cultural, and service areas. This network of public spaces would favor the appropriation, understood as a sense of belonging. The conception of the urban space in these terms, does not arise only from the “places” but of the relationships between people, with which, citing Smith [10], are shared memory, values, symbols, myths, and traditions. The rescue of the heritage value of this avenue could contribute to the development of the history of the present. As Augé [11] acquaint, a re-reading in which are told the transformations that led to the current reality, and that contributes to face the challenges of the future.

It is well known the deterioration of many sectors of Juan Ponce de León Avenue by vandalism, a situation that could compare with the psycho-social experiment of the broken windows, the message which is being transmitted is: here nobody cares about this, this is abandoned. Contrary to this, if the public space is well taken care of and contributes to the increase of the quality of life, are built ties. In the words of Vidal and Pol [12], the appropriation facilitates environmentally responsible behaviours, as well as involvement and participation. Therefore, increase the experience of public space along the avenue is essential to achieve the sense of ownership and cooperation in its improvement and maintenance, these being the fundamental objectives of this proposal.

Environmental field: according to the Council of Climatic Changes in Puerto Rico [13], almost 90% of the work-related travel is made in private vehicle, which generates a high amount of emissions of greenhouse gases. Incorporate sustainable mobility - like bicycle and pedestrian lanes - to Juan Ponce de León Avenue could decrease the emissions produced by cars, considering that this avenue connects a large part of the institutions that are sources of employment.

However, this theme should be understood far beyond its landscape value or its contributions to environmental quality. This paper proposes that this avenue will configure as a large articulating machinery of urban metabolic processes. For this, it is necessary the reconfiguration of the street in two main senses: As a debugger capable of absorbing CO₂ through the greening of its paths, and as manager of the runoff through its collection, driving, and filtering. Because of these functions would result in the reduction of urban situations as water logging, or heat islands, which affect the city and increase the impact of natural phenomena. The integration of The Martin Peña Channel and Rio Piedra's River ecosystems would give continuity to the biophysical matrix that has been fragmented with the paving. This strategy would allow the recovery of biodiversity, as well as scenic and environmental qualities. Opportunities that also would achieve with this system are the incorporation of other sustainable practices such an integrated sustainable mobility circuit between the estuaries and the Avenue, waste separation, and the integration of renewable energy and environmental education. All these practices are fundamentals to achieve the primary objectives of urban sustainability.

Economic field: Revaluation of public space that would provide the system formed by Juan Ponce de León Avenue and its possible transverse axes would encourage investment and employment opportunities, which would result in economic prosperity. This avenue runs through areas of tourist value that are interrupted by broad depressed areas. The proposal of this urban corridor system would help to retrieve the value of the soil along its entire length. Recognizing the tourism as one of the primary economic sources of the island it can be identified that this proposal could contribute to increasing this potential. Participation of the community is considered fundamental to avoid the possible gentrification that tends to occur with these urban improvement processes.

To be able to recognize the criteria on which guide the study of the Juan Ponce de León Avenue and its possible configuration as the backbone of the urban metabolism, its proposed



a methodology aims at discovering and working with characteristics of a given locale. These features include the basics outlined above.

1. Spatial Criteria: Characterize the physical qualities of the place. Includes four specific topics:

- a) Intrinsic qualities: Recognizes characteristics of the site regarding morphology, geography, and other uses that allow defining best uses for some types of activities depending on the conditions of the street, such as tree planting, urban gardens, bike-lanes, others. As McHarg [14] proposed this ecological approach sees design as an iterative process that is largely shaped by the interactions between humans and ecosystems.
- b) Articulation: Identifies opportunities to set up organizational structures such as axes, nodes, and edges through the definition of possible spatial sequences, as well as environments with high functional dynamics that can concatenate the social and natural processes.
- c) Confluence: Explores and defines spaces for the meeting, which may already be configured or not. The Avenue and the system that integrated is supposed to facilitate the identification of new areas of social interaction.
- d) Management of metabolic fluxes: Examines the potential for acting in the transformation of the urban metabolism from its fluxes, mainly of the energy used for transport, the raw materials, and water. The reconfiguration of the metabolism fluxes is possible from the social action, from the citizen, without the need for high technologies nor very complex processes. So, the water, for example, given its strong presence in the city, in its streets and public spaces, could, through appropriate management, transport raw materials and fertility to the soil and no contamination, as is currently the case. This water management, as a concatenator flow of many of the processes of urban metabolism, facilitates the action on other metabolic fluxes. Therefore, it is necessary to carry out a map of metabolic fluxes to identify its behaviour. In the case of water, it would reconnect its channels and give continuity to hydraulic spaces. The streets are important because they inevitably are configured as artificial basins that lead the water flows by gravity to the natural water courses, and with this fluid, the material of runoff.
- e) Symbolic Criteria: Define referential places from the recognition of spaces that exemplify the city and represent it in the collective imagination. The importance of these areas for the reconfiguration of the urban metabolism lies in its social value, which could be achieved by the participation and involvement of the people with the places from which they feel are part and with which they form a sense of identity [15].

These criteria, as well as the research of parametric and GIS information used to describe the structural and functional properties of the study area, were considered to propose an Urban Metabolic Corridors System, defined as an organizational structure oriented to canalizing the natural and social processes in urban space. In which the streets would serve as corridors. Consequently, it is proposed a guideline oriented to:

- a. Describe the priorities and principles that will ensure future development achieves high design quality and design excellence.
- b. Improve habitat connectivity across the System, particularly between priority sites, and between identified habitat areas in adjoining natural ecosystems Caño de Martín Peña and Río Piedras.



- c. Increase the quality of urban life measured out from a substantially decrease a city's transport emissions and congestion through reduced car ownership and car mileage.
- d. Protect heritage items, heritage conservation areas and other highly valued characteristics across the System.
- e. Relate the street to the public space and to the empty spaces to encourage and support biodiversity.
- f. Reflect historical and cultural context.
- g. Encourage public transport use, walking and cycling.

The main themes of the guideline proposed are:

- Turn Juan Ponce de Leon Avenue into a main ecological corridor and generate transverse connectors that allow expanding the network of bike-lines and pedestrian pathways through integrated circuits to achieve a simple approach that aims to connect the social, economic and cultural life of the city to these means of transport.
- Nodes with amenities as water fountains, public toilets, public telephones, garbage bins, ATMs, street vendors and street entertainers at crossing points between the main and transverse axes, related to buildings or relevant urban spaces.
- Green Gateways to connect the hydrological ecosystems Caño de Martín Peña and Río Piedras, this would be allowing for efficient circulation systems (streets, metros, bus lanes, cycling paths, walk paths), attracting uses and activities, thus enhancing safety, providing opportunities for recreation, thus improving general good health and well-being. Gateways would facilitate citizen participation and engagement in the conception, production and/or subsequent maintenance of the space.
- Detailed analysis of the heritage items and conservation areas located within the Frame Areas along the System. As well as the unfunctional spaces and their opportunities of adaptive integration.
- Identifying the key elements of the existing built form which are significant from a heritage perspective, including consideration of the character and fine grain, and innovative ways to celebrate heritage along the System.

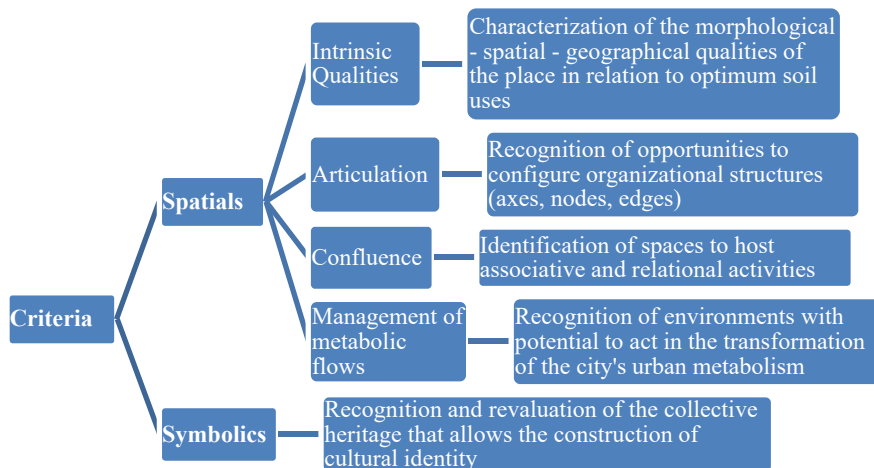


Figure 5: Criteria scheme.

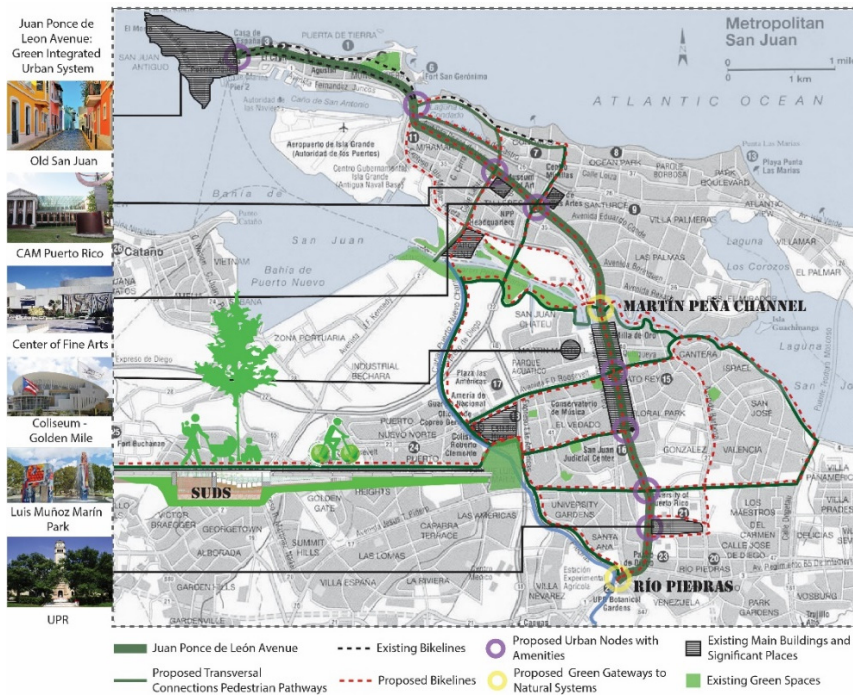


Figure 6: Proposal scheme.

7 CONCLUSIONS

The street loses its metabolic function as the crops disappeared from the periphery and the cistern discarded because the water can be driven to the city from remote places. Most of the current roadway infrastructure was developed based on guidelines that emphasize vehicle mobility and safety and minimizing short-term upfront costs, with less consideration given to social and environmental aspects. This paper raises to retake the role that the history of the street shows us. So, this proposal is addressed to restore and enhance its original value as functional, aesthetic, social and cultural configurator of the city with minimal impacts.

Achieving sustainable urban streets can create more liveable communities. With amenities nearly located, individuals would be more likely to utilize alternative mode choices such as walking, biking or transit, which leads to improved urban health. Streets busy with pedestrian and bicycle traffic are safer and strengthen a sense of community.

This work provides a view of Avenida Juan Ponce de León from its latent heritage, which can be exalted through a reconfiguration of its urban metabolism. This reconfiguration represents an opportunity to lead San Juan towards a more sustainable city scheme.

Further investigations will provide planners, designers and decision makers with a precise understanding of the dynamic flow patterns in San Juan.

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SUSTAINABLE DEVELOPMENT FOR RECOVERING ECONOMIC CRISIS: A POSSIBLE SOLUTION FOR BRAZIL

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ABSTRACT

Brazil has been going through a period of intense political turmoil. The impeachment process of former president Dilma Rousseff started in December 2015 and brought significant upheaval to a country that now faces a deep political crisis. Accused of abuse of power, Mrs. Rousseff was charged with criminal administrative misconduct and violation of the federal budget, and in August 2016 was removed from office and replaced by Vice President Michel Temer. The new administration, in conjunction with the National Congress, lost no time in implementing new law reform programs, a questionable tactic designed to dodge lawsuits. To control expenses, Constitutional Amendments such as PEC 241 propose the freezing of public expenditures in health care and education for the next 20 years, potentially harming the development of the country and well-being of the citizens. It is precisely at this moment that Brazilian Urban Policies come into context and one must ask if the current policies are designed to benefit the government and its leaders or the people of Brazil. From this point of view, this paper aims to discuss how public policies that once generated social and economic development have been affected by the presidential impeachment process and how this can become a moment of opportunity to pursue a sustainable development capable of reviving Brazil's economy. Through a social, environmental and economic approach, it is possible to develop a resilient economy capable of surviving, adapting and flourishing in the face of turbulent events. Designing cities that meet future needs, while improving human quality of life over time, is a clever way to develop the country, create meaningful jobs, restore the confidence of people in their institutions and assure the existence of natural resources for future generations. This article is intended to examine the current situation of Brazil's urban policies and to propose feasible solutions within the country's current context, which will benefit the entire population and improve overall quality of life.

Keywords: sustainable development, resilient economy, urban policies, right to the city, urban acupuncture.

1 INTRODUCTION

The following paper aims to discuss ongoing urban policies in Brazil and how the presidential impeachment process affected them. In the midst of the current political crisis, most cities in Brazil underwent severe structural changes, highlighting the brazen political contest that in many cases left the management of the *urbe* and well-being of the citizens as a secondary priority.

Successful cities rely on active participation of citizens and commitment of the government to build thoughtful and well-designed urban environments. Urban policies have the potential to set in motion improvements in the city that strengthen the local economy, guarantee quality of life for all citizens and ensure the preservation of natural resources. In this process, is important that all agents of the city are able to participate in decisions that have a direct impact on their lives. The triumph of our cities depends on the ability of people to exert their civic rights to achieve a humane urban environment. Our cities are our legacy; therefore, it is imperative to include the social, environmental and cultural responsibilities of our society in the political agenda.

The Brundtland report [1], defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their



own needs". That means awareness of resources consumption, waste management, technology and ways of living and building in the present.

"The satisfaction of human needs and aspirations in the major objective of development. A world in which poverty and inequity are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life." [1].

The concept of urbanity [2], has been used to evaluate the quality of the built environment according to its relationship to the people and consideration of how these spaces welcome citizens and adapt to their needs. This index synthetically describes the qualities of urban spaces according to desirable standards and when coupled with social, environmental and economic analysis, provides insight into existing problems of the built environment. This analysis allows identifying policies that generate undesirable outcomes and allows urban planners to learn from past experiences and to prevent future mistakes.

Zoning laws that encourage construction of housing settlements in the outskirts of cities favours urban sprawl and brings serious undesired ripple effects: longer daily commutes; difficulty accessing city centres; increased dependence on automobiles and fossil fuels; higher volume of cars in the streets; accentuated traffic jams; etc. A policy and land use regulation has tremendous impact on how people live and what they have to do every day. On the other hand, if the same resources were allocated to the creation of mixed-use areas in city centres, it would be possible to decrease distance between home and work; provide people with alternative and healthier ways of commuting such as walking or biking; improve the existing infrastructure; preserve and spread knowledge about historic city centres, etc., all of which could significantly improve the quality of life of the citizens. By spending less time in traffic and having more free time for leisure activities people are able to include healthier habits into their daily routine. What is observed in recent Brazilian policies is an antithetical version to the urban sustainable development guidelines so widely debated in the world right now.

But Brazil does have its own example of successful sustainable urban developments. The city of Curitiba, under the administration of the Mayor and architect Jaime Lerner, underwent an intense process of restructuration, where social interactions were the framework for creating a more vivid and vivacious spaces. His idea is that small scale interventions are capable of transforming a much larger urban context if pinpointed in strategic areas of higher stress, a technique known as urban acupuncture. A localised and community approach that offers feasible solutions for less cost that can quickly be accomplished and will release energy and create positive ripple effects throughout the city as a whole.

2 REFLECTION OF CURRENT URBAN POLICIES AND THE RIGHT TO THE CITY

We live in a time where the ideals of human rights have come to the fore with a lot of good intentions to build a better place. Many countries around the world have raised their voice against abuse of power and political corruption as in Russia and South Korea [3]. It was no different in Brazil. When people were exhausted by lies and new corruption scandals every day on the news; they reacted. There were many public manifestations of a pro-impeachment sentiment that demonstrated a collective desire for political change.

According to Harvey [4], these public manifestations mean that people are exercising their collective rights in the process of urbanization:

"The right to the city is therefore much more than a right of individual or group access to the resources that the city incorporates: it is a right to change and reinvent the city according to our deepest desires."



In the midst of the crisis, the current Mayor of São Paulo, João Doria, was elected and took office January 2017. In the first few weeks of his term, his administration judged it necessary to cover kilometres of graffiti art walls throughout the city with grey spray paint. The measure created much discussion among citizens about an authoritarian act by the government to erase public statements. Artists defended graffiti as an expression of the city they want: “The graffiti is the most present expression of the city; it is the peripheral subject screaming in colors.” [5]. Aside from covering artist statements and public manifestos, the urgency of the matter is questionable, given São Paulo faces great challenges such as rising unemployment and low levels of public security in the midst of one of the country’s deepest recessions.

The acts of the new government of São Paulo shows an attempt to silence the voice of artists and public manifestos in the streets instead of working towards constructive dialogue that will have the power to change the reality of the citizens. In addition, it is an authoritarian act that discourages the expression of people and is contrary to the inclusive, participatory and multidisciplinary approach public administration should aspire to.

São Paulo is the biggest city in Brazil, exerting national and international influence in terms of culture, economic and political views. Unfortunately, today it is our greatest example of a city in political and urban crisis. In the last few years São Paulo reacted against paradigms imposed by conservative governments in an attempt to reduce and change habits rooted in traditionalism. Its former mayor, Fernando Haddad, who was in office from 2013-2016, tackled some of these urban issues by attempting to create more public recreational areas, the use of parklets, incentives for food trucks and an overall improvement of urban spaces. But mainly his politics related to urban mobility were the subjects of great polemic during his mandate, with a strong attempt to prioritize pedestrians, bicycles and public transportation over use of private cars. The creation of dedicated cycle routes, cycle paths and bus corridors aimed to reduce the average time spent in transportation and improve the quality of the air and life of the citizens. His administration also approved creation of more than 150-night line buses, modernization of the fleet, buses with GPS, Wi-Fi and created free pass for students from public schools and the unemployed.

Haddad’s administration fulfilled goals by re-qualifying public spaces for the overall benefit of the population and prioritizing collective and non-motorized ways of transportation; breaking down existing schemes like the ISS, which is tax on services of any nature; reorganizing and creating new secretariats such as Human Rights, Politics for Women, and Racial Equality, etc. in an attempt to achieve a more participative and democratic city for all citizens. He also created the office of the municipality’s general controller to combat corruption and licensed secretariats to regulate real estate approvals, managing to recover more than R\$600 million reais (\$230 million dollars) of public money. [6].

In terms of mobility, he reinvented the policy of traffic regulation and speed enforcement with radar, reducing speed limits from 90km/h to 70km/h on highways as a measure to protect pedestrians and reduce accidents. São Paulo went from the 7th position to the 58th [7], in the world congestion ranking. Even though his measures brought great advancements and a new way of thinking in the city, his politics were strongly criticized by an elite that disliked this social and environmental approach. With acceleration of the political crisis at a federal level towards the end of his term, Haddad’s affiliated Worker’s Party lost great prestige due to scandals of corruption and the start of the impeachment process. In October 2016, he lost re-election to his successor João Doria.

The current administration of São Paulo doesn’t have the same social approach as its predecessor. João Doria graduated in Marketing and is the ex-president of Doria Group. One



promise of his campaign was to increase the speed limit on highways in the first week of his mandate. He denied that the speed limit reduction had relation to accidents and deaths on the roads. He also wanted to eliminate secretaries of Human Rights and Policies for Women. Extinguishing internationally recognized programs for drug control that tackle crack dependants is also in the agenda [8]. This specific program has helped more than 800 people and improved the area known as “Cracolândia” [9], that were in the past controlled by drug dealers, street dwellers and organized crime.

The media characterizes him as a disciplinarian leader who is using his background as a businessman for the service of people but he seems to have a problem with protesters, artists and activists on the left.

It is noticeable that the current management of Sao Paulo uses marketing and the media to promote public urban policies of immediate reach, skipping the necessary planning and analysis of the overall context so necessary for complex urban studies in a megacity like Sao Paulo. The result is the formulation of weak plans and strategies that do not necessarily have a long-term reach or benefit the greater part of population. This mentality is problematic for the overall development of the city and results in potentially undesirable projects at the expense of public resources that once again fail to improve the well-being of population.

In Brazil, thousands of municipalities and states are having their public policies put at risk due to the excesses of national politics. Many in the country are currently protesting the public spending limiting amendment, called PEC 241. This Constitutional Amendment limits spending on health, education and social assistance by freezing public expenditure to the limit of last year's inflation rate, with the goal to reduce the country's debt. The argument against PEC 241 is that limiting spending also limits investment potential, harming the development of needed programs that could be the catalyst for economic revival. This amendment, which can be extended for up to 20 years, can have devastating consequences by blocking the development of the country and making it harder for Brazil to leave the current state of recession.

In this sense, it is important to understand the need for investments in the cities as a way to generate jobs and revitalize the economy. Public policies with the goal of improving urban environments under the light of sustainability, besides improving overall quality of life for the citizens, have the potential to spark relevant changes in ways of production, consumption and income distribution. In addition, such policies offer tools for Brazilian cities to develop economically. Programs such as “Sustainable Cities” [10], offers agendas for cities to grow sustainability, addressing different segments of public management, data collection and national and international benchmarks, stimulating citizens' development, government and business organizations.

Sustainable design should be part of the planning of any city and any public policy, and not just occasional thinking. In 2013, the federal government prepared projects for the joint initiative of four ministries: Planning, Environment, Mines and Energy and Social Development and Combating Hunger, with the primary objective of encouraging federal institutions to adopt actions aimed at the rational use of natural resources. Consequently, this planning eliminates wasteful public expenditure and stimulates innovation and improves process management. More important than the implementation of the program, is the introduction of strategic planning for institutions that aim for short, medium and long-term results.

3 URBAN ACUNPUNTURE

Every city is a complex living organism with overlaying flows of energy that determine how citizens must act [11]. These multiple strings of energy naturally create points of higher



stress, and Urban Acupuncture works by focusing on strategically pinpointed small-scale interventions that alleviate pressure around entire areas, restoring vital signs and creating positive ripple effects. Many architects believe in this theory, and Jaime Lerner, Brazilian architect and former mayor of Curitiba for three terms, was one of its great defenders.

According to Lerner, what bring life to a city are its people, and the better the quality of life of the city the better it will be for all citizens. He believes that a city is a collective dream, and that the involvements of its inhabitants is essential to build this dream.

“It is crucial to project successful scenarios that can be desired by the majority of population, to the point that they commit to it. Building this vision of the future is a process that acknowledges, welcomes and embraces the multiple visions that managers and inhabitants, planners, politicians, business, and civil society have of their city and set up co-responsibility equations to make it happen.” [12].

Urban acupuncture is based on strategic punctual interventions, which are identified through a holistic analysis of the social, economic and environmental aspects of the city and a dialogue between planners and the community. They are aimed at creating new energy and help the desired scenario to be consolidated by triggering positive chain-reactions and helping to cure and enhance the system as a whole.

According to Lerner [13], there are three fundamental issues that bring good quality of urban life:

1. Sustainability: aiming for less consumption of energy, less use of cars, living close to work, using energy efficient materials, etc.
2. Mobility: prioritizing public transportation over private cars; use of all modes available in the most efficient way.
3. Socio-diversity: embracing and celebrating the multiplicity of people that is only possible in urban spaces, ensuring social cohesion and urban safety while allowing for a greater number of encounters within the city and keeping it alive.

These three key points help identifying the issues that are harming the well-being of the population and how urban acupuncture can be used as a technique and design tool for achieving a sustainable urban development that focuses on the needs of people. The idea targets the use of local resources and promotes the idea of citizens caring for the urban renovations, helping boost community morale and catalysing further revitalization. It provides a more realistic and less costly method for city planners to make improvements in communities and counts on participatory planning for achieving greater success.

A small, subtle, bottom-up approach directs a communities' energy in positive ways to heal urban issues and improve the city space. As opposed to large, top-down, mega-interventions that require greater amount of resources, it reclaims the ownership of land for the public and emphasizes the importance of community development through small interventions throughout the city.

4 CONCLUSION

Brazil is going through challenging times, but no difficulty is too great to be overcome. Any city, willingly, has the potential to be transformed for better provided it is embraced with a generous and loving approach. It is necessary to look inward at its own culture, and find what is special and unique, then take these characteristics and develop them further.

History shows that times of crises have been successfully surmounted with investments in infrastructure that boosted the confidence of the people, generated jobs and turned the wheel of the economy. Brazil has an abundance of natural resources envied by many



countries in the world and to protect this wealth is the country's responsibility. The cities have a great amount to do with that.

The changes start locally. But first, it is necessary to spread the knowledge regarding sustainability. Many professionals that work in local governments are still unaware of how to achieve a sustainable urban development. Inform professionals and the community about the benefits of sustainable environments means calling people to action. If more people share the same goal and a collective dream is created, better the chances of the success of this project.

The country could greatly benefit from a program at the federal level that goes into cities with intention to dialogue with the local governments. It should be comprised of a skilful group to pass along the knowledge of sustainability and, in dialogue with local multidisciplinary teams, identify the points of higher stress and act as policy advisors. In the next step, the federal government could finance such developments, making sure that were aligned with guidelines of sustainability and complied with desired outcomes that could be pre-defined by a national agenda. This could significantly impact the development of the country as a whole if there were a serious commitment to strategize and put the plan to action. It would build a stronger and wider network to support local governments with knowledge, advisory and financial resources.

Investments in sustainable urban development can turn the wheel of economy by requalifying spaces, creating jobs, boosting the confidence of the people in their institutions, and improving quality of space for all. That means a holistic approach that considers social, economic and environmental aspects and ensures a paced development to a resilient economy. Local, strategic, pinpricks interventions strengthen communities for lesser cost and positive outcomes create ripple effects. Communities grow stronger and the country benefits as a whole.

Brazil has the potential to be a role model for sustainability. The path is neither easy nor fast, but the moment requires attitude and the time to start is now.

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ALTERNATIVE SOLUTIONS FOR URBAN HOUSING: THE CASE OF BATIKENT SETTLEMENT, ANKARA, TURKEY

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ABSTRACT

The present study is an effort to remember and reveal the potentials of Batikent settlement which was realized in the west part of the capital city of Turkey, Ankara in 1980s. In the period after 2nd World War, big cities in Turkey, like many other countries, entered in the process of rapid urbanization under the influence of mechanization in agriculture and migration from rural to urban areas. Increase in the population of cities and scarcity of shelter brought with the emergence of squatter areas. Batikent settlement was developed as a flagship solution to this housing problem and established a precedent with its model of implementation for future urban cohabitations. Batikent, as a new settlement area, was initiated by Municipality of Ankara and developed a never-before-seen operational model with three main collaborators: central government, municipality and association of housing cooperatives (Kent-Koop). Separation of roles – such as passing fiscal and housing laws, providing financial support, expropriation of land, constructing technical infrastructure, establishing municipal and commercial services, preparing master plan and designing site and house plans – through these collaborators provided this new mass development project with effective, practical and economical solutions. This study will focus on how Batikent was developed as a platform for innovation with the operational model based on dialogue between different parties. Collection of plans from master plans to layouts of apartments, meeting notes and feasibility studies documented and published by Kent-Koop will be used in this study to achieve a better understanding of the planning process of this exemplary quarter.

Keywords: Ankara, Batikent, sustainable settlement, cooperative planning, urban design, Kent-Koop.

1 INTRODUCTION

Explosion in urban population is relatively a new concept for the cities in developing countries like Turkey when compared to European cities which had experienced such a process in the 19th century with the effect of industrial revolution. The population of Turkey, which was 13 million in 1880, reached 21 million in 1950 and 45 million in 1980. Moreover, the percentage of population living in urban areas rose rapidly after World War II from 25 to 44 percent [1]. This increase in urban population caused by migration from rural to urban was not only related to mechanization of agriculture but also associated with fragmentation of agricultural areas because of inheritance and better social conditions proposed in cities. It would not be wrong to say that the problems of rapid urbanization in Turkey have begun in 1950s, a century after European countries.

The urbanization and housing problem emerged in the big cities of Turkey revealed different solutions. While some of these solutions were developed by authorities, some of them were generated by people informally, such as squatter houses (gecekondu) which constituted another urban problem. At the first stage, scarcity of shelter being an urgent problem brought with rapid constructions aiming to increase housing quantity without considering quality of living environments. In 1974, Batikent project emerged as the first attempt to respond the need of cheap and healthy housing in such large scale in Turkey.

The present study aims to describe some of the key issues about Batikent settlement project, especially its original organizational and operational model carried out jointly by cooperatives, local authority and central administration agencies. In order to comprehend the necessities behind the emergence of this new settlement project, it is thought that to begin



with urbanization process of Ankara as a newly-declared capital city, the problems of it in different periods, and developed solutions in accordance with these problems would be useful. The paper will continue with emergence of Batikent project with its organizational model and planning principles and end up with discussing how it is possible to interpret the lessons learned from innovative experience of Batikent with today's point of view.

In order to touch briefly, after the declaration of Ankara as the capital city of Turkish Republic on October 13th, 1923; Ankara entered into a rapid transformation process due to the attempts to enhance the image of new capital city. Günay [2], evaluates the development process of city with three main planning periods. As the first plan of city, 1928 Jansen plan (Fig. 1) proposed a modest approach trying to incorporate social values with the values of new regime in line with the culturalist Garden City understanding. It submits a main artery in the north-south direction which connects the old town in north to the new governmental zone in south and a secondary artery providing east-west extension. It could be said that this new governmental zone called 'Yenişehir' was the first consideration of housing problem in the history of Turkish Republic. Because of the transfer of capital from İstanbul to Ankara, housing problem was peculiar to Ankara at that time and Jansen Plan solved this problem with a low-density neighbourhood comprising of garden houses. As another new settlement planned in this period, Bahçelievler district should also be mentioned as being a cooperative enterprise constructed outside of the city. On the other hand, the macroform developed by Hermann Jansen was considered for three hundred thousand population within the next 50 years; however, at the end of 1940s, Ankara started to experience a critical population pressure and a necessity for a new plan had emerged.

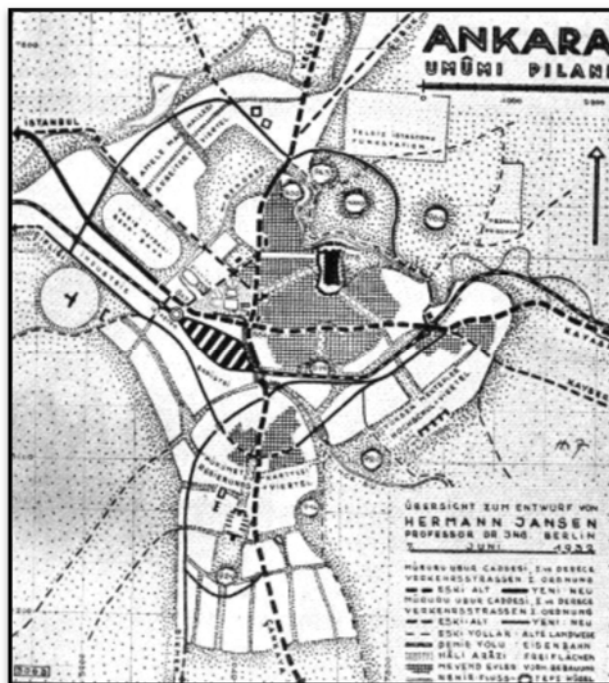


Figure 1: First plan of the capital city, Ankara. (Source: <http://www.goethe.de/ins/tr/ank/prj/urs/geb/sta/jan/trindex.htm>.)

According to statistical entries of Turkish Statistical Institute [3], the overall population of Ankara increased more than two times between 1927 and 1950, whereas the share of rural population decreased from 75.51 percent to 57.48 percent as shown in Table 1. In 1955, a competition was organized for a new city plan and it was won by the proposal developed by Raşit Uybadin and Nihat Yücel in 1957 [2]. As the main contribution of plan, peripheral roads – two arteries towards west, one towards east, one towards north – constituting an intercity highway network could still be observed in today's Ankara.

Table 1: Ankara: Evolution of urban and rural population 1927–1980.

	Years					
	1927	1940	1950	1960	1970	1980
Rural	305,515	414,549	471,141	537,529	574,340	615,722
Urban	99,066	188,416	348,552	783,851	1,467,304	2,238,967
Overall (a)	404,581	602,965	819,693	1,321,380	2,041,644	2,854,689
Percentage of rural population over (a)	75.51	68.75	57.48	40.68	28.13	21.57

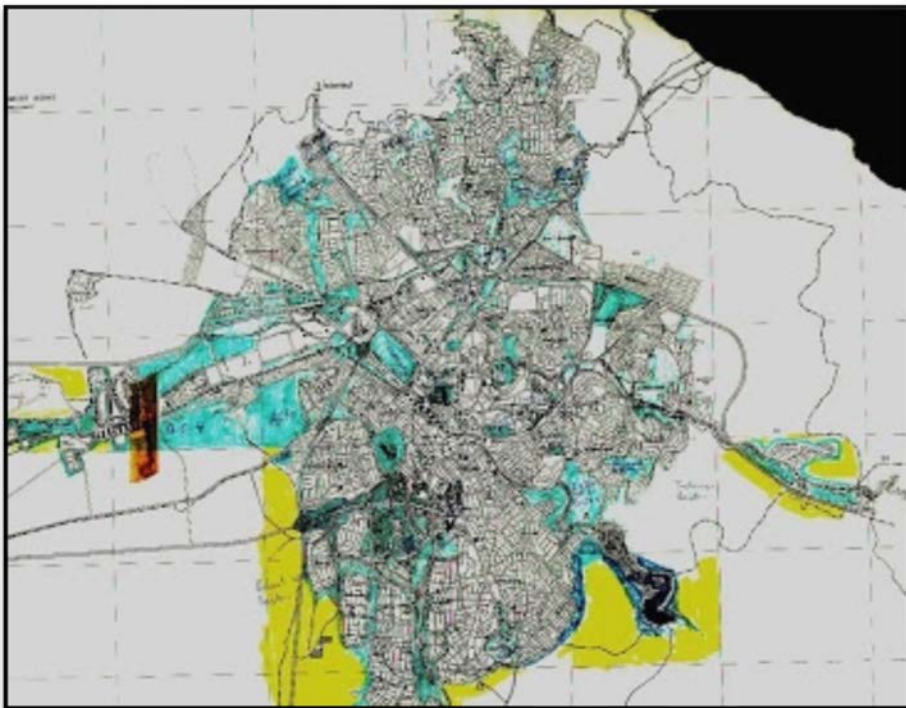


Figure 2: 1957 Uybadin-Yücel plan of Ankara. (Source: http://2.bp.blogspot.com/_j9HNJ1Pyy_M/Sxfrg3DRvII/AAAAAAADI8/mzaRKAj1obk/s1600-h/YücelUybadinPlanu.JPG.)

Uybadin-Yücel Plan (Fig. 2) is generally evaluated as the extension of Jansen Plan whereas it continued to concern central district of the city. In order to deal with the population pressure, Uybadin-Yücel Plan paved the way for increasing the density of central north-south artery which was designed with the principles of Garden City in Jansen Plan. Thus, small-scale private developer could purchase lots in order to construct new apartment blocks and sell each unit to different owners. This 'build-and-sell' concept as a new way for housing in Turkey was also related with The Law of Property Ownership introduced in 1966. Because of the increasing density of cities and inability of local administrations to provide infrastructure for new settlement areas, the law legitimized build-and-sell housing production with allowing the ownership fragmentation in buildings. As another new mode of housing emerged in this period, squatter houses started to be built on peripheries by low-income groups and migrated population from rural to urban. These squatter houses were mostly constructed with poor quality materials without considering infrastructure. Despite their unhealthy living conditions, the housing units were in harmony with topography, the residents could control and create their own living environment within a neighbourhood relationship system which might be hard to achieve in planned housing settlements [4].

As a new settlement area planned in this period, Yenimahalle was formed in order to prevent the increase of squatter houses and unplanned development of the city. It was different from Yenışehir and Bahçelievler examples because the owners were also the constructors of their houses. The lands with ready infrastructure were given to people and each individual built their own house according to their needs [5]. However, as the city expanded, these settlements started to be parts of central city and could not preserve their original formation which was superseded by higher apartment blocks and denser character.

The last planning period mentioned by Günay was the 1990 Master Plan developed by Metropolitan Planning Office in 1970 [2]. This plan proposed a development towards western corridor with respect to natural boundaries of Ankara plain which is closed at the northern, southern and eastern edges with mountains. In order to prevent land speculation and develop solutions for squatter areas and problems of middle and low-income groups, the plan foresaw the placement of squatter prevention zones, new housing developments and industrial zones on this western corridor [6]. In this respect, it would not be wrong to say that it offered a development strategy rather than a macroform proposal. In parallel with the decisions taken in this plan, the idea of creating a new settlement on the west side of the city emerged. With all the experiences gained from previous projects, the intention to form a new town revealed the outstanding example of Batıkent with its scale, organization and construction method, and planning process.

These three Ankara plans mentioned above are critical for this study in order to understand the situation of the city at that time, the reasons necessitated new plans for the city, and accordingly, development process of Ankara. In most general words, in 1970s, increased population, rapid urbanization and squatter areas were main problems of the city. Therefore, in order to solve housing problem, developing new settlement areas especially for low and middle-income groups was one of the major concerns of that time. Hereafter, this study will continue with investigating Batıkent project as an alternative solution to housing problem.

2 PLANNING A NEW SETTLEMENT: BATIKENT

Batıkent (which corresponds to West-Town in English) as a mass development project was located on the Ankara-Istanbul highway at 11 km from the city centre, covering an area of 10,5 million sq.m. surrounded by Atatürk Forest Farm in the west, Ostim industrial area in the north-east and a strip of small industries in the south (Fig. 3). In 1974, the project was initiated by social democrat mayor (1973–1977) of Ankara, Vedat Dalokay, who was also an



architect. He proposed a vast housing development programme to be achieved through expropriation of a large area on the west of the capital city in order to orient the urban development in accordance with 1990 Master Plan [7]. Before going inside the formation process of Batkent, it would be necessary to mention the political atmosphere of that time. At the beginning of 1970s, Turkey experienced an indirect military intervention – coup by memorandum – to end a period of terrorism and political instability. In the period from 1971 to 1980 military coup, Turkey had two general elections, both of which concluded with coalitional majorities of two political parties: Bülent Ecevit's centre-left Republican Peoples Party (CHP) and Süleyman Demirel's centre-right Justice Party (AP). Although Turkey could not achieve stability through general elections, 1973 local elections concluded with the victory of CHP in most of the cities including the biggest cities (Ankara, İstanbul, İzmir) of Turkey by way of Ecevit's contact with non-elite masses and new poor arrivals to major cities. Accordingly, CHP municipalities approached local administration with a new understanding called 'socialist municipalism' [8].

Being one of the prominent actors of this socialist approach, Mayor Dalokay, in order to regulate the social structure and to provide housing for low-income new immigrants, advocated the establishment of housing cooperatives gathered under the roof of Kent-Koop (Association of Housing Cooperatives). In spite of being the centre of decision-making and administration, the Municipality of Ankara preferred to play the role of helping and liberating hand in the operational model of Batkent. At this stage, it would be useful to depict the organizational structure comprising of municipality, housing cooperatives, and central government and planning principles developed to achieve a healthy environment in Batkent.

2.1 Organizational structure of Batkent

The division of labour through three main collaborators of Batkent project (Fig. 4) was determined as following: central government would introduce required fiscal and housing laws, providing financial source for all expanses of infrastructure construction and partly of housing construction; municipality would allocate site, construct technical infrastructure (water, sewage, roads), provide green areas and ensure the social infrastructure such as



Figure 3: The place of Batkent in the city of Ankara. (Source: Rendered by author.)

educational and health facilities; and lastly, Kent-Koop would organize the demands of different cooperatives, prepare the master plan, architectural and engineering designs of houses, order building production mechanisms and maintain control of each actor involved in the process.

In terms of financial sources, Murat Karayalçın [9], who was the president of Kent-Koop between 1981–1991 and the mayor of Ankara between 1989–1993, says that a never-before-seen approach was developed for Batıkent: Kent-Koop made a small amount of payment to the municipality for site; thus, financial burden on municipality was suppressed. On the other hand, for construction expenses, Kent-Koop was expected to obtain credits from foreign and domestic sources apart from the source provided by the solidarity of different civil organizations such as trade unions, associations and professional chambers. However, this model could not be a long-lasting solution. After the military coup realized in 1980, change in government brought with lacking the funds which should have been made by the State and only the local authority left as the supporter of the project. It would not be wrong to say that, under favour of Kent-Koop with its more than 200 associate cooperatives, Batıkent was completed as a self-sustained project.

To mention the inner-organizational system of Kent-Koop as depicted in Fig. 5, it constituted a non-governmental organization whose decision-making bodies were formed by the elected members of associate cooperatives. The general assembly, made up of three delegates from each cooperative, was the main decision-making body of Kent-Koop with annual meetings for operational and organizational discussions. Every four year, general assembly elected eleven members (three of whose constituting executive committee) of board of directors and three members of board of auditors. Kent-Koop with its different professional departments, such as administrative, financial, architectural and technical units, provided services to each associate cooperative [10].

2.2 Planning principles

The initiative works started in 1974 was completed in 1979 with expropriation of area and preparing of development plan for the new settlement. The construction of project was started in 1981 and first settlement comprising of 516 housing units settled in 1983. Whereas half of the total area was planned to allocate houses, the other half was intended for physical, social and other spatial needs of a settlement of 250.000 people [11]. The development plan of Batıkent was prepared according to some principles in order to achieve a well-ordered

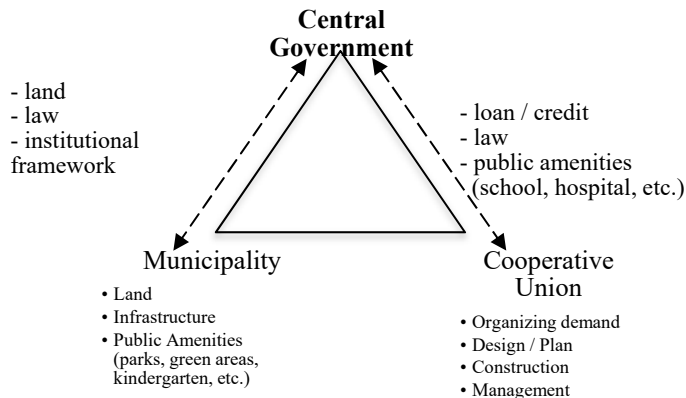


Figure 4: Organization model of Batıkent. (Source: Rendered by author.)

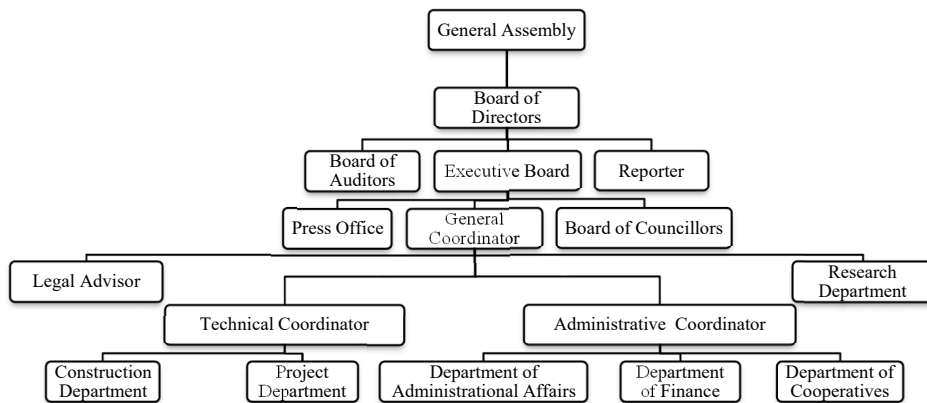


Figure 5: Organization Chart of Kent-Koop. (Source: Rendered by author.)

environment. In respect to this plan, Batikent comprises of five different-scale units identified with varying characteristics.

The smallest unit for Batikent was determined as a ‘cooperative block’ consisting 300 housing units with a social centre for commercial activities. Above the cooperative block, ‘neighbourhood level’ was identified with the facility of nursery. Two neighbourhood units constituted the ‘quarter unit’ which includes a primary school, parks, playgrounds and piazzas. ‘District unit’ formed from five quarter units was characterized by a high school and a subcenter serving to 50,000 people. As the largest unit containing whole settlement, ‘main centre’ was able to serve all Batikent with commercial activities, religious units, social and cultural centres. In total, Batikent was developed with 40 nurseries, 20 primary schools, 4 high schools, 4 health centres and several social and commercial units in proper for 250,000 people.

On the other hand, in order to control the density, the concentration of zones was predetermined as delineated in Fig. 6. Whereas high-rise apartment blocks of brown concentrated area were located around the main centre, orange-coloured medium concentration area encircled the brown zone. Lastly, low-rise units symbolized with yellow colour were placed along the periphery of Batikent. To mention representations of other colours; red zone refers to commercial areas, white zone with purple stripe refers to craft production, purple zone refers to industrial areas, blue zone refers to social facilities and green zone refers to parks.

In parallel with these concentration zones, residential units in Batikent were limited with two types (Fig. 7): duplex houses with small gardens and multi-storeyed (five or ten storeys) apartment blocks. While multi-storeyed blocks were settled by middle-income families, duplex houses were constructed mostly for new arrivals of the city. The reason behind this distinction, as explained in [12], was mostly about approaching housing problem as a social and urban problem. In order to facilitate immigrants’ adaptation to urban conditions, instead of a sharp change, it was intended that duplex houses with gardens would provide a suitable environment for the lifestyle, which they were accustomed to, through maintaining their relationship with land. At this juncture, it should be mentioned that in the publications of Kent-Koop, these duplex houses named as ‘tidy houses’ (Figs 8, 9), referring ordered versions of squatter house settlements. Another critical point behind this envisagement was

the aim of developing a heterogeneous social composition to avoid social and economic segregation. To sum up, the planning principles regulating the formation of Batikent mainly aim developing qualitative solutions to housing problem, as well as considering quantitative aspects.

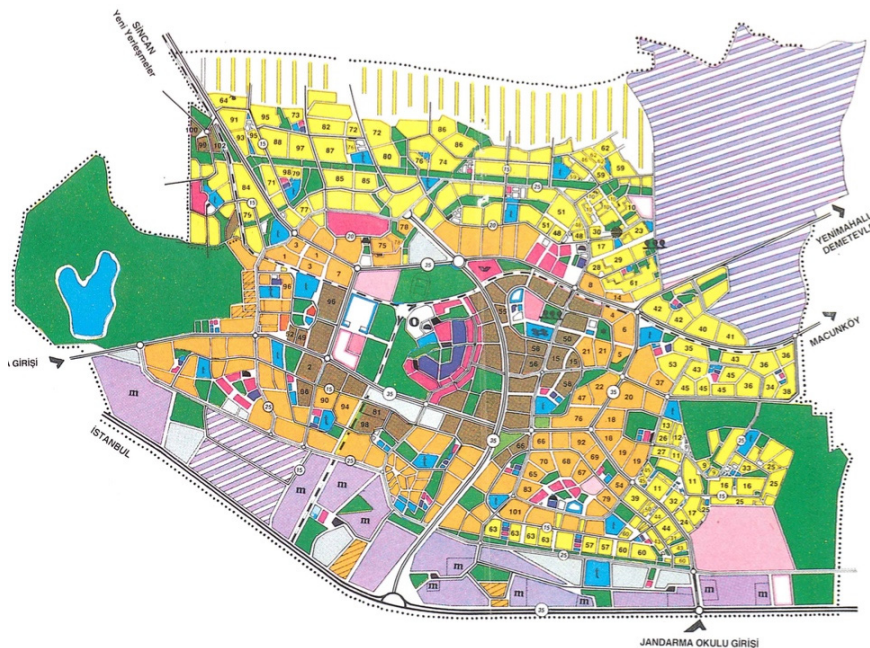


Figure 6: Site plan of Batikent. (Source: <https://archnet.org/system/publications/contents/2949/original/DPT0592.pdf?1384768990>.)

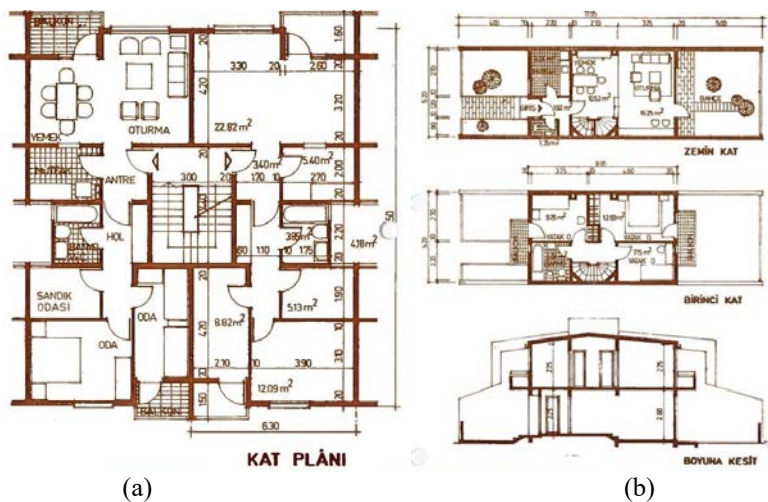


Figure 7: Sample plans of different housing types constructed in Batikent. (a) Plan of an apartment; (b) Plans and a longitudinal section of a duplex house with garden. (Source: Archive of MESA Construction Company.)

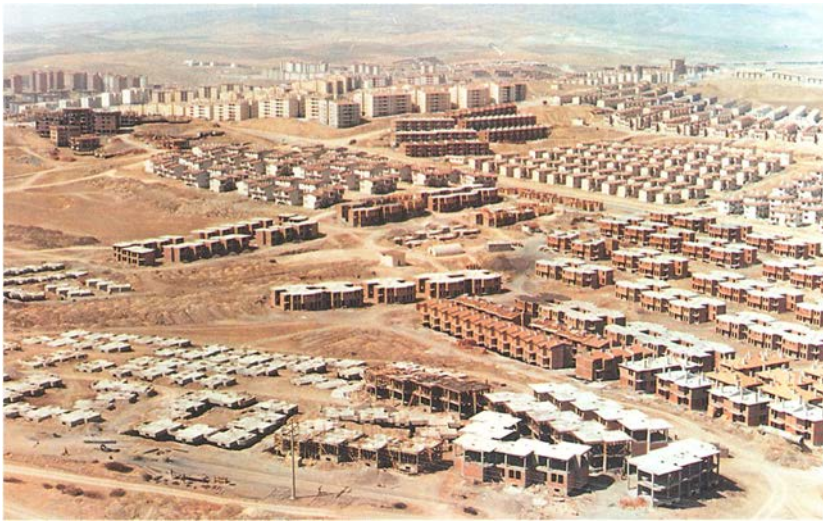


Figure 8: Aerial view of Batikent in late 1980s. (Source: <https://archnet.org/system/publications/contents/2949/original/DPT0592.pdf?1384768990>.)



Figure 9: Current situation of Batikent. (Source: Photographed by author.)

3 CONCLUSION

It could be undoubtedly said that Batikent as an outstanding example proposed more than housing to urban housing problem. With three main collaborators – central government, municipality and association of housing cooperatives, it demonstrated the success of public and private partnership in the field of housing in Turkey for the first time. Batikent project drew its strength from the solidarity, especially of cooperatives gathering people together to

decide for themselves about the characteristics of houses, involve in the implementation process and meet their social and cultural needs through their own organizations. In this way, variations in building designs could have been made and the problem of monotonous environment could have been prevented. Under favour of cooperatively working, the project accomplished to organize real sufferers of housing problem and create a qualified urban sector through the democratic participation of public. Batikent's new model having the aspiration of developing participatory and democratic project was explained with more than 40 publications (housing yearbooks, housing sector reports, books, monthly newspapers, etc) of Kent-Koop in order to set a precedent for following mass development projects realized in different cities of Turkey in 1980s. This national success of Kent-Koop on Batikent project was awarded International Year of Shelter for the Homeless 1987 which was organized by UK Building and Social Housing Foundation [13].

If what Engels said about the urbanization is remembered, we see that he highlighted the overwhelming conditions suffered by low-income groups "The result is that the workers are forced out of the centre of the towns towards the outskirts; that workers' dwelling, and small dwellings in general, become rare and expensive and often altogether unobtainable, for under these circumstances the building industry, which is offered a much better field for speculation by more expensive dwelling houses, builds workers' dwellings only by way of exception" [14]. Since these sentences were written in 1872, there is not much change in the conditions of low-income groups. Problem of housing, as not being particular to a certain geography or time period, is still one of the most prominent matters of today's cities. The model developed for Batikent, although it has turned into a settlement favoured by upper-middle and high-income groups and being considered among the top-choice residential areas in today's Ankara with respect to changing policies, could be evaluated as one of the possible answers of Engels' housing question.

It has passed more than 30 years since the building of first houses in Batikent which presents the opportunity of evaluating whether it could become a successful urban development or not. However, evaluation of current environment with social and physical aspects would be the matter of a different study. What is critical for this one is the liberating aspects of the overall system applied in Batikent and its power to organize people to take an active role for having a proper living environment without abandoning the housing issue to goodwill of private enterprises.

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SAHARAN CITY AND THE PROBLEMS OF URBAN STRUCTURE: A CASE OF THE MICRO-REGION OF SIDI OKBA, ALGERIA

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ABSTRACT

The services are localized according to their sector, in various territories of varying size, so the real organizational unit is constituted by all the centers necessary to provide all the services required by economic activities and the life of the population. In this research, the focus is on the micro region of Sidi Okba, Algeria. This micro regional area consists of several urban and rural centers of different population sizes, different socio-economic situations and a variety of articles related to easements and equipments. The layout of all components of the territory and their potential seem to impose a state of affairs which reflects hypothetically inconsistency and imbalance of its spatial structure which deserves to be diagnosed in order to understand the strengths and weaknesses which characterize it and correct the hiatus in order to achieve balance and consistency as sought by the government. This finding, also shared by managers at different levels of responsibility, begs various research questions: This imbalance is it related to the uneven distribution of public facilities on the centers in this micro region? Or the imbalance related to the demographic distribution of its human settlements? Or even to the poor management in terms of infrastructure and economic activities? The answer to these questions lead to poor urban planning that has been established for many years as head of the inconsistency of the urban structure of the sub-region of Sidi Okba. This research will try to highlight the reality of this spatial entity by using various techniques and analysis models such as gravity models (Reilly model), statistical demographic models (Zipf and Beckmann models) Multi-criteria models (AMC), statistical processing models, as well as the systemic approach that considers the space as an organized whole with inter-related, inter-dependent and inter-active elements of composition.

Keywords: urban structure, urban planning, micro-regional space, urban demography, urban imbalance.

1 INTRODUCTION

Cities can be defined today by quantitative criteria, such as demographic size, density or even the volume of market production. On the other hand, the functional definition of the city can be in its administrative status, its economic specialization or its role in the urban hierarchy or structuring of exchanges and communications.

The micro-region of Sidi Okba consists of several urban and rural centers of different demographic sizes, various socio-economic situations and a range of statutes related to easements and facilities. The disposition of all the components of the territory and their potentialities seem to impose a state of fact that hypothetically translates the incoherence and imbalance of its urban structure.

The objective of this work is to demonstrate the reality of this spatial entity by using various techniques and analysis models such as gravity models (Reilly model), statistical demographic models (Zipf and Beckmann models) Multi-criteria models (AMC), statistical processing models, as well as the systemic approach that considers the space as an organized whole with inter-related, inter-dependent and inter-active elements of composition.



2 METHODOLOGICAL APPROACH

The methods most frequently used in the analysis of modern urban systems in terms of urban structure and hierarchies are: the rank-size law which emphasizes the demographic definition of the centers [1]–[4] and the multi-criteria analysis that favors the functional approach whose urban hierarchy concept includes the differentiation of the centers by their size of the services they make available to the residents and the influence they exert on the space in a given system [5]–[8].

For this, in order to better diagnose the state of the urban structure of the micro-region of Sidi Okba we will analysis the demographic distribution through the use of Zipf and Beckmann models.

About functional analysis, we will use multi-criteria analysis where a grid based on five criteria has been established; A: public facilities, B: retail, C: health, D: transport, E: zone of urban influence.

3 DEMOGRAPHIC ANALYSIS

The total population of the micro-region of Sidi okba is estimated at the end of the year 2016 at 81373 residents [9], distributed on 33 urban and rural centers (see Table 1) on a total area of 1627 km².

3.1 The Zipf model (rank/size): demographic disparity and predominance

This distribution rule of rank/size that is applied to cities consists on classifying them according to the rank of their population, the established relationship between the population of each city and its hierarchical rank in a classification per number of residents would be constant [2]. In a landmark of dual logarithmic scale, X and Y, the curve of the ensemble of points representing the population and the rank of cities follows a line of adjustment. Any significant gap can be considered an anomaly and raises the ‘why’ question?

The application of rank/size model of Zipf on the ensemble of urban and rural centers of the micro region of Sidi okba shows different anomalies.

The first reading of the rank/size distribution shows exist of different gaps which are repeated each time by forming classes of population. The predominance of Sidi okba is evident not only when compared to other centers but even to the result of the line of adjustment where Sidi okba detaches slightly above the line of adjustment (see fig 1) accompanied by its two administrative centers Chetma and Ain Naga of the second class and then third class centers Drouh, Horaya and Seriana. The centers that count a population of less than 500 residents are located below the line of adjustment.

3.2 The Beckmann model: a significant demographic deficit in intermediate and lower ranks

The application of Beckmann model is based on the rank and dimension of the correlation between its three variables (population of the biggest city, population and rank of a given center and the demographic constant μ). A coherent system requires that the size decreases proportionally to the next row by a constant which must have the value of 1 for the biggest city [1]. This model is simplified by eqn (1):

$$Y_n = \frac{x}{Z_n \cdot \mu}, \quad (1)$$



Table 1: The population of the micro-region of Sidi Okba. (Source: *Monograph of Biskra, 2016.*)

Centers	Rank	Population
Sidi Okba	1	35302
Chetma	2	13296
Ain Naga	3	9724
El-Haouche	4	4076
Drouh	5	3521
Horaya	6	3112
Seriana	7	2835
Garta	8	1320
El-Saada	9	1117
Sidi Khelil	10	924
Souiket	11	887
SMB	12	805
Tehouda	13	612
El-Sadra	14	588
El-Dibia	15	324
Zemourra	16	322
Mansoria	17	306
Mebdouaa	18	242
Faid Sella	19	236
El-Maleh	20	223
El-Hamra	21	214
El-Tajdid	22	203
Alb Lagtat	23	189
Zone Faid	24	174
El-Nabka	25	166
Sidi Saleh	26	149
Mnaicef	27	134
El-khafedj	28	127
Trig Chegua	29	123
El-Hmedj	30	118
Trig Saada	31	116
Rokna	32	108
Alb chermat	33	102

where Y_n represents the population of a center n , x is the population of the biggest city and Z_n the rank of the center n .

The deficit and oversized of population depends on the value of the constant μ of each center if it is greater than or less than 1 including:

- $\mu > 1$: shows a deficit.
- $\mu < 1$: shows an oversized.
- $\mu = 1$: shows coherence in the demographic distribution.

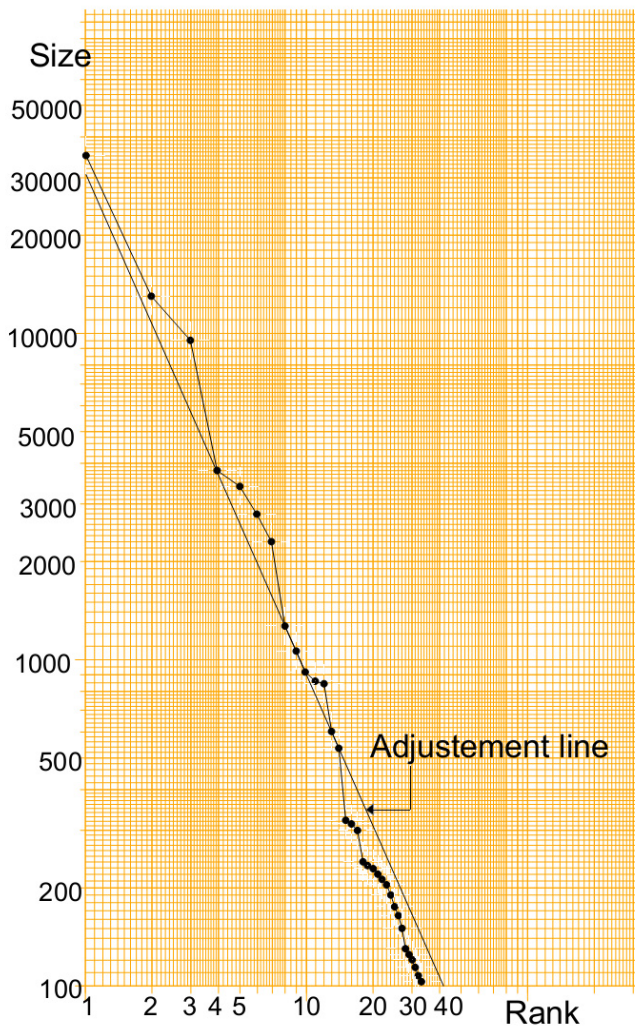


Figure 1: The distributions of the urban and rural centers of the Sidi Okba micro-region according to the Zipf model. (Source: Authors, 2017.)

Ain Naga and to a less degree Chetma that have the constants close to the unit and equal to 1.21; 1.32. The rest of the centers have superior constants than 1 (see Fig. 2). This reflects the demographic deficit of all the centers compared to the population of the biggest center.

The secondary agglomerations know the largest demographic deficit of the whole micro-regional system of Sidi Okba with high constants that reach 10 for Alb chermat and Rokna, the other centers have constants between (1.77 and 9.97). This demographic imbalance is explained by the rurality, the absence of public facilities and infrastructure and the lack of jobs that know these centers.

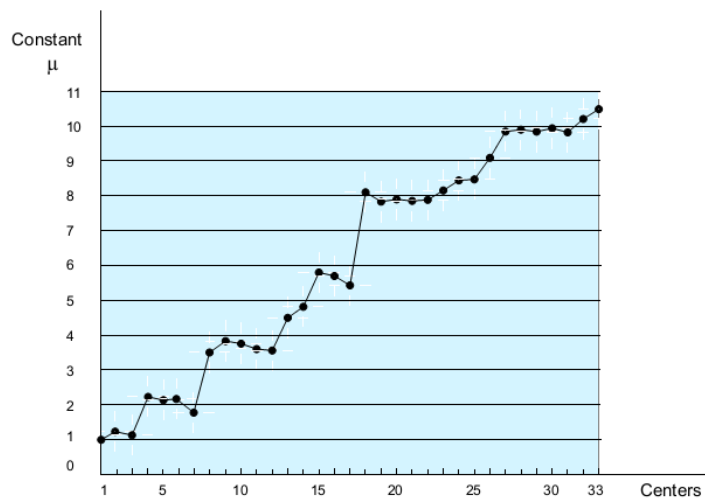


Figure 2: Hierarchy of the urban and rural centers of the Sidi Okba micro-region according to the Beckmann model. (Source: Authors, 2017.)

4 FUNCTIONAL ANALYSIS: THE SOCIO-ECONOMIC SITUATION OF SIDI OKBA MICRO REGION

4.1 The distribution of public facilities

A good distribution of public facilities is aimed at reducing individual transport, ensuring a sufficient user base for each public facility while providing the necessary services for the inhabitants and making the whole region live.

In this sense, we have set up a grid of public facilities hierarchized in six different levels gradually distributed from basic infrastructure to superior services totalling thirty-eight indicators [10] (see Table 2).

Reading the results indicates that the Sidi Okba micro-region is dominated by the center of Sidi Okba, its position at level 6 includes all urban facilities (Level 2 + level 3 + level 4 + level 5), followed by Chetma, Ain Naga and El-Haouche, at the 3rd level. The absence of the secondary centers or poles at levels 4 and 5 reflects the weakness of the distribution hierarchy. In other words, the population of the lower centers (Levels 1, 2 and 3) go directly to the Sidi Okba center because they do not find centers at levels 4 and 5 for their service needs.

4.2 Commercial concentration in the center of Sidi Okba

The classification of the 33 centers of the Sidi Okba micro-region according to the commercial activity (traders, artisans, etc.) gives a hierarchical grid based on the number of retail trade stores per center (see Table 3), including six levels ranging from 01 to more than 200 stores distinguish the 33 centers which constitute the micro-region [11].

24 centers out of 33 in the Sidi Okba micro-region do not have any retail business, a fact that explains the fragility of the urban structure; only 02 centers have between 1 and 3 retail trade stores, which place them at level 2.

Table 2: Hierarchical grid of existing functional public facilities. (Source: M. Cote, 1982, A. Farhi, 2001 and reformulated by Authors, 2017.)

No.	Public facilities	Level	Note
1	Primary school	From 1 to 5 facilities= Level 2	0 facilities= Level 1
2	Drinking water supply		
3	GAS and electricity		
4	Sanitation		
5	Play area		
6	Room of nursing	From 6 to 12 facilities = Level 3	All facilities = Level 6
7	Health Center		
8	Place of worship		
9	Stadium		
10	Taxi stop		
11	Phone network		
12	Post Office		
13	Asphalt road	From 13 to 17 facilities = Niveau 4	
14	Polyclinic		
15	Middle school		
16	Pharmacy		
17	Public lighting		
18	Town hall	From 18 à 38 facilities = Level 5	
19	Gas station		
20	Hospital		
21	High school		
22	Technical High School		
23	Touristic agency		
24	Sports Hall		
25	Swimming pool		
26	Youth center		
27	Hostel		
28	Bus station		
29	House of culture		
30	Library		
31	Insurance Agency		
32	Bank		
33	Financial center		
34	Social security center		
35	Hotel		
36	Dentist		
37	Doctor		
38	Architect		

The commercial sector is dominated by the center of Sidi Okba, which has more than 200 retail trade stores (69% of the total). A single Chetma center plays the second role with 143 retail trade stores, which places it at level 5, at this level appears the weakness of the urban structure of the micro-region of Sidi Okba because only one center plays the secondary role, in spite of its remote distance from the other centers.

4.3 Very unequal distribution of health facilities and medical staff

The center of Chetma has a population of 13296 residents and it regroups 4 doctors distributed in 2 polyclinics, whereas the center of El-Haouche has a population of 4176 inhabitants and it gathers 2 doctors and two polyclinics.

The center of Sidi Okba is at level 6 with a rate of 1 doctor per 1000 residents that is to say 29 doctors for 35302 residents distributed in 4 polyclinics and a service of the surgical emergencies. 17 centers in the Sidi Okba micro-region or 7310 residents have no doctor, which places them at level 1, level 2 and 3 are empty, a break that reflects the inconsistency of the urban structure of the micro-region of Sidi Okba (see Table 4).

The distribution of medical staff is very unequal geographically. Some urban centers have a medical density of less than 5 doctors for 13296 residents, others have a density greater than 2 doctors for 4176 inhabitants.

Table 3: Hierarchy of the 33 centers according to the distribution of trade. (*Source: Authors, 2017.*)

Levels	Trade	Number of centers
1	0	24
2	1 to 3	2
3	5 to 20	4
4	20 to 100	1
5	100 to 200	1
6	More than 200	1

Table 4: Medical staff and health facilities. (*Source: Authors, 2017.*)

Level	Medical staff	Health facilities				Nbr of centers
	Doctor/1000 residents	T.R	H.C	Poly	emergency	
1	0	0	0	0	0	17
2	0	1	0	0	0	11
3	0	0	1	0	0	1
4	1 doctor/4000 residents	1	0	1	0	1
5	1 doctor/2000 residents	1	0	2	0	2
6	1 doctor/1000 residents	2	1	4	1	1

4.4 A weakness in public transport link

In order to classify the 33 urban and rural centers which constitute the micro-regional Sidi Okba area according to the transport criteria, a grid was established based on the number of directions per center and the number of operators, these two indices are related to a third one, that of movement per day because when the number of directions and the number of operators increase the movements per day increase and the centers become more accessible.

The center of Sidi Okba is linked to the centers of Chetma, El-haouche, Horaya, Ain Naga and Sidi Khelil by means of 05 transport lines, of which 10 operators daily make more than 4 movements (1 movement = round trip). This places it alone at level 6.

No center is at levels 4 and 5. At level 3 there are Ain Naga and Chetma, each center has 2 directions, the number of operators is between 1 and 3 with 2 movements per day. At level 2 there are Drouh, Seriana, Horaya, Sidi Khelil and El-Haouche with only one direction per center, one operator and one movement per day.

28 centers out of 33 which constitute the micro-regional space of Sidi Okba are completely isolated from the transport network which explains the absence of the secondary poles in levels 4 and 5 (see Table 5).

4.5 Zone of urban influence

According to Reilly [12], the influence (I) of a center is proportional to its weight (P) and inversely proportional to the square of the distance (D) which separates it from another given center:

$$I = \frac{P}{D^2} \quad (2)$$

The hierarchy by level of the different centers according to the criteria of urban influence by public facilities, retail trade and services has highlighted the four types of attraction ($Att > 75\%$, $75\% > Att > 50\%$, $50\% > Att > 25\%$, $Att < 25\%$), which show different levels of functioning of the micro-regional space of Sidi Okba (see Fig. 3).

The center of Sidi Okba is at level 5, followed by Chetma, Ain Naga, El-Haouche, El-Saada, Souiket and El-Sadra on level 2. The rest of the centers are at level 1. No centers occupy levels 3 and 4. This represents a hiatus to consider.

Table 5: The levels of connection to the transport network. (Source: Authors, 2017.)

Level	Nbr of direction	Nbr of operators	Movement per day	Nbr of centers
1	0	0	0	25
2	1	1	1	5
3	2	1 to 3	2	2
4	3	3 to 5	3	0
5	4	5 to 10	4	0
6	more than 4	more than 10	more than 4	1



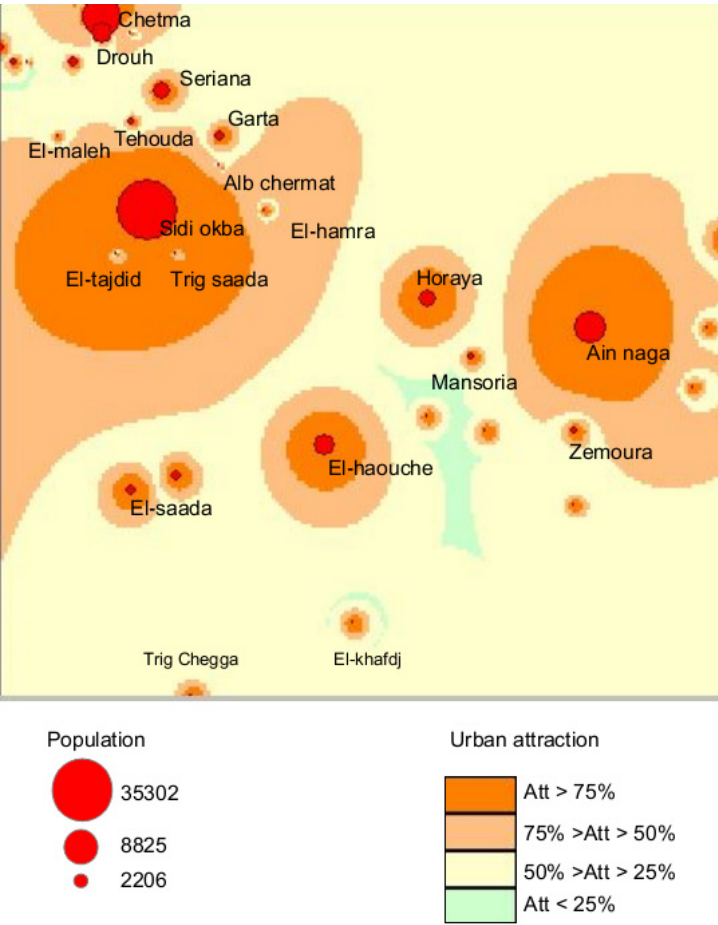


Figure 3: The areas of urban influence according to the Reilly model. (Source: Authors, 2017.)

5 DISCUSSION

The superposition of the results of the criteria applied to Sidi Okba's micro-regional system (A: public facilities, B: retail, C: health, D: transport, E: zone of urban influence) draw up a synoptic table (see Table 6).

This multi-criteria systemic analysis has enabled us to identify the synthetic level pyramid (see Fig. 4).

The reading of the pyramid shows three important facts: the incontestable domination of the center of Sidi Okba, a break between levels 6 and 3, reflected in the absence of the centers at level 5 and 4, which reflects the weakness of intermediate relays and a very large base occupied by three-quarters (3/4) of the centers of the micro-regional system.

The micro-regional system of Sidi Okba is clearly unbalanced, the absence and weakness of the relay centers leaves the center of Sidi Okba receiving thousands of residents to satisfy their needs for services, the concentration of public facilities in one center polarizes the corresponding system.



Table 6: Hierarchy of centers by levels. (*Source: Authors, 2017.*)

Center	A	B	C	D	E	Tot	Level
Zone Faïd	1	1	1	1	1	5	1
El-Hmedj	1	1	1	1	1	5	1
Trig Chegga	1	1	1	1	1	5	1
Alb Lagtat	1	1	1	1	1	5	1
Mnaïcef	1	1	1	1	1	5	1
Faïd sela	1	1	1	1	1	5	1
Sidi Saleh	1	1	1	1	1	5	1
Mebdouaa	1	1	1	1	1	5	1
Alb chermat	1	1	1	1	1	5	1
El-Maleh	1	1	1	1	1	5	1
El-Tajdid	1	1	1	1	1	5	1
Trig Saada	1	1	1	1	1	5	1
Nabka	1	1	1	1	1	5	1
Mansoria	2	1	1	1	1	6	1
Zemourra	2	1	1	1	1	6	1
El-Hamra	2	1	1	1	1	6	1
Souïket	2	1	1	1	2	7	1
Rokna	2	1	2	1	1	7	1
Khafdj	2	1	2	1	1	7	1
SMB	2	1	2	1	1	7	1
Dibia	2	1	2	1	1	7	1
Tehouda	2	1	2	1	1	7	1
Garta	2	3	1	1	1	8	1
Elsadra	2	1	2	1	2	8	1
Horaya	2	2	2	2	1	9	1
Seriana	2	2	2	2	1	9	1
Sidi Khelil	2	1	3	2	1	9	1
El-saada	2	3	2	1	2	10	2
Drouh	2	3	2	2	1	10	2
El-haouche	3	3	5	2	2	15	3
Ain Naga	3	4	4	3	2	16	3
Chetma	3	5	5	3	2	18	3
Sidi Okba	6	7	6	6	5	30	6

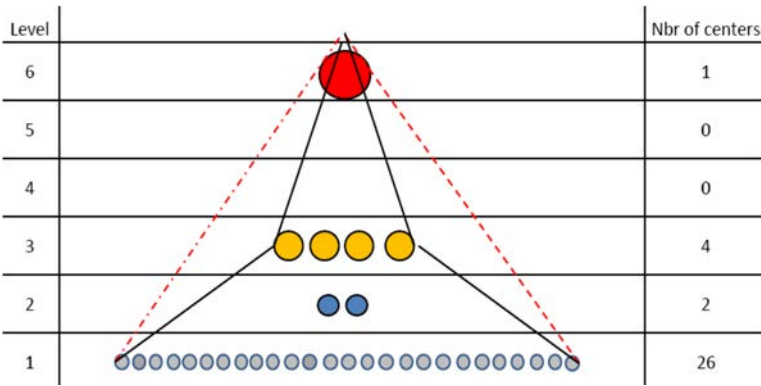


Figure 4: The pyramid of the levels of the centers of the micro-region of Sidi Okba.
(Source: Authors, 2017.)

6 CONCLUSION

In the light of what has been analyzed, we can deduce that the demographic analysis and functional analysis agree on one and the same principle: the incoherence of Sidi Okba's micro-regional system. The centers and agglomerations have not amortized the demographic deficit with the center of Sidi Okba and have allowed the micro-regional system to be increasingly unbalanced. Research based on systemic vision allows us to have an idea of the strengths and weaknesses of a given space. The application of this approach to Sidi Okba's micro-regional system has shown the concentration of facilities, activities and services within the center of Sidi Okba, the absence of secondary centers or relayers that can support this center by constituting a passage relative to the needs of the populations of the other centers causes an imbalance of the urban structure at all levels.

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SECTION 2
URBAN CONSERVATION
AND REGENERATION

CONSIDERING NEW URBANISM, NEW RURALISM AND GREEN URBANISM IN RESPONSE TO MULTIFUNCTIONALITY: THE CASE OF VERKYKERSKOP, SOUTH AFRICA

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ABSTRACT

Paul Davidoff charged planners in 1965, as a profession making urban life more beautiful, exciting, creative and more just, as having little to say. The task thereupon was to train a generation of planners to go well beyond the designers of the sixties in their ability to prescribe future urban life. Nijkamp, in 1980, affirms the utopians' claim that the future is open and flexible, and that every development in the community, could imply a surprising step towards something better. A half century since Davidoff's indications, planners encounter ever expanding planning approaches, "towards something better", ranging from compact cities, transit oriented developments, new urbanism, new ruralism, shared cities, to smart growth and, of late, green urbanism and eco-cities; all in response to multifunctionality. Although the concept of multifunctionality has gained increasing attention the last decade, there is much frustration amongst planners regarding a proper set of broadly based definitions and clear statements concerning its scientific points of departure. This research argues that a combination of planning approaches are a more suitable response in attaining multifunctional land use; especially as megatrends underscore the need for moving away from seeking a predictable single future or outcome. The uniqueness of the Southern African landscape, inherently being rural, necessitated a rural accentuation on multifunctionality. Applying theory-based sampling as part of qualitative inquiry into the recently planned rural village of Verkykerskop, acclaimed by the Charter for New Urbanism in 2012, it is questioned whether the reciprocal employment of planning approaches induced multifunctional rural land use. Offering a design philosophy, whereby "farming, playing and living" is attained through the combined appliance of new urbanism, rural urbanism and green urbanism in planning the rural village, conclusions are drawn relating to the conduciveness of these approaches in achieving multifunctional rural land use.

Keywords: multifunctionality, multifunctional land use, multifunctional rural land use, new urbanism, new ruralism and green urbanism.

1 INTRODUCTION

Paul Davidoff charged planners in 1965 [1], as a profession making urban life more beautiful, exciting, creative and more just, as having little to say. In prescribing future urban life, the obligation was to ensure a generation of planners to surpass the designers of the sixties. Nijkamp [2], affirms the utopians' claim that the future is open and flexible, and that every development in the community, could imply a surprising step towards something better. A half century since Davidoff's indications, integrated planning approaches "towards something better" echo extensively across the different fields [3], of compact cities, transit oriented developments, new urbanism, new ruralism, shared cities, mixed land use to smart growth and, of late, green urbanism and eco-cities; all likely responses to multifunctionality. These approaches prolong the methodologies of the sixties, where urban development and design was known by Jacobs [4], as homogeneous development leading to spatially separated residential-working and commercial areas. It was affirmed by Katz et al. [5], in 1994, that the suburban paradigm that has dominated since the 1940s and 1950s, will not be able to



meaningfully sustain another generation of growth. In intercepting this phenomenon, and in response to homogeneous approaches, multifunctionality is offered to contemporary planners as a holistic solution to development and redevelopment, where this perspective seems to enjoy prominence [6]. The research of Dijst et al. [7], emphasise that traditional planning policies are no longer suitably addressing the demands, stemming from a diverse group of actors, typically found in rural areas. In considering future rural life, Kopeva et al. [8], underlines that multifunctional land use plays a significant role in attaining sustainable development and elaborates that a multifunctional approach, combining economic with ecological principles, augments economic results in peri-urban and rural areas. This paper considers the reciprocal implementation of three planning approaches, new urbanism, new ruralism and green urbanism, to reflect on multifunctionality and draws preliminary conclusions with regard to the case of Verkykerskop, a rural village set in a unique rural South African landscape, and the conduciveness of these approaches in achieving multifunctional rural land use.

2 UNDERSTANDING MULTIFUNCTIONALITY

Most of us have some favourite landscape, M.E. Hardy, 1913

Restructuring is high on the agenda in South Africa, as the recently promulgated Spatial Planning and Land Use Management Act, Act 16 of 2013, requires planners to to grapple rural revitalisation [9]. Coupled with the all too familiar occurrence, described by Keneley [10] as the “dying town syndrome”, the imagination of planners is captured, angling them towards multifunctionality as a promising perspective to implement in revitalising the rural landscape. Although the concept of multifunctionality has gained increasing attention in the last decade, there is copious frustration amongst planners regarding a proper set of broadly based definitions and clear statements concerning its scientific points of departure [11]. A prelude to the complexity of multifunctionality is presented by the research of Batty et al. [12], cautioning “that the whole concept of multifunctionality and mixed use is more convoluted spatially than its discussion implies”. It is perceived by them as a theme running through many substantive discussions of the contemporary urban scene. Attempting to frame a structured point of departure, Brandt et al. [6] postulate a similar complex three tier approach, defining multifunctionality as (i) spatially combining separate land parcels, differing in function, (ii) applying different functions to the same land parcel, but at different times and (iii) applying different functions to the same land parcel but at the same time. Multifunctionality, it seems, proposes the intertwining or combining of different functions by utilising limited space more effectively [13]. The combination of functions should, amongst others, offer increased health and wellbeing benefits for the public and equally secure intact ecological systems [14]. In associating with this interpretation, Vreeker [15], comprehends multifunctional land use as a form of urban development where different land uses are concentrated in a specific area and comprising synergy amongst the combined land use functions.

Far from the partisan agricultural perception of multifunctionality, Wilson [62], takes a step in a different direction by presenting its broader application, to include, inter alia, the “production” of social functions and social capital. Social capital in its expansive terms implies the networks of relationships among people who live and work in a particular society, enabling its effective functioning [11]. He points social capital out, as an impetus for the ultimate creation of social resilience and that multifunctionality, amongst other, is attainable when environmental, economic and social capital are in equilibrium. The leitmotif of Schama



[64], is simply that “landscapes are culture before they are nature”. Hansen and Pauleit [16], lament that multifunctionality should not be understood in a meagre measurable sense of “the more functions the better”, but rather as is a normative approach, implying a broader view on urban areas, being “interrelated social–ecological systems”; a perspective deemed essential to inform the design of planning processes. This perspective is standing in stark contrast with times, when urban development and design, was known to be homogeneous and where planning lead to spatially disconnect residential, working- and commercial areas [4]. In response to homogeneous approaches, multifunctionality is offered as a planning concept for contemporary planners to attain interactive environments, generate social cohesion and economic benefits to the rural community [23]. This discussion is concluded by Nelson [35], in laying claim, that just as the physical landscape is examined, the social landscape must similarly be examined.

This paper consequently pursues a combination of planning approaches as an apposite response in attaining multifunctional land use; especially as megatrends underscore the need for moving away from seeking a predictable single future or outcome [17]. In the contemporary planning fraternity, urban development and design enjoy great focus considering a more holistic approach to development and redevelopment, where multifunctional planning approaches are highly applicable and also serve as a condition for sustainable development [6]. The denotation of multifunctionality infers that the landscape provides multiple material and immaterial goods to meet societal demands and processing of the landscape. Wiggering et al. [18], in this regard, specifically illustrates how land use affect landscape functions and how they satisfy the multiple demands society places on the use and services of the landscape and further suggests that landscape functions should also include biodiversity and habitat functions. De Groot [19], directly relates to this assumption, appositely arguing for a thorough analysis of the ecological, socio-cultural and economic values of the landscape in planning and decision-making, causative towards multifunctional landscapes. In attaining these landscapes, he deems the involvement of local people as significant and their role to be effectively communicated to planners and decision makers. In supporting, and by emphasising the significance of the economic advantages, Balmford et al. [20], maintain that the multifunctional and sustainable use of natural landscapes, typically surpasses the “gains of their conversion to single-purpose land use types”. Collaborative planning amongst economists, ecologists, social scientists and planners (and local people) is stoutly advocated by researchers to obtain understanding in the compromises involved in land use change decisions.

The concept of multifunctionality should conversely be context driven. The uniqueness of the Southern African landscape, inherently being rural, necessitates a rural accentuation on multifunctionality [22]. Nonetheless, it is alarming that despite the proven economic value of the multifunctional use of the natural environment, its large-scale destruction and degradation in the South African rural landscape, is imminent [21]. The increasing pressure on land, if an efficient spatial planning approach is not implemented and improving multifunctional land use is not timely found will, according to Djist et al. [7], result in conflicts and loss of environmental quality. These pressures relate to demographic and lifestyle changes, increased mobility, the growing need for housing in nature, landscape and recreational space conversion and the demand on rural space for water. The challenges for multifunctional land use are highlighted by the research of Pallarès-Blanch et al. [24] and Bielsa et al. [25], contemplating agricultural abandonment and countering it through “naturbanization” (an approach, perhaps, to some extent, related to new ruralism); a process of attracting residential dwellers towards near protected natural and rural areas, thereby

changing the socio-demographic and economic structure, the form of settlements and agricultural landscapes. The causes for changing residential preferences by opting for “suburban or ex-urban residential environments” are concluded by Audirac et al [26], as “...the ideal of owning a single family home, the need for an adequate environment for raising a family, a strong desire for privacy and the appeal of a rural ambience...”.

In explaining the rural landscape’s transition to multifunctional land use, the research of Vereijken [27], recommends physical and economic restructuring thereof; in principle proposing “dualistic planning”, firstly designating areas for “openness, quietness and silence” focusing on nature, recreation, cultivated farms and grazing and secondly designating areas for “main road” functions, permitting living, soft (retailers and services) and hard enterprises (production, trade and transport). In preparing an analysis, the structural arc of this paper ensues new urbanism, new ruralism and green urbanism as probable building blocks in response to multifunctionality and in suggesting the rural landscape’s conversion to multifunctional land use.

3 INTERFACING NEW URBANISM, NEW RURALISM AND GREEN URBANISM

The dossier of scholars, independently contemplating the planning approaches of new urbanism, new ruralism and green urbanism and its relevance to urban and rural landscapes, appears full, but in contrast with a shorter list of thinkers, seeking the collective interface between all three approaches. The difficulty of translating new urbanism principles in the new ruralism philosophies, is lamented by Newman and Saginor [28], indicating that rural communities often encounter the integration of new urbanism concepts in low-density environments as demanding. In a similar attempt, Lehmann [29], firstly by comparing the definitions of new urbanism and green urbanism, then targeting a set of holistic principles for green urbanism, perceives “eco-city theory” as the future of urbanism and the city itself. In turn, the research of Jepson and Edwards [30], advocates that planners notice new urbanism, smart growth and the ecological city as complex approaches to prepare development strategies for, although the ecological city approach was found to be more complementary to the other two. His findings suggest the planning profession’s responsibility to outline a hybrid methodology, prompting this research, in combining a trio of seemingly intertwined planning approaches. The necessity to reciprocally apply more than one planning approach, or a combination of approaches, is promoted by Trudeau [31], as he, similar to Jepson and Edwards [30], identifies a “hybrid urbanism”, describing low-density projects and selecting the attributes of new urbanism in conjunction with other design features that typify conventional forms of development. Given planners’ position of influence “towards something better”, an awareness of the limitations of the approaches of new urbanism, new ruralism and green urbanism, and a clearer sense of collectively defining and correlating them, may well be conducive towards a hybrid approach and a more sustainable development pattern.

Kraus [32], identifies new ruralism as a framework, bridging sustainable agriculture and new urbanism, suggesting an equivalent with new urbanism’s vision of compact, mixed-use urbanised areas, the elimination of low density, auto-dependent sprawl, and distinct edges between towns and their surrounding rural and agricultural areas. Highlighted by several scholars, agricultural preserves may well present itself in the form of green food belt perimeters, buffers between city and rural lifestyles, countryside residences, small agricultural parks in the urban-rural interface or bigger preserves further afield, including larger farms and rural settlements. Several researchers [6], [28], [32]–[35] regard this



combination of functions, in the same spatial unit, aside their status as “spatially well-defined or diffused”, as conducive to the multifunctional landscape.

3.1 New urbanism

New urbanism, as a planning approach, offers diverse dimensions ranging from its direct development principles to laying foundations for social goals and may well be viewed as an already multiple approach to planning. Muschamp [36], formerly described new urbanism as “the most important phenomenon to emerge in American architecture in the post-Cold War era”. He further affirms that the Congress for the New Urbanism started out with an unpretentious approach to, amongst others, model new suburban developments on the compact scale of small towns, increase residential development density, placing urban amenities within walking distance of houses and positioning plans toward pedestrians and public transportation. It was later defined as the creation and restoration of walkable, compact, mixed-use communities, arranged in a manner that its components are still based on conventional development, but assembled in a more integrated fashion; all of which are argued to counteract sprawl and reduce car dependence [37]. Mayo and Ellis [38] added that new urbanism additionally values community, civility, a sense of place, beauty, equity and sustainability, not necessarily reflected upon in conventional planning approaches. In seeking a relationship between design principles and social goals, Talen [39], underscores the Charter principles, applied to social goals, indicating that new urbanism is primarily concerned with common good, followed by social equity and then community. Put forward by Duany and Plater-Zyberk [40], planners tend to focus on the economic and environmental consequences of the urban form, navigating from social consequences and goals. New urbanism is therefore “new”, as it proposes an unusual approach to making suburbs and redeveloping cities by also placing strong emphases on its inhabitants’ well-being.

In a regional context, Bohl [41], endorses its promotion of rural hamlets and villages, small towns in districts, in providing compact alternatives, applicable to different rural settings. Limited research of new urbanism in its regional form and the few new urbanist regional plans in existence, suggest that a better understanding of the different scales at which the urban form is shaped as well as the relationships that exist between elements at the different scales, will be necessary [42].

3.2 New ruralism

New Support for new ruralism gradually increases as scholars are observed intending to frame its definition, approaches and priorities. New ruralism, in broad, is entrenched in past models, comparable with the agricultural context of the ‘Garden City’ and the self-sufficiency components of agri and eco-villages. It furthermore incorporates current initiatives and mechanisms to preserve and enhance regional agriculture and natural resource. Although Nelson [35] agrees that the forces of the new ruralism are already afoot, they are only rudimentary theorised and he perceives building the new ruralism as a necessary step in “sharpening the resolution with which social scientists can describe the effect of place on people”; further adding that we should “examine the social landscape stratigraphically, peering down through all its layers to understand it as a whole”.

In attempting a more refined and comprehensive definition of new ruralism, Newman and Saginor [28], recommend that it should read “clustered, small-to medium-scaled suburban style developments, occurring in rural areas, under urban influence, characterised by large

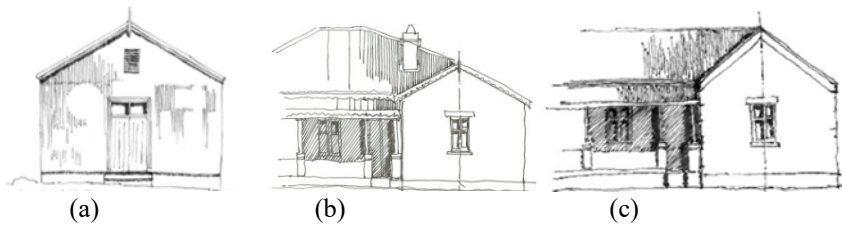


Figure 1: Façade studies of vernacular architecture. (Source: GWA Studio, 2014.)

ratios of viable preserved farmland, that contribute to local and regional food systems and help contain/sustain metropolitan regions”. In attaining permanent preserves, as the primary goal of new ruralism, multiple economic opportunities, optimal preservation of farmland and green space (enabling open space networks) and ensuring stable and adaptable working farms, are also ascertained in their research. Versaci [34], agreeably claims that new ruralism ought to be viewed as the flip side of new urbanism, signalling a strategy to develop new communities in country places, offering a way to preserve the rural landscape and agricultural heritage. He describes new ruralism as a better way to develop rural areas, seeking to preserve the ambiance of a place by reinterpreting traditions, patterns and customs in designing new communities. New ruralism, at its core, considers environmental stewardship in a context of conserving (preserves) agricultural land for vernacular architectural traditions (typically illustrated in the case study of Verkykerskop in Fig. 1), wildlife habitat, natural settings and recreation, but also recognising imminent development markets, where home buyers deem the country life and its features as desirable. It, however, seems more applicable to small- to medium-scale sustainable agriculture, overlapping with areas for wildlife, habitat management and realises the opportunity for adding value to agricultural areas to permit clustered residential development [33].

A workshop aimed at developing a framework for new realism, held at the University of California, April 2006 [43], signalled the opinion of Dean Fraker, that new ruralism is a constellation of many different parts, with strong linkages between the built environment and health as well as the need to observe the urban-rural interface issues in terms of mega issues and regions. Delegates generally agreed to simply tell the story of the lifestyle, recreation and habitat benefits of a new relationship between city and country and concluded that “above all, new ruralism is not just the absence of urbanism,”. Kraus [32] realises that new ruralism is an approach built on twenty years of reform in food, agriculture, and land use planning and determines that sustainable agriculture, made farmers’ markets a basic town-centre amenity. During this time, new urbanism projects and smart growth initiatives have demonstrated the possibilities of creating healthier, more liveable urban centres. She therefore compares new ruralism as a corollary of new urbanism, with a related framework of principles, policies and practices.

Regarding the local agenda, Louw [44], substantiates new urbanism and “new ruralism frameworks” as potential tools for sustainable development in the rural setting of South Africa. A combined strategic approach is called for in understanding the linkages between urban and rural spaces as a mechanism to achieve suitable rural-urban linkages [45] and equality in ensuring balanced investment in urban and rural settlements, to promote linkages and eliminate urban or rural biases. Latterly the farming landscape of South Africa was skilfully divided into cities, towns and countryside; final destinations announcing the vast

wilderness in between. Farmsteads built in the regional vernacular style were dispersed through a mainly open landscape, while small rural towns served as centres for the community. Rather than “bulldozing the countryside into oblivion”, this landscape resonated Versaci’s [34], assessment that the preservation developments of new ruralism draw the best of the past into the present.

3.3 Green urbanism

The Universe is wider than our view of it, Henry David Thoreau, Walden, 1854

Although Laforteza et al. [14] expressed that the city region and its adjacent “wildland interface” appears to be the most useful region for the implementation of green infrastructure, attempts to ensure the incorporation of the environment and urban planning, largely accepted as “green urbanism”, are not contemporary. McHarg [46], already in 1967, urged society to “give expression to the potential harmony of man-nature”. He later, during 1981 [47] indicated that “ecological planning should seek to fit the consumer and the environment”. In the much earlier writing *Garden City of Tomorrow*, Ebenezer Howard in 1902 [48] suggested green urbanism; a political and social agenda recently surfacing. The turn of the century saw a worldwide diaspora of sustainability principles into neighbourhood development [49]. It is believed that, compared to the planning approaches elaborated upon in the preceding sections, green urbanism, as a planning approach, is seen as metamorphic and presented in many forms and tributaries [16], [50], [51]. It emerged internationally as a way of understanding, how green assets and ecological systems function, as part of the infrastructural fabric that supports and sustains society and builds resilience [52]. Apart from its apparent ecological benefits, if managed properly, Tirlă et al. [53], are assured that green infrastructure may become local tourist assets, thus enhancing the communities’ economic benefits and concluded that green infrastructure is able to guarantee the self-sustainable cities of the future. In an era of rapid urbanisation, of which Africa is taking an unenviable lead of 3.5% per annum [54], principles for achieving green urbanism have to be promptly, clearly defined and adjusted.

In generalising, green urbanism theory focuses on adjusting the relationship between urban and nature and has emerged as a conceptual and theoretical basis for a new planning paradigm. Beatley and Newman [56], agree we are “desperately trying to learn how to become more sustainable, how to use less and live better, how to regenerate the ecology of the city and its bio-region and, sense of place, means something in a globalised economy, how to make a new economy out of green jobs and so forth”. Planners are, however, cautioned by Tirlă et al. [53], that the pressing dilemmas of the 21st century have its focus on rapid exhaustion of conventional energy resources, abrupt urbanisation, pollution at various levels and global warming; all having an impact on the quality of life, consequently necessitating the reconsideration of the planning and functioning of settlements. They recommend that this reconsideration may well regard multi-disciplinary approaches, sustainability plans, environments that are quiet, clean and effective, compact communities and green transport, ecosystem services, urban greening, gardens and green roofs, city farms and urban agriculture, renewable energy projects, sense of place and lifestyle. In this respect, Nilsson et al. [57] explain that urban greening embraces the planning and management of urban vegetation on streets, parks, playgrounds, local gardens and the urban periphery, also aiming to add value to the local community. Quite by contrast, Palmer and Simon [58], argues that the world is not able to “merely afford urban sustainability utopianism”.



In view of this contrasting assertion by Palmer and Simon [58], equated with the scholarly emphasis on green urbanism, this paper contemplates whether the mere application of a single planning approach will discourse the “pressing dilemmas of the 21st century”, or will a progressive understanding of the reciprocal application of planning approaches, expand solutions through multifunctionality. Lehmann [29], is adamant that our “cities can and must become the most environmentally-friendly model for inhabiting our earth”. He lays claim that it is more important than ever to rethink cities and their infrastructure, to be compact, comprising mixed-use and a high-level polycentricism. It is not simply finding technical solutions to eco-friendliness, but rather a comprehensive and holistic process of pledging principles for healthy communities. While the linkages between human well-being and environmental preservation are known, Cilliers and Cilliers [59], alert that socio-economic pressures often take precedence in the South African context. The current reality suggests that green infrastructure and green spaces are often neglected or sacrificed, affirmed by Artmann et al. [50], by also emphasising this phenomenon on a regional scale. Green urbanism is not viewed as a phenomenon confined to elite academia. Green infrastructure, ecosystem services, resilience and adaptive planning, amongst other, should form part of the common language of future planners. Green urbanism “has to become the norm for all urban developments” [29].

The ensuing Table 1 aspires to capture the interface of multifunctionality with new urbanism, new ruralism and green urbanism, based on the design principles of each planning approach. The principles of multifunctionality were purposefully selected, based on the literature captured in section 2, aiming to illustrate the possible linkages and interface with the contemplated planning approaches. The selected principles were recoded, applying a theory-based sampling methodology, into six broad thematic categories, considered inherent to multifunctionality and derived from the literature investigation, supporting this research.

4 MULTIFUNCTIONALITY IN RURAL CONTEXT: RESPONSES FROM VERKYKERSKOP

Applying theory-based sampling, as part of a qualitative inquiry, this paper ruminates whether the reciprocal employment of the discussed planning approaches, may well induce multifunctional rural land use. In this instance, the interpretation of Brandt and Vejre [6], is accepted that a multifunctional landscape comprises “several functions at the same time” and further listing examples such as, housing opportunities, wildlife, habitats, groundwater, climate regulation, recreational, aesthetic, cultural and spiritual values. No single paper, will conclusively contribute to the academic landscape and Table 1 should be weighed as an emergent analysis. Pertaining to interfacing, the (i) identified design philosophy and planning approaches employed during the design of Verkykerskop, (ii) relating to the multifunctional principles derived from theory-based sampling, (iii) an overlapping and correlating matrix, was prepared. Following an extensive literature review of the three planning approaches, design principles were selected pertaining to each. These were selected to enable a comparison between the unique design approaches of the case study. All the design principles were not employed, merely a purposeful selection thereof for the scope of this paper. Where these principles interfaced with the principles of multifunctionality, it was nominated as such in the prepared matrix (see Table 1). In applying this integrative approach, a synthesis of the case study and its interface with the three planning approaches, comparative to multifunctionality, is captured. The approach was further undertaken to illustrate whether the reciprocal application of the three planning approaches, was conducive to multifunctionality, in this instance, in a rural landscape. The matrix is not exhaustive and does not reflect upon the complete assessment that was endeavoured, as part of the contributing research. It is



acknowledged as a mere illustration of the conduciveness that seems to exist as an outcome of the reciprocal application of the considered planning approaches, as promising agents to attain multifunctionality. Verkykerskop, replanned during 2012, is located in the Free State province, South Africa, between the rural towns of Harrismith, Warden and Memel. Its setting is characteristic of a predominantly agricultural region comprising, amongst others, facilities in support of the agricultural community in the form of cattle and sheep auction pens and a small community hall. Although the aim of this section is not to comprehensively

Table 1: Multifunctionality interface with design principles of new urbanism, new ruralism and green urbanism [6], [7], [11], [13]–[16], [18]–[20], [24], [25], [27], [29], [32], [59], [61].

Purposefully Selected Design Principles of Assessed Planning Approaches		Principles of Multifunctionality															
		Land Use				Ecology				Economic				Social			
		Land scarcity	Land use synergy	Combination of different functions	Densification & land use mixing	Ecological systems & green services	Ecological impact reduction	Intact ecological systems	Agglomeration vs dispersion forces	Commodity and non-com production	Economic benefits	Rural markets	Society involvement	Social utility in production schemes	Health and well being	Unconventional policies	Countering agricultural abandonment
New Urbanism	Mixed-use/ diversity	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Mixed housing	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Quality architecture & urban design	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Increased density	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Ruralism	Small-medium scale	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Overlapping wildlife, habitat & recreation	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Tourism & residence	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Comprehensive plan	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Green Urbanism	Renewable energy	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Density & retrofitting	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Green buildings & passive design	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Cultural heritages/sense of place	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

deliberate on all the selected interfaces, a brief discussion will follow, demonstrating certain applications of the planning approaches in Verkykerskop, responding to multifunctionality.

From the onset, replanning of the village embraced new urbanism, incorporating new and innovating planning tactics, bidding the interception of the rural town's dying syndrome reprimands [10], but not destroying its rural ambiance. This was attained by inserting focus on historic buildings, landmarks, continued agricultural activities, intact ecosystems and pristine views. A dualistic planning approach followed, identifying "openness, quietness and silence" related areas and "main road" functions [27]. Findings resultant of this approach were comprehensively described in the Green Living Compendium [60], that was prepared for the village; furthermore, including a comprehensive development plan [32]. In optimally utilising scarce land [15], a mere 50 ha of land is earmarked for the replanned village (including the existing settlement), as the remaining farm (measuring 800 ha in extent), perseveres with diverse agricultural activities [11]. Sustainable agricultural and environmental management [19], were integrated into the larger fabric of the village and its surrounding rural landscape in preparing its "green framework" (Fig 2(a)), that delivers a combination green open space [29], productive open space, productive streets, urban and rural productive space and a matrix reflecting on projected ecosystem services, inclusive of green, grey and blue infrastructure. Consequently densification [15] and mixed land use were attained by intertwining different functions in limited space [59].

The proposed residential component [24], [25], pertinently reflecting the regions' vernacular architecture (Fig. 1), is measurably not monofunctional and commodity and non-commodity [11], production (Fig. 2(b)) and processing (Fig. 3 (b)) are permitted. All buildings are pre-planned [60], incorporating energy-efficiency [6] and employing green architecture and ecosystem services (Fig. 3 (a)) [14]. In denoted areas, guest houses are intrinsically permitted [29], augmenting the region's tourism basis [53].



Figure 2: Green framework (a); Production and processing in the residential component (b).
(Source: GWA Studio, 2014.)

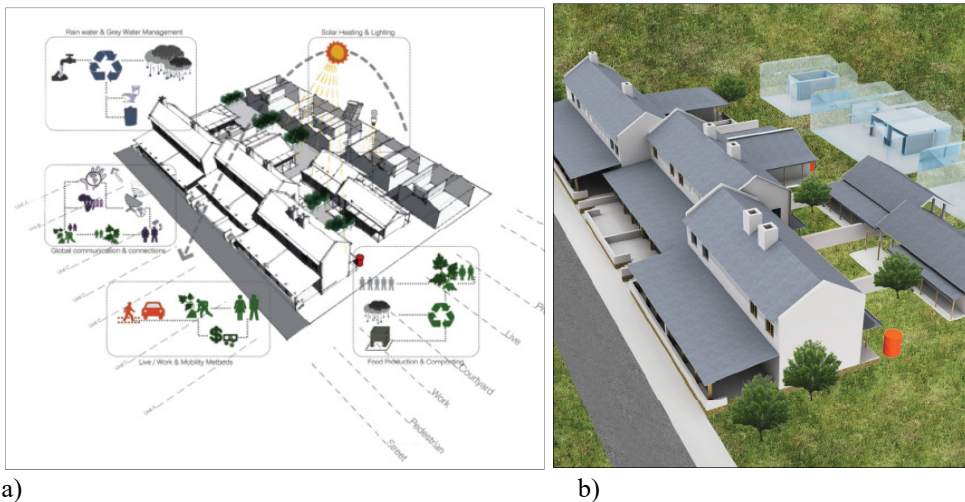


Figure 3: Residential green services, renewable energy (a); Production and processing residential land use options (b). (Source: GWA, Studio, 2014.)

Synergy is additionally created by assigning permissible live-work and live-commercial (Fig. 3 (b)), residential options [15]; all by introducing non-conventional land use management policies [7]. This discussion is simply indicative of a substantial analysis that was endeavoured of the case study, signalling that further papers should be anticipated that will aim at discussing the attainment of multifunctionality in this specific and unique case study, as a corollary of reciprocally applying a trio of planning approaches.

5 CONCLUSION

As a consequence of the continuous pressures exerted on rural landscapes, it may well be concluded that traditional planning policies are no longer suitably addressing the demands of actors, typically found in these areas and that an increasing need for hybrid [30], [31] and integrated planning approaches is required [7]. The case study illustrated that rural landscapes comprise the potential to accommodate multifunctionality; especially by pursuing interfaces between the applied planning approaches. Finding interfaces amongst new urbanism, new ruralism and green urbanism may well inform multifunctional land use. The creation of multifunctional landscapes, as an essential constituent of future rural life, ought to be a traversing theme, attainable amidst various planning approaches, driven by the numerous benefits conducive to the revitalisation of rural areas. Refining the interfaces applicable to the rural context, is the exciting charge forward.

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ADAPTIVE REUSE AS AN EFFORT TO PRESERVE AN HISTORICAL DISTRICT: A CASE STUDY OF THE BRAGA CORRIDOR IN THE CITY CENTRE OF BANDUNG, INDONESIA

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ABSTRACT

Cities are constantly evolving from time to time which can be identified from the development of the buildings. In city centres as the embryo of the city there are still many old buildings which is part of the history and inheritance. In big cities in developing countries such as Indonesia, old building are considered old fashioned, incompatible with time, and destroying them is preferred. Generally, the buildings will be left uninhabited, not well maintained until it becomes obsolete and dangerous. Thus, for security reasons dismantling them will eventually be allowed. This paper describes the development of old buildings in the Braga corridor, an old commercial district in the city centre of Bandung. By applying adaptive reuse method, the style and shape of the shop houses are maintained, while there are some changes and additions in the inside of the shops adjusted to the new functions. Similarly, on the corridor are some changes and additions of the elements that create unique characters of the district, old buildings with modern atmosphere. Since there are many activities can be carried out in Braga corridor, the new appearance of the corridor has attracted many people and become one of the tourist destinations. By exploiting the potency of the city, adaptive reuse can be proposed as a form of technology in development while maintaining old buildings as a cultural heritage. It is expected that the intervention of the local government in the supervision and implementation of the conservation laws can preserve the authenticity and existence of heritage building as cultural heritage.

Keywords: adaptive reuse, sustainable design, historical district.

1 INTRODUCTION

Reduce, reuse and recycle have been hot issues discussed lately. They are related to the decline of the environment quality, decrease of natural resources and damaged environment. Reduce, reuse and recycle could also be implemented to buildings by, for example, building fewer new buildings and optimizing the use of the existing ones, transferring function and reusing the available material.

At present, building function transfer has been generally performed to old buildings. The old buildings in this case were those that were built in the Dutch colonial era. These kinds of old buildings could be found in major cities of Indonesia, and some have been marked as cultural heritage. Not only buildings, but some areas have also been marked as cultural heritage, one of them is the Braga trade area in Bandung city.

The Braga area, also known as the Braga corridor, was constructed in the beginning of the 20th century as an elite shopping area for the Dutch and other expatriates. Thus, the buildings in this area were functioned as shop houses, and still are. This area stretches North to South and is divided into 3 segments, each segment has its own building type and style. The longest segment lies in the middle of the corridor, most of the shop houses in this segment have the Art Deco style. Nowadays, even though some shop houses have experienced some function and physical changes, the remains still illustrate the old area character.

This area used to be one of the prestigious shopping areas. Unfortunately, due to the increase of population, city expansion and growth of economics - which boost the



establishment of new and more modern trade centres - the Braga corridor economics were downgraded. Besides the lack of parking spaces, the relatively high leasing cost has been an obstacle for investors to run businesses in the corridor. As a consequence, some buildings could not be sold or rented, and eventually are left uninhabited. This condition had faded the image of the Braga corridor as an elite shopping area.

Numerous revitalization to attract more visitors had been attempted including developing a mall building, changing the shop functions, but the result was not so great. However, since the change of the city mayor in 2013, the attempts to revitalize the area has shown to have a better result. The revitalization performed by the mayor has not only been on the building functions but also on the road corridor, such as road material change and some additions to the street like benches and unique street lamps. In addition to the physical revitalization, more and more various street public events have been held on the corridor to attract people's interest to come and look at the corridor closer. These events are observed to attract investors as well, so even though some buildings are still uninhabited, many abandoned buildings in the area are refunctioned.

Observing the phenomena in this area, the present study sought an answer to a research question: Could adaptive reuse be one attempt to revitalize a historic area? To answer the question, the qualitative approach and field observation (to some selected adaptive reuse cases based on building type and its adaptation process) were employed. The results showed that an intervention of the local government is needed to supervise the development of the area, and with the adaptive reuse knowledge the existence of the buildings in the cultural heritage can be maintained. The success of the preservation in this area can become an example for other cultural heritages in Bandung city or other cities with similar history and area character.

2 LITERATURE REVIEW

2.1 Adaptive reuse

Adaptive reuse in this paper refers to a process of reusing an old site or building for a purpose other than what it was built or designed for and its approach towards conservation practice [1]. This process is believed to be one of the solutions to revive a historical district and to increase the sense of belonging of the urban community. This process preserves the district potential by maintaining the style and shape of the buildings. It is observed that the Braga corridor has survived for several decades by adapting itself towards modern architecture and different lifestyle. As a result, the corridor has successfully attracted many visitors. However, it still expects more visitors to come. So, what can attract people to the conserved area? According to Plevoets and Cleempoel [2], there are some strategic approaches that can be used: (1) Building within; (2) Building over; (3) Building around; (4) Building alongside; (5) Recycling material; (6) Adapting new functions; (7) Building style. These strategies are believed to lead to sustainability.

2.2 Sustainable design

Adaptive reuse is indeed a part of the principle design process in sustainability. The criterion of sustainability describes three basic human needs: (1) Environment, (2) Social and (3) Economy. While one of the embodiments of sustainable design is in connectivity. Thus, to strengthen the relationship between the sites of the area with the community (as the social aspect), the environment and the economy is by strengthening the value of the local



characteristics [3]. This connectivity could be built by the process of adaptive reuse. As in the case of the Braga corridor, which has strong identity of the place particularly as a historical or a conserved district, this potential will gain the corridor to be preserved for the next generation.

2.3 Historical district

A community needs historic preservation to reserve its historical identity, not simply in order to gain profit from tourism but to give strength and permanence to its local community [4]. Preservation is needed to maintain the identity of the place and the memory of the past. In the Braga area, the local Bandung government has a policy to maintain the buildings and its architectural elements, but it doesn't prohibit adding new elements to the buildings. In Bandung city, Braga is one of the six areas of the districts to preserve as it is a part of Kawasan Pusat Kota (the Downtown Area), according to Perda Bandung No. 19 Tahun 2009 [5]. The Six areas mentioned earlier are: (1) *Kawasan Pusat Kota Bersejarah* (the City Centre of Historical District); (2) *Kawasan Pecinan/ Perdagangan* (the China Town/Trading District); (3) *Kawasan Pertahanan dan Keamanan/ Militer* (the Military District); (4) *Kawasan Etnik Sunda* (the Sundanese Ethnic District); (5) *Kawasan Perumahan Villa dan non-Villa* (the Villa and Non-Villa Residential District); (6) *Kawasan Industri* (the Industrial District).

3 CORRIDOR BRAGA AS CASE STUDY

3.1 Location

The location of Braga Street is in the city centre of Bandung, the northern end of the street intersects with Perintis Kemerdekaan Street and the southern end with Asia Afrika Street as shown in Fig. 1. It is a corridor of Bandung that needs to be preserved and conserved, which until now has proven adaptive through time. Its strategic location and very open accessibility make it threatened as a conservation area in terms of sustainability and its existence. Therefore, it is necessary to get a picture of the characteristics of the sustainable design that can become a consideration in solving the problem and can be a guide strategic plan of its development as a region of historical values.



Figure 1: Braga district. (Source: Edited from Google map 2017.)

3.2 Historical background

Braga Street in Bandung was initially a small road in front of a fairly quiet settlement so called the Road *Culik* (kidnap road) due to its vulnerable condition at that time. This street was also known as *Pedati weg* (cart road). Early in its planning and construction (early 1900), the Braga area was designated as a shopping centre for Europeans residing in the Indies (Indonesia now). Braga Street became extremely busy by that time because many businessmen, especially the Dutch, opened shops, bars and entertainment venues in the area such as *Onderling Belang* shop. In the 1920s there were shops and clothing boutiques that took the model of the city of Paris, France, which was then a mecca of clothing models in the world. As a result, Braga area became the shopping centre and lifestyle of Europeans in the Netherland Indies at that time [6].

Braga, with its own characteristics, is shop house buildings composed two storeys high with a similarity of the façade composition. The buildings have a special typology and character which is the adaptation of the four seasons of the European origin buildings with the footprint in a tropical country of Indonesia. The buildings have Indo-European Architecture Style (*Indo Europeeschen Architectuur Stijl*) which is a combination between the European architectural styles and the local style. The typology of the Indo-European Architecture Style in Braga is a series or twined buildings with a height of two floors with a unity of roof and continuity of the visual elements on the building appearance (Fig. 2).

3.3 Present condition

Along the Braga Street are as many as 94 buildings from the south of the Asia Afrika Street to the north of the Railway Line (Fig. 3). The buildings are mostly located at the segment 2

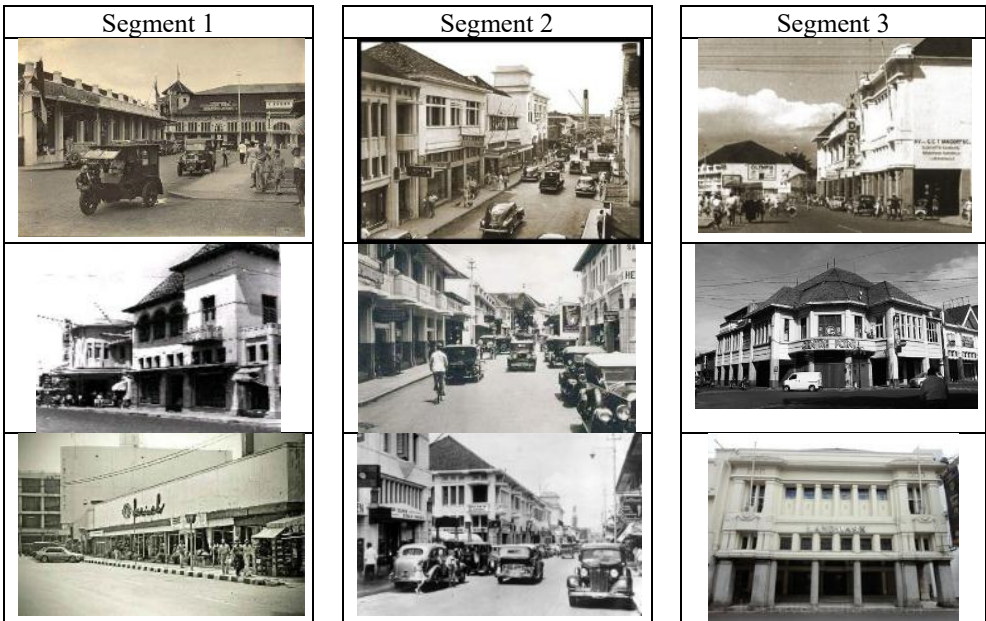


Figure 2: Braga in the past. (Source: David B Soediyono, 2017.)

which has 69 buildings in total. On the other hand, there are only 16 buildings in segment 1 and 9 buildings in segment 3. Buildings in segment 1 and 3 have a different axis than that of in segment 2. This makes segment 2 disparate.

As mentioned earlier, the Braga corridor has the *Indo Europeeshe Architectuur Stijl* (Indo-European Architecture Style) building typology as a Dutch heritage. Thus, the buildings on the foreground are dominated by 2 floor high elevation with shop house typology. In general, there are several building typologies which could be recognized by the front elevation such as: single elevation, double elevations, serial elevations and ensemble elevations.

In addition to the old buildings, currently there are 3 new tower buildings in the area, they are: Ibis Style Braga Hotel in segment 1, Gino Ferruci Hotel and Braga City Walk Hotel and Apartment in segment 2 (Fig. 4). These 3 towers occupy the rear part of the shop house row. The presence of the towers adds building typology that could be divided into 5 types: 1. Single front elevation; 2. Double front elevations; 3. Series front elevations; 4. Ensemble front elevations; 5. Modern front elevation. The Serial, Double and Ensemble front elevations were the initial planning and design idea for the Braga as a European corridor in the Dutch *Indische* [7].



Figure 3: The spread of the buildings on Braga segments. (Source: Edited from Google maps 2017.)



Figure 4: Three new tower buildings.


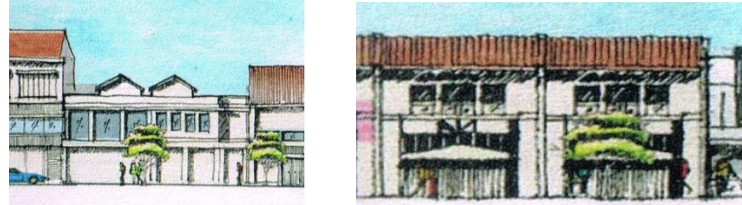
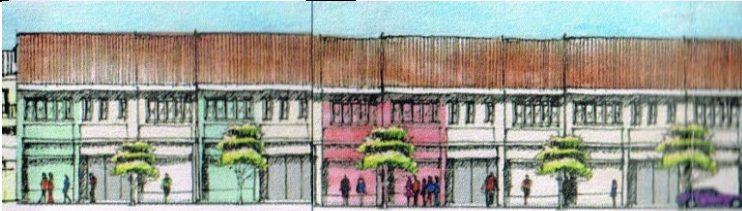


No.	Typology	Figure
1	Single Front Elevation	
2	Double Front Elevation	
3	Series Front Elevation	
4	Ensemble Front Elevation	
5	Modern Front Elevation	

Figure 5: Present's building typologies. (Source: UNPAR Magister Student, 2016.)

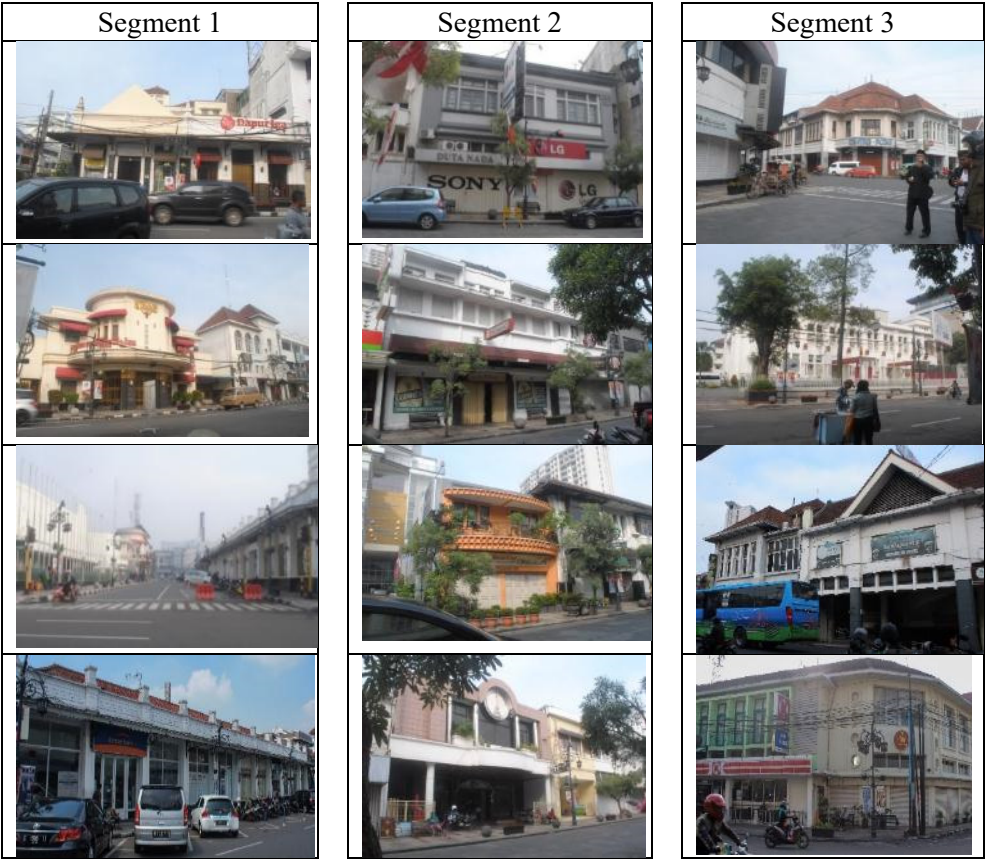


Figure 6: Braga at present condition.

4 ANALYSIS



4.1 The corridor

4.1.1 Street

Table 1: Analysis of activities at Braga.







Activities	Space: street	Captions
Vehicle circulation		<ul style="list-style-type: none">• One-way circulation from south to north• Street material change from asphalt to andesite stone

Table 1: Continued.

Activities	Space: street	Captions
Parking		<ul style="list-style-type: none">One site of the street for a parking lot
Culinary	 (Source : Tribun,2014)	<ul style="list-style-type: none">An event is held once every two weeks on Saturday nights or on special occasions (e.g. Bandung city's anniversary).

4.1.2 Pedestrian

Table 2: Analysis of activities at Braga pedestrian.

Activities	Space: pedestrian	Captions
Sitting		<ul style="list-style-type: none">The sidewalk is dilated by 50cm to a total of 2 metersThe wide of the sidewalk is purposed to accommodate various activities.  <ul style="list-style-type: none">The placement of decoration elements, round stones (bollard), benches, advertising poles, flower pots and decorative lights to beautify the environment 
Waiting		
Selling		
Walking		

4.2 The buildings

This paper only discusses the buildings on segment number 2 considering the specific building style it has, especially on Series type buildings which makes it typical of Braga corridor.

4.2.1 The present condition

Table 3: Analysis of building at present condition.






Present Condition	Captions
Double Front Elevation	
<div> </div>	<ul style="list-style-type: none">• Some buildings could be recognized as the initial shape.• Some have experienced physical and function changes• Physical building changes have eliminated the Serial building typologies which is one of the unique characters of Braga corridor.
Series Front Elevation	
<div> Series of 3 units</div>	<ul style="list-style-type: none">• On the still intact Serial buildings, changes occur in the inside according to the different functions of each unit.

Table 3: Continued.

Present Condition	Captions
 Series of 6 units	<ul style="list-style-type: none">• The appointment of buildings and Braga corridor as a cultural heritage, changes to buildings should get permission from the Bandung city Cultural Heritage team.
 Series of 8 units	

4.2.2 The case studies

The results from the site observation and case study, it is believed that Braga corridor located in Bandung city centre still does have its own attractiveness, one is the enchantment of the buildings and the old environment. It cannot be denied that the history of Braga, once a well-known shopping centre in *Parijs van Java* still imprints so various revitalization attempts performed by the Local Government. The attempts have indicated to have a positive result, proven by the increasing numbers of investors and the fewer number of the unused old buildings.

Modernization and needs for business spaces, modification to old buildings is inevitable. Change is seen as a adjustment to the new functions, differ from the initial function at the beginning of the Braga environment (at the beginning of the 20th century). Applying adaptive reuse technique, the transformation could be under control so that the existence and authenticity of the cultural heriage buildings could be maintained whilst the demand of investors also could be fulfilled. In the meantime, the presence of 3 new tower buildings, contrast to the old buildings, is rated as complementary facilities in the Braga area as a commercial district.

At this moment, the Conservation Law is enacted so the Local Bandung Government requires all changes to buildings and the cultural heritage environment must have recommendation from the Cultural Heritage Team and the implementation itself is under the supervision of the City Government. This effort seems to have worked out, even though not completely 100%, but the Harmonization as a conserved corridor could still be precieved. The success to revive the Braga area is inseparable to the effort of the Government to liven up open spaces surrounding the area such as Alun-alun (city square plaza), Cikapundung River Side and the City hall garden. These efforts contribute to the increase of the economy

of the surrounding people. Therefore, it could also be concluded that the revitalization of this area has a close relation to the condition of the surrounding area.

Table 4: Analysis of case studies.

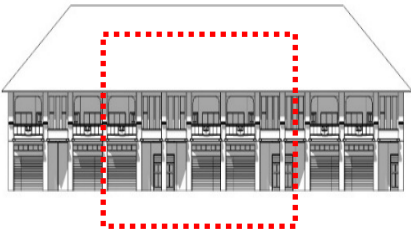


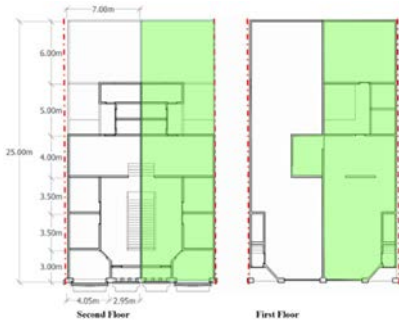
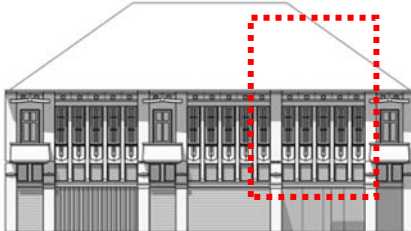

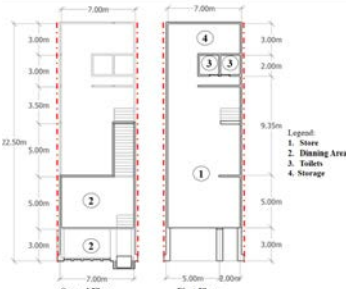
<p>Case 1: One part from Series of 8 units.</p> <p>The uniqueness of this type is that each unit is separated, even the first and the second floor are divided.</p> <p>Every 4 units has one join lobby leading to each unit.</p>	
 	
<p>Previous Condition.</p> <p>The first floor used as a shop house</p> <p>Second floor used as a Bank's office</p>	<p>Present Condition.</p> <p>The first floor used as Sugar Rush Café; The second floor used as an office.</p>
	
<p>Case 2: One part from Series of 3 units of shop houses</p>	
 	

Table 4: Continued.

<p>Previous Condition.</p> <p>It was used as a shop house. The first floor was for the shop and second floor was for the residential use.</p> <p>This unit has been rented several times so the initial condition is no longer recognizable.</p>	
	<p>Present Condition.</p> <p>One unit in the left side is still under construction for a restaurant use</p> <p>The unit in the middle is used as a bar which opens in the afternoon</p> <p>The unit at the right side is used as a mini market “Indomart”.</p>

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HEDONIC PRICING MODEL FOR THE ECONOMIC VALUATION OF CONSERVATION LAND IN MEXICO CITY

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ABSTRACT

Urban sprawl is a worldwide tendency that affects agricultural production land, forests, and areas of environmental value in peri-urban areas. A hedonic pricing model, specified with GIS measures, was applied for a sample of plots for sale in the conservation land (CL) of Mexico City. It was used for determining the value of the urban fringe land and for estimating the impact of both infrastructure and amenities on price per square meter. Physical and locational characteristics of rural land were considered, such as price per square meter of land, supply of public services (water, electricity, sewage), distance to infrastructure and distance to a natural area. Results indicate that the specification performed well across two functional forms (semi-log and log-log). The model showed that proximity to a natural area has positive influence, nevertheless the sewage system is the main feature that determines a higher price. Analyses of land prices in the rural-urban fringe can help in decision-making and policies regarding environmental conservation.

Keywords: hedonic pricing, peri-urban, environmental valuation, land values, conservation land, Mexico City.

1 INTRODUCTION

Cities have multiplied and expanded rapidly worldwide over the past two centuries, so they have increased pressures on the world's ecosystems [1]. According to UNFPA [2], in developing countries, cities of 100,000 or more inhabitants are expected to triple their built-up land area to 600,000 km² in the first three decades of this century. This situation is especially severe in fast urbanizing and industrializing developing countries, such as China and Mexico [3]. Hence, urbanization and city expansion threaten the provision of ecosystem services that are supplied by the periphery.

Rural land, forests and farmland in both the urban and peri-urban areas provide multiple ecosystem services (e.g., biodiversity, climate regulation, rural culture, aesthetic and recreational services and open space), as well as characteristics that impact agricultural production [4]. Thus, these green areas are commonly regarded as a remedy to the urban environmental problems [5]. However, urban sprawl is explicitly affecting peri-urban areas, because they provide land for current and future real-estate developments, so these plots are disputed by diverse sectors, such as agricultural production, ecological preservation, or residential development [4].

Economic valuation of ecosystems has been used since the 1960s, but this kind of studies strongly increased in the 1990s as they provided information on the economic importance of ecosystem services, or the costs derived from their loss, which proved useful for decision-making [6]. It is based on the intensity of changes in people's preferences under small or marginal changes in the quantity or quality of environmental goods or services [7]. There are two broad methodological approaches for estimating economic values of market and nonmarket goods and services: stated preferences and revealed preferences [8]. The latter



category includes the hedonic pricing method, which implies that the economic value of land is influenced by adjacent natural assets.

1.1 Background

The literature examined for the case of Mexico City, reveals few studies on environmental valuation. Almeida-Leñero et al. [9], studied the importance of the Magdalena River Basin. Martínez-Rivera [10], made an economic valuation of the environmental services of agriculture, the recharge of the aquifer and carbon sequestration of the natural areas surrounding Mexico City, labelled as the “conservation land” perimeter (CL). Arreguín-Sámano and Torres-Pérez [11], examined the water ecosystem service of the Magdalena Contreras area. Another valuation study was carried out in the urban wetlands of Mexico City [12] and Martínez-Jiménez's [13] work focused on the economic valuation of hydrological environmental services of the CL, specifically in the mountains in southern Mexico City.

Hedonic pricing models carried out in Mexico City are scarce. In fact, Sobrino [14] conducted a study on housing prices and submarkets in the city, however, this author highlights the lack of information on urban housing prices. Lara et al. [15], used a hedonic pricing model in order to estimate the costs of urban sprawl in the Mexico City metropolitan area. Another example is the study of Chakraborti et al. [16], who analysed the variation in air pollution levels with respect to the values of buildings within the city.

In this sense, this article aims to provide an economic valuation of the Conservation Land in Mexico City by using a hedonic pricing model (HPM). It was estimated for determining which attributes are relevant for plot values in the peri-urban area.

2 THEORY OF HEDONIC PRICING VALUATION

A comprehensive explanation of the history and theory of hedonic pricing is given by Freeman et al. [17]. It was Rosen [18], the first to postulate that houses, or similar heterogeneous products, are not homogeneous and have different characteristics, who defined hedonic prices as the implicit prices of attributes revealed from observed prices of differentiated products. The hedonic pricing models (HPM), including the variables delimited by the geographical information systems (GIS), allow to infer the impact of attributes on the values of a property (e.g., houses or parcels) [19]. For example, one cannot purchase a view of a lake on its own, but must purchase property that provides a lake view as well as other amenities and disamenities associated with the property [20].

Applications of HPM have been used to estimate different land value attributes. Geoghegan et al. [21], incorporated GIS to analyze the pattern of surrounding land uses, which affect land values in Washington, USA. Shonkwiler and Reynolds [22], determined non-agricultural uses of the land, located at the urban fringe. Bastian et al. [19], measured recreational and scenic amenities associated with rural land. The literature reviewed reveals natural or environmental amenities [23], [24], as factors contributing to land values. For example, Tyrväinen [25] studied how urban forest benefits are capitalized in property prices in Finland [26]; grassland in France [27], landscapes also in France [28]. Hence, it is important to note that hedonic pricing is often used to value urban green space [29] and open space [8], [30].

3 METHODS

3.1 Study area

Mexico City has a population of about 8.9 million inhabitants [31]. According to the Land Management Program of Mexico City [32], its surface comprises urban areas (about 60.9



thousand ha (41%) and conservation land (about 873 thousand ha (59%), distributed in nine city municipalities: Cuajimalpa de Morelos (7.5%), Álvaro Obregón (3.1%), La Magdalena Contreras (5.9%), Tlalpan (2.4%), Xochimilco (11.9%), Tláhuac (7.2%), Milpa Alta (32.2%), Gustavo A. Madero (1.4%) and Iztapalapa (1.4%) (Fig. 1).

The Conservation Land (CL) decree was set up in 1978, when the Master Plan for Urban Development of Mexico City, divided the territory into “urbanized sectors, territorial reserves and land dedicated to conservation, recognized as essential (with strong restrictions on land use), in order to maintain the ecological balance of the city” [33], [34].

The CL provides many ecosystem services (ES), such as: aquifer recharge (about 60–70% of available water comes from aquifers); climate regulation; carbon-sequestration and biodiversity preservation functions. It also provides opportunities for recreation, aesthetic and cultural values, as well as production of food and raw materials [35].

Nevertheless, this land has been under several sources of pressure, resulting in a decreased capacity for supplying ecosystem services [33]. For example, urban expansion, from 2003 to 2007, covered 5.3 thousand ha of CL, which is, approximately 1.3 thousand ha per year [36]. Urbanization is characterized by three forms: (1) expansion of traditional towns; (2) poor and illegal settlements; and (3) land occupations by middle classes [37].

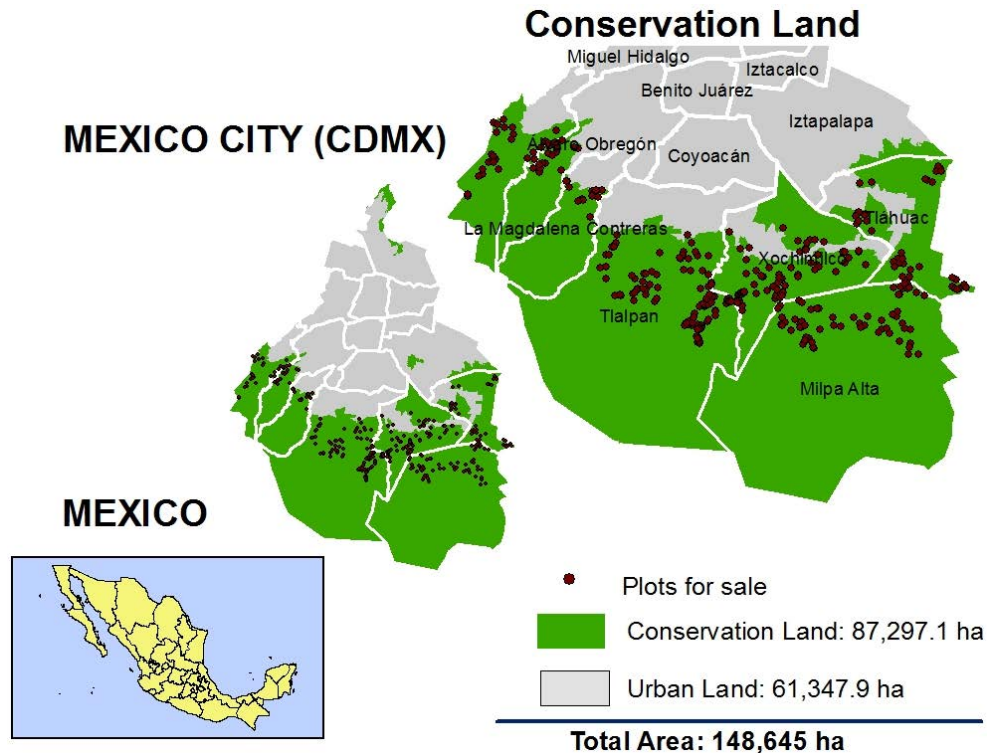


Figure 1: Map of Conservation land in Mexico City showing the sampled plots for sale used in our analysis. (Source: prepared by the authors by using data from INEGI (2010) and PAOT-SEDEMA (2012).)

Another element of pressure is the land use change, which occurs because agricultural income is rather low in comparison to urban income. Therefore, land owners get a greater profit by selling it, rather than engaging in agricultural or forestry activities, which provide a lower income [34].

Despite the ban on the establishment of urban construction in the CL, the expansion of irregular settlements continues to grow, and the real-estate market remains, increasing the environmental deterioration of the entire area. Thus, keeping conservation land as a natural reserve has proven extremely difficult due to urban expansion, both legal and illegal.

3.1.1 The survey

The analysis was conducted for the CL, where developable parcels/plots (e.g., mainly pasture and forest areas) with environmental benefits are being rapidly converted to residential use. In order to estimate the hedonic pricing eqn, fieldwork was carried out from March to August 2016. Data was collected in two ways. One consisted in searching data on real-state websites (www.metroscubicos.com; www.inmuebles24.com), and the other was to map several routes and look for plots for sale banners by foot. The “mystery shopper technique” [38], was used, although this practice is commonly applied in service organizations to measure intangible service experiences. In this case, we act as if we were buyers to get real information on sale prices. The survey provided information for 348 plots for sale located on the CL as shown in Fig. 1.

3.2 Data

Three types of explanatory variables were used: attributes, location and environmental features. The plot attribute's set included plot size and urban services, as electricity, sewage and water service. The second group of variables refers to the location characteristics of the plots, such as proximity to marketplaces, rural communities, highways and roads. Finally, the environmental set relates to the distance to a natural protected area or woodland, and whether the parcel is sloped, which is a feature that determines its suitability for construction. Distances were estimated with a geographic information system (GIS) in which each variable represents the lineal distance from the plot i to the nearest point of each category. The variables used in estimating the HPM are summarized in Table 1.

3.3 Econometric model

We used the typical hedonic pricing equation:

$$P_i = X_i b + \epsilon_i \quad (1)$$

where P_i is the price of plot i , X_i the matrix of explanatory variables (including an intercept), b the vector of parameters to be evaluated, and ϵ_i an error term [28].

The explanatory variables comprise three sets of characteristics: 1) variables that describe urban services, 2) characteristics of the area, and 3) environmental attributes.

The dependent variable (in this case price of plot per square meter - Priceplot) is statistically disaggregated into marginal implicit prices for each explanatory attribute. Linear and logarithmic functional forms were used, with a semi-log and double log specification as the best fit. The semi-log equation estimated was:

$$\ln \text{Priceplot} = \beta_1 + \beta_2 \text{Water} + \beta_3 \text{Sewage} + \beta_4 \text{Electricity} + \beta_5 \text{Market} + \beta_6 \text{Ruralcom} + \beta_7 \text{Via} + \beta_8 \text{Carr} + \beta_9 \text{ANP} + \beta_{10} \text{BOS} + \beta_{11} \text{Slope1} + \beta_{12} \text{Slope2}. \quad (2)$$



Table 1: Variables description and expected sign of coefficient. (Source: prepared by the authors.)

Name	Variables	
	Expected sign	Description (units of measure)
Priceplot	Dependent	Price per square meter of land in Mexican pesos.
Water	+	Dummy variable: 1 if the plot has water service, 0 otherwise.
Sewage	+	Dummy variable: 1 if there is sewage, 0 otherwise.
Electricity	+	Dummy variable: 1 if the plot has electricity, 0 otherwise.
Market	-	Distance to nearest marketplace in meters.
Ruralcom	-	Distance to nearest rural community in meters.
Via	-	Distance to nearest road in meters.
Carr	-	Distance to nearest highway in meters.
ANP	-	Distance to nearest natural protected area in meters.
BOS	-	Distance to nearest woodland in meters
Slope1	-	Dummy variable: 1 if the property is sloped and it is not appropriate for construction, 0 otherwise.
Slope2	-	Dummy variable: 1 if the property is semi sloped and it is not appropriate for construction, 0 otherwise.

For the double log model, the natural log was used for all continuous variables, the equation was:

$$\ln Priceplot = \beta_1 + \beta_2 Water + \beta_3 Sewage + \beta_4 Electricity + \beta_5 \ln Market + \beta_6 \ln Ruralcom + \beta_7 \ln Via + \beta_8 \ln Carr + \beta_9 \ln ANP + \beta_{10} \ln BOS + \beta_{11} Slope1 + \beta_{12} Slope2. \quad (3)$$

4 RESULTS

4.1 Descriptive statistics

We used price per square meter rather than total sale price, to standardize the prices because land parcels considerably varied in size. The average sale price is \$2054.5 (112.9 usd; the average exchange rate from March to August 2016 was 18.2 Mexican pesos per US dollar), with a minimum of \$400 (22 usd) to \$8500 Mexican pesos (467 usd) per square meter, and a standard deviation of \$1351.6 pesos (74.3 usd). The average plot size is about 1800 square meters, with a minimum of 80 to 100000 square meters. The parcel size variable was excluded because its coefficient was insignificant. Descriptive statistics of variables are presented in Table 2.

4.2 Econometric results

The hedonic models were specified and estimated by ordinary least squares (OLS). Several diagnostics were performed to improve the accuracy of estimates. The Jarque-Bera test was conducted, and showed data have the skewness and kurtosis matching a normal distribution.

The White's test for heteroskedasticity, failed to reject the null hypothesis of homoscedasticity, so residuals are homoscedastic.

Multicollinearity, after the Theil index and Variance Inflation Factor, was not found as a problem. It has to be noted, however, that the correlation matrix showed correlation between some urban services variables, due to the fact that these might be complementary. Water and sewage (0.61) and water and electricity (0.63) presented the highest correlation. Since the Durbin-Watson test was inconclusive (i.e. values were in the undefinition zone), we decided, nevertheless, to include these variables in the analysis.

The results of each model (semi-log and double-log, for both dependent variable is the natural log) are shown in Table 3. Both models have a low adjusted R squared statistic: 0.27 and 0.28, respectively. Seven out of 12 estimated coefficients (58%) were statistically significant at the 10% level in the semi-log model. With respect to the double-log model eight out of 12 estimated coefficients (67%) were statistically significant at the 5% level. This indicates that the double-log model had a better fit. As expected, the estimated coefficients of the plot attribute's set were positive, but only sewage was found statistically significant. Signs for the other variables were identical between the two functional forms, except for marketplace variable, which has a negative sign in the semi-log model, however it was not statistically significant. For the double-log model, the estimated coefficients represent elasticities: the percent change in the dependent variable given a percent change in an independent variable [21]. In other words, a 10% increase in distance to a highway leads to a 0.5% decrease of the plot selling price.

5 DISCUSSION AND CONCLUSION

Even though the coefficients were significant, both models presented rather low R-squared values: 0.27 and 0.28 for the semi- and double-log models, respectively. The fact that the constant term in both models was highly significant ($p < 0.01$) means that unobserved variables also explain the dependent variable [39]. Indeed, hedonic pricing modelling sometimes involves low R-squared values which nevertheless, fits the data and also generates reasonable results (e.g. [8], [40]). This might be the expression of very specific features that change according to the local context, which are difficult to measure and include in econometric analyses of hedonic pricing. Geoghegan et al. [21], discuss ways to improve estimates for this method.

Table 2: Descriptive Statistics of the sampled plots for sale in the conservation land of Mexico City. (Source: prepared by the authors.)

Variable name	Descriptive statistics				
	Mean	SD	Max	Min	Units
Priceplot	2054.5	1351.6	8500	400.0	\$ pesos
Water	0.44	0.50	1.0	0.0	Dummy
Sewage	0.32	0.47	1.0	0.0	Dummy
Electricity	0.63	0.48	1.0	0.0	Meters
Market	3151.7	2550.3	11293	197.0	Meters
Ruralcom	633.1	502.7	3388.8	8.9	Meters
Via	429.9	567.2	3441.4	0.3	Meters
Carr	1508.1	2075.1	11557	0.1	Meters
ANP	3275.4	2153.4	9603.9	1.0	Meters
BOS	984.1	1313.7	6221.3	1.00	Meters
Slope1	0.09	0.29	1.00	0.00	Dummy
Slope2	0.66	0.47	1.00	0.00	Dummy



Table 3: Hedonic regression results for semi-log and double-log models.

Variable name	Semi-log model	Double-log
	Coefficient (t-statistics)	Coefficient (t-statistics)
Constant	7.61*** (50.55)	6.68*** (15.33)
Water	0.03 (0.37)	0.08 (1.06)
Sewage	0.21*** (2.92)	0.20*** (2.80)
Electricity	0.08 (1.06)	0.04 (0.62)
Market	-9.96E-06 (-0.70)	0.09** (2.59)
Ruralcom	2.77 E-04*** (4.84)	0.16*** (4.76)
Via	-9.42E-05* (-1.84)	-0.05** (-2.42)
Carr	-3.07E-05 (-1.61)	-0.05*** (-2.80)
ANP	-5.63E-05*** (-3.04)	-0.04** (-2.35)
BOS	-4.92E-05* (-1.67)	9.97 E-03 (0.59)
Slope1	-0.11** (-2.40)	-0.30** (-2.54)
Slope2	-0.28 (-1.42)	-0.09 (-1.23)
R-squared	0.27	0.28
Akaike info criterion	1.40	1.39
Schwarz criterion	1.53	1.53
Durbin-Watson stat	1.64	1.72

*, **, *** Indicates statistical significance at the 10, 5 and 1% level.

In general, the farther from the city center, the lower the land prices [41]. According to Geoghegan [8], this is because towns comprise the main sources of employment, commercial activity, and other urban amenities. It is important to note that the positive sign in the distance variables, does not mean a positive value, but a negative influence on the selling price, since at a shorter distance from that variable, the lower the price of the land. In the present study, it was expected that the MARKET and RURALCOM variables presented a negative sign, but it was the opposite in the case of the double-log model. This may seem a contradiction, however, it could be explained by the importance given by respondents to the presence of urban services near their location, rather than being close to commercial areas, reflecting a lower value for rural areas.

Hence, it would be expected that the availability and proximity to urban services influence on higher land prices. In this way, the model revealed that the value for urban services is differentiated. For example, the sewage system is the main feature that determines a higher price. For the double-log model, if a plot has sewage, the price increases in 20%. Arguably, respondents might see sewage infrastructure as a more advanced stage in urban development, rising their property's value.

The signs of the coefficients of the distance to highways and roads (VIA and CARR variables), correspond to those found by other authors. For example, Izón et al. [42], reported a coefficient of -0.01, consistent with our model value of -0.04 and -0.05. Furthermore, Lara et al. [15], reported that with every 1% increase in distance to the nearest transport center, the sale price was reduced by 0.15%. It means that the greater the distance with the communication routes, the lower the price of the land. Thus, access to the city is considered very important to people.

Regarding the distance variable to a protected natural area (ANP), it turned out to be negative and significant in both models as expected. Therefore, the value of the property in terms of its proximity to a natural area is positive, but low. Thus, for every 10% increase in the distance to the protected area, the price will be reduced by 0.35%. This result supports previous studies that have analyzed the influence of a natural area or forest land [42], [43]. To get the elasticities in the semi-log model, the estimated coefficient must be multiplied by the independent variable mean. In this case for every 10% increase in the distance to a natural protected area, the price will be reduced by 1.8%. The model also shows that land price suffers a 30% discount if the plot is sloped, as it is inadequate for residential housing. Results are consistent with Abelaíras-Etxebarria and Astorkiza [43], who found "reserve effect" on land prices is less powerful than the proximity to the urban area.

In conclusion, the hedonic pricing models presented differentiated value estimates for the sampled plots on sale in the urban fringe of Mexico City. On the one hand, natural areas do have an influence (albeit small) on the selling price. On the other hand, sewage is an important factor in determining the parcel price. This result suggests that individuals value more urban services than open space, and that a parcel not sloped, with sewage system, and access to transportation represents a more valued asset than one located in a rural area. So, this reveals that people who are buying these plots, look presumably for a place to live in close to an urban area, rather than living nearby an environmental asset, because we are facing an informal and irregular land market. Therefore, the information here presented helps to understand the factors of urban growth that can support guiding future public policies. In this sense, to achieve the conservation of this territory, it would be important to focus on stopping investment projects in housing, and to find mechanisms that prevent the sale of plots in the CL of Mexico City.

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IMPACT OF GENTRIFICATION ON THE DEGREE OF SATISFACTION OF RESIDENTS IN RESIDENTIAL AREAS

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ABSTRACT

In the past 20 years in Seoul, South Korea, there have been continuous changes in deprived urban spaces, and, now, the urban trend that began with redevelopment projects has proceeded to regeneration and gentrification. Many Korean scholars are researching about gentrification-related issues, such as changes in physical environment and process of commercialization; however, researches on residents, the most essential element in urban space, have not been accentuated by the scholars. Consequently, this study attempted to put more emphasis on the residents living in the area. The purpose of this study is to reduce negative impacts of commercial gentrification on residents. It investigated general impacts of gentrification on the area; then, it examined the elements that influence the degree of satisfaction of residents. Finally, through factorial analysis, it verified the effects of gentrification on the study area. The results of the study show that the official land price, the number of building permits, construction permits, and pedestrians have increased. Also, a commercialization has been progressed in the gentrified area, and the overall residential satisfaction has decreased from the satisfaction level to the ordinary level. However, 10 of the 15 indicators of housing satisfaction rose and 5 indicators showed a decline, indicating that a gentrification does not give negative impacts on the region. Lastly, the factor analysis, conducted to figure out factors affecting the resident's satisfaction of the local residents, revealed a degree of influence in the order of comfort, convenience, and accessibility. This study is differentiated from the previous studies for focusing on the residents of the gentrification phenomenon. In order to clarify further phenomenon of gentrification in residential areas and obtain more reliable results, surveys and questionnaires should be conducted to residents who are dissatisfied with the area or already left the area.

Keywords: gentrification, degree of satisfaction, commercialization.

1 INTRODUCTION

For the past 20 years, various efforts have been made from urban redevelopment to urban regeneration in order to change the backward regions in Seoul, South Korea. In this regard, "Gentrification", a phenomenon in which the backward residential area is replaced by a certain class rather than the existing resident after being reactivated due to commercialization, has become a rising topic. However, most of the studies in South Korea mainly focus on the trends of gentrification, physical environment change, and analysis of the commercialization process, and there is no research on residents, which is one of the most important factors in urban environment.

The purpose of this study is to investigate residents living in the area from the physical and commercial viewpoint of the city. Also, it will analyze how the effect of the gentrification phenomenon affects the region and the resident's satisfaction on the assumption that the commercial gentrification phenomenon will affect the place and residential satisfaction of residents.

1.1 Scope

The scope of this study can be divided into contents, spatial, and temporal scopes. First of all, the scope of contents is the definition and influence of the gentrification, and the factors



that may affect the residential satisfaction of the resident's due to the gentrification. Spatial coverage includes Yeonnam-dong, Mapo-gu, Seoul, and Itaewon2-dong, Yongsan-gu, Seoul, where commercial gentrification phenomenon is currently the most active in Seoul. Finally, the data on the gentrification sites were constructed and analyzed from 2008 to 2015, and surveys on the residential satisfaction of local residents were conducted from May 26, 2016 to June 7, 2016.

1.2 Method

This study investigated how physical and nonphysical changes due to gentrification affected the region and investigated how the residents' satisfaction with housing changed as follows.

1. This study examined the influence of gentrification through preliminary research and theoretical review, and examined the elements of housing satisfaction measured by residents.
2. Based on the residential satisfaction factors derived from previous studies, it surveyed residents' satisfaction with the residents residing in two selected sites over 5 years.
3. The results of the survey were statistically analyzed with paired t-test, factor analysis, multiple regression analysis, and frequency analysis. Based on the analyzed results, physical and non-physical effects of gentrification occurred at the site and the housing satisfaction factors that affected residents were derived.

2 LITERATURE REVIEW

2.1 Gentrification

The term gentrification was first used in 1964 by the British sociologist Ruth Glass to explain the phenomenon of urban change, where low-income residences in London were replaced by high-income and middle-class residential areas. Since then, the phenomenon of gentrification has been studied extensively in many places in the city. In this study, it examines the phenomenon of commercial gentrification in residential areas.

Zukin defined gentrification as a retail landscape that is transformed into a place for upscale consume. The old residential areas in the downtown area, which had not been attracted to the relative attention due to the suburbanization, were renovated with aesthetic value, leading to an increase in the value of potential rents [1]. The study area is experiencing gentrification similar to what Zukin called, so it is defined as the phenomenon that the backward residential area is reactivated by commercialization. This is a series of processes in which localities are transformed and commercialized by a movement of a certain class rather than the existing residents in an underdeveloped area next to an active commerce area such as downtown and sub-urban areas or a region rich in history and cultural resources.

2.2 Physical and non-physical impact of gentrification

2.2.1 Physical impact

Most studies on existing gentrification have focused on physical changes and have confirmed the relationship between changes in roadside and gentrification. The researches that deal with the physical changes are characterized by the fact that the site is located in the old city area and focused on the physical changes due to the expansion of the commercial area in the low-rise residential area. Especially, in the case of Zukin, the process of creating new

entrepreneurial shops such as boutiques, gallery cafes, restaurants, and interior accessories shops [2].

This study reviewed a number of Korean papers, and most of the previous researches have focused on physical changes, especially on physical forms such as new construction, extension, renovation, and remodelling. In this study, it tries to analyze by using statistical data which is primary data. Therefore, it will focus on the physical changes such as new construction, major repair, change of building usage, number of business, and report of business.

2.2.2 Non-physical impact

Most of the existing studies focused on physical changes of gentrification. However, not only the physical impact but also the non-physical impact is also very important and largely influential to localities. Zukin analyzed not only the physical changes due to the entry of new entrepreneurial shops but also various perspectives, and urged policy changes [2].

The studies of non-physical impact of gentrification in Korea have been studied in relation to the change of the number of pedestrians, the change of the land value, and the change of the symbolic ownership. Ahyun Song revealed the symbolic ownership and the change of local image in the commercialization process of the residential area in case of Yunnam-dong area [3].

In this study, it analyzes statistical data related to non-physical changes such as land price, number of pedestrians, sales, and regional image in order to figure out the non-physical change of commercial gentrification.

2.3 Positive and negative impact of gentrification

2.3.1 Positive impact

Gentrification has a lot of influence on the society, and there are many changes in the urban space due to the gentrification. In particular, gentrification is being actively carried out for various reasons in commercial areas in Korea such as Hongdae, Garosu Street, Samcheong-dong, Gyungridan Street, Suchon, and Yeonnam-dong. Gentrification in the commercial space has been positively evaluated in terms of spontaneous revitalization of the underdeveloped urban areas, and is adding to the rise of new places of consumption. In addition, it has been positively evaluated because it can increase the local government's tax revenue and bring the middle class back into the city [4]. Gentrification changes the area making similar kinds of groups match each other, and it prevents the social conflict and makes new neighborhood. Furthermore, the declining region has stabilized and the real estate value of the region has risen [5].

2.3.2 Negative impact

Gentrification can be a source of concern because of excessive commercialization. According to various media, new upper class entering the downtown area increases the rents, so that the existing residents and merchants are being kicked out. In the case of low-income households, due to the limitation of housing costs, there is restriction on the choice of the residence and falling into the homeless.

2.4 Residential satisfaction

Housing satisfaction is an emotional response to the social, natural, and physical environment in which people live. From the perspective of residents' satisfaction with residential services, residential satisfaction means the level of subjective satisfaction of residents. The importance



of residential satisfaction was firstly mentioned by Fried and Gleicher, and it was defined as the most appropriate criterion for evaluating residents' satisfaction and residential quality among various types of residence concepts and forms. Francescato et al. and Craik and Zube found that by measuring housing satisfaction, they could induce public institution's efforts to improve the current residential environment. Since then many studies on the satisfaction of housing have been studied based on various variables, and many studies have been conducted in Korea. Han defined residential satisfaction as the degree of subjective satisfaction of the residents in residential housing [6]. Choi showed that characteristics of the various variables surrounding the resident area affects the decisions of the residents on the choice of housing [7]. This means that the value of the housing meets the purpose and the desire of the human being, and the internal and external housing environment of the house should be done together.

3 STUDY DESIGN

3.1 Selection of study area

The candidates of the study area were selected from the areas of commercial gentrification in Seoul. Commercial gentrification phenomenon occurs mainly in residential areas and semi-residential areas, and is happening in low-rise residential areas adjacent to core commercial areas. The candidates of gentrification-occurred area for the analysis is mainly located in the vicinity of the nearby commercial and historical cultural properties and has a low rental rate compared to the core commercial areas. In the end, Yeongnam-dong and Itaewon 2-dong were selected.

3.2 Research question

The purpose of this study is to investigate the physical and non-physical effects of gentrification on the region through theoretical considerations. As a result, it can be seen that the influence of the gentrification is influenced by the change of the area and the residents living in the area. So, how does the effect of the gentrification affect the local people? The following detailed questions were derived from the question.

1. What are the changes in the area due to the effects of commercial gentrification?
2. How has the residential satisfaction of residents living in the area changed as a result of the phenomenon of gentrification? What are the residential satisfaction factors that affect satisfaction?

3.3 Variables setting for residential satisfaction

The variables of residential satisfaction which are considered to affect the satisfaction of residence in the residential area were set up primarily by the gentrification prior to setting the variables. In order to ensure the reliability and accuracy of the selected factors, it conducted a questionnaire consisting of 30 experts who were studying gentrification or practicing directly, and revised and supplemented the elements through questionnaires. As a result, it excluded three variables which were considered to have no effect on residential satisfaction due to the effect of the gentrification. Among the variables, "pedestrian safety and convenience" were classified into "pedestrian safety" and "walking convenience". Table 1 shows the 18 selected housing satisfaction variables for this study.



Table 1: Selected variables.

Variables	Selected Variables
Cleanliness of roads and walkways	Cleanliness of roads and walkways
Pedestrian safety and convenience	Pedestrian safety
	Pedestrian Convenience
Parking Space	Parking Space
Educational Environment	Educational Environment
Convenience of commuting	Convenience of commuting
Local Image	Local Image
Property value	Property value
Investment value	Investment value
Place Attachment	Place Attachment
Privacy	Privacy
Noise Pollution	Noise Pollution
Security and Crime	Security and Crime
Ease of use of leisure facilities	Ease of use of leisure facilities
Ease of use of neighborhood facilities	Ease of use of neighborhood facilities
Ease of use of cultural facilities	Ease of use of cultural facilities
Use of car	Use of car
Residential level of local residents	Residential level of local residents
Meeting place of villagers	Excluded
Disaster safety	
Relationship with neighbors	

3.4 Survey design

The questionnaire was conducted at Yeonnam-dong, Mapo-gu, Seoul, and Itaewon2-dong, Yongsan-gu, Seoul. The questionnaire was conducted for a total of 13 days from May 26, 2016 to June 7, 2016 for residents who live for more than five years based on the administrative boundaries of the two sites. The total number of questionnaires was 123, but the two questionnaires were excluded, which were unresponsive and unanswered. 121 valid questionnaires were obtained from the two sites. The questionnaire included general characteristics of the respondents, including gender, age and occupation, years of residence and type of building. The main content of the questionnaire is to compare the level of residential satisfaction between 2011 and 2016, and to measure the level of overall residential satisfaction and how the score of the factors that constitute residential satisfaction changed. The outline is shown in Table 2.

4 ANALYSIS METHOD

4.1 Analysis on local impact of gentrification

In order to analyze more precisely the change of the influence of the gentrification phenomenon in the area, it constructed a time series analysis data of 9 years based on the data from 2007 to 2015. By constructing this data, it was thought that it would be possible to analyze not only the commercial area but also the change of the living area. Therefore, it analyzed the changes due to the gentrification of the site by conducting a cross-sectional



Table 2: Outline of survey.

Category	State
Area	Yeonnam-dong, Mapo-gu, Seoul Itaewon2-dong, Yongsan-gu, Seoul
Target	Residents residing in the site for more than 5 years
Date	May 26, 2016 ~ June 7, 2016
Method	Random Sampling Interview Method
Type	5 Point Likert Scale, Nominal Scale
Contents	Respondents general, satisfaction with residential satisfaction factors and overall residential satisfaction
Total Number of Copies	121 valid copies of 123 copies

analysis and tried to deduce the correlation with the influence of the indicators according to the change of data.

4.2 Analysis on residential satisfaction

4.2.1 Change of satisfaction

This study measures the satisfaction of residents who have lived in the area for more than 5 years in order to find out how the satisfaction of the residents in the area has changed. During interviews, residents were asked whether they had lived in the area before 2011, which is considered to be before the occurrence of the gentrification phenomenon. The survey was conducted only on residents who had lived before 2011. The questionnaire consisted of 18 housing satisfaction factors about satisfaction before 2011 and after 2016 (5 point Likert scale). The paired t-test was used for the analysis by SPSS statistics21.

4.2.2 Analysis on satisfaction factor

In order to investigate the satisfaction factors of residential satisfaction, 18 factors were selected as independent variables to analyze the satisfaction of housing as Table 1. The dependent variable used overall satisfaction for residential satisfaction. Factor analysis, reliability analysis and multiple regression analysis were used for statistical analysis. Statistical program was SPSS statistics 21.

5 ANALYSIS RESULT

5.1 Analysis on local impact of gentrification

5.1.1 Yeonnam-dong

In Yeonnam-dong, Mapo-gu, the rate of change in many indicators has started to change significantly due to the influence of commercial gentrification in 2011. Among physical changes, the rate of change in construction permits has increased significantly. In 2011, after one big increase, it showed stagnation for a while, and then it increased steadily. Particularly, there is a bigger change in permits of new construction than a change in permits of changing building uses. It is inferred that when a new building is introduced into an undeveloped area, physical changes occur in the neighbourhood. In addition, the number of restaurants has been steadily increasing.

Among the non-physical changes, the move-in population of Yeonnam-dong decreased on average, while the number of move-out increased. The total population gradually decreased. It is inferred that the quality of housing has declined due to the commercialization of residential areas, the total amount of housing has decreased, and the number of transfers has increased. The number of sales and the price of the house also steadily increase, and it can be seen that the transaction of the house in the surrounding area increases and the price increases. It is believed that this will encourage the departure of the native residents. Finally, the number of pedestrians has increased explosively, and the number of refers to large portal sites has also increased. The commercial gentrification phenomenon has changed the image of the neighbourhood, and visitors are increasing.

5.1.2 Itaewon2-dong

The rate of change in many indexes also started to change significantly in 2011 and 2012 in Itaewon2-dong, Yongsan-gu. Like Yeonnam-dong, Itaewon2-dong showed a remarkable physical change. Except for 2009 and 2012, construction permits continued to increase. Not only the construction permits for new construction, but also the construction permits for change of building uses have increased. It is inferred that not only are new stores coming into the underdeveloped area, but also existing buildings are changing for commercial purposes. In addition, the number of restaurants is also increasing sharply.

Looking at non-physical changes, on average, both move-in and move-out transfers of Itaewon2-dong decreased. However, the total population was decreasing because there were more moving out than moving in. This is also attributed by the decrease in the quality of housing and the decrease in the total amount of housing due to commercialization. The standard land price has been steadily rising, and also the number of trades and the price of the residence have steadily increased. Especially, when the number of trades is increasing considerably, it is deduced that the increase of the prices often causes the native residents to dispose of their houses. In addition, the number of pedestrians and the number of refer to large portal sites have increased sharply. It is also deduced that many references in various media changed the image of the area, thereby increasing the number of visitors.

5.2 Analysis on change of residential satisfaction and satisfaction factor

5.2.1 Demographic characteristics

The demographic characteristics of respondents were 26% for males and 74% for females compared to males. By age, 4.1% of respondents were in their 20s, 14.6% in their 30s, 18.7% in their 40s, 22.8% in their 50s, 18.7% in their 60s and 21.1% in their 70s and over. In the case of residence type, 66% of the residents, 25% of the charterers, and 9% of the renters were listed. The residence period was 24% for less than 10 years, 18% for less than 20 years, 12% for less than 30 years, and 46% for more than 30 years. In the occupation group, homemakers accounted for 62%, private businesses accounted for 15.7%, sales and service accounted for 2.5%, office & technical accounted for 2.5%, professional & liberal posts were 4.1% and others accounted for 13.2%.

5.2.2 Change of residential satisfaction

A paired t-test was conducted to examine whether the effects of commercial gentrification had a significant effect on the change of residential satisfaction for the local residents. Test compared with the year 2011 in which Gentrification appeared and the year 2016 in which the survey was conducted.

Overall Satisfaction level, which was satisfactory level in 2011 (3.64), changed to unsatisfactory level (2.90) in 2016. Except for three factors, “pedestrian safety”, “neighbourhood affection”, and “investment value”, all other factors had a significant impact on residents' satisfaction compared with 2011 and 2016.

Satisfaction with most factors has declined due to the impact of gentrification. Especially, the factors showing the greatest change were the ‘cleanliness of roads and walkways’, “educational environment”, “privacy”, and “noise pollution”. With the three factors, the average of satisfaction dropped by more than 0.7. It is inferred that the street became dirty and noisy because of the rapid increase of pedestrian’s due to commercialization.

The five factors that showed an increase in satisfaction were “regional image”, “property value”, “using cultural facilities”, “ease of using rest and leisure facilities”, and “residential level of local residents”. It is inferred that the regional image has risen due to the commercialization of the region, the increase of the property value of the region, and increased visitors. In addition, the ease of using rest and leisure facilities has been increased by the introduction of cafes and leisure facilities in the area, and the introduction of cultural

Table 3: Residential satisfaction before and after the gentrification phenomenon.

Residential Satisfaction Factors	Average		Standard deviation		t-value	p-value
	Before (2011)	After (2016)	Before (2011)	After (2016)		
Overall Residential Satisfaction	3.64	2.90	0.532	0.870	7.398	.000
Cleanliness of roads and walkways	3.29	2.55	0.554	0.718	8.318	.000
Pedestrian Safety	2.89	2.79	0.560	0.741	1.179	.241
Pedestrian Convenience	2.92	2.43	0.476	0.835	5.811	.000
Parking Area	2.60	2.16	0.664	0.885	7.770	.000
Educational Environment	3.27	2.52	0.548	0.620	11.457	.000
Convenience of Commuting	3.13	2.93	0.515	0.680	3.159	.002
Local Image	2.72	3.86	0.536	0.711	-13.982	.000
Property Value	2.77	3.73	0.544	0.775	-10.259	.000
Investment Value	3.02	3.13	0.428	0.974	-1.160	.248
Neighbourhood Affection	3.61	3.61	0.637	0.579	.000	1.000
Privacy	3.51	2.79	0.579	0.766	10.328	.000
Noise Pollution	3.79	1.86	0.576	0.820	25.206	.000
Security	3.20	2.77	0.586	0.824	4.743	.000
Ease of Using Rest and Leisure Facilities	2.71	3.69	0.554	0.669	-12.225	.000
Ease of Using Neighbourhood Facilities	3.17	2.49	0.454	0.708	10.173	.000
Use of Cultural Facilities	2.82	3.23	0.465	0.559	-6.949	.000
Use of Cars	2.69	2.15	0.563	0.654	10.224	.000
Residential Level of Local Residents	2.83	3.23	0.506	0.680	-5.842	.000
*p<0.05						

facilities has become a factor of satisfaction. It is believed that the increase in rents and housing prices due to commercialization of the area has also increased the residential level of the local residents.

5.2.3 Factor Analysis

For the regression analysis of the factors affecting the residential satisfaction of the local residents, factor analysis was performed and the variables with high correlation were tied together. 'Educational environment' and 'ease of using nearby facilities' were excluded because the communality was less than 0.4.

As a result of the factor analysis, the KMO (Kaiser-Meyer-Olkin) measure was 0.750, so it was appropriate to select the variables. The communality of 16 elements was more than 0.4, and it was judged that factor loadings of 0.3 or more were appropriate for all of the rotated component matrices. The four extracted factors and the corresponding variables were classified as shown in Table 4.

Table 4: Results of factor analysis.

Category		Component			
		1	2	3	4
Comfort	Noise Pollution	.698	-.120	.388	.174
	Security	.675	-.002	.006	-.395
	Pedestrian Convenience	.629	.166	-.039	.097
	Neighbourhood Affection	.593	.475	.094	.080
	Pedestrian Safety	.532	.309	.068	-.019
	Cleanliness of roads and walkways	.433	.270	.325	-.318
Convenience	Local Image	.042	.819	.139	.071
	Residential Level of Local Residents	.041	.753	-.049	-.033
	Ease of Using Rest and Leisure Facilities	.449	.704	.096	-.078
	Use of Cultural Facilities	.432	.474	.172	.061
Accessibility	Use of Cars	-.173	.134	.842	-.138
	Convenience of Commuting	.034	.448	.621	.018
	Privacy	.411	-.020	.618	.253
	Parking Area	.346	-.074	.526	.000
Economics	Investment Value	-.053	-.145	-.006	.818
	Property Value	.113	.223	.031	.762
Factor Extraction Method: Principal Component Analysis. Rotation method: Varimax with Kaiser normalization.					

The reliability analysis was conducted to confirm whether the extracted variables consisted of homogeneous variables through factor analysis. As a result of the reliability analysis, Cronbach α value of "Comfort" was 0.738, "Convenience" was 0.769, "Accessibility" was 0.634 and "Economics" was 0.562.



5.2.4 Regression analysis

Multiple regression analysis was conducted between each factor and overall satisfaction extracted from factor analysis to identify variables that affect residential satisfaction of local residents. Statistical significance was analyzed at significance level 0.05 (t value> 1.96, $p < 0.05$). Statistical significance was also analyzed at significance level 0.1 (t value> 1.96, $p < 0.1$). The Durbin-Watson index was 1.835, and the regression model was considered appropriate because there was no correlation between the residuals.

As a result of analysis, factors affecting residential satisfaction were “comfort” and “convenience” at $p < 0.05$. When the significance level was increased to 0.1, ‘accessibility’ was significant. “Comfort” (0.468) was the highest and “convenience” (0.285) was the next most significant factor to affect the residential satisfaction. “Accessibility” (0.125) also had an effect on residential satisfaction.

The variables of ‘comfort’ factor, which showed the highest level of influence in the multiple regression analysis, were “noise pollution”, “security”, “convenience of walking”, “neighbourhood affection”, “pedestrian safety” and “cleanliness of the road and walkway”. One of the biggest changes in the region due to the gentrification, the change of the floating population, seems to have the greatest impact on the quality of life of the residents. Especially, it can be deduced that the increase of the floating population had a big impact on the decrease of the satisfaction of the resident’s due to the dirty and noisy neighbourhood. It can be deduced that the satisfaction of walking convenience is reduced by increasing the flow population while keeping the walking route narrow. In addition, it can be deduced that the increase in the number of people and vehicles, and the construction and renovation of the building caused dissatisfaction in the safety of walking.

The variables of “convenience” factor, which showed a high level of influence, were “regional image”, “residential level of local residents”, “ease of use of rest and leisure facilities”, and “use of cultural facilities”. As a result of the change caused by the gentrification, the commercialization of the area will increase restaurants, cafes, small workshops and galleries. Therefore, it can be inferred that ease of use of rest and leisure facilities and cultural facilities improved the satisfaction of residents. Also, as people refer to the area a lot, the area turns into a charming place, so the image of the area has risen. As a result, housing prices and rents have risen, which can be inferred to have increased the residential level of local residents.

Table 5: Results of regression analysis.

Model		Non-standardization		Standard-ization	t	Significance Probability	Collinearity Statistic	
		B	Std. error	Beta			Tolerance	VIF
1	(constant)	-1.783	.499		-3.572	.001		
	Comfort	.809	.134	.468	6.042	.000**	.691	1.448
	Convenience	.490	.127	.285	3.857	.000**	.761	1.314
	Accessibility	.209	.121	.125	1.721	.088*	.793	1.261
	Economics	.083	.077	.070	1.078	.283	.995	1.005
a. Dependent variable: overall residential satisfaction $*p < 0.1$, $**p < 0.05$ $R = 0.720$, $R^2 = 0.519$ $F = 31.260$ / $p = .000$ / Durbin-Watson=1.835								



Finally, “Accessibility”, which has a significant effect on the significance level of 0.1, consists of variables such as “use of car”, “convenience in commuting”, “privacy” and “parking space”. In the case of accessibility, it can be deduced that there are traffic congestion and traffic problems due to commercialization. Especially, the increase in the number of people who visit a unique shop by car makes it clear that the satisfaction of local residents' use of the car has decreased.

6 CONCLUSION

In this study, the effect of gentrification on the residents of the surrounding residential areas was examined. The actual impact of gentrification was investigated and the research was conducted focusing on measuring the satisfaction of residents in the area where gentrification occurred.

First, cross-sectional analysis was conducted by constructing statistical data on changes in previous studies and media in order to determine how physical and non-physical changes are caused by commercial gentrification in the area. As a result, several related indicators have changed drastically in the region based on the specific year 2011. For example, the number of places where restaurants and eateries were first increased sharply. As a result, construction permits, the number of trades, and the official price of land have also risen. Since then, the number of moving out has increased, the number of moving in has decreased, and the area has become commercialized. In addition, as the area became known to the outside world and the number of referrals in large portal sites increased sharply, various indicators such as floating population, restaurants and eateries, building permits, and official land prices also increased steadily.

Second, the questionnaire survey was conducted to investigate how the changes in the area according to the commercial gentrification affected the residential satisfaction of residents. As a result of the analysis, the overall satisfaction of the residents decreased within the statistical significance from “the satisfaction” (3.64) to “the ordinary” (2.90). Of the 15 variables related to residential satisfaction, satisfaction with ten variables, such as “cleanliness of roads and walkways”, “convenience of walking”, “parking spaces”, “educational environment”, “convenience of commuting”, “privacy”, “noise pollution”, “ease of use of facilities”, and “use of car”, has decreased. Satisfaction with the other five variables, such as “local image”, “property value”, “ease of use of rest and leisure facilities”, “use of cultural facilities”, and “residential level of local residents”, has increased. In this way, the commercial gentrification increased the economic satisfaction and the satisfaction with “local image” and “the use of facilities in the area”, but the residential satisfaction of the residents decreased overall.

Finally, regression analysis showed that “comfort” decreased. As the commercialization progresses, the increase of the floating population causes the noise in the neighbourhood and problems in security. In addition, the number of people increases, the walking becomes uncomfortable, the number of vehicles increases, and the traffic risk increases. It can be inferred that these factors led to a decline in housing satisfaction. To solve this problem, CCTV and integrated management center, which is a kind of ubiquitous city management method, should be introduced. On the other hand, “convenience” increased. It is believed that the commercialization has enabled the residents to enjoy rest and leisure in the new commercial facilities and cultural facilities. It can be interpreted that “accessibility” has affected the decrease in satisfaction. As a result of commercialization, there will be more cars in the area, which means that the inconveniences of commuting and parking at the local residents are increasing.



This study evaluated the satisfaction of the local residents according to changes in urban space (i.e., gentrification). However, there were limitations of the study as follows. Because there are many changes in the urban space at the same time, it has been difficult to control the influencing factors other than the gentrification. The study area is limited to two places in Yeonnam-dong and Itaewon2-dong. Due to the difficulty of questionnaire survey time, except for housewives and self-employed people, there were not many people in the area, so it was difficult to obtain samples with various characteristics. It has not been possible to conduct surveys on residents who have left the area for reasons such as residential dissatisfaction. However, if people who left the area are included in the questionnaire, the result is even more negative.

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URBAN REGENERATION WITH CARBON ECONOMY

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ABSTRACT

In Turkey, approximately 6.5 million dwelling units are deemed to be under disaster risks and it has become a government policy to rebuild this building stock. In order to fulfill the financial dimension of this urban regeneration attempt, the Ministry of Environment and Urbanization has developed a planning standard called “Sustainably Performed Urban Regeneration” SuPerUrban to mobilize the economies of sustainable living styles. Compared with the classical urban planning approaches, the environment friendly planning and urban design standard has focused on reducing the carbon footprint of the redevelopment and to create a new urban lifestyle in terms of the use of land, energy, water, natural resources and transportation. SuPerUrban reduces living costs of the households and local government expenditures and provide efficiencies that can be measured with the reduced percentage of the overall carbon footprint. Eventually, while being urban friendly it provides the means for the households to finance their share of the cost of regeneration with their reduced daily expenditures. In order to facilitate the model, carbon footprint calculation tool is developed to assist the project owners at both the neighborhood and building levels. Certain technology alternatives are provided to choose and compare the savings and reductions easily from the web. A pilot project is also developed using the standard and the tool in Eskişehir, Turkey. The technologies to be used in the project are intended to be produced in the area in order to provide jobs and create a green economy.

Keywords: Sustainability, Urban Regeneration, Ecological Labelling System, SuPerUrban.

1 INTRODUCTION

In the early part of the 21st century, disasters threatening future of humanity, climate change and dependence to hydrocarbon are regarded as topics that a solution method has to be developed immediately on the international agenda. These topics which are raised as symptoms of dependence to non-renewable energy sources and to lifestyle accordingly these sources should not be approached separately and must be studied together. Precautions taken against to threats to our planet are going to show how our planet will be shaped and at the same time these precautions have a role in providing economic development trends.

Associated with Climate Change Adaptation, developing resistance to natural disaster, reducing heat island effect, carbon emission, conserving biodiversity, supporting organic and local agriculture, promoting sustainable energy source and energy efficiency targets are important topics of today’s planning agenda. Therefore, these targets must be addressed in current planning studies. To reach these targets and to adapt these targets to our socio-cultural life, local and unique solutions should be developed.

Today, humanity understand that economic development due to carbon emission is not sustainable and begin to develop a new economic model in which development-oriented activities can be realized with the lowest possible carbon emissions. With this trend, the concept of “Low Carbon Economy” has emerged as the economic development model of 21st century. This concept gives a different perspective to climate change/disasters and dependence to non-renewable energy sources. It is possible to generate an economic model which causes minimum greenhouse gases emission when a value generated by the Low Carbon Economy, which plays a role in solving problems in both topics, is operationalized.

Another important role of Low Carbon Emission is to provide a chance to realize world’s new trend with urban regeneration operations. Urban regeneration which is carried out by



sustainability principles is emerged as an important tool for our country to meet its national obligations on climate change. In order to use this tool more efficient and to transform the areas under disaster risk into more healthy and durable places, The Law of Transformation of Areas under the Disaster Risks (Law No. 6306) has been put into force in 2012.

The Law of Transformation of Areas under the Disaster Risks has been put into force in order to reduce possible damages of earthquake and other natural disasters. However, if urban regeneration is implemented by taking measures to reduce carbon emissions, households can provide savings from energy, water and transportation expenses. These savings can be used for repayment of urban regeneration credits. In the framework of this idea, first steps of an “Ecological Settlement Unit” have been taken by Directorate General of Infrastructure and Urban Transformation Services.

By the year 2015, the country has reached the resource limits of the existing policy observed in urban transformation and has entered a trend of deceleration and the rent subsidy assistance provided for urban transformation has decreased. Therefore, the method used to finance the urban transformation by the carbon economy savings has begun to work on a project to open a new page in the urban transformation sector. In other words, Low Carbon Economy will play a key role to realize urban transformation.

By using savings generated by Low Carbon Economy and lifestyle developed independently from hydrocarbons on financing of urban transformation, an environmentally friend cities, production and consumption could be achieved. This achievement will create sustainable, localized, energy efficient and resistant society that uses its own resources. In order to reach these targets, Ministry of Environment and Urbanization started to carry a pilot project called “Sustainably Performed Urban Regeneration” SuPerUrban in Kocakır Province, Eskişehir to obtain an ecological settlement unit standard.

In this context, in the Law no. 6306 frame, “neighborhood standards” have been developed that aim to obtain SuPerUrban neighborhoods with ecological characteristics. Within the scope of this standard, social, economic and environmental criterion for the implementation of urban transformation has been determined. Especially, it is aimed that the criticism on the question of the social effects of transformation practices not being measured will be abandoned by this urban transformation model based on the socio-economic sustainability principles laid out in the standard.

With “Sustainably Performed Urban Regeneration” SuPerUrban, a new concept of urban transformation and a new model has been defined and the implementation of this model is planned to be carried out through the project named as “Kocakır Ecologic Settlement Unit Project” which can be considered as a small satellite city that can satisfy its need by its own sources.

The implementation of this new model is planned to be carried out in the Reserve Building Area of 838 hectares in Kocakır District of Eskişehir. The project will be carried out in five stages and around 45.000 people will live in project area. When the project is completed the value of Eskişehir will increase and the welfare level of the city will increase.

2 “SUSTAINABLY PERFORMED URBAN REGENERATION” SUPERURBAN AND “KOCAKIR ECOLOGIC SETTLEMENT UNIT”

“Kocakır Ecologic Settlement Unit Project” is a first in terms of setting a standard that will provide carbon reduction for residential areas both in our country and in the world through its labeling system.

The application of this new model, which will open a new page in urban transformation, is located 11 km from Eskişehir City Center, also it is in the center of Istanbul and Ankara and these cities can be reached by high-speed train. The main reason why this project is



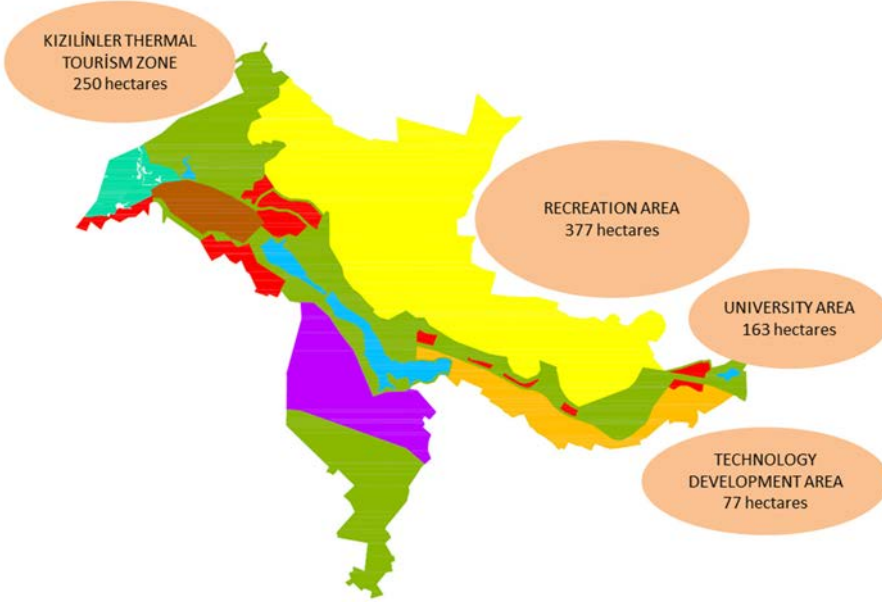


Figure 1: Eskişehir Metropolitan area central region 1/25.000 scale master plan.

implemented on Kocakır District is presence of the reserve building area of 838 hectares which will provide suitable space for the project to be carried out in the area. Absence of agricultural land, endemic and protected species, forest, risk of disaster in the area are the other good characteristics of Kocakır District. Moreover, there is solar and wind renewable energy potential in the region.

The project also contributes to the macro form of Eskişehir city. The project area is associated with the Kızılınler thermal tourism zone, the third university area and the olympic village recreation area, which are located nearby with applications done on the 1/25.000 scale master planning and plan decisions [1]. The welfare of the project area will increase and the value of the area will make the area a center of attraction with its nearby.

The project, aiming to develop a standard for residential areas alongside buildings, sets out general standards for these new settlements, which minimize harmful environmental impacts of buildings and settlements and enhance compliance with the ecosystem. Minimum criteria and performance criteria have been defined in six main criteria (land use and urban design, water, energy, transportation, materials and sources and socio-economic sustainability) within the framework of these standards. All these criteria will be called “Sustainably Performed Urban Regeneration” SuPerUrban [2].

2.1 Innovations of SuPerUrban system according to other systems

All world examples related to “Sustainably Performed Urban Regeneration” SuPerUrban such as BREEAM Community (England), DGNB District (Germany), HQE Quartier (France) and LEED Neighborhood (USA) had been examined before the protocol for

SuPerUrban was prepared. It is considered that the most comprehensive system among these systems is the LEED Neighborhood Certification System.

In this manner, it is stated in the protocol to prepare the project will be based on the LEED Neighborhood Certification System [3]. In addition to this, the project will be developed to include all the other leading certification systems in the world and to be over them.

Project has introduced the concept of climate change adaptation criteria, neighborhood modelling in energy, waste water treatment criteria, neighborhood life cycle analysis and minimizing transportation demand in field and surroundings in the existing system in Turkey. In addition, a socio-economic sustainability criterion, which is not available on the other systems, is another innovative approach that the project has introduced.

SuPerUrban Label System, which is based on many progressive system and making them more comprehensive, aims to provide sustainability in structures and neighborhoods in accordance with existing building legislation [4].

The SuPerUrban label system has been developed as a certification system which is over all other certification systems and has been made more comprehensive and superior to all other systems by changing the existing evaluation system in accordance with the needs of Turkey.

2.2 SuPerUrban label system – evaluation system

A comprehensive rating and labeling system has been developed as the first step in the realization of the ecological settlement unit in order to measure the benefit that will be achieved as a result of the specified standards, and the minimum criteria and performance criteria have been set in this direction.

The methodology adopted in the SuPerUrban Label System is a system operation that scales ecological settlement units as how the world counterparts do and at the same time internalizes national norms and is flexible enough to integrate with the world system in the future. SuPerUrban Label System not only focus on environmental impacts, but also allow to reach the achievement of a certain level of economic and social impacts. In respect to this, such effects, which are more difficult to quantify with an EPD system, is thought to be associated with a labelling system. So, in addition to EPD System, ISO 14024 Type-I eco-label structure is deemed to be created. With the label system to be used by the Ministry of Environment and Urbanization, settlements can be labelled and different incentives and financial models would be applied to the ecological settlements units.

In order to get SuPerUrban Label, an ecological settlement unit must be labelled in six main criteria: Land Use and Urban Design, Energy, Water, Transportation, Materials and Sources, Socio-economic Sustainability [5].

2.2.1 Land use and urban design

In this criterion title, the rules that are required in an ecological settlement unit are defined in planning, urban design and application phases. To select environmentally sensitive land for a sustainable planning approach, to increase the carbon sink potential of the area after urban planning compared to pre-planning, to form mix-use neighborhoods with archaic urban fabric and to present different housing typologies to live different income groups together have been identified as key objectives. An approach to urban design was adopted in which residential and business places are within walking distance with walkable streets.



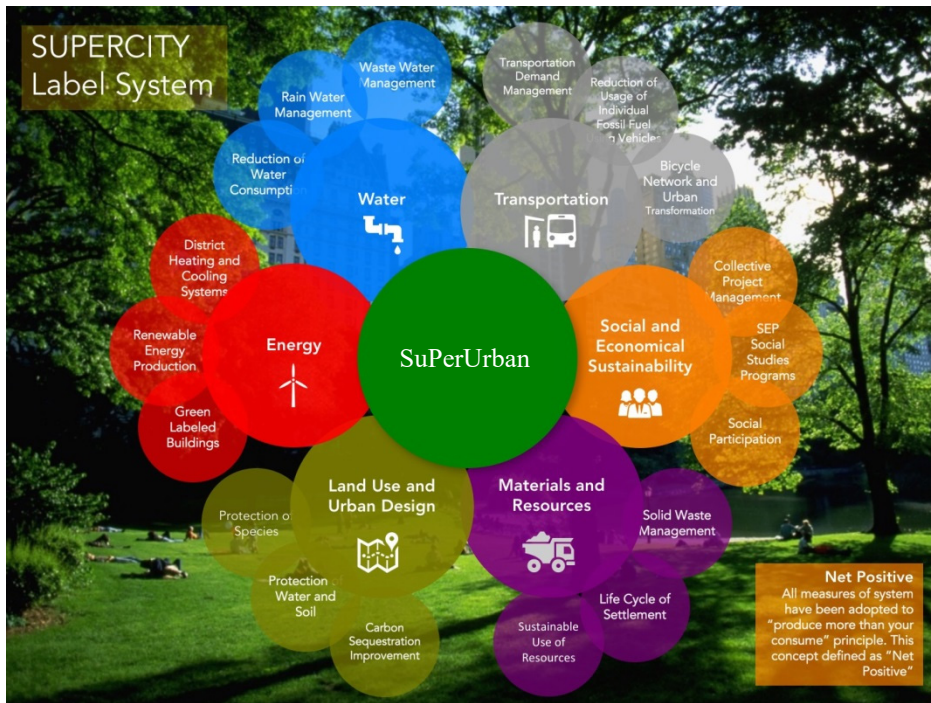


Figure 2: SuPerUrban system schematics.

2.2.2 Energy

In this criterion title, to create an ecological settlement with green buildings that is energy efficient, solar oriented and cost optimal, to reduce the heat island effect, to use central heating and cooling systems in district scale have been identified as key objectives. In addition to these, the principle of generating the energy demand of the ecological settlement in project area is adopted.

2.2.3 Water

In this criterion title, to reduce regional, indoor and outdoor water consumption, to establish rainwater and wastewater management systems and to produce ecological settlements own water needs have been identified as key objectives.

2.2.4 Transportation

It is aimed to reduce transportation-related energy consumption and emissions by introducing a holistic approach to urban transportation within this criterion. For this reason, strategies that intra-city transportation requests to be directed to walking, cycling and using low-emission public transport vehicles have been adopted. It has been aimed to meet the transportation energy need from the renewable sources. Also, high quality transportation facilities have been created by creating compact residential units connected to the environment that reduces travelling distances between residential and commercial.

2.2.5 Materials and sources

This criterion encourages the use of construction materials that have a low environmental impact in infrastructures and buildings and construction materials manufacturers to produce these materials.

2.2.6 Socio-Economic Sustainability

In this criterion, in the ecological settlements, it is essential for the project to create value added community and an environmentally conscious society. It is aimed that the people to be active as much as the investors are in the urban transformation operation and to take an active organized role in all the processes.

These six main strategies aim to determine the main standards for planning an ecological settlement while evaluating this ecological settlement in terms of sustainability criteria. Carbon footprint performance is taken into account when evaluating settlements and determining public support with these obligatory criteria. The carbon emission effect of some criteria, the carbon sink effect of some criteria, and the measurable performance of other criteria is taken into account to calculate performance of ecological settlement.

The principle of producing more than consuming in the SuPerUrban System has been adopted and this is called the “Net Positive” concept. All greenhouse gas emissions are accounted for and calculated on the basis of carbon emissions in this system. With this feature, SuPerUrban is an environmental impact assessment tool that makes a scientific measurement of the settlement units according to the global warming potential of settlement. In order to reduce carbon footprint of a settlement throughout whole lifecycle, a “Carbon Calculator Tool” has been obtained to make a lifecycle analysis to estimate how much carbon will be emitted [6]. Within this scope, settlement units are rated with six performance levels which are Base, Base+, B+, A+, Net~ and Net+. These performance levels are shown in Table 1.

2.2.7 Methodology

Data entries based on these six main criteria are registered in the Carbon Calculator Tool. The carbon calculator analyzes the input data according to CO₂ emission values and gives information about the settlement place. The amounts of interest support to be given to the area of urban regeneration are determined according to the results.

Methodology is the calculation of the life cycle effect of a settlement site based on CO₂. In addition to these calculations, the life cycle cost of the settlements and the household savings are compared to each other to determine social and economic sustainability. As a result of these detailed calculations, interest support to be applied in the urban transformation

Table 1: SuPerUrban performance levels based on reduction of carbon emission.

Level	Reduction of CO ₂ Emission
Net+	> 100%
Net~	> 80%
A+	> 60%
B+	> 20%
Base+	> 0%
Base	= 0%



area will be determined by Ministry of Environment and Urbanization. TS EN 15978 the method of building life cycle analysis has been adopted in the settlement site Life Cycle Analysis approach.

The GHG Protocol, published by the World Resources Institute (WRI) and the World Sustainable Development Council (WBCSD) and in addition to this IPCC-based methodology PAS2070 is based on calculating the amount of CO₂ emissions [7].

For the accuracy of the system, all carbon emission sources in the settlement area will be determined and the effect will be considered throughout the year.

2.3 SuPerUrban system structure and organizational model

SuPerUrban Label System is not a new system alternative to Turkey's existing planning system. But this system is a new approach that introduces innovative practices that will reduce negative environmental impacts within existing legislation. This system has been a first to handle ecological settlement and urban regeneration together.

The SuPerUrban Label System has unique training system and expertise documents. Starting with building material production, green building construction, ecological settlement planning and construction processes will be evaluated along with integrated design understanding and participation processes. Projects will be valued by integrated expert assessment teams and incentives will be given according to project performance.

In the SuPerUrban System, the design of ecological settlements and green buildings will be carried out by integrated planning and design teams consisting of interdisciplinary experts [8]. In this direction, there are Integrated Planning and Designing Teams and Integrated Expert Inspection and Approval Teams within the system. Training programs for label system experts will be provided by expert training teams authorized by the Ministry of Environment and Urbanization. Training contents will be created by expert training teams also authorized by the Ministry. Experts graduated from these training programs will be certified in the areas of specialization they are trained in.

The SuPerUrban Labeling System consists of 29 minimum and 28 performance criteria in 6 main criteria. Therefore, each criterion requires a separate approval process, as too much technical requirement is required. After the urban planning process of the integrated design team, Integrated Expert Inspection and Approval Teams, which has been trained for each criterion, inspect and approve the plans.

Social participation is one of the important elements of the SuPerUrban Label System. The participation of the householders should continue not only in the design process but also in the construction and lifecycle of the settlement. This new organizational structure aims to ensure that ecological settlement performance level does not change during the life cycle of the settlement and that their performance continues at the same level. This new organization is called "Community Management" [9]. Community Management can improve the performance level of the settlement according to the developing technologies in time.

SuPerUrban Labeling System evaluates the settlements in three stages that are Conceptual project, preliminary project and application project.

The conceptual project is the stage in which the goals of the project are set out before the project starts. Counterparts can argue and make a decision about the project in this stage. This process represents the decision period before the application to the Ministry.

The preliminary project is the stage in which quantities are determined, the sizes are revealed and the spatial characteristics of settlement are planned. It is necessary to come to a mutual agreement with the householder after this stage.



The application project is the stage in which all the decisions related to the project are taken and the final shape of the project is obtained. the most precise measurement of the project is carried out at this stage.

All works done for “Kocakir Ecologic Settlement Unit Project” are preliminary projects. The application projects are being prepared for the realization of this project.

3 CONCLUSIONS AND EVALUATION

When evaluating the six key strategies developed within the “Kocakir Ecologic Settlement Unit Project”, it is seen that the project fulfills all targets set during the planning phase and achieves the emission reduction in the direction of performance in these criteria.

When the performance level of the targets determined in the six key strategies, “Kocakir Ecologic Settlement Unit Project” succeed these scores:

On the Land Use and Urban Design Strategies, the project has increased its carbon sink area by 140% and reaches “Net+” level. To achieve this result, low density settlement design, small lot coverage and increased plant density were used. Floor area ratio is 0.37 for whole project area as it is 1.4 for residential area and the lot coverage is 0.08 for the project. It is estimated that monthly income of 162 TL per household will be obtained with the savings provided by Land Use and Urban Design.

On the Energy basis, carbon emissions have been reduced by 83.24% and reached Net~ level. In order to reach this level, cogeneration system, heat pumps, micro grids and PV solar panels installation is planned. Also, buildings are directed to the sun and heat island effect is set to be zero. In this way, the infrastructure has been made to be 75% efficient and monthly income of 385 TL per household will be obtained.

Water saving was calculated as 91.3% and Net~ level was reached. In order to get this level, water consumption reduced by 75% for irrigation and all water demand is met from gray water systems and rain water collection system. Householders can save up to 72 TL from water bills.

Transportation-related carbon emissions decreased by 92% that means Net~ level has been reached. 26% walking, 13% cycling, 55% public transport and 6% private vehicle use is aimed to catch this level. In the project area, it is planned that EV, PHEV, biodiesel and CNG based vehicles to be used. Householders can save up to 196 TL from transportation costs.

Carbon emissions in material and resources criteria were calculated as 65% and A+level has been reached. In order to achieve this level, it is aimed to provide 25% recycled content for infrastructure, 50% recycled content for buildings and 97% of debris recycling.

Projects done to provide the social and economic sustainability, urban agriculture, employment opportunities provide 115.6% added value for householders and Net+ level has been reached.

When all the criteria are considered together throughout the project, 97.93% carbon emission reduction, which is over the European standards, has been achieved and Net ~ level has been reached. In the other words, householders can save up to 815 TL from living expenses [10]. In addition, Banks can provide zero-interest loans to householders through government support and the low interest foreign-funded loans for ecological settlements unit. So, this amount corresponds to 87% of the households' urban regeneration credits repayments. Thus, a significant contribution is provided to home and country economies.

When people find the opportunity to live in a healthier and safer place, the energy dependence to foreign countries of Turkey will be reduced by “Kocakir Ecologic Settlement Unit Project”. Considering increased house value, householder has a chance to own an upper-class residence by paying low rent.



By the SuPerUrban Label System, people will be given to an opportunity to live in sustainable places and sample cities. Also, technologies developed within the project will be a new source of innovation for the construction sector of Turkey. The draft “Regulation on Sustainably Performed Urban Regeneration” was prepared and submitted for receiving opinions of the relevant institutions and organizations. The Regulation is ready to be sent to Prime Ministry to introduce law.

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THE RELATIONSHIP BETWEEN CONSERVATION-REVITALIZATION PROJECTS AND SITE MANAGEMENT PLAN: A CASE STUDY FOR SÜLEYMANIYE MOSQUE AND ITS ENVIRONS

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ABSTRACT

The aim of this paper is to examine the relationship between site management plans and the conservation-revitalization projects in context of the spatial-functional plan decisions and institutional authority-responsibility. These examinations have been handled with a method which depends on comparative-assessment of three basic data sources: conservation plans, conservation-revitalization projects and site management plan. The case study is The Süleymaniye Mosque and its environs which had been declared “historic-urban protected site” in 1977 and was inscribed on UNESCO World Heritage List within the scope of “Historic Areas of Istanbul” in 1985. However; socio-spatial and functional strategies for the Süleymaniye Mosque and its environs have been determined by Historical Peninsula Site Management Plan dated 2009. We believe that this study will present alternative perspectives to the problems arising in the context of coordination among stakeholders in the process of conservation-revitalization of historical urban environments through the re-evaluation of the institutional and managerial scope and content of the site management models through the case of Turkey.

Key words: conservation-revitalization projects, site management plan, the Süleymaniye Mosque.

1 INTRODUCTION

Historical sites and monuments, which are called cultural heritage, play an important role in reflecting the daily rituals, beliefs, education, art and architecture of the period when they were constructed. These sites are accepted as common heritage of humanity, due to their outstanding universal values. The deterioration or destruction of any part of these sites is thought to constitute impoverishment for the all nations in the world and the protection of these sites is regarded as international responsibility [1]. Therefore, the search for the conservation of the integrity and authenticity of cultural heritage sites from all kinds of destructive action that may arise due to reasons such as traditional destructions as well as social dynamism and urbanization problems and for the maintenance of their continuity between generations has been continuing since the early 20th century. The most important of these works is the “Convention Concerning the Protection of the World Cultural and Natural Heritage”, signed in 1972 by UNESCO member states to develop a multidimensional, comprehensive and participatory protection understanding, to identify a common conservation language and policies in all countries of the world. The natural and cultural heritage sites which have outstanding universal value and policies to ensure effective and holistic protection of these sites on the basis of sustainability, broad participation, cooperation and transparency principles were defined in this convention. In addition, the World Heritage Committee notes that a site management plan, including the vision for the future of the site, main objectives for the protection of the site, strategies, actions and implementation techniques have been necessary since the adoption of the convention in order to guarantee the effective and integrated protection of universal natural and cultural heritage sites. In the Operational Guidelines for the Implementation of the World Heritage Convention



dated 2008, it is stated that as “Each nominated property should have an appropriate management plan or other documented management system which must specify how the Outstanding Universal Value of a property should be preserved, preferably through participatory means. The purpose of a management system is to ensure the effective protection of the nominated property for present and future generations” [2]. Thus, it became compulsory for the sites proposed as World Heritage or previously added to the World Heritage List to have a management plan. Following the international developments in cultural and natural heritage preservation works, Turkey also became a party to the World Heritage Convention in 1983. In addition to this, in order to ensure the coordination of our legislation on conservation with international developments, the concepts of “management site” and “management plan” were added to the Law No. 2863 on the Conservation of Cultural and Natural Property in 2004. According to this law, management plans need to be prepared not only for “World Heritage Sites” but also for all cultural and natural sites that are legally under protection and these management plans that define the responsibilities of institutions-organizations and ensure coordination-cooperation among all stakeholders need to be compatible with traditional conservation plans [3].

This study aims to examine the conservation-revitalization works for the protection of The Süleymaniye Mosque and its environs, accepted as “memory space” [4], in terms of Ottoman history, culture and architecture, along with the objectives, targets and strategies in the site management plan in terms of integrated conservation principles and coordination among stakeholders. These examinations are based on the interpretation of the social-cultural, economic and institutional contexts problems of protection-implementation that cannot be solved as an example of Süleymaniye and comparison of these problems on the basis of sustainable and integrated protection principles.

We believe that this study will present alternative perspectives to the problems arising in the context of coordination among stakeholders in the process of conservation-revitalization of historical urban environments through the re-evaluation of the institutional and managerial scope and content of the site management models through the case of Turkey.

2 METHOD DESCRIPTIONS

The study was conducted within a method based on the evaluation of the relation between the preservation-revitalization works and the site management plan in terms of planning-implementation processes and audit-monitoring mechanisms in the context of authority-responsibility accompanied by written and visual sources. In this context, design planning implementation works (plans-projects and reports) in all scope and scale for the protection-revitalization of the Süleymaniye Mosque and its environs have been examined in detail.

These examinations have been discussed as two phases:

The first is to evaluate the preservation-renovation process of Süleymaniye Mosque and its environs in chronological order (Table 1).

The second is to evaluate comparatively the relation between conservation-revitalization plans and the site management plan in the context of objectives-targets and strategies and to question the duty and responsibility areas of the stakeholders expected to take an active role in the protection process in the context of planning-implementing and auditing-monitoring mechanisms.

3 SÜLEYMANIYE MOSQUE AND ITS ASSOCIATED CONSERVATION AREA

The Süleymaniye district is located in the Historical Peninsula in Istanbul and is named after Süleymaniye Mosque built in 1557 by Architect Sinan. [5]. The structures that characterize the district in addition to the Mosque the Süleymaniye Mosque, are caravanserai, madrasa,



Table 1: Chronological process of conservation-revitalization-site management works.

CHRONOLOGICAL TABLE OF CONSERVATION PROCESS OF THE SÜLEYMANIYE	
2006	The site was declared as urban revitalization area by the ministry.
2011	Last conservation plan was accepted by the municipality(effective).
2011	Historical peninsula site management plan was accepted by the municipality.

medical school, library, bath building, hospice and imperial tombs, provide supreme examples of ensembles of palaces and religious complexes of the Ottoman period. For this reason, it was developed as a residential area preferred by religious scholars, prominent administrators of the palace and rich merchants., this site was declared as a protected area by the Ministry of Culture and Tourism in 1977 and it was taken legally under protection as one of the important places where the Ottoman neighbourhood culture was experienced.

The Süleymaniye Mosque and Its Environs Protection Site was taken to the World Heritage List in 1985 by named as “Historic Areas of Istanbul” after complying with the “cultural criteria” along with three other protected sites in Istanbul following Turkey’s signing the World Heritage Convention. Other selected sites except Süleymaniye Mosque and its Environs Protection Area are Archaeological Park, Zeyrek Mosque (Pantocrator Church) and its associated conservation area) and Land Walls of Istanbul [6].

In addition to the social-political events and fires that occurred since the 18th century, the fact that life in different parts of the city, such as Galata (Pera), became attractive and that the original owners of Süleymaniye left the region [7], These changes were some of the causes leading to the socio-spatial decay of the region. However, the most important point for the district was the fact that the labour force in the country emigrated from various parts of Anatolia and settled in the empty houses of Süleymaniye after the land reform and agricultural policies in the 1950s. The majority of the people living in Süleymaniye are composed of disadvantaged groups of the society such as tenants who hardly meet even their basic economic needs and have informal jobs such as paper collecting, working at a workshop, construction, porter age and manufacturing [8].

This change has led to the demolition of architectural texture over time. However, the rapid housing without aesthetic concerns that started from the 1950s led to the increase of concrete apartment buildings in the area. The fact that these spatial destruction are brought to the agenda of the public and, on the other hand, the fact that UNESCO frequently warns of excluding the site from the list on the grounds that it is not protected required urgent intervention to the Süleymaniye cultural heritage. Therefore, the site was declared a Revitalization Site by the Ministry of Culture and Tourism in 2006 in accordance with Law No. 5366 [9].

Despite the fact that the Süleymaniye Mosque and its environs were taken under protection in 1977 and defined as a historic-urban protection area in 1995, area was not taken into consideration both because of the legal objections made to the plan decisions and because of the lack of protection awareness; so, it took about fifteen years for this area to be subject to comprehensive conservation work. As the last conservation plan, the Istanbul Metropolitan Municipality prepared the Historic Peninsula Site 1/ 5.000 Scale Conservation Master Plan in 2011.



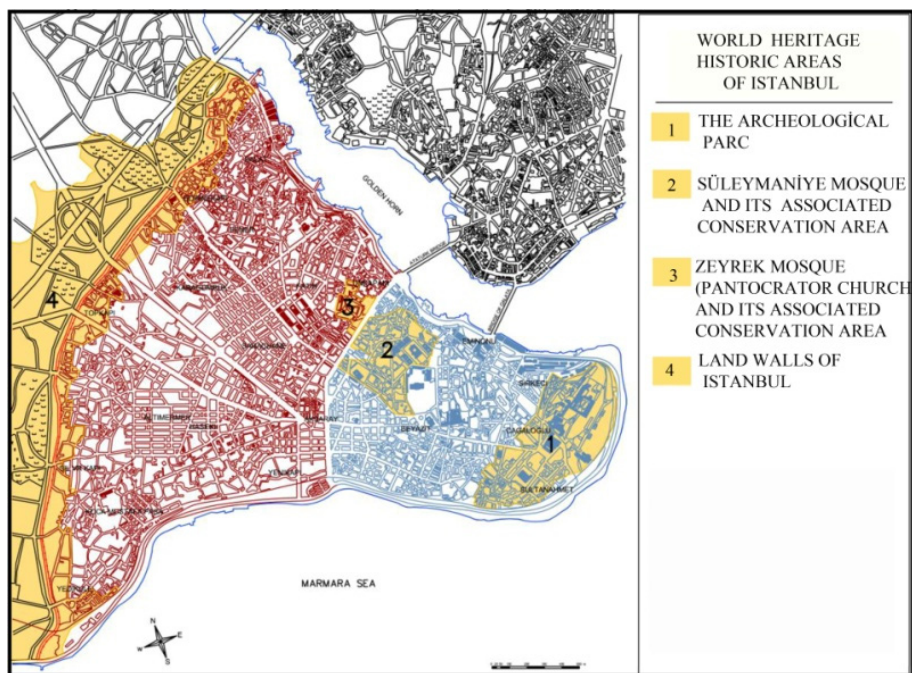


Figure 1: World Heritage areas of İstanbul. (Source:<http://whc.unesco.org>.)

The addition of the concept of management plan to the national conservation law in 2004 provided the start of a new protection process for İstanbul's historical sites, which are on the World Heritage List. In fact, the İstanbul Site Management Directorate was established for historical sites in 2006 and the work for management plan was initiated. In 2011, the Historical Peninsula Management Plan was approved by the İstanbul Metropolitan Municipality.

Despite the fact that conservation studies have been carried out since 1977 for the conservation of Süleymaniye settlement, the heritage site has not reach the desired level in spatial-environmental or socio-cultural and economic terms yet. This section will examine in detail the institutions responsible for the purpose, scope, content and plan preparation-implementation-auditing processes of the three recent conservation approaches to the Süleymaniye World Heritage Site and the common practices and fundamental problems in the three different conservation approaches are going to be identified.

3.1 Revitalization projects

Due to the increasing socio-spatial damages of historical-cultural heritage sites such as Süleymaniye and the warnings of UNESCO in 2004, in 2005, the Law No. 5366 on "Usage of Timeworn Historical and Cultural Real Property with Restoration and Protection" was promulgated. The law aims to reconstruct and restore the protected sites in accordance with the development of the region, to provide housing, trade, culture, tourism and social facilities in these regions and to protect historical and cultural immovable properties through restoring them. [10]. 93 hectares of the Süleymaniye district was declared as Revitalization Area on 24.05.2006 within the scope of this law.

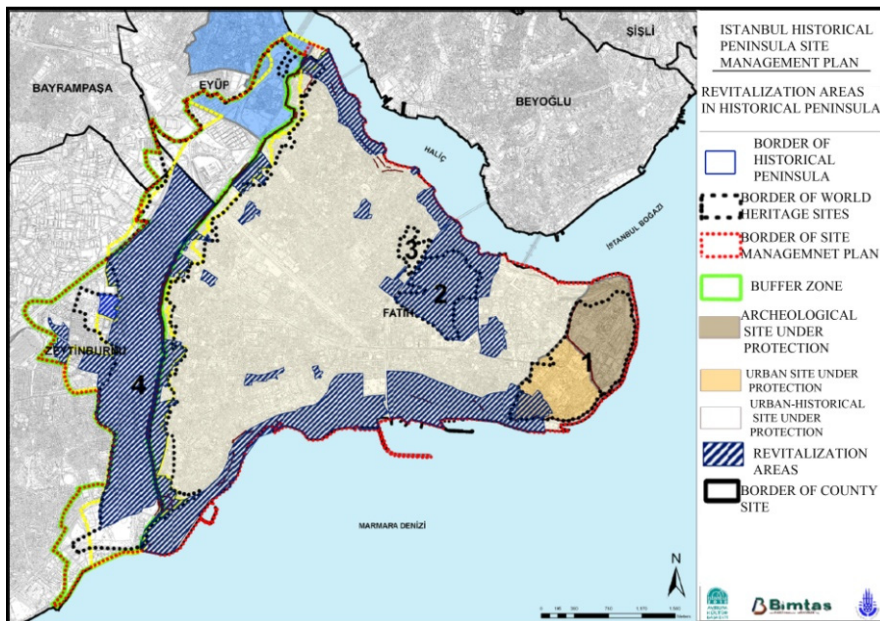


Figure 2: Revitalization areas in the historical peninsula.

The implementation process of the project which was divided into 5 stages, while 1st, 2nd and 3rd stages of the project, have monuments, registered examples of civil architecture and unregistered buildings, the 4th stage has Istanbul Drapers Market and the 5th stage has Süleymaniye Complex and Istanbul University Beyazıt Campus. In the first process, the revitalization project is aimed at the restoration of the cultural properties that are standing. The second process is projected as the reconstruction of cultural properties, which are destroyed or lost because of improper practices and about which information and documentation have been reached, in accordance with their originals. The third process aims new structures to be built on parcels without information and documentation or on parcels with unqualified structures [11]. Furthermore, functional decisions such as trade, tourism and social facilities can be taken for the region within the scope of the project.

3.2 Conservation plan

According to the definition of “conservation plan” in the Law no. 2863 on the Conservation of Cultural and Natural Property, it is compulsory to conduct field surveys not only of archaeological, historical, natural, architectural and demographic data of the historical sites but also of cultural and of socio-economic data. [12]. The main envisaged functions for the Süleymaniye Mosque and its Environs Protection Area in the conservation plan are the housings and public institutions such as religious facilities and training facilities. It is also foreseen that social cultural sites such as parks and recreation areas. Regions used for manufacturing and warehousing have been decided as trading area in the plan. The madrasas around Süleymaniye Mosque are defined as cultural facilities in the plan. In addition to the functional decisions, 400–700 populations/hectares density were planned in the housing areas [13].

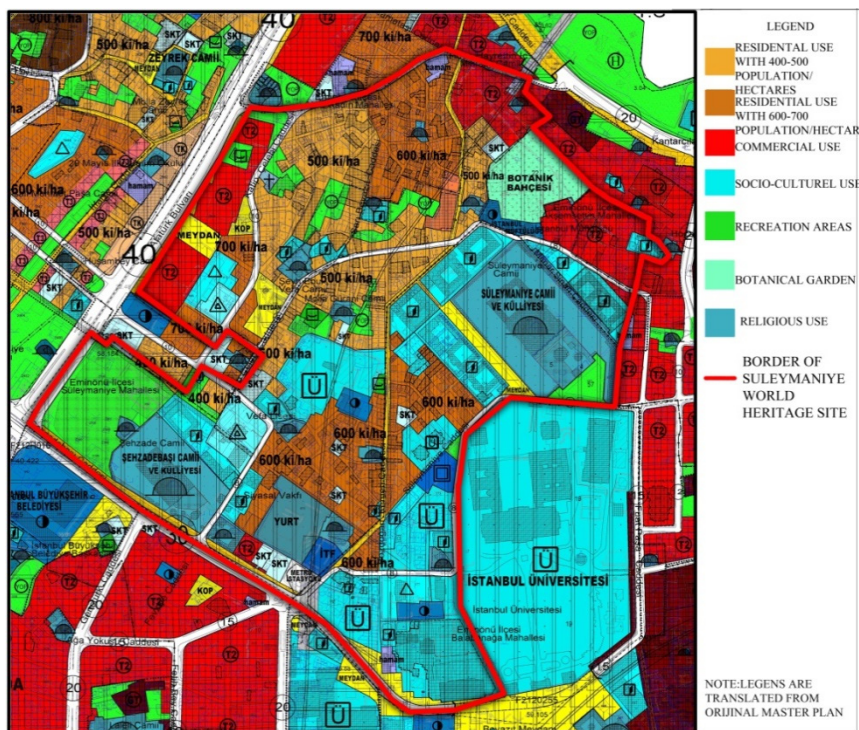


Figure 3: Plan decisions pertaining to the Süleymaniye World Heritage Site in the Fatih District Urban Conservation Site 1/5000 Scale Conservation Plan. (Source: IMM, 2010a.)

However, except functional, demographic plan decisions, there are no decisions to improve the socio-economic structure of the area and to protect the intangible cultural properties in the Historic Peninsula Conservation Plan.

3.3 Site management plan

When determining the Management Plan boundaries, it was found appropriate to prepare for the whole of the Istanbul Historical Peninsula considering that all of the Historical Peninsula had been a historical-urban protected area at national level since 1995, instead of preparing separate management plans for the four regions in the World Heritage List.

The problems identified regarding the settlement in Süleymaniye in this management plan are as follows:

- Inadequate conservation, decay of Monuments at Süleymaniye World Heritage Site
- Inability to protect urban architectural structures and their decay, being run-down, and in a state of collapse
- Scientific and technical errors being made in conservation and restoration implementations, not being able to achieve required quality with respect to materials and labour
- Widespread approach of demolishing and rebuilding of registered structures

- Widespread reconstruction efforts of monuments, which do not have certificates or have been destroyed
- Financial resources created regarding conservation not being used efficiently in the effective conservation of cultural properties in the Site
- Certain sections of social complexes (Süleymaniye, Sehzadebasi) and civil architectural buildings being used for inappropriate functions
- Possible threat of loss of traditional street pattern
- Süleymaniye Mosque and surrounding World Heritage Site not being sufficiently known

Furthermore, institutions and organizations foreseen to take an active role in the implementation-monitoring and evaluation processes of the main objectives, strategies, actions and plans for these problems, which are described through spatial destruction and functional inaccuracies, are defined with general statements [14].

4 COMPARISONS OF CONSERVATION APPROACHES IN TERMS OF CONTEXT AND COORDINATION

Integrated urban protection, also described as a contemporary conservation approach, highlighted in the 1972 World Heritage Convention and 1975 the Declaration of Amsterdam means that physical-spatial environments must be preserved along with their social, economic, administrative and occupational values [15]. This part of the study will compare the relation among the three conservation approaches being applied to the Süleymaniye

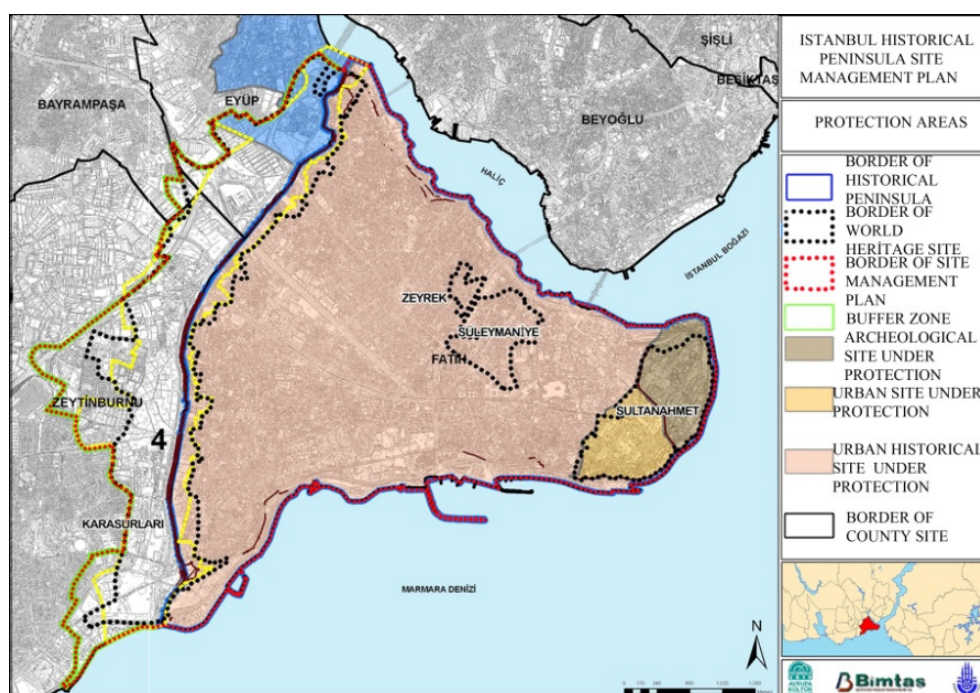


Figure 4: The borders of the site magement plan.

Cultural Heritage in the context of objectives-targets and strategies and the scope and content of the plans will be evaluated in terms of integrated and sustainable conservation approaches by specifying the active institutions in the production-implementation-audit processes of the plan.

Firstly, revitalization projects consider the Heritage Site, as an area consisting of structures as a scope and only architectural projects has been prepared; therefore, the lack of socio-cultural and economic analyses does not contribute to the improvement of the socio-economic structure of the region, the preservation of intangible cultural values and the maintenance of the region's soul. Considering that the physical renewal of the structures and the change of the trade structure will increase the value in the region, it seems unlikely that the region will continue to be a living space for the low-income group since it will appeal to a new mass of population. Therefore, it seems unlikely that the project will be sustainable due to the new physical, social and economic texture, it will create and it will also be a weak one in terms of integrated and versatile protection principles. It is also possible that new structures, one of the purposes of the revitalization projects can create an artificial physical environment that is foreign to the cultural heritage and it may pose a threat to the integrity and authenticity of outstanding universal values. Apart from very special cases, it is a wrong method or at least it should be discussed very seriously to set out from the stylistic features of old buildings and to determine the characteristics of the architectural elements in form, size and composition and to write them in plans and regulations for new buildings to be built in a historical environment [16]. Despite the fact that the restoration projects are based on the partnership of the private sector, the public institutions and the landlord, the restoration projects of the civil architectural structures have mostly been undertaken by private architectural offices. It can be seen that the planning and projecting processes are performed with a centralist understanding and commanding attitude, that only professionals join in decision making and the relevant parties are only given information about the results of the process and that these processes are entirely left to the initiative of the administration [17]. The fact that in the implementation process private architectural offices become the dominant actor of the project by purchasing a large part of the civil architectural structures from the owners with no economic power to restore the structure and that the municipalities also have the authority to expeditiously expropriate the civil architectural structures according to the law demonstrates that conservation principles in projects are not considered in a collaborative, transparent and broad participatory way.

The objectives set out in the conservation plan as second approach, relate only to spatial, functional and population density of the area. For this reason, multidimensional conservation approaches have been ignored and the decisions on the improvement of socio-economic structure and preservation of intangible cultural values have been insufficient. Moreover, in the case where the purposes regarding the population density are not determined in the revitalization projects, new structures have been proposed. It may be incompatible with the density decisions determined in the conservation plan and may change cultural, functional and density relations. Unclear and conflicting decisions about what should be done to protect the heritage integrity and originality in these two practices, which are carried out independently of each other to protect the cultural heritage of Süleymaniye and the uncertainty about which institution will be more effective with which actions cause concern about managing the process.

Despite the fact that there are many spatial, demographic, socio-economic and cultural problems in settlement, in the management plan, which is the latest work to protect Süleymaniye Cultural Heritage, these are not emphasized. The fact that the problems are mainly related to the spatial decay and the lack of publicity cause concern in terms of the



intangible cultural values of Süleymaniye. The fact that there are no decisions among the objectives, target and strategies regarding the conservation and socio-economic development of the intangible cultural values of the Heritage Site makes the plan inadequate for the integrated protection of the site with sustainable methods similar to the other two protection applications. The aims have been expressed in very general statements in the plan as well as there are no specific action decisions that are described in detail on the basis of the values that make up the unique character and urban identity of the region that can create distinctiveness and awareness. The Site Management Plan contains superficial and general purposes in terms of content and implementation. The lack of mention of long-running revitalization projects in the section related to the protection of civil architecture buildings in the plan and the lack of private architectural offices in the definition of responsible institutions may also lead to confusion of authority. Furthermore, the fact that the local people are not defined as stakeholders in the protection activities and that the same institutions and organizations are regarded as responsible for carrying out all the actions shows that the requirements of the participant protection have not been understood enough.

5 CONCLUSION

Integrated protection problems become clearer in the case of Süleymaniye when the objectives, strategy and responsible organizations defined in the conservation-renewal and site management plan are considered according to the integrated protection criteria of the Amsterdam Declaration and the following criterias of Operational Guidelines for the Implementation;

- a) A thorough shared understanding of the property by all stakeholders;
- b) A cycle of planning, implementation, monitoring, evaluation and feedback;
- c) The monitoring and assessment of the impacts of trends, changes, and of proposed interventions;
- d) The involvement of partners and stakeholders;
- e) The allocation of necessary resources;
- f) capacity-building; and
- g) An accountable, transparent description of how the management system functions [21].

As can be understood by UNESCO Implementation Guidelines, it is requested that all related stakeholders should act with a common understanding of protection in the state party's approach to conservation of cultural and natural heritage properties. However, the conservation approaches, we have examined, have objectives that are inconsistent with each other and are produced independently by different institutions. In addition, the social, scientific, economic and technical sustainability approaches that the Amsterdam Declaration defines under its integrated conservation criteria are lacking in all three studies. Therefore, for the settlement of Süleymaniye, there are projects, which only have an understanding of spatial revitalization and protection and do not care about the historical soul of the place.

Due to the fact that the objectives set in the site management plan are expressed with very general statements, that the two other studies are not mentioned and that the revitalization projects are implemented independently from conservation plans, it does not seem possible to achieve the "Planning-implementation-monitoring-evaluation and feedback cycle" suggested in the second criteria with these highly fragmented and independent approaches.

According to the fourth criteria, which suggests that partners and stakeholders are involved, the government must make an objective definition of relevant party, ensure equal representation of all parties, plan their participation and make all stakeholders active in protection efforts. However, 'participation and informing the public' that is expressed in the



guidance on was not provided in the form of transparent and equal representation in renewal projects, conservation plans and finally site management plan. These plans and projects developed independently about the Historical Peninsula demonstrate that the concept and process of the 'Management Plan', which the World Heritage Committee is trying to ensure in all states, have not fully been understood.

The plans prepared without the participation of the public by the separate institutions for the protection of Süleymaniye settlements have not been successful both due to the lack of a reliable and transparent atmosphere for the implementation process and the incompatibility of the scopes and contents with the contemporary conservation understanding. In addition, the participation of actors and corporate stakeholders is a process that cannot be managed and learned in Turkey yet. The examined examples indicate that the subject is continuing over non-systematic and non-scientific applications and that there are inaccurate accumulations.

In the case of Turkey, due to legal and institutional confusions and multipartite authorities on the protection of cultural heritage sites, the contribution of the Site Management Plan has not been at the expected level. Despite these three conservation approaches for the Süleymaniye settlement, spatial and social decay has been continuing to increase over time. The main cause for this is that protection work is prepared with a multipartite perspective, without taking integrity into account, and more importantly far from the principles of integrated protection and participation. All the three examined examples demonstrate that the institutions that take part in conservation work, focusing on Turkey's natural and cultural heritage must first develop a common and integrated conservation language, conduct a good stakeholder analysis and have comprehensive and holistic conservation legislation. Cultural heritage is a whole, not only with the superior single structures but with the people, their cultural values and social lives and it should be protected thus. Historical urban centres should be considered together with the social and economic problems of the inhabitants of the region as much as possible and should be designed with intangible cultural values. Moreover, the protection of the cultural heritage should not be a matter of only experts, institutions and organizations, society should give conscious support to conservation work. People must effectively take a part in every stage of the work, from planning to its implementation and control, in a participatory, transparent and collaborative atmosphere. If we cannot integrate concrete architectural items with the community and cannot deal with them, protection will never be fully ensured.

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REVITALISATION OF HISTORIC PUBLIC CEMETERIES IN CENTRAL ZONES OF URBAN AREAS

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ABSTRACT

Historic public cemeteries, thanks to their social function, are an integral part of urban areas. They exemplify a relationship and respect for values which were created by previous generations. A relatively large extent of the historic public cemeteries, founded during the 18th and 19th century, have been preserved until now in the Czech Republic. Some of them could be extended to fulfil their social function to this day. But some of them, thanks to fast development, have appeared in central zones of urban areas and therefore have ceased to fulfil their original function. Other cemeteries ceased their activity and instead, housing estates, factories or parks were created. In some cases, the original ethical principles were not respected. Questions arise here: what is and what will be the fate of historic public cemeteries which cease to fulfil their function? How will the outcome be handled by representatives, investors and conservationists? The aim of this article is to explain the influence of urban structures on cemeteries as well as how cemeteries influence urban structures and adaptation of these areas to meet its current needs and the needs of the society. It will also give a prognosis for the further development of cemeteries within towns.

Keywords: cemetery, urban area, Czech Republic, grave, cemetery wall.

1 INTRODUCTION

Cemeteries are places built and shaped by the gradual adding of new graves over a long time. Their location is thus formed by the rules and laws from the past, earlier than other surrounding buildings were built. Cemeteries have experienced different time eras and styles; they are like time capsules [1]. In cities, cemeteries are often attached to a park or garden or they alone create a garden among which graves are located. Each cemetery is different, not due to poor arrangement, but because their location within the city is different, and therefore they all meet different needs. This is essential for the proper functioning and operation of cemeteries.

The prognosis for individual cemeteries cannot be determined in general: each of them is unique and fills different needs in the city in terms of certain size, location, faith and links to the funeral buildings and other parts of the city. That is why we will focus on three specific cemeteries in a European city and find out how they are fighting for their place in the present time of growing infrastructure and overcrowding. The following examples can offer examples of ideas for revitalising and renewing other cemeteries.

2 HISTORY

First row graves were located outside residential areas (on nearby roads, etc.), but with the onset of Christianity they moved closer to homes or became part of the church (nearby or within it). In the 2nd century, grave burial became highly popular (as a legacy to pre-Christian culture and Christianity) [1]. In 789 Charles the Great issued a decree that prohibited the cremation of bodies, with a punishment of the death penalty. This ban was respected in Europe for more than one-thousand years. From the 11th century, burials started to change in the Czech Lands: instead of burials in remote areas, they were happening closer to city centres. From the 12th century onwards, we can notice an increase in churches with cemeteries. Thus, cemeteries became a common part of towns and villages [2].



Medieval cemeteries have been referred to as public spaces which can serve as marketplaces [3]. But the idea of the bustling marketplace in a church cemetery is at odds with everything we know about burial and respecting the deceased. However, before that, both in Europe and elsewhere in the world, a cemetery stretching around the church in the middle of the village could have become a marketplace at times if there were no other alternatives due to the lack of free space. Similarly, early Christians that hid during times of persecution in the Roman catacombs had to come to terms with the fact that their meetings and ceremonies were taking place in burial sites. Otherwise, medieval Europeans avoided graveyards and only visited them with a mixture of respect and fear, even though they had more frequent and intensive experiences with death than we have today [4].

Cremation was brought back to society by various activists. The main credit for this belongs to the organised movement 'Supporters of Cremation' which began in the middle of the 1870s. Cremation associations, established during this time in Germany, Great Britain, the Netherlands and the USA, sped up the reintegration of cremation when it became possible to transform wishes into reality – the opening of the first modern crematorium (in 1876 in Milan and Washington after the changing of medical laws) [5].

In 1782, Josef II reformed the funeral business by creating the Dvorský decree which influenced burial in the former Austro-Hungarian Empire, which contained the Czech Republic (then known as Czechoslovakia). Among the most important regulations which influenced the development and planning of cities and towns in the Czech Republic was the establishment of cemeteries away from urban centres. After eight centuries, graveyards cease to be a part of the community. This is also the time when the law dictating the compulsory building of walls around cemeteries was approved as well as the recommendation to separate cemeteries from villages by a forest, hill or river [6]. Thus, around European cemeteries walls were built, separating the worlds of the living and the dead. This law still exists in Catholic circles. Calvinist and Lutheran cemeteries in Holland and Scandinavia are not normally surrounded by fences and graves remain unmarked. However, Catholic cemeteries, as well as public cemeteries in countries with Catholic tradition, are clearly fenced, with marked grave sites and eye-catching monuments [4].

Over time, some cemeteries approached towns due to the development of built areas, and in some cases, they even became a part of them again, this time in peripheral suburbs rather than urban centres. However, many of them have remained isolated in areas that least affect the surrounding public spaces, and that are least affected by surrounding public spaces.

It is therefore questionable whether the removal of cemeteries from urban centres is the right thing, or whether we should find ways to integrate cemeteries back into towns and to make people more aware of their existence. Given the increase in vandalism and the lack of interest in some of cemeteries the answer is clear: only those which are still functioning today and have something to offer a visitor should receive the public and religious interest which they deserve either as a final resting place or because there are representative of the rich sepulchral art of the past.

3 NICE: THE MONASTERY CEMETERY OF CIMIEZ

The Monastery Cemetery of Cimiez in Nice is situated on a hill overlooking the sea. In the neighbourhood, there are the old Roman ruins and a park. The cemetery was founded alongside the building of the monastery, which boasts a garden full of flowers. This wonderful cemetery is filled mainly by chapel graves, which also create the cemetery wall on the north side. The graves are located next to each other along the main paths, shadowing the terrain. We enter the cemetery at the monastery and follow along one circular path, and another perpendicular path lined with graves joins it. The cemetery as a whole does not have



any dominant features; each Chapel Tomb is a dominant item on its own (Fig. 1). Some tombs are leaning on the monastery wall and therefore look more significant. Thus, the monastic wall here is also a dominant feature, but it competes with small, detailed white graves. The cemetery has a dominating exterior and the cemetery metal gate acts as a small door; however, after you cross the border to the church, it immediately takes a step back and we find ourselves in a majestic place.

The cemetery is divided into two floors: one of them is at the entrance to the monastery and in the direction of the parking lot and the other is slightly lower, where it is possible to walk around the monastery and gardens. Each section is visibly separated: a monastery with a fitted marble room close to it, ordered with longitudinal paths, along which you can walk into the green area of gardens with a view of the entire city and the sea (Fig. 2). The cemetery itself is defending its place as much as the terrain has been allowing, on one side it is limited by the cemetery walls, behind which you can see a parking lot. On the other side is sharply

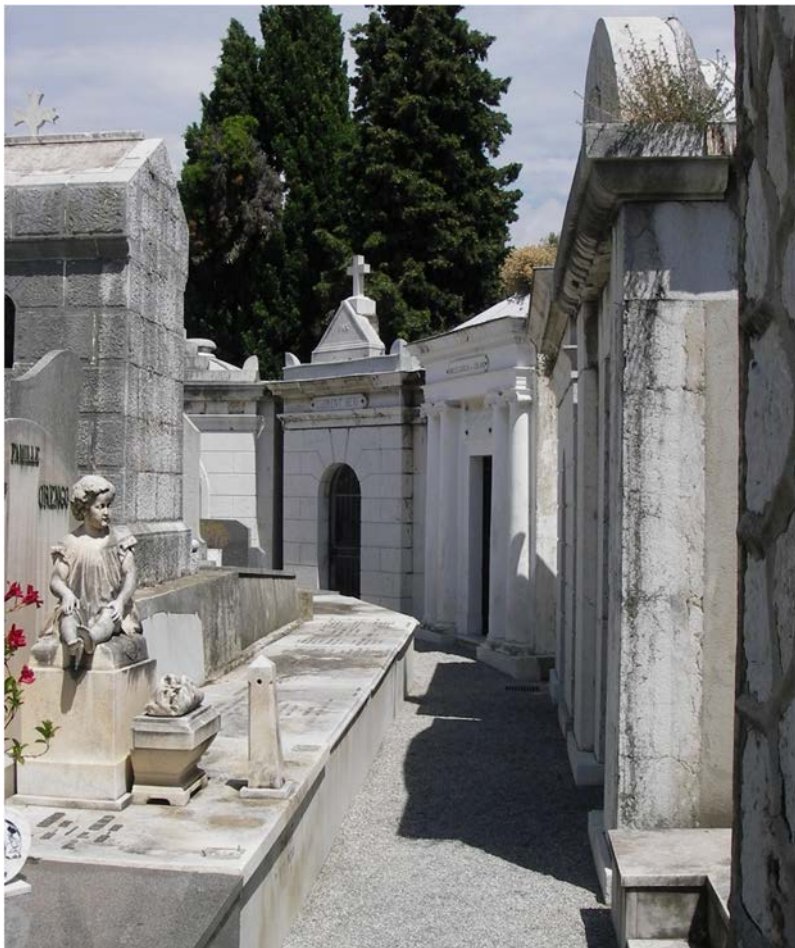


Figure 1: Chapel graves in the cemetery in Nice around the outer peripheral cemetery wall. (Source: Ivona Dlábková.)



Figure 2: Views of the sea from the cemetery in Nice. (Source: Ivona Dlábková.)

sloping ground from the side by the monastery wall to the road, however it is not losing any of its value. Its white marble interior with beautifully sculpted statues and concrete paths gives a sense of purity and timelessness. There are no trees or grass: every square inch is used as part of the graves, plinths, cornices, steps and gravestones. In 'The White City', Henry Matisse, a well-known artist, rests and he has been immortalised by The Museum of Henry Matisse, just near the cemetery. We can also see little spires from the palace of Queen Victoria from the cemetery, dating back to the days of the Belle Époque from which the period of her government was derived and where a considerable part of the construction of the city originated. The Palace, called Regina by the local inhabitants, is formed by the original cluster of homes, united into one complex with the same front. Currently, they are luxurious private apartments with a sea view and a private swimming pool.

The part of the town of Cimiez where the cemetery is located is very old; the Colosseum, which is still there, comes from the Roman times and it is said to be the smallest amphitheatre in France, with a capacity of 5,000 spectators. Once, it served only in the town of Cemenelum where the Roman baths were. Only the excavations of these places were preserved can be found in the Archaeological Museum there. This entire district with the graveyard, ruins of the Roman baths, a small amphitheatre, a palace, a park, the museum of Henry Matisse and, at the edge the monastery, a cemetery with a garden all stretch high above the city.

From the gardens, you can see the centre of Nice and the acropolis of the former castle called "Castle Hill" protruding from the coast. From this place, you can see almost all parts of the city and its borders, which are shown by the steep hills. This district once was a village, but today it is a part of the town of Nice, connecting with the centre via a long boulevard with a road lined by trees in the residential area descending down to the wider centre. This was built at the time of the reconstruction of Paris following the example of Haussmann. The wide boulevards and extensive promenades along the coastline called Promenade des Anglais were then created. One side is defined by the faces of the residential blocks and on the other side there is stony beaches and a view of the horizon over the sea. The town of Nice also has a part called Old Town Vielle with the building of the court and the building of the opera

house, which was burned down and then rebuilt in 1881. This part is full of salespeople in shops and a market with domestic crops. The newer construction is linked to the old town by a promenade along the Paillon River which flows under cobbled paths and a park. From the other side, the old town is regressing into the Castle Hill. The castle is no longer there, only the foundations from the days of Celtic and Roman settlements remain. Today, there are gardens with a view and also the castle and Israeli cemetery. These two cemeteries are located near to the centre of the town, although they were brought up to the height of the acropolis. Otherwise, there are a further thirteen cemeteries mostly adjacent to the part of the church in the suburbs. The area is mountainous and the town is surrounded by the Alps. In the framework of the town the cemetery in the monastery in Cimiez is on the borders, but it has good contact with it because of its high position. It looks as if it is watching the life of the city from a distance.

Its location is multiplied by the surrounding excavations and buildings. Thus, it occupies an honourable place over the city like the cemetery on Castle Hill. It is therefore obvious that our ancestors used to bury the dead in important places. Certainly, this was due to the specific coastal areas where it would not have been appropriate to put a cemetery, due to the risks that come with being near water. Practical reasons certainly play a big role there, however we can see great differences in understanding the cemetery as the stone city, next to which there is an independent garden and a park unlike the cemeteries in Central Europe, where they themselves are designed as the place with trees, grass and flowers, unifying a park, garden and a cemetery in one. Such a unity creates a certain space between the individual deceased; it mirrors the sacred groves established by the Slavs where they used to bury their deceased [7]. In Europe, this tradition has been encountered again in the form of forest cemeteries [8]. On the other hand, the cemetery in Cimiez in Nice is like a room where you can go and see the deceased; it corresponds to the concept of “living forever”. A room for the rest of the deceased, a room for a walk through a garden with a generous view and a monastery for prayer. These separate parts then form a single cemetery, which if one was to go through, they would feel the journey and the sequence of it.

4 VIENNA: MEIDLING CEMETERY

The cemetery in Meidling can be seen directly from the train station. It is not separated by an opaque wall, but instead by the fence, through which you can see gravestones (Fig. 3).

In the vicinity, there are mainly residential houses that interact with the garden of silence which they are facing. It is crowded by the railways and a road. The composition of the cemetery is a regular network of moon-shaped passageways with a middle axis ending at the train station. The height of the cemetery does not change, therefore, the focus of the cemetery cannot be recognized from eye level. It is only clear from the guide at the entrance because of poor organization, meaning that it does not show the strict layout at first glance. The city of Vienna is built on a plane and the Danube river flows through it; therefore, the distances between them are longer and the city can afford to be generous with space. There are 55 graveyards in Vienna, but not one of them is situated in the heart of the city. They are located on the outskirts and are conceived as a place with trees, flowers and graves. For example, the main cemetery of Vienna called Zentralfriedhof has a number of areas which rather resemble a meadow than a cemetery. Each space can be reached by car or by bus.

Its area is so vast that it was important to build roads inside the cemetery. It has a double axes symmetrical composition, in the middle of which there is a monumental chapel in a Jugendstil or Austrian Art Nouveau equivalent style (Fig. 4), which you can reach from the main entrance by a broad alley lined with graves of famous Austrians (Amadeus Mozart, Johannes Brahms, Johann Strauss, Franz Schubert, Ludwig van Beethoven, etc.). The



Figure 3: The Cemetery in Meidling directly next to the train station. (Source: Ivona Dlábková.)



Figure 4: The chapel in Vienna in Art Nouveau style, Zentralfriedhof, Vienna. (Source: Klára Frolíková Palánová.)

generous areas between graves serve as space for future burials. The chapel itself dominates due to its height, and it is visible even from the more distant parts of the cemetery. We can always know what awaits us at the end of the journey to the centre of the cemetery. But the cemetery is located at the edge of the town, so the name ‘Central’ then loses its significance in relation to the city. The Cemetery in Meidling is situated in the residential area with a large park and is close to the Schönbrunn Palace Gardens, which are then connected to the

Ringstrasse or Wiener circuit by a boulevard. Thus, it is still connected to what is happening and is linked to the city. It is an ideal place for relaxation and waiting for train connections as well as being a garden in the middle of a densely populated city. There is almost no cemetery wall: the boundary between the world of the living and the dead is disappearing. The cemetery is becoming more of a public space, but it will probably never become one in full. In the majority of European cemeteries there are certain restrictions, therefore, the cemetery has never been and never will be a common part of public space. However, it belongs to the wider area of the town or municipality as a place which must continue to retain its uniqueness [4].

5 PRAGUE: VYŠEHRAD CEMETERY

Last but not least, the cemetery in Prague at Vyšehrad is significant. The cemetery is a part of the district of the original seat of Czech princes, which was used from the 9th century before the construction of Prague Castle began. High above the Vltava river there is a hill (comparable to the Castle Hill rising from the sea in Nice), where you can find the Basilica of St. Peter and Paul (after the last reconstruction in the neo-gothic style), next to which a cemetery containing big names can be found.

The cemetery wall is formed of an arcade corridor with tombstones on three sides. The cemetery is composed of irregular paths. The main path seems to lead along the perimeter wall with arcaded walkways, along which the visitors walk intuitively and which leads to Slavín. Slavín is the conjoint tomb of the greatest personalities in Czech culture. The impression from this sculpturing is enhanced by slightly ascending terrain and thus, the cemetery has its own dominant feature. As the dominant feature can be seen as well as the church (Fig. 5), which is adjacent by one wall with the cemetery, we guess there is kind of border with the other world of the church. The cemetery is adjacent to the Vyšehrad Orchards decorated sculptures. In the vicinity of it there is also the Romanesque Rotunda of St Martin. The Vyšehrad premises are surrounded by a rampart which ends with the gate Leopold or Cihelná. These monuments are proof of the ancient times and connect the past with the present. Once again, the element of water appears: the Vltava river washes the feet of the spur on which Vyšehrad is situated. The river still flows; it never stops, much like the never-ending cycle of life. Vyšehrad is one of 29 cemeteries located outside of the city centre, with the exception of the Old Jewish cemetery. The largest and the most essential (next to the Vyšehrad and Vinohrady cemetery) is Olšany cemetery in which visitors feel as if they were in a different world due to its peace and quiet (Fig. 6), in contrast to the sound of the traffic behind its walls. Mothers with prams go for walks there and relax on a bench; managers in suits come to eat their lunch and break up the scenery from just looking at the green trees. the cemetery is surrounded by a wall on one side, lined by chapel graves on the other side by the columbarium. The cemeteries in Prague are places with trees, flowers and graves, but most of them have an wall separating themselves from the rest of the world; they are sovereign units and enclosed gardens of silence. They are predominantly on the ground plan of the regular streets and paths, and are lined by graves which are very close to each other, according to the Austro-Hungarian establishment of cemeteries. The main axis is in the shape of a cross and the regular plan is only disrupted by diagonals paths. On the street corners and along the central axis there are graves of significant personalities.

Vyšehrad Cemetery is located on a hill out of the main routes for walking or transport, is built on a pedestal as a place for important personalities and is enriched by numerous sepulchral arts. It is an exceptional location and tourist destination. The significance of the place means that is is removed from the centre of the town and in this case, it is correct. On the other hand, Olšany cemetery in Prague is in close proximity to walking and transport



routes, shopping centres and administrative structures. The space is limited by walls, which isolates it from the rather close public space. It is a place for relaxation, thinking, meditation and prayer. The management of the cemetery have tried to link the two worlds by opening a café and gift shop, and a map of the graves of famous people was made.

On the other hand, there are the cemeteries on the borders of the capital city, intended purely for burial, which are now disappearing, are perishable and, given the high degree of cremation in Prague (98%), they no longer fulfil their purpose. How do we aim for the future? How do we re-integrate them into the public space of the city?



Figure 5: The arcade corridor and the base of Basilica of St Peter and Paul at Vyšehrad. (Source: Klára Frolíková Palánová.)



Figure 6: Olšany cemetery, less frequently attended part, Prague. (Source: Klára Frolíková Palánová.)

6 SUMMARY

Burial is an integral part of every society. The growth of cemeteries depends entirely on the deceased. The mentality, ceremonial rituals, method of burying (inhumation or cremation) and their symbolism are largely influenced by time, place and also by various events such as the development of human activities, for example warfare [9]. From the 18th century, Europe experienced large changes in the health sector. The improvement of hygiene conditions and nutrition led progress in medicine to a significant reduction in mortality [10]. People started to die in hospitals, not at home as it used to be before. Thus, death alienated us. The phenomenon of death appears to be independent of the time [11]. It will always be here, only our view on it is changing. The considerable influence on the current behaviour in society means that the desacralization of burying has increased in the course of the last century. That is why it is necessary to look for new directions of cemeteries so that they would be a fully-fledged part of our cities even in the current century.

Some of the selected cemeteries, like many others, e.g. Vyšehrad, part of Olšany cemetery and Meidling, and also the cemetery in Nice, work as fully-fledged parts of the urban areas, yet they are enclosed by walls and have limited opening hours. From the point of view of the public space: if we can see it according to the definition of a “non-personal part of urban settlements, where people meet who do not know each other personally or are known only categorically” [4], we find out that this model of cemetery fulfils that. However, if we add the sociological definition, which adds a condition of legal access for all that is under the normal conditions [4], we come across gateways which close the cemeteries after the opening hours. This is the difference between Lutheran and Catholic cemeteries at present. According to the condition “the loss of public positions” (Kovář et al. [4]), which the religion in the Czech Lands recorded in the last 50 years and then consequent high rates of atheism which have caused a change of the moral values of society, it cannot be dealt with differently. Other deterioration of our cemeteries appeared with the production and distribution of monuments and frames and even entire tombs made of synthetic stone with a very imperfect shape, colour and processing, especially in its early days, but conspicuous even with the best processing, which is not substantially different in price from natural stone [12].

Whereas the cemeteries are not public spaces in the truest sense of the word, they are an essential part of an urban area [4]. The experience shows that people visit cemeteries no matter what their location (see displaced Vyšehrad cemetery, or the cemetery remote from the city centre in Nice), but the likelihood of visits depends on what they can offer. Former Director of Administration of Prague Cemeteries, Martin Červený, describes the situation as follows: “Because of the high number of cremations there is decreasing interest in grave places. Partly the function of cemeteries is changing. People go there for a walk or to seek quiet” [13]. So, the whole image of the cemetery is changing, gradually there is a declining number of graves and the premises are becoming more like a city park which people go to for a walk. As inspired by the interest in sepulchral art, funeral/ cemetery tourism is also growing. As an example, the aforementioned Vienna Central Cemetery, where buses full of tourists arrive who tour perfectly decorated gravestones of famous personalities with a map. A similar trend is developing at the cemeteries in the Czech Republic. For a long time Vyšehrad cemetery in Prague worked similarly (where e.g. the Čapek brothers are buried, as well as the opera singer Ema Destinnová and also Milada Horáková, who have symbolic graves there). A great potential is laid in Olšany cemetery due to the position in the city, but also due to the extraordinary sepulchral art and the personalities that are buried there. The Administration of Prague Cemeteries (SPH) have already worked out a plan for their reconstruction and they have already established the educational trails around and about the cemetery. Furthermore, the Administration of Prague Cemeteries (SPH) wants to build a café,



for example, which would serve not only to mourning guests, but to visitors and tourists. A similar one already operates in the Berlin Kreuzberg. Prague Lesser Town cemetery, after a total revitalisation, launched guided tours [13].

Many cemeteries, however, got stuck in development, lacking an imaginary half-step towards the world of the living. This may be just the restoration, revitalisation, revival – such as the building of a new background premises not only for the maintenance of the cemetery, but for visitors too. Each cemetery can be proud of its long history, the prominent location or the quantity of personalities, even though that was not their original purpose. Not country, but mainly urban cemeteries (cemeteries in the larger cities) “suffer” from lack of interest from a secularised society, low attendance and subsequent decline which is an attractive space for vandalism (Fig. 7). Neglected cemeteries are bad reminders of the present day.

There seems to be a fundamental need to rethink their future direction and if they no longer fulfil their purpose, they should be converted gradually to a park with reference to their original purpose. To maintain the piety of the place, they should display the names of the dead into the walls or tiles and expose artistically valuable gravestones. This idea is offered for example at the cemetery in Ostrava-Hulváky which has not been used for burials and has not allowed ash storage since the 1950s. Its original plan was disrupted by its partial cancellation and substitution of the bustling street and new building of Vítkovice Ironworks. If, however, the unceasing interest is recorded, it would seem to be more than appropriate to complement the existing cemeteries with the possibility of new forms of burials, especially ash storage. In a country with an abnormally high rate of cremation and with a high number of crematoria as well as cremations, this seems to be a further possible way to maintain the current necropolis, therefore keeping their original purpose. The construction of columbarium, graves for storing the urns or spaces for epitaph plates and of memorial scattering meadows which are enjoyed with great interest allow continued functioning of the premises of cemeteries and convert them into the 21st century.



Figure 7: The current state of the cemetery in Ostrava – Mariánské Hory, the view of the Vítkovice Ironworks through the cemetery. (Source: Klára Frolíková Palánová.).

7 CONCLUSION

The sanctity of the place and its meaning today, which the Roman Catholic Church has been spreading for centuries, evokes an exceptional experience when entering the necropolis. Piety is not distorted, even by the funerals and graves of extraordinary personalities, it is supported as it provides a new sense of cemeteries for today's society, particularly at The Central Cemetery in Vienna, The Olšany in Prague, in Nice and at the Vyšehrad. The tribute in treating the past as well as the present supports cultural, but also national, sentiments and helps to educate younger generations. The awareness that remains in their subconscious helps to eliminate vandalism which often occurs at the peripheral cemeteries.

The renewal of the necropolis with facilities for visitors also proves beneficial, particularly in more distant locations. If the place for the dead is combined with the needs for the living, there is a positive interaction and experience of an exceptional moment when "visiting" our loved ones, as well as when relaxing and meditating. In these moments, a wall is not an obstacle, but defines it as a sacred place, allowing for warning and instruction from the different authorities which look after that location. Increasing the quantity of gates will help the accessibility of the area without building a barrier in the city, and, at the same time, more sites will be available, even those which are normally ignored by the visitors (the oldest part of Olšany cemetery). Last but not least, in the cemeteries which do not serve to the funeral tourism only and are not in an appropriate location for walks, there is a need to supplement them and to ensure the new forms of burial. There is the possibility of storing ashes so that they can continue to fulfil their function for which they have been set up for originally, such as the establishment of columbarium in unused chapel tombs, the establishment of the memorial scattering meadows in locations of defunct graves, or allowing urn storage in the area of the existing tombs.

We can take the example of the cemeteries in Nice, where there are separate places for the deceased and then there is another "area" in the form of a garden or a park; one using this additional element can get away from the death which is looking at them in the form of gravestones. The graves are then placed one next to the other, unusually dense in comparison with those in Central Europe. The space is given by the garden itself. We can take as an example the cemetery of Meidling because of the courage which is shown by having a location directly next to a railway station that they can live together. We appreciate that it has not been transformed into a park or that they avoided building new premises, as it happens at the time of the rapid construction. It has lived on its own even next to the busy road and fully serves its original function. It is not a directly public space, but it lives within the environment and offers a place for a quiet contemplation away from the busy world. Vyšehrad cemetery has a long history, first a place on the upper position for a stay of princes and today, a place for eternal rest of important personalities. Such a position has been being built for centuries, but we can notice how important places for the living changed to an important place for the dead. The cemetery has literally an exceptional position. Why should the word cemetery evoke abandoned, not maintained, aside and a sad place to most people in society today? With the exception of the country cemeteries in churches that keep their traditions and rules, the urban cemeteries are usually a place which many people do not attend, unless it is the holidays. These are the places without rules, which not kept tidy. The places like Vyšehrad or Olšany cemeteries are the opposite examples. The shelter for the dead is dignified and the living can admire it. The cemetery deserves an important place in today's society.

The cemetery as a unit in a town in the framework of time seems to be stagnant. It is changing slower than the rest of the city, so let us give it more time and space, as with the other buildings; it used to be here before and will stay longer than we will.



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SECTION 3
URBAN TRANSPORTATION
AND PLANNING

MANAGING THE ENVIRONMENTAL ADAPTATION OF VEHICLE OPERATIONS

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ABSTRACT

The growing vehicle fleet, which is the largest consumer of the hydrocarbon fuels and the emitter of toxic substances and greenhouse gases, creates the serious environmental challenges that require an integrated approach to solve them. Simulation of the alternative scenarios for the traffic flows distribution allows evaluating the impact of various schemes of the road traffic organization and changes of the road infrastructure on the state of atmospheric air. It is necessary to consolidate the application of the legislative, economic and management mechanisms, orienting parties responsible for the negative consequences of the car operation to implement the optimal technological solutions. Possible economic incentives for the manufacturers of the vehicles, fuel producers, and the car owners are discussed, which enable to improve the environmental safety of the motor vehicles operation. The proposed model of an environmental fuel tax has been tested in the evaluating of the annual value of the possible additional tax revenues from a number of Russian refineries. The introduction of the proposed tax model can significantly reduce the negative consequences of vehicles operation.

Keywords: vehicle, traffic flows, environmental fuel tax, technological solutions, vehicles operation, greenhouse gases, economic mechanism.

1 INTRODUCTION

The continuous growth of the world vehicle fleet, already exceeding one billion units, entails an intensification of the hydrocarbon fuels consumption. Fig. 1 compares the contribution of the transport to the global energy consumption with the other sectors, Fig. 2 shows the contribution of the transport to the petroleum products consumption dynamics. The increase in the energy consumption by the transport is accompanied by an increase in the fuel combustion products emission into the atmosphere, causing both local and global changes in the state of the natural environment and creating environmental and climatic hazards that require a serious approach to the problem solution. Fig. 3 shows the contribution of the transport to the global emission of carbon dioxide. It should be noted that although the considerable attention has been paid to the introduction of the alternative types of energy and fuel, by the current moment their use by the world vehicle fleet is not significant. It is necessary to ensure the positive dynamics of the environmental safety of the transport operation using legislative, economic and management mechanisms that optimize the technological and organizational measures for increasing the energy efficiency and reducing the negative environmental consequences. While elaborating the urban areas development strategy it is also important to simulate the different scenarios for the traffic flows distribution and the corresponding change in the atmospheric air quality.

2 MODELLING APPROACH TO MOBILITY AND TRAFFIC DISTRIBUTION

One potential meaningful instrument that can be used in order to limit the deleterious impact of the automotive transport on the air quality of the metropolitan areas is the identification



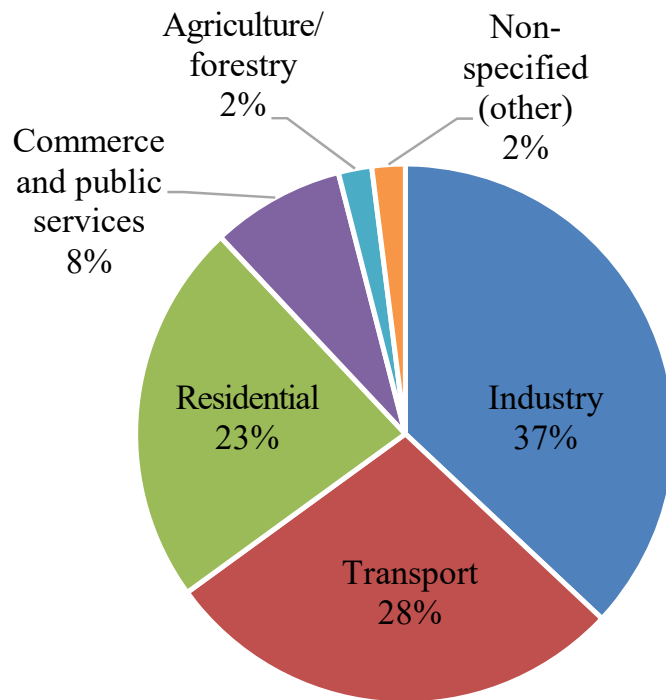


Figure 1: Energy total final consumption by sectors in 2014 (according to [1]).

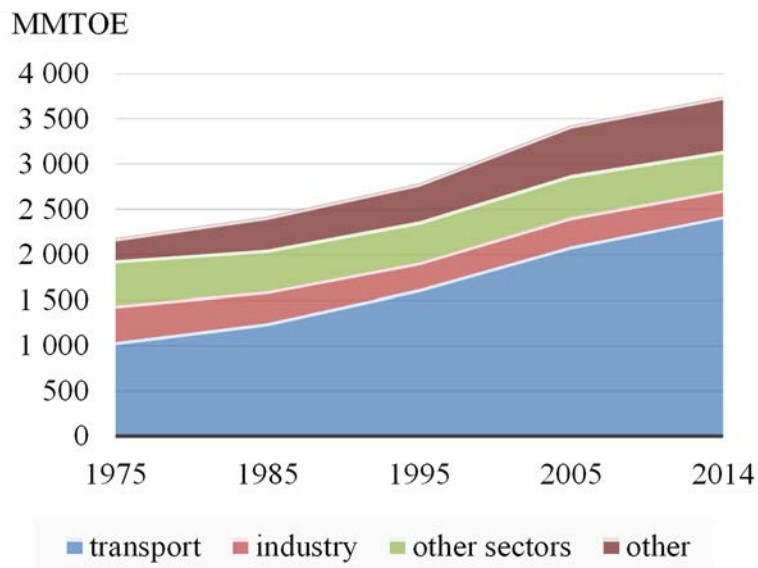


Figure 2: The petroleum products consumption in the world by the sectors (according to [2]).

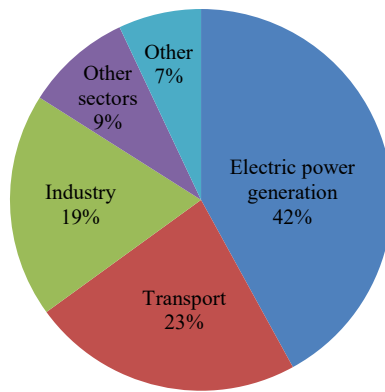


Figure 3: The structure of CO₂ emission from the fuel combustion in the world by the sectors (according to [3]).

and the following implementation of the optimal traffic networks by evaluating the effect of different traffic schemes regarding the concentration of the most critical air pollutants.

The following steps for this approach are required:

- Determination of the different traffic scenarios established on the basis of the realization of the road infrastructure, implementation and stimulation of the public transport usage, limitation of the traffic in the most critical hours of the day and in the most critical areas. While determining these scenarios it is necessary to take into account the potentialities of the public authority's regulations, the cost of the new infrastructure realization, the possibility to use economic tools to motivate or demotivate some traffic choices;
- Evaluation of the traffic flows resulting from the choice of a specific traffic scenario: the largely used traffic models, that are well consolidated in the practice of the city planners, can be utilized on the basis of the traffic needs and the consequent determination of the road and public transport infrastructures, to determine the potential future traffic flows;
- By using well known and consolidated emission factors for the different operating transport vehicles, it is possible to associate the potential maps of the emission distribution in the considered scenarios with the traffic flows determined as indicated in the previous point; the comparison of the emission distribution in the evaluated present and future scenarios leads to a first indication of the benefits of the established choice in terms of planning sustainability;
- Creation and evaluation of an atmospheric transport, dispersion and transformation model, which enables to establish the correlation between emissive fluxes of the principal pollutants and the air quality in the considered area on the basis of meteorology, atmospheric chemical kinetics, and topography of the area. Many complex models have been created and implemented for the evaluation of the dispersion from a linear emission area (like a road), and in particular the models of the Caline series defined by the California air quality authorities, they are highly effective for this purpose. It is important to carefully consider the complexity of this step from the point of view of data collection, model implementation, sources

definition, but it seems to be a fundamental step in order to arrive to a useful concrete final result;

- Use of the validated atmospheric model to determine the pollutants concentration distribution (air quality) in the considered area and for the hypothesized scenarios with the final result to establish the comparative benefits of the proposed scenarios. This comparison is done on the basis of the real determined impact, evaluated not in terms of the potentiality (emission scenarios) but in terms of the real effect on the population and biosphere based on the local air quality determination.

The final results consist in the determination of the emissive flows and the modified air quality with the aim to compare different traffic scenarios. The comparison of the scenarios results can become a very important tool for the urban planners and to define the future strategies of the city development.

As an example, Fig. 4 shows two simulated maps of PM_{2.5} concentration in the United States, with and without adoption of the procedures established by the Clean Air Act (Clean Air Act Amendments (CAAA))).

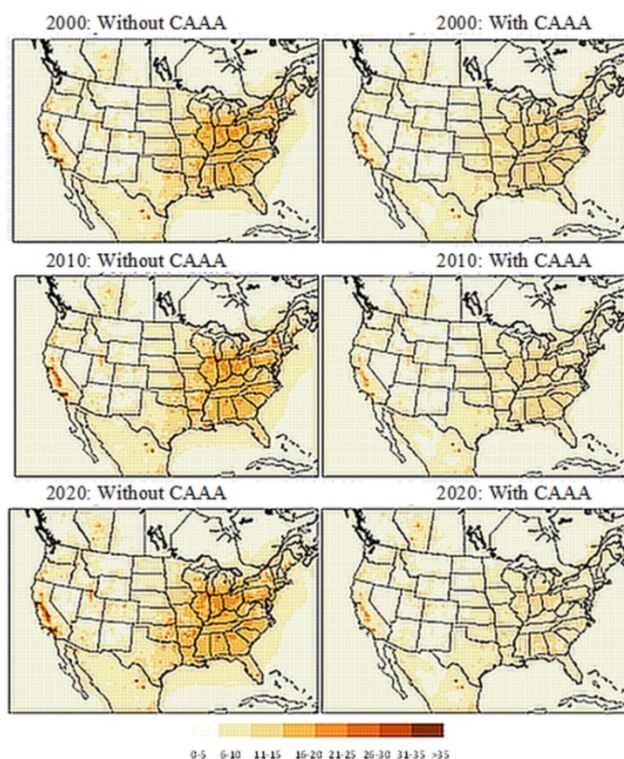


Figure 4: Simulated maps of annual average PM_{2.5} species concentration ($\mu\text{g}/\text{m}^3$) across the 36-km continental U.S. modeling domain for the period from 1990 to 2020 (according to [4]).

Such a tool based on modelling prevision must be evaluated in the combination with the other intervention possibilities (new fuels, engines improvement, different movement requirements), and it must be coordinated with them: a real, effective strategy is composed from the use of the best environmentally acceptable cars and their distribution in the areas less susceptible to the atmospheric pollution: a direct benefit from this strategy practical introduction is the air quality.

3 THE STIMULATION OF THE INCREASE IN THE ENVIRONMENTAL SAFETY OF THE VEHICLES OPERATION

The growth of the transport sector on a global and national scale happens mainly due to the motor transport, and first of all due to the passenger cars in personal property. According to the IEA [5], motor transport makes a determining contribution into the fuel consumption structure and, accordingly, into the carbon dioxide emission by the transport sector. It should be noted that carbon dioxide emission during fuel combustion correlates with toxic substances emission as a whole and thus is an indicator of the total negative load on the environment from the transport operation [6]. Consequently, the motor transport is the main contributor to the negative environmental impacts of the transport sector. Fig. 5 shows the dynamics of the vehicles number in Russia.

When choosing the measures to improve the environmental adaptation of motor vehicles, it is necessary to take into account not only the technological aspects, but also the possible changes in the way of life, the surpassed development of the public transport relative to the personal transport. The replacement of the existing fleet of the old cars with new ones, which have the improved fuel efficiency and lower specific emission of the toxic substances and greenhouse gases, should be initiated at the state level.

The main parties responsible for the environmental safety of the vehicles operation are vehicles manufacturers, the motor fuel producers and the car owners. Accordingly, various incentive measures are applied to them, using the state support, tax, and financial and credit instruments, as well as flexible pricing policies and an environmental certification system.

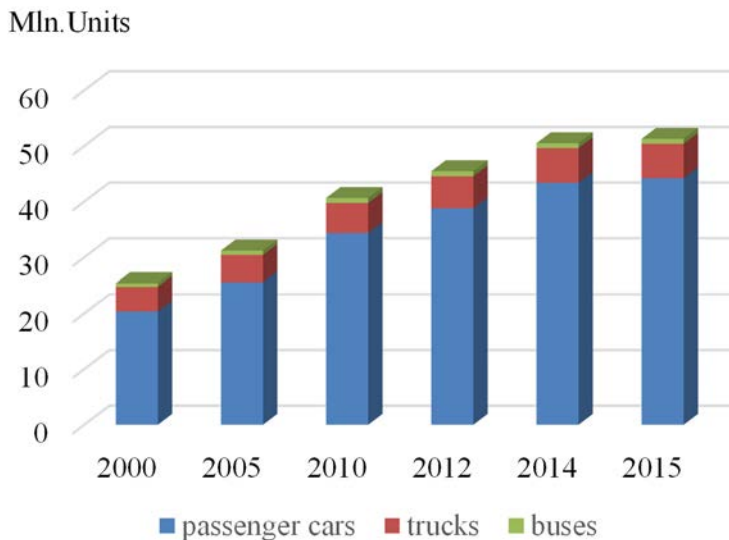


Figure 5: The dynamics of the vehicles number in Russia [7].

Among the measures of the economic incentives for the vehicles owners (both auto enterprises and private individuals) that ensure the compliance with the principles of the economic driving, one can note the state support of the development and introduction of the new technologies for the application of the smart transport systems, the construction of the road network and the transport systems reconstruction. The system of penalties for the untimely maintenance and repairs, the progressive tax on the car owners depending on the period of use of their cars contribute to the observance of the car operation rules. Such methods as the preferential prices for the cars with high fuel efficiency, including those using the alternative fuels and energy, preferential taxes for the auto companies with a high share of such models in their stock, programs for the recycling of the old cars will contribute to a structural shift in the vehicle fleet in favor of the fuel-efficient models.

Stimulating measures for the manufacturers of the transport equipment include the preferential loans, as well as the provision of the environmental subsidies for the development of the technologies to improve the engines and cars design, including the transfer of the vehicles to the alternative fuels and energy.

It should be noted that the quality of the produced fuels is a limiting factor in ensuring the vehicles environmental safety – all other things being equal. When using the low-quality fuel it is impossible to achieve a positive dynamics in the environmental safety of the cars operation by other methods, including the improvement of the construction parameters, road infrastructure, traffic control systems, etc. Therefore, the incentive measures aimed at the fuel producers are particularly significant. Such measures can be presented by the state support for the oil-refining industry modernization, the development and production of the alternative fuels, as well as the concessional lending for the new refineries construction, the development and production of the alternative fuels, and investment subventions. Considering that the fuel of the higher environmental class is sold at a higher price, which is a demotivating factor for the consumers, a government restriction on the growth of the motor fuel prices and the provision of the tax subsidies to the producers of the fuel of environmental friendly quality may be a useful measure. It is also necessary to support the developers and manufacturers of the fuel additives that reduce the specific fuel consumption, and to introduce the mandatory use of the additives in standards and technical regulations, as the use of the highly effective additives is a very successful method for increasing the energy efficiency and the motor vehicles environmental safety [8]–[11]. Considering that both the fuel consumption and the emission of both the polluting toxic substances and greenhouse gases increase with the content of the aromatic hydrocarbons in the fuel [12] and, accordingly, with the fuel density increasing [13], it is advisable to introduce the density index into the quality certificates of the produced fuel.

Fiscal regulation of the oil and gas complex ensures a steady increase in budget revenues and stimulates the attraction of the investments and modern technologies of the world level. The tax mechanisms contribute to the economic development of the oil and gas complex and can become a factor of the sustainable development of the motor transport [14], [15].

Taking into account the correlation of specific indicators of the carbon dioxide emission, the fuel consumption and emission of the toxic substances by the transport, earlier the authors proposed the following model of the environmental fuel tax [16]:

$$T_{envij} = R_{ij} \cdot G_{ij} = (R_b + R_{ad}) \cdot G_{ij}$$

where T_{envij} is an environmental tax value on the i fuel type of the j environmental class, monetary units; R_{ij} is a motor fuels environmental tax rate, monetary units / ton of fuel; G_{ij} is a weight of the



sold i fuel type of the j environmental class, tons; R_b is a basic environmental tax rate on the i fuel type of the j ecological class, monetary units / ton, established for a given fuel environmental class; R_{ad} is an additional rate of the environmental tax on the i fuel type, monetary units/ton, determined depending on the amount of CO₂ emission from the fuel combustion related by the linear correlation with the fuel density.

This approach was used by the authors to estimate the annual value of the additional tax revenues provided that the proposed environmental tax is introduced relative to the current excise taxes for certain refineries in Russia, Table 1.

Table 1: The annual additional value (relative to the current excise taxes) of the proposed environmental tax on motor fuels.

Refinery	Productive capacity (oil processing volume), mln.tons	Production volume in 2015, mln.tons		The amount of the environmental tax due to the additional rate proportional to the fuels density, mln. rubles
		Gasoline	Diesel oil	
ROSNEFT ^a				
JSC «Ryazanskaya oil refining company»	18.8	2.9	4.0	130.8
LLC «RN-Tuapsinsky refinery»	12.0	0	3.1	84.6
JSC «Angarskaya petrochemical company»	10.2	1.3	3.0	91.6
JSC «Novokuibyshevsky refinery »	8.8	1.3	2.6	80.7
JSC «Syzransky refinery »	8.5	1.1	2.3	71.0
LLC «RN-Komsomolsky refinery »	8.0	0.4	2.5	71.2
JSC «Achinsky refinery VNK»	7.5	1.0	2.1	64.8
JSC «Kuibyshevsky refinery »	6.8	0.9	2.1	64.0
PJSC «Saratovsky refinery »	7.0	1.0	1.7	53.9
LUKOIL ^b				
LLC "LUKOIL-Nizhegorodnefteorgsintez"	17.0	4.0	5.0	165.6
LLC "LUKOIL-Permnefteorgsintez"	13.1	2.0	4.6	140.7
LLC2 "LUKOIL – Volgogradneftepererabotka")"	15.7	2.3	5.2	158.7
LLC «LUKOIL-UNP»	4.0	0.6	1.0	30.4
GAZPROMNEFT ^c				
Omsky refinery	20.9	4.4	6.3	204.3
Moscow refinery	11.0	2.7	2.1	77.2
Processing complex NIS	2.9	0.5	1.3	38.0
SURGUT-NEFTEGAS ^d				
LLC "KINEF"	20.5	2.5	6.4	193.3

^aAccording to the annual report of JSC "NK ROSNEFT" of 2015, available at https://www.rosneft.ru/Investors/statements_and_presentations/annual_reports/

^bAccording to the report for the investors of LUKOIL, available at <http://www.lukoil.ru/InvestorAndShareholderCenter/IrTool/InteractiveAnalysis/interactive-analysis-neww8?wid=wid4dcOqUy0a0OihSw0u4ieug>

^cAccording to the annual report of GAZPROMNEFT of 2015, available at <http://ir.gazprom-neft.ru>

^dAccording to the annual report of SURGUT-NEFTEGAS of 2015, available at <http://www.surgutneftegas.ru/investors/reports/annual/>



On the scale of Russia, with the existing volumes of gasoline and diesel fuel production [17], the replacement of the current excise taxes by the environmental tax can lead to the increase in the tax revenues to the budget, estimated as up to 2.4 billion rubles per year. Due to these additional funds, a road fund can be formed to finance the rehabilitation of road surfaces; some of the funds can be used to implement environmental protection measures. The proportion of the funds from the payment of the proposed tax allocation should be determined individually, taking into account the features of the region in question (the region, where fuel is sold in this period). When switching to the production of the motor fuels with a minimum density within the given environmental class, the motor fuels consumption and emission of the toxic substances and greenhouse gases during the motor vehicles operation will significantly decrease.

4 CONCLUSIONS

The flow of the pollutants into the environment during the vehicles operation is associated, on the one hand, with the technological aspects determining the specific emission and fuel consumption, and, on the other hand, with the traffic distribution and characteristics of the vehicle fleet that are largely determined by the political decisions and socio-economic factors. The impact of the different traffic distribution schemes on the air quality can be determined using the well-consolidated model approaches, which allows making strategically important decisions in the planning of urban infrastructure development. On the other hand, it should be noted that the formation of the secondary pollutants is difficult to predict due to the complexity of the corresponding kinetic dependencies.

It is necessary at the state level to stimulate the environmental solutions aimed at reducing the negative consequences of the motor vehicles operation, using the economic and management levers to influence the parties responsible for the emerging externalities. The tax instruments are very promising in this respect. The proposed model of the environment fuel tax can be effectively used in the conditions of the different states for more objective stimulation of the environmental characteristics improvement of the produced oil products. This will ultimately improve the environmental safety of the vehicles operation and their fuel efficiency. This approach can also be used at the interstate level, similar to the mechanisms of the Kyoto Protocol.

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A NEW LOOK IN DESIGNING SUSTAINABLE CITY LOGISTICS ROAD PRICING SCHEMES

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ABSTRACT

The congestion caused by freight vehicles within city logistics has become a serious problem for the cities round the world. Furthermore, the pollutant impacts of these vehicles are very high also at urban scale. Many cities are trying to propose planning strategies aimed at reducing these external impact of freight transport through sustainable transport policies. The idea of introducing a toll for rationalize the use of the road infrastructures by freight vehicles in city logistics is one of the most common Transportation Demand Management policies. The development of ITS technologies today allow to design these pricing schemes in several ways connecting the price to individual trips either on the congestion level as well as to the freight vehicle consumption/emission characteristics or the size and the loading factor. The road-pricing is a well-established practice all round the world. One of the main limits of the available case studies is that they don't take into account the impacts on the acceptance and on equity among the freight carriers. The aim of the study is to propose a new look in designing a sustainable city logistics road pricing schemes based on transport-related "*acceptance and equity*" measures useful for enlarge both the acceptance of this policy among the carriers and the equity produced in term of transport costs supported by the freight companies competing in the market. The origin-destination net perceived utility $s(V)$ is the variable proposed as an acceptance and equity measure. The idea was to consider the dispersion of $s(V)$ as a measure of equity and the change in $s(V)$ deriving from a road-pricing scheme as an inverse measure of acceptance (the smaller the change the larger is the acceptance of the policy among freight carriers). Furthermore, an application to a toy network was performed to test the benefit and the applicability of the proposed measure at reducing external and internal impacts deriving from a city logistics policy.

Keywords: freight transport, urban distribution, transportation planning, decision support system, optimization problem, decision-making process, welfare, quality of life.

1 INTRODUCTION

A sustainable city is composed of three pillars: environment, society and economy and must be, at the same time, viable, equitable and bearable. Within this vision, transportation system cover an important role in sustainable city, because of its impacts (external costs) in environmental emissions and quality of life. Many cities are adopting planning policies aimed at reducing external costs deriving from transport sector, through the implementation of rational planning policies (e.g. Cascetta et al. [1]) based on sustainability (e.g. Carteni [2]). Among these policies, the road pricing is one of the most useful ones. The road pricing is based on the introduction of a toll (pricing) for the use of a road infrastructure at urban scale. This policy is a well-established practice round the world as demonstrate by the copious state of the art on this topic (e.g. Cools et al. [3]; De Palma et al. [4]; Ecola and Light [5]; Ferrari [6]; Grisolia et al. [7]; Levinson [8]; Kim et al. [9]; May et al. [10]; Odeck and Kjekreit [11]; Verhoef and Rouwendal [12]; Viegas [13]). The road pricing schemes could be grouped into:

- toll pricing, for which vehicles pay for using a road infrastructure;
- cordon/area pricing, for which the vehicles pay for entering in a restricted area of a city (e.g. an Historical area in the city centre).



With respect to city logistics, the development of the Intelligent Transportation System (ITS) technologies allow today to design pricing schemes in a most sustainable ways, for example, linking the toll both to the characteristics of the trip and to the type of freight vehicle used for the urban distribution, as for example:

- distance-based toll, where the price is (directly) function of the trip distance;
- time-based toll, where the price is function of peak and off-peak hours of the day, or the seasons within the year (e.g. summer and winter months);
- congestion-based toll, where the price is function of the congestion level of the network;
- vehicle-based toll, where the price is function of the freight vehicle typology. Different tolls could be defined according to both the environmental impact of the vehicle (e.g. electric vehicle vs. traditional vehicle; old vehicle vs. new vehicle, light goods vehicle vs. heavy goods vehicle) and the loading factor (e.g. 0–30% of vehicle loading factor, 30–60% of vehicle loading factor, >60% of vehicle loading factor).

Among the examples of applied freight (and passengers) road-pricing schemes there are: Singapore (cordon, time peak/off-peak hours, distance of the trip and vehicle-based); London UK (cordon and time-Based); Milan Italy (cordon, time and Vehicle-based); New York USA (bridge/tunnel crossing and time-based). Singapore is probably the oldest case study, based on a “pay-as-you-use” congestion cordon pricing scheme (e.g. Goh [14]; Phang and Rex [15]; Seik [16]). London proposes a time-based cordon pricing scheme (e.g. Beevers and Carslaw [17]; Santos and Fraser [18]; Santos and Bhakar [19]), while Milan has introduced in 2008 a time and vehicle-based cordon pricing scheme (e.g. Percoco [20]; Danielis et al. [21]).

All the available case studies aim in reducing vehicles usage and their external costs. Unfortunately, the number of applications of road pricing schemes is definitely lower than its potential benefits due to the consensus difficulties in introducing it (acceptance). Furthermore, in the design of these policy the impact on equity (among the involved users/companies/carriers) is not taken into account. Equity is related with the distribution of benefits/costs among users/companies/carriers. Such benefits/costs (and their variation with respect to a design scenario) can be distributed in an acceptable (or not) way among the users, depending on different criteria. According to the economists, equity (and its variations) could be measured through welfare-based measures based on microeconomic theory. By contrast, according to the transportation planners’ equity could be measured through transportation accessibility indicators (measures). Some authors (e.g. Cascetta et al. [22]) propose to consider both a horizontal and a vertical equity. The horizontal equity means how users from a same group (e.g. different type of the companies, carriers with low transport accessibility) fare relative to one another. As proposed by Ecola and Light [5], all people in a group are equal and should benefit equal opportunities (e.g. activities and services). For example, all the carriers operating in a city, pay the same toll/km. By contrast, vertical equity refers to the distribution of benefits/costs across groups (Ecola and Light [5]) and measure the differences between groups with respect to their ability to pay (e.g. company’s income; transportation accessibility/opportunities).

As said, with respect to the acceptance related to a road pricing policy, the current case studies are often followed by a very low consensus, that sometime produce barriers and protests of the freight companies and carriers against the administrations, up to obtain its abrogation (there are many failures all around the world). The difficulties in decision-making processes at urban scale has long been recognized in literature, together with the need to

“open up” such decision-making processes toward the “*consensus buildings*” on city logistics policies. To increase the acceptance in a freight policy it could be performed a Public Engagement – PE (or Stakeholder Engagement – SE), that is the process of involving stakeholder concerns, needs and values in the urban planning decision-making process. As defined in Cascetta et al. [1], PE is a two-way communication process that provides a strategy for exchanging information and promoting stakeholder interaction with decision-makers and the design team. The aim of engagement is to achieve a planning process with greater input from stakeholders and their support for the decisions that are taken.

The aim of this paper is to propose and apply an original transport-related “*acceptance and equity*” indicator (measure) useful to enlarge both the acceptance and the equity (in terms of impacts produced on the freight companies and carriers) in the design of a freight road pricing scheme.

2 AN “ACCEPTANCE AND EQUITY” INDICATOR FOR DESIGN URBAN FREIGHT ROAD PRICING SCHEMES

According to the RUM (Random Utility Models), in a transport decision context, a decision-maker (e.g. a carrier or a freight company) assigns to each alternative j in his/her choice set (e.g. the paths to follow within a distribution channel) a perceived utility U_j (where \mathbf{U} is the vector of all the U_j perceived utility in the choice set) and choose the alternative that maximizes this utility. U_j can be expressed as the sum of a systematic utility V_j (\mathbf{V} is the vector of all the V_j) and a random residual ε . V_j estimate the mean perceived utility (e.g. relative to a path j) by all carriers (users) having the same choice (e.g. the same alternatives and attributes). The random residual ε is the unknown deviation of U_j by a generic carrier from this mean value and estimate the joined effects of all the factors that introduce uncertainty into the choice context.

The OD Origin–Destination net perceived utility is the measure proposed as an “*acceptance and equity*” indicator. In RUM, the EMPU (Expected Maximum Perceived Utility) variable $s(\mathbf{V})$ related to an OD pair could be considered as an estimation of the OD net perceived utility (surplus):

$$s = s(\mathbf{V}) = E[\max_j(\mathbf{U})] = E[\max_j(\mathbf{V} + \boldsymbol{\varepsilon})], \quad (1)$$

Choosing a ML Multinomial Logit model (and this is the case of the proposed case study), the EMPU measure has a simple and closed form (e.g. Cascetta [23]):

$$s(\mathbf{V}) = \theta \ln \sum_j \exp(V_j/\theta), \quad (2)$$

where θ is the Gumbel variable parameter. The $s(\mathbf{V})$ proposed “*acceptance and equity*” is also a transport-related accessibility measure (e.g. Carteni [24] and Cascetta et al. [25]) because increasing the impedance (e.g. trip distance/time/cost), decreases $s(\mathbf{V})$, and increasing the number of opportunities (e.g. paths, freight services) increases $s(\mathbf{V})$. The proposed measure (2) is a useful instrument to design road pricing schemes increasing both equity and acceptance among carriers/companies for city logistics (Fig. 1):

- equity impact: the dispersion of $s(\mathbf{V})$ (e.g. the Mean Absolute Deviation – MAD) is a measure of equity with respect to transport accessibility. This means that pricing the OD pairs with more opportunities (e.g. paths for urban freight distribution), generally decrease the $s(\mathbf{V})$ dispersion (e.g. Fig. 1) and so increases equity (if all the

carriers/companies support the same $s(V)$ value, this means that the dispersion is null and so the equity is the highest);

- acceptance impact: the absolute change in OD EMPU $s(V)$ indicators produced by a freight road-pricing scheme is an inverse measure of acceptance, in the sense that the smaller is the change, the larger is the acceptance among the carriers of the policy. Generally, also in this case, pricing OD pairs with more opportunities (e.g. paths), produce a lower (absolute) increase in $s(V)$, and this probably enlarge the acceptability of the road pricing scheme.

To better understand the acceptance and equity implication of the proposed measure, see the example in Fig. 1. As showed, the carriers better tolerate (more consensus and less barriers) a scenario in which the toll is imposed in one of the two paths available within the OD_2 pair (and this enlarge also the equity from a transport-related point of view as defined before), while the opposite occurs pricing the unique path connecting the OD_1 pair (no price-free path alternatives available for the carriers to reach the destination 1).

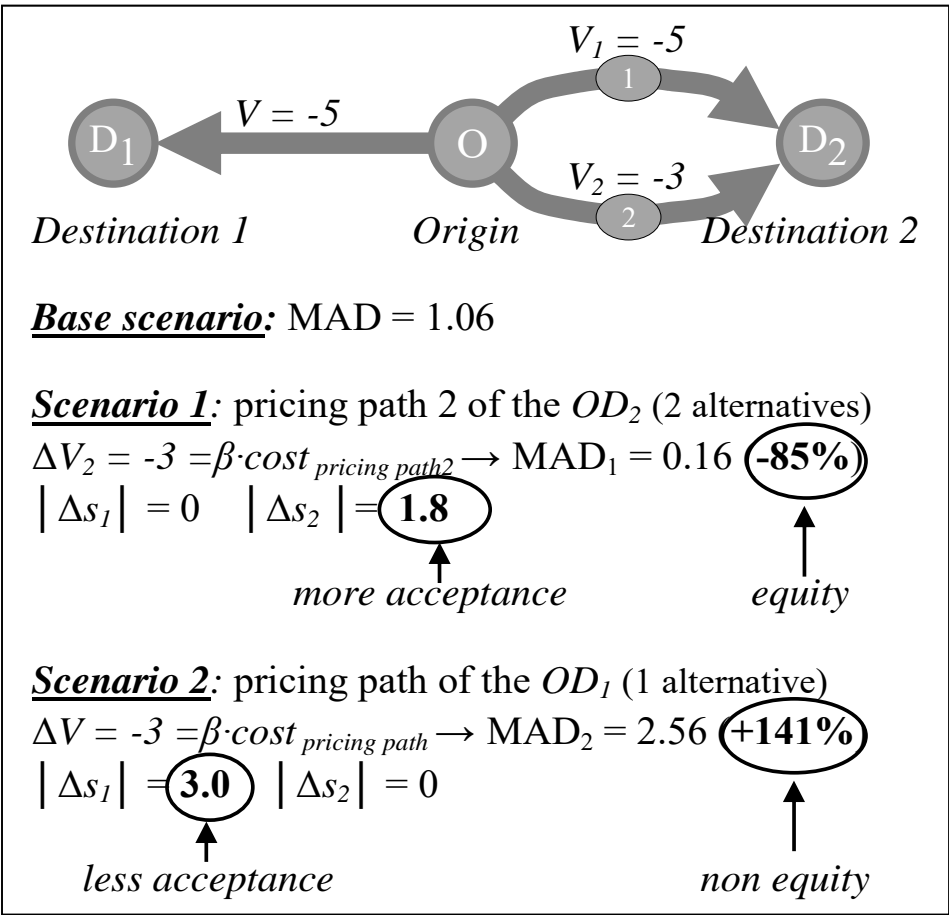


Figure 1: Acceptance and equity impacts in designing a road pricing scheme through the EMPU variable $s(V)$ measure.

3 APPLICATION TO A TOY NETWORK

The proposed $s(V)$ “*acceptance and equity*” indicator was applied as a design variable for an urban freight road pricing scheme. A toy network (reported in Fig. 2 and Table 1) was used to test the applicability of the proposed variable and to better understand its potential in increasing acceptance and equity of a sustainable transport policy.

Different path-based pricing schemes, aimed at increasing the city sustainability (e.g. reducing pollutant emissions and/or traffic congestion), were tested.

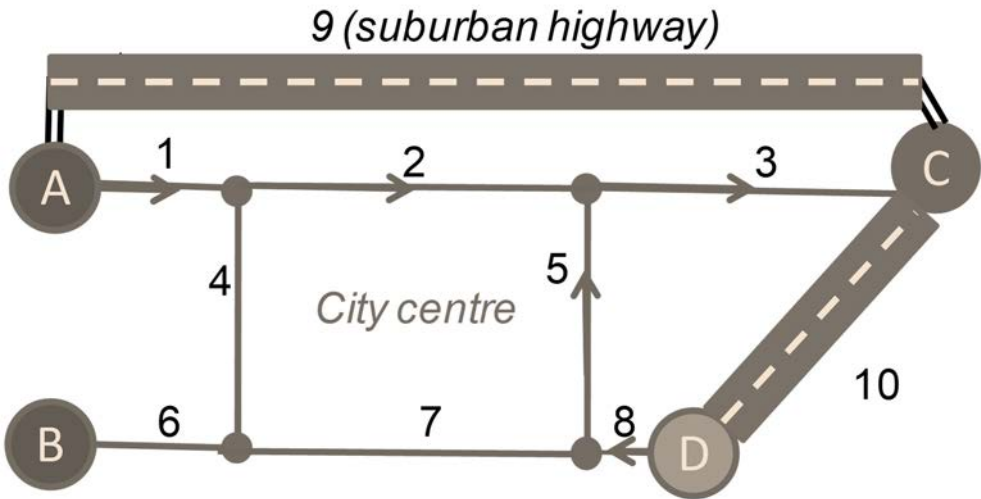


Figure 2: The toy network used in the application case study.

Table 1: The toy network characteristics.

OD pairs	Urban Path		Urban Road links	Urban paths lengths (km)	Alternatives (urban/suburban)
A–C	1		1, 2, 3	10	Urban + suburban paths
	2		1, 4, 7, 5, 3	18	
B–C	3		6, 4, 2, 3	16	Urban paths
	4		6, 7, 5, 3	10	
D–C	5		8, 5, 3	7	Urban + suburban paths
D–B	6		8, 7, 6	6	Urban path

Jointly with the toy network reported before, both a demand and an assignment models were applied to the case study proposed. The overall transportation system model consist in a within-day static models with variable demand (Fig. 3):

- urban impedance function (supply model) was considered as suggested in Carteni and Punzo [26], where the link generalized transport cost is equal to the sum of the trip travel time (in a congested network with a pre-load of a private car OD demand) plus the fuel cost (estimated considering 0.15 Euro cent/km). Furthermore, for the suburban highway was considered a ticket price equal to 1.0 Euro/trip;
- a nested Logit demand model as proposed in Carteni and Russo [27] and Russo and Carteni [28] for city logistics and in Bifulco et al. [29], hypothesizing an origin-destination freight demand flow equal to 1,000 light good vehicles/hour for all the OD pairs;
- an elastic SUE (Stochastic User Equilibrium) supply-demand (assignment) model for congested network as suggested in Cantarella et al. [30].

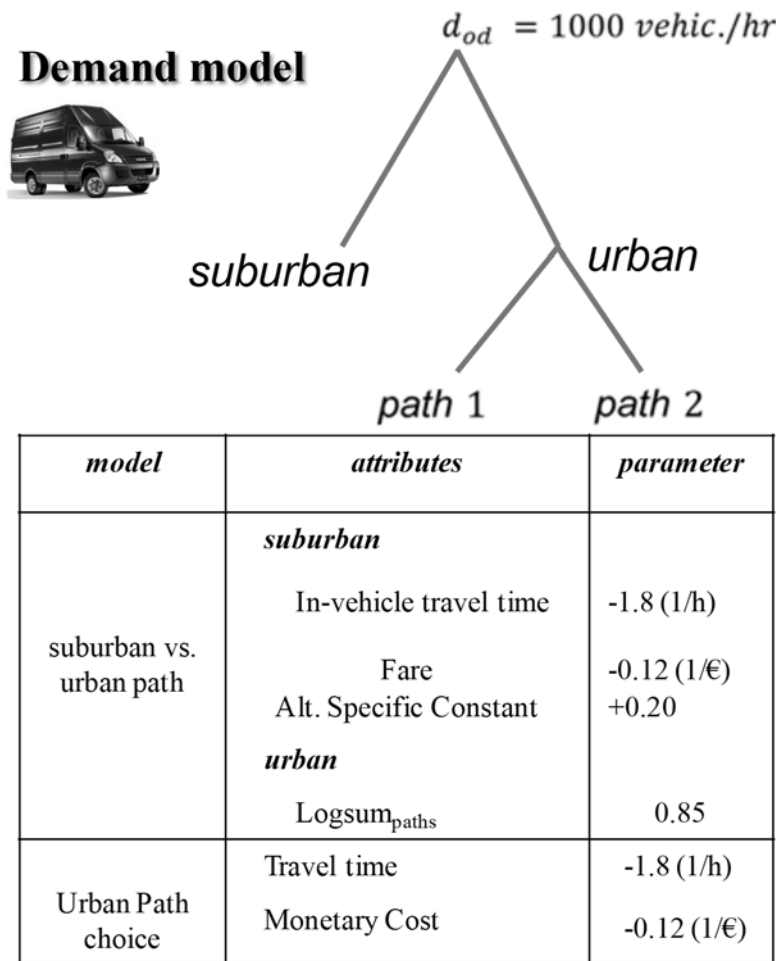


Figure 3: The city logistics demand model.

The proposed constrained optimization road pricing problem was:

$$\mathbf{P}^* = \underset{\frac{P_{\text{toll},j} - P_{0,j}}{P_{0,j}} < 1.0}{\operatorname{argmin}} \left(\sum_j TT_j \right) \quad (3)$$

where:

- \mathbf{P}^* is the vector solution of the optimization problem representative of the freight path tolls (6 tolls values for the 6 freight vehicles paths in the network as reported in Tab. 1);
- $P_{0,j}$ is the no-project (base) fuel cost relative to the path j without any road pricing schemes;
- $P_{\text{toll},j}$ is the total monetary cost relative to the path j (equal to the fuel cost plus the toll result of the optimization problem);
- a constraint was introduced, $(P_{\text{toll},j} / P_{0,j}) / P_{0,j} < 1.0$, imposing that the path j cost increase is always lower than 100% for all the paths;
- $TT_j = T_{\text{mpj}} h_j$, is the Total Travel time of the freight path j , where T_{mpj} is the average trip travel time relative to the path j and h_j is the freight demand flow that choose the path j (result of the assignment model);
- $\sum_i TT_j$ is the total network trip Travel Time.

Similar results were also obtained with other “traditional” constrained optimization problem (e.g. minimizing the network congestion level or the total pollutant emission caused by the freight vehicles), not reported in the paper for brevity.

Generally, defined the design criteria (e.g. minimizing the total travel time), there are multiple (equivalent) problem (3) solutions (in term of price vectors \mathbf{P}^*). For this reason, was needed to define evaluation criteria for choosing the “best” solution to implement. Among the “traditional” criteria there are, for example, the minimization of:

- environmental emission caused by the freight vehicles;
- overall traffic congestion;
- network Total Generalized Transport Cost (TGTC):

$$TGTC = \sum_j (VTTS \cdot \text{Time}_j + \text{Cost}_j) \cdot h_j \text{ [Euro]}, \quad (4)$$

where:

- VTTS is the Value of the Travel Time Saved (e.g. Carteni et al. [31]);
- Time_j is the average trip travel time on the freight path j ;
- Cost_j is the total freight monetary cost (fuel and toll) on the path j ;
- h_j is the freight demand flow on the path j .

The indicators proposed to measure the equity and the acceptance of a road pricing policy were:

$$\text{Equity:} \quad -(\text{MAD}^{\text{toll}} - \text{MAD}^0) / \text{MAD}^0 \quad (5)$$

$$\text{MAD}^{\text{toll}} = \sum_i \left| s_i^{\text{toll}} - s^{\text{toll}} \right| / N_{\text{OD}} \quad (6)$$

$$\text{MAD}^0 = \sum_i \left| s_i^0 - s^0 \right| / N_{\text{OD}} \quad (7)$$

$$\text{Acceptance:} \quad \Delta s = \sum_i \left| s_i^{\text{toll}} - s_i^0 \right| / N_{\text{OD}} \quad (8)$$



where:

- si_0 is the “acceptance and equity” indicator relative to the OD pair i and to the no-project (base) scenario (no road pricing scheme), results of the eqn (2);
- $sitoll$ is the “acceptance and equity” indicator relative to the OD pair i and to the toll scenario (result of the optimization problem), results of the eqn (2);
- NOD is the number of the origin–destination pairs c in the toy network proposed;
- $stoll = \sum_i sitoll / NOD$ is the average network “acceptance and equity” indicator value result of the optimization problem.
- $s_0 = \sum_i si_0 / NOD$ is the average network “acceptance and equity” indicator value relative to the no-project scenario.

Because of, as said before, the optimization problem (3) produce multiple solution (in term of price vectors P^*) it needs to define one (or more) evaluation criteria for choosing the “best” solution to implement. Using only one (or more) among the “*traditional*” criteria (e.g. minimization of environmental emission and/or traffic congestion and/or total generalized transport cost) it is possible to choose a solution which produces a decrease in equity and / or is less acceptable among the carriers/freight company. To understand this, it is possible to compare some of the solutions of the optimization problem (3) reported in Table 2. Considering, for example, as a unique criteria to choose the solution to implement the minimization of TGTC, it would be induced to choose the solution number 10 (that produce an increase of +8% of TGTC) which significantly increase the inequity among the transport carriers/freight companies (-88%).

However, considering a “*cap and price*” strategy, for example, capping (constraining) the TGTC maximum percentage variation to 30%, and using the proposed “*acceptance and equity*” indicator as an additional (not alternative but integrative) criterion for choosing the solution to implement, it would be possible to choose the solution number 5 or 7 in function of the relevance (in weight) awarded to the equity and to the acceptance criteria. For these solutions, even the TGTC increases of a 21% and 19% respectively, both the equity (+61% and +32%) and the acceptance (absolute Δs between 0.33 and 0.33) significantly will increase implementing the road pricing schemes obtained.

4 CONCLUSION AND FUTURE RESEARCHES

The aim of this research was to propose an original transport-related “*acceptance and equity*” variable useful for enlarge both the acceptance and the equity (in term of impacts produced in urban freight distribution) in the design of an urban freight road pricing scheme.

Results of the application underline how the proposed indicator could enlarge both the acceptance and the equity if used as an additional criteria for choosing the “*most satisfying*” (among multiple solutions) solution to implement.

Among the research perspective:

- apply and compare the proposed indicator in different pricing scheme (e.g. link-based and OD-based);
- apply the proposed methodology to a real case application (e.g. a medium-size city in Italy);
- extend the proposed “acceptance and equity” measure also to the non-users of the transportation system aiming to perform a sustainable city improving the overall quality of life in an urban context.



Table 2: Solutions of the optimization problem (3): freight vehicles path pricing tolls; percentage variation (respect the no-project scenario) of the TGTC and MAD (as measure of equity); absolute change in OD “acceptance and equity” s(V) variable (as measure of acceptance).

Path Id.	Solutions of the optimization problem (3) [10*Euro]									
	1	2	3	4	5	6	7	8	9	10
1	1.1	0.3	0	0.3	0.5	0.2	0.3	0.2	0.3	38
2	13	7.2	2.3	2.4	1.4	12	13	13	13	0.6
3	2.3	1.6	2.3	1.3	1.2	1.6	1.4	1.6	1.6	41
4	0.8	0.2	0	0	0	0	0	0	0	0
5	1.6	1.5	1.6	1.1	1.2	1.5	1.5	1.7	1.5	0
6	0.6	0.7	0.5	0.5	0.5	0.3	0.3	0.3	0	0
TGCT % var.	49	32	20	22	21	19	19	16	10	8
–MAD % var. (equity)	–82	–46	–13	15	61	–7	32	3	–27	–88
10*Δs (accept.)	5.8	4.5	4.1	3.5	3.3	3.6	3.3	3.5	3.2	3.6
Dominated solution	YES	YES	NO	YES	NO	YES	NO	NO	NO	NO
Satisfying solutions					YES		YES			

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SECTION 4

ARCHITECTURAL ISSUES

SUSTAINABLE ARCHITECTURE: BUILDING DESIGN METHOD INTEGRATING USER'S COMFORT, ADAPTIVE BUILDING, PASSIVE OPTIMIZED BUILDING AND BUILDING INTEGRATED PV – EXPERIENCES FROM A UNIVERSITY COURSE

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ABSTRACT

Buildings are constructed to deliver users indoor comfort. There are two further requests to realize in the 21st century: Firstly, buildings should be carbon free, energy demand and supply of renewable energies should be in balance. Secondly, buildings should allow an adaptive use, users should have the possibility to control temperature, ventilation and lighting through comfort-relevant parts of the building. During a master course for students of architecture was investigated how to achieve these objectives and which design method is appropriate. Thus, a design method strictly following comfort criteria was applied. The assignment was to design an office building (moderate climate, Germany). The design method taught and experienced related main comfort criteria with the progressing building design. Shape of the building and shading by different parts of it determine the access of daylight to the later areas of usage. Size and placement of operable windows or separate openings determine natural ventilation, placement of desks determines if it is draught-free or not as well as the view out of the window. Window size and shading system determine overheating protection and the need of cooling systems. The remaining energy demand should be covered as much as possible by renewable energies gained on-site mainly by PV modules on the building's roof and façades. Then only in the last step the aesthetics of the building was regarded. The paper will report about all the different design steps with examples from student's works. A special chapter will deal with the experience of the students with that design process and if they assess it as a helpful method on their way of becoming architects.

Keywords: adaptive building, aesthetic, building design method, building integrated PV, comfort, education.

1 GENERAL IDEA OF THE UNIVERSITY COURSE

The design process of a building proceeds often in the way that first the shape of the building and its façade are developed not asking explicitly for comfort aspects of the later users. The result is also often sub-optimal in regard to energy demand.

To make students more conscious about that result they experience an “inverse” design method that starts from the users experience on his desk and thus from the interior to the exterior. Only at the end of the design process aesthetics is regarded. Of course, all participants knew this “inverse” design method alone is not appropriate, and that aesthetics has to be regarded also from the beginning on. But target of this course was to help students to find the right way between both opposite design methods, to overcome inhibitions and to make them capable of finding the best compromise fulfilling all targets in aesthetics, comfort and energy demand.

In regard to energy demand the chances to realize the 2020 target of a Zero-Energy-Building were investigated. For moderate climates, the demand for heating is quite well known from passive house literature. Much more interesting was the question if and how the



remaining energy demand could be covered with PV modules on-site touching the topic of building integrated PV.

Supplementary, two more qualitative interviews with the participants were conducted. In the first one in the first week of the course they should describe their dream office; the questions had a (partly hidden) connection to comfort criteria. The results were used for the following building design. The second one was conducted at the end of the course, here students were asked about their opinion what contemporary architecture should show, if they feel well informed in their training as architects to do this work and how do they see their role as future architects. The results of the interviews are shown too; even if it is not a quantitative survey it gives a good impression following our experience (also of the situation at a department of architecture of a German main-stream university).

2 DIDACTICAL APPROACH

The course integrated 31 students from the third semester of a master program in architecture. Its value is 5 CP (150 working hours) and it is held in one semester. It was structured as an interactive development of the design of an office building.

Students were organized in eight groups. To avoid a competition with too similar results and to foster a diversity of different but successful solutions the 8 groups dealt with the same task but on a different plot and location. The design process was separated in a sequence of steps. In each step corresponding input to comfort criteria and dimensioning of systems for the passive optimization of buildings was delivered. Each step ended with a short presentation of student groups where the other groups should discuss the findings of the presenting one. Special investigations of one group (to innovative shading systems e.g.) of common interest were interchanged with the other groups. It was a central target to form a collective of groups where each single group contributes to the process.

A step by step design process in architectural teaching is discussed in literature [1], more general in multi-author compilations [2], [3].

With each presentation, the work was commented and assessed by the supervisor so that the students had a quick feedback and knew where they were. The assessment as well as the design process were based on comfort criteria (see table 1). Therefore, clear and widely objective criteria for the assessment could be used for the students to recognize which task should be fulfilled next time.

The design process had an open end, the only request is human comfort but not a specially shaped architectural highlight – all results would be accepted as well done.

3 SURVEY IN STUDENTS GROUPS – MY DREAM OFFICE

Students of the course were handed a questionnaire to describe their dream office. It included questions about the office's ideal dimensions and orientation, furnishing, comfort adaptability, as well as properties of its windows openings and shading. The most favourable lookout, storey and the possibility of a dress code in combination with preferred temperature in summer were asked as well. Obviously, the questions corresponded with the design criteria of the class and summarized them.

Considering the dimensions of the dream office and number of fellow workers the answers had a wide range from single- to large offices with a preference at four to six people in one office. (This matches the “studio” – type offices of the task.) The furnishing should be both flexible and economical. Locating the desk close to a window is widely preferred. One third wishes storage area in the office room; a few wanted to incorporate a couch, a coffeemaker, presentation area, a community table, a designated coffee break area, individually adaptable furniture or a terrace to increase their comfort.



There was no preference of a certain orientation. A generous glazing is favoured, 30% added opaque façade elements or a window to wall ratio of 50%. The majority of 89% wish for a clear glazing (non-coloured).

According to 80% the shading system needed to let in natural daylight and allow a reduced view outside. Often an outside jalousie was mentioned, a third wants to add glare protection on the inside.

Table 1: Sequence of steps in the design process and relation to comfort criteria, comfort assessment and used methods/tools for assessment.

Phase of building design	Aspect of human comfort	Comfort assessment	Method/tool for assessment	Description in chapter
Building shape and depth	Daylight	Daylight coefficient $\geq 5\%$, in minimum 3%	Geometrical rules	5.1
	View out of the window	Something to watch at (no static view)	Visualization/description	
	Privacy	Next part of the building	Distance in minimum 20 m	
First ideas for separation of façades	Natural ventilation	Air to breath, Tempering of the room (night ventilation)	Rules for necessary size and placement of ventilation openings and shafts	5.2
First ideas for floor plans and placement of desks	Draught-free ventilation	Necessary ventilation openings not there where the desks are	Visualization	
	Cooling breeze in summer, communication	Supplementary ventilation openings exactly there where the desks are	Visualization	
	Visual comfort	Placement of desks near to windows	Visualization	
Façades and shading system	Thermal comfort in summer	Indoor temperatures in comfortable range	Adaptive comfort model, transient thermal simulation	5.3
	Visual comfort	View out of the window also with activated shading system	Visualization	
	Adaptive user	Possibility to personal control of all elements that influence comfort	Description/visualization	
Final design of façades and roof	Aesthetics and renewable energy production	Human scale, Zero-Energy-Building	Modulor of Corbusier, Calculation of harvested renewable energy with web-based tool	5.4 and 5.5

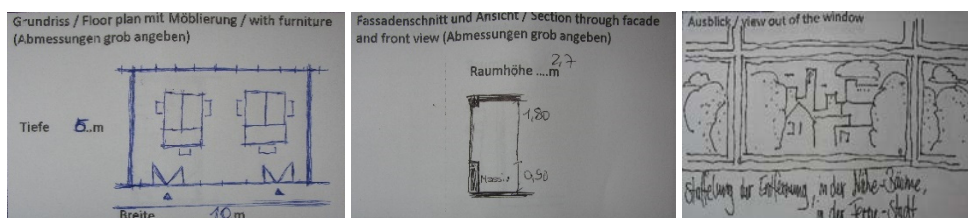


Figure 1: photos of sketches from questionnaires showing the most favoured situation [20].

Everyone wished for a dynamic view out of their window; which lead to two different types of view: about half of the students prefer a location from 1st to 4th floor looking at the city and vegetation; the other half aims for a wide view from 5th to 10th story all over the city.

Except for one student none desired a dress code but 54% could agree on a less strict, casual dress code, whereas 42% reject a dress code entirely. The ability to adapt all technical systems individually was desired 100% at ventilation openings, natural ventilation at about 83%, shading at 90% and 75% at thermostats. Therefore 17% prefer mechanical ventilation and 20% a central operated thermostat. For tolerance of temperature it is desired that the inside temperatures varies slightly during the year corresponding to the outside temperature but are limited to 22°C to 25°C, about 20% would accept a maximum temperature of up to 28°C.

To meet the preferences from the dream-office-survey a building should be adaptable in general, meaning it can be regulated manually and personally but is supported by centralized systems. These systems therefore can be - but do not have to be - switched on additionally. During some transitional periods, e.g. the mechanical ventilation could be turned off because natural ventilation provides high comfort already. This variant can meet almost all criteria.

4 GENERAL TASK FOR A NEW OFFICE BUILDING

The student's task is the development of a medium office building of 10.000 m² net floor area for an innovative company with well-motivated staff. The location should be in or near to one of the growing cities in Germany, well connected to public transport but in a nice surrounding. An estate of up to 15.000 m² allowing each building shape was assumed as available.

The users know quite well what kind of building they want to have, perhaps because of some lacks in their old building and because they know well how they want to work together. General wishes are no sky scraper and no air conditioning. The building shall deliver highest comfort in regard to an excellent daylight situation and natural ventilation. There is no dress-code, users are ready to adapt to floating temperatures in hot summer periods and would accept also 28°C to 30°C in their rooms for a few hours in the year. The building shall allow an adaptive use, users want to have the possibility to control operable windows, ventilation flaps, light switches, thermostats etc.

The building contains two different types of offices, a standard type for administration (2 to 4 persons, 14 m² per person) and a special "studio" - type with high equipment for the core units of the company, a number of creative working teams (6 to 8 persons, 18 m² per person). Each of these studios should have its own character by shape, height, equipment etc., all studios should be linked by a circuit.

5 DESIGN APPROACH AND DIDACTICAL STEP BY STEP PROCEDURE

5.1 First step – proposal for building shape, analysis of daylight situation, view out of the window, privacy

First groups should show their choice for the estate and propose per student one building shape (footprint and height) as different as possible. Statements for the design of outside facilities, local public infrastructure and positions of intermediate floor slabs and staircases should be made. The view out of the window to inner courts and the exterior should be shown by exemplary pictures. Students should analyse the pros and cons of the different proposals and decide for one building shape (or a synthesis of all) and give reasons for their decision. In a discussion in the whole group recommendations for the final decision were delivered.

Simple tools for the analysis of the daylight situation [5], [6], were delivered. The basic rule is that the daylight coefficient is 5% up to depth that is equivalent to the room height and 2% up to twice the room height. The recommended minimum window to wall ratio for cloudy sky in Germany is 50%.

Access to the building and the connection to public transport were part of the investigation. But main subject of this step was just the shape of the building as a structural work without any consideration of the façades.

Fig. 2(a) shows for the same estate two different proposals for the building shape. After the analysis, the bottom one was chosen for further work. Fig. 2(b) shows the corresponding analysis of the daylight situation.

Central part of the discussion was to ensure an excellent daylight access to all main areas of usage by moderate room depths of about 5 to 6 m and an arrangement of different wings of the building in a way that daylight access is not limited by shadowing.

This analysis shows the potential of daylight access only as consequence of building shape and intermediate ceilings, no information about windows and façades is necessary.

5.2 Second step – analysis of natural ventilation concept and visual comfort

In the second presentation groups should develop a concept for natural ventilation and visualize it. A first estimation of the size of ventilation openings and their positioning relative to the working places should lead to first conclusions for the following dimensioning of the façades.

Perspectives of the interior room situation with equipment seen from a typical working place should demonstrate the reference to the other working places as well as the reached visual comfort, also for the view out of the window with exemplary pictures.

Natural ventilation has two driving forces, buoyancy and wind. If there is a temperature difference between inside and outside buoyancy wants to move the air vertically. To reach a sufficient velocity an acceleration path of some metres is necessary – best arrangement of ventilation openings is one with a big height difference. Thus, small and high openings in the façade are better than horizontal ones. Buoyancy reaches its full potential only with a height difference of 4 m and more - more than the standard height of office rooms. Thus, air change is further increased with ventilation through the roof of atria or ventilation shafts [5].

Wind wants to move air horizontally through the building. To reach efficient cross ventilation openings on both opposite façades are necessary and internal partition walls must contain corresponding openings to allow overflow [5].

The necessary size of openings for the different types of natural ventilation can be taken from a German standard for offices [7]. As a rule of thumb openings to deliver air to breathe

need about 10% of the façade and those to temper the room (see 1.3.3 here below) in minimum 50%.

Ventilation openings can be operable windows but also separate, opaque flaps in the façade or the reveal. The relation between the possible location of desks and the position of ventilation openings should be carefully determined (see table 1). Fig. 3 shows proposals for size and positioning windows as well as ventilation flaps in the façade. All together save daylight, provide view out of the windows and allow all functions of natural ventilation.

Fig. 4(a) shows an example for cross ventilation and ventilation with big height differences through flaps in the separating walls to the floors. A very interesting architectural solution is the extension of floors in their width. Between the walkways on both sides an open-air space can act as vertical ventilation shaft. The roof of these mini-atria has ventilation flaps to exhaust air and can be transparent and deliver daylight to the floor zones as well (Fig. 4(b)). The total building depth increases but the gain in quality to stay there in a day lit communication zone should be worth it. Finally, the relation between windows, ventilation openings and the placement of desks was to clear up (see Fig. 5). Users should have the possibility to adapt the façade to their personal wishes and to enjoy a nice view out of the window.

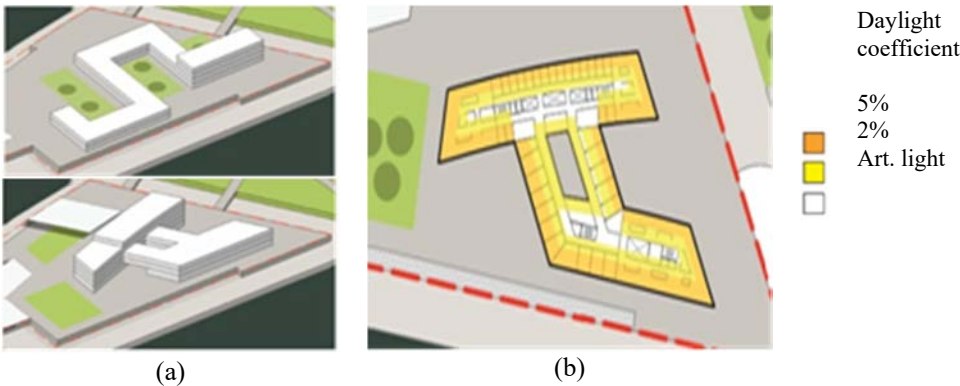


Figure 2: (a) Two different proposed building shapes [4]; (b) Daylight analysis of the chosen building shape [4].



Figure 3: Arrangement of windows and separate ventilation openings in façades [8], [9].

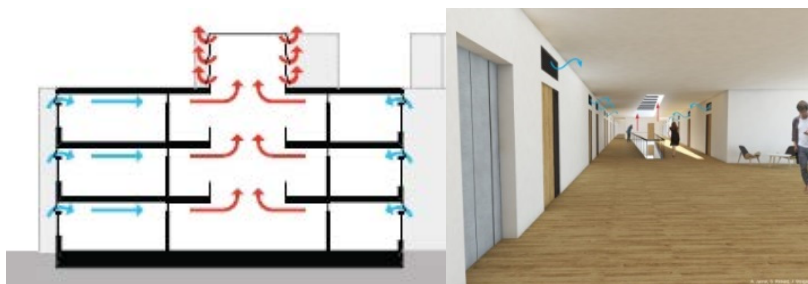


Figure 4: Principle (a) and perspective (b): of natural ventilation with big height difference using extended, floor zones as atria [10].



Figure 5: Possible desk-placement relative to windows and ventilation openings [11].

5.3 Third step – overheating protection and shading system; thermal and visual comfort in summer

The company has no dress-code, users can adapt to higher temperatures with their clothing. The building is adaptive with natural ventilation. Thus, everybody knows that temperatures indoor will be near to those outdoor. To prove that, selected critical rooms should be investigated with a transient simulation delivering the indoor temperatures in summer, they should be comfortable and fulfil the standard of the adaptive comfort model EN 15251 (energy plus based Primero-Comfort software [12], was used). The last parameters could be fixed: Strategy for natural ventilation, the optimal window size and the shading system. Finally, sections and elevations of the façades summarise placement of windows, ventilation openings and shading system. Last but not least the visual comfort for the view out of the window with an activated shading system should be demonstrated with exemplary pictures.

The main statement of EN 15251 is that in hot periods people feel well with temperatures that move slightly with outdoor temperatures. It defines 3 different comfort classes, whereas comfort class II is recommended for new buildings. A limited number of exceeding hours of 3 to 5% of yearly hours of use should be allowed (see Fig. 6).

Main target is the overheating protection or in other words thermal comfort also in hot periods. The necessary strategy for natural ventilation to temper the room in summer has to be found out. Fig. 7 shows a section through a façade with the integrated external shading system and the corresponding view onto the façade.

Note that in the suspended ceiling is a horizontal ventilation shaft. It transports the air from the opposite room through the floor and the regarded room. The exhaust opening is hidden in the façade view. Fig. 8 shows a possible arrangement of desks relative to the façade and the resulting view out of the window without and with activated shading system.

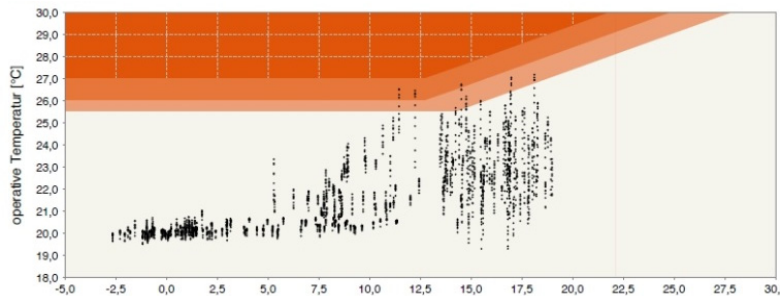


Figure 6: Example for assessment of indoor temperature according to adaptive comfort model EN 15251. Horizontal axis shows the daily mean value of outdoor temperature, vertical axis temperature indoor. Each point in the graph stands for one hour of usage. The three red fields represent the comfort categories to reach [12], [13].

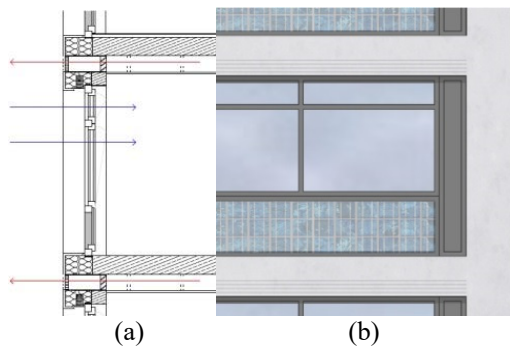


Figure 7: (a) Section through a façade with integrated external shading system; (b) Corresponding view on the façade [14].

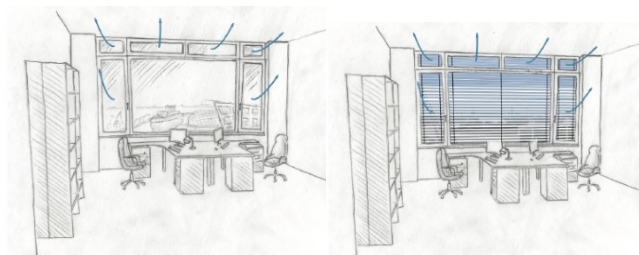


Figure 8: View out of the window without (left) and with (right) activated shading system [11].

The simulations of the student's groups showed that the maximum of 65% should not be exceeded otherwise problems with overheating would increase remarkably.

Under this precondition overheating protection could be realized with an intelligent strategy for natural ventilation and a corresponding shading system without hard changes in window size. For ventilation strategy, a high air change during the day was recognized as the most important criteria. That is because of the widely comfortable outside temperatures even in hot periods in cool northern part of Germany. For locations more in the south night ventilation and storage mass would become more important. External shading system is necessary. The best behaviour is shown by venetian blinds. With lamellas in cut off position enough daylight is transferred to avoid artificial light and it allows a (reduced) view out of the window.

5.4 Fourth step – integration of active solar systems

Possible areas for active solar systems on façades and roof of the building and on the estate should be located. The construction of modules and collectors should be defined. The energy demand of the building is estimated and compared with the prognosticated harvest of renewable energies. For the calculation of PV harvest PV-GIS [15], was recommended. For the assessment of the energy demand of the building a simple, self-developed excel sheet was delivered. The chances to reach a Zero-Energy-Building are assessed. Fig. 9 shows an example for the arrangement of PV modules on a roof. Fig. 10 shows possible arrangements for façade integrated PV modules.



Figure 9: PV modules on building's roof [10]. Because of the roof landscape areas can't be filled with modules.



Figure 10: PV modules integrated in façades. (a) Between windows [10]; (b) As parapet [14].



Figure 11: PV modules integrated in façades and design [9]. Left version was chosen.

There is a competition between the area of usage producing energy demand and the area of the roof and suitable façades for active systems. The higher the number of stories the less the possible area for active systems (still only one roof; façades have less insolation and are already used for windows and openings). Consequently, the different developed buildings showed different chances to reach a Zero-Energy-Building. Up to 3 stories it seems to be possible, for higher buildings not. The comparison between energy demand and the potential of harvesting renewable energies on-site showed that in first priority the energy demand should be further reduced down to a Passive House standard. Only then the potential for renewables is in the same range and a Zero-Energy-Building could be reached.

5.5 Fifth step – final design of façades, materials and color

Now and finally the students should deal with the design of the building, especially with the façades. Perspectives from the view of a pedestrian who is approaching to the building should demonstrate an impression of the building like it is. High qualities in façade design should be proved with a “zoom” onto the façade in 4 scales (about 1:200, 1:100, 1:50 and 1:20). Declarations to the choice of materials and a color concept complete the building design.

Fig. 11 demonstrates the final design process with aesthetical decisions where to place which element and how the façade shall look. PV modules play a central role in this context. The left variant with modules between the windows was assessed as more aesthetic and proposed for realization. Fig. 12 shows examples for the final design of the created office buildings.

Operable windows, ventilation flaps and shading systems create a lively and dynamic change in façade. Caused by the adaptive use where each user can adjust elements in the façade according to his personal wishes the view onto the façade shows a lively, dynamically changing picture. This dynamic can be explicitly shown and reinforced by different elements



Figure 12: Perspectives of the building showing the final design ((a) [13]; (b) [9]).



Figure 13: Examples for adaptive façades. (a) A dynamic façade [18]; (b) A static façade [19].

and colors. The contrary view point tries to hide this entire dynamic and to create a more static view onto the façade or the façade itself is sealed and static and does not allow adaptive use. An example for a dynamic façade is shown in Fig. 13(a) (GSW headquarter Berlin, Sauerbruch and Hutton), a static façade is shown in Fig. 13(b) (Alstercity building in Hamburg, Helmut Greve).

6 EXPERIENCE, EVALUATION AND ACCEPTANCE OF THE COURSE BY STUDENTS

After the course was finished the students answered an evaluation questionnaire. Students were asked about their view on certain future (global) challenges, sustainable architecture and their overall experience with the course, 23 questionnaires were analysed.

The first part of the survey asked for aspects of the world view and possible development. 78% agreed that the current generation of people was better off than their parent- or grandparent-generation, 18% disagreed and 4% were indecisive and whether future generations would be better off than the current 83% agreed, 4% were indecisive and 13% disagreed. The ones who disagreed saw future challenges leading to a decrease in quality of life. They also covered personal circumstances such as more pressure to perform, digitization and automation, more stress factors, less privacy and social life.

Everyone but one believes transforming the existing society into a sustainable society by 2050 is the right development of society and necessary to accomplish.

A slightly less strong believe can be observed when it comes to these suggestions regarding sustainable architecture and the question whether it should be seen as the new, central challenge of architecture and to play a part in it as young architects. The question “Do you feel adequately prepared and skilled?” gives an idea of the restraint responses: Only 13% feel utterly qualified, 9% not at all and 78% feel only partly qualified. This majority stated they lack certain knowledge and most of their education stayed theoretic only - except for this course.

The experienced and applied approach from this course is seen as very helpful and goal-oriented by 61% of the students, 30% think the taught approach is wrong and the remaining 9% believe the approach is partially helpful but use additional tools such as a window grid.

The following two questions went further into detail: “How would you, as (future) architects, deal with the dynamic appearance of an adaptive building (e.g. open and shut windows/ shading) to achieve an in your opinion appropriate design?” 77% want to show the dynamic appearance and even take it a step further and celebrate it; since they believe it shows people feel comfortable in the building. The other 23% prefer a static appearance of the façade and would rather hide the dynamic appearance. The next question asked for the

opinion on integrating active solar systems to the building envelope. None disliked the idea or believed it could not be designed properly. Whereas 70% think BIPV is obligatory for building in the 21st century and a carbon-free society in the future, 26% wants BIPV only hidden on roofs and 4% had some resentment still.

Finally, the students should decide on their preferred role as future architect between two alternatives: advisory expert leading the development or service provider fulfilling the wishes of the client. Three-quarters preferred the role of the leading expert and like the idea of architecture being a pioneer of development. One quarter does not believe they can determine the market and have to follow the client's wishes even if their personal opinion differs.

Overall the students agreed that our current generation is better off than the former but future generations might be facing some obstacles, when trying to continue the trend of improvement. Most see the need to develop a sustainable society and believe sustainable building is the key to build adequately in the 21st century. Unfortunately, many do not feel properly trained e.g. to apply their theoretical knowledge to their designs, they reflect some of their education as partly superficially or when learning to design a sustainable approach may not even be appreciated by instructors. The acceptance of solar energy systems and a dynamic appearance of the façade is high or even desired. Three quarters of the students interviewed – to generalize even further- who think positively of sustainable building are those who would rather take up the role of leading experts than an indifferent service provider.

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EMERGING TRENDS OF TROPICAL RESIDENTIAL BUILDINGS IN THE PACIFIC-RIM REGION IN THE AGE OF GLOBALIZATION: BASED ON CASE ANALYSIS IN CHINA, COSTA RICA AND AUSTRALIA

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ABSTRACT

This paper attempts to discover the changes of tropical residential buildings in the pacific-rim region under the globalization, to find the emerging trends which this kind of building can follow. The trends can be identified through case studies in China, Costa Rica and Australia by comparing the traditional and modern tropical residential buildings and analysing the authenticity of them. The emerging trends include the relationship with the natural environment, the local identity and personal experience. The paper consists of three parts. The first and second part analyses the characteristics of traditional and modern tropical residential buildings. The third part compares these characteristics, thus summarizing the changes and identifying which parts can be represented as trends.

Keywords: tradition, modernity, tropical architecture, globalization, emerging trends.

1 INTRODUCTION

Tropical residential buildings are a branch of architecture. The basic function of them is for the shelter of human beings [1]. From the geographical perspective, the forms and the main material of it are different across the regions as the effect of local environment which include: climate, topography, nature resource and culture. From the perspective of time, tropical residential building mainly used local material before the 20th century because of the limitation of transportation [2]. Nowadays, the limitation disappeared with the development of science and technology and the characteristics of this kind of building keep changing with the rapid process of globalization. Therefore, the essences and the forms, which should be kept and developed, of the contemporary tropical residential building should be considered.

Due to this situation, the paper committed to discovering the differences between the traditional tropical residential building which was built before the 20th century and the modern ones which is under the influence of globalization. Furthermore, analysis these differences and clarify the essence of tropical residential building which should be considered as the emerging trends. There have three parts are focused which include: material, structure and the identity which reflect the local culture.

2 TRADITIONAL TROPICAL RESIDENTIAL BUILDING

A pervasive stereotyping of the traditional tropical residential building has four features: wood structure, sloping roof, deep eaves and sun-shading louver. But it is one form of this kind of building, there also have many other forms exist. The variety of regional resources creates the diversity of traditional tropical residential building.

In Hainan, which is the second largest island in south of China, the indigenous people have lived there for hundreds of years. The main kind of traditional residential building is called Ship-type house (Fig. 1). As the forest is the mainly natural resource, the trunk and bamboo are used as the beams and columns of buildings, the branches paly as connections between columns and roofs, the dried grass are used to cover the roofs.





Figure 1: Outside the Ship-type house, Hainan, China.



Figure 2: Inside the Ship-type house, Hainan, China.

The main feature of its structure is that the roof and wall work as one body (Fig. 2). The connections between components use rattan to tight together. Therefore, all components in the structure are connected which can enhance the stability of houses and resist the typhoon [3]. The shape is similar as an arch which represents the local culture. As the ancestors of these indigenous people came from mainland, ship is the main transportation means to connect two sides. Therefore, in order to commemorate the ancestors, they took the shape of ship as the form of their buildings.

In Costa Rica, which is twice as big as Hainan island, leaves and wood are the main material in their buildings. Leaves are tight together as roofs and wood stakes play as walls. As the feature of wood stake is irregular and high, the internal space of the building is quite large and wind can through into it. A large interior space with a long cornice would be considered as the characteristics of this kind of building at the time that before this mainland was discovered by Europe. In colonial period, the Europe brought new technologies and materials. The adobe is one of them. It is used to replace the leaves and wood as the main material of buildings. Compare with the former kind building, this one has changed in many parts. For instance, there only have few openings on the wall which block the visual connection with surrounding environment. But in the building, there have a courtyard which can introduce the natural light and promote ventilation [4]. The main concerns of these two

kinds of buildings are different. One is tending to get the connection between inside and outside. The other is seems to isolate the building. These changes can be thought as the representations of different cultures.

In the North Territory, which is located in north of Australia, the existing traditional residential buildings were mainly built during the colonial period, therefore, they can be thought as reflections of British culture. The main material of these buildings is wood. They usually have steep pitched roofs and open eaves to catch the wind (Fig. 3).

According to the weather conditions, the internal space could be adjusted by louvers. The rooms are separated, but on the top of the wall there have space left for cross-ventilation (Fig. 4) [5]. Compare with the traditional tropical architectures which located in Hainan and Costa Rica, these buildings are more intelligent as they can modify the internal environment by louvers.

Through the cases analysis in these three countries, the key elements of the traditional tropical residential building can be found: the slopping roof which is designed to satisfy the requirement of drainage. The long cornice which is set to played as a sunshade to avoid the sunlight through into the interior directly. The ventilate opening which is used to promote the air exchange and dehumidification. All the key elements run through stages of the development of traditional tropical residential building.



Figure 3: Burnett House outside, Darwin, Australia.



Figure 4: Burnett House inside, Darwin, Australia.

3 MODERN TROPICAL RESIDENTIAL BUILDING IN GLOBALIZATION

The study of modern tropical residential building should be divided into two periods. One is the first half of the 20th century, the other is the second half of the 20th century.

At the beginning of the 20th century, the movement of modernism sweeps the whole world. It also has influenced the tropical residential building [4]. The modernism has introduced some new ideas and concepts into the design of this kind of building, for instance, an open space with concise façade, a reinforced- concrete structure with a dynamic building style. As the material, structure and form have changed, compare with the traditional tropical architecture, the modern ones might be more attractive. Therefore, tradition and modernity are usually thought on opposite sides at that time. The former one would be related to stagnation and regression, the latter one should be thought as progress [4]. New material with advanced technology is the key element of tropical residential building in that period.

There have two styles of tropical residential building in that period. One is traditional style which prefers use tradition building languages to represent the culture, but they do not use the same material which was adopted in real traditional tropical architecture. They choose to use polymer material to make the fake structure which is similar like the long cornice or the complex structure with decorations. They take artificial material to achieve the effect of natural ones. At the end, this kind of building is meaningless. It is only an imitation of traditional tropical architecture. The other is modern style which focuses on the new material and structure with high technology. However, this kind of building is only workable in developed countries which have enough financial resources to support it. Developing countries cannot afford the high cost and hard to meet the requirement of new technology at that period [1].

Fortunately, with the development of society, this situation has changed in the second half of the 20th century. There have some new concepts which start thinking respect the environment and recover the feature of traditional culture in recent years [6]. These new architectures excavate the essences of traditional building language and express them in a modern way. This paper chooses three buildings as examples to analysis the new concepts.

The villa fifth: located in Shenzhen, China. It is a residential area. The concept of this project is bases on the traditional tropical architecture. The design refining the traditional village architectural forms and expresses them in a modern way. In order to get more connections with environment, the plan is integrated by many open spaces such as outdoor corridor, terrace and courtyard. Free layout creates an interesting internal space (Fig. 5).

Many essences of the traditional tropical architecture have been used on the façade design, such as the slopping roof with long cornice, timber sun-shade and large terrace. All of them have real functions and not only used for decoration (Fig. 6). The long cornice avoid the sunlight through into the interior directly while make sure there have enough light in interior. Large terrace which use as open space provide more opportunities for people to connect with nature. For the material, they choose tiles, wood and shale which are produce from local. The texture of these materials express the original beauty of nature and similar as the traditional tropical architecture. All of these things express the features of tropical architecture in an appropriate way.

Casa Atrevida: located in Osa Peninsula, Costa Rica. This is a two-storey villa with open space layout (Fig. 7). In order to follow the concept of sustainability and keep harmony with environment, the architect use the local bamboo as the main material in the structure, set the solar photovoltaic to provide electricity and hot water for the building. The whole building built above the ground to stay away from damp and flood.



Figure 5: The internal space of Vanke 5th Garden, Shenzhen, China.



Figure 6: The public building of Vanke 5th Garden, Shenzhen, China.

The indoor temperature is mainly regulated by natural ventilation and electric fan. All of them are simplified modernist forms while express the characteristics of tropical architecture. Compare with the first example, it is more obviously to see how a building uses a modern way to express the essences of traditional tropical architecture.

House X (name unknown): located in suburb of Darwin, Australia. The form of this building is similar like the traditional tropical architecture in Darwin. Steep pitched roofs, open eaves, louvers which use to adjust the temperature of interior, large internal space with enough natural light, good ventilation as all the rooms are connected with outside (Figs 8 and 9). The different part is the structure, it mainly uses steel as its structure. Wood, metal and glass cooperate with each other. In order to protect the building from moisture, the whole ground floor is elevated. It would also be good for the modification of indoor temperature as the wind can flow under the floor. This is simple project with new idea that combines the essences of traditional tropical architecture with new material and structure.



Figure 7: Casa Atrevida, Osa Peninsula, Costa Rica.



Figure 8: House X outside, Darwin, Australia.

From these practices, the spirit of modern tropical residential building can be considered as combine the tradition with the characteristics of different regions. In the process of globalization, there will have more and more new tropical residential building which is similar like these examples. They would have these features: respect to nature environment, represent the characteristics of regions, new material with low consumption.





Figure 9: House X inside, Darwin, Australia.

Table 1: The characteristic of traditional tropical residential building and modern tropical residential building.

Style	Material	Structure	Identity
Tradition	Wood/Adobe	Timber/Brick-timber	Local culture
Modernity (the first half of the 20 th century)	Concrete	Brick-concrete	Meaningless
Modernity (the second half of the 20 th century)	Wood/Steel/Concrete	Timber/Steel/Reinforced concrete	Local culture

4 THE EMERGING TRENDS OF TROPICAL RESIDENTIAL BUILDING

Compare these two styles of tropical residential building, the change mainly happens on the material, structure and the identity of the building. The material of the building keeps changing with the change of times. The structure changed with the development of science and technology. The identity of the building is also affected by the society transformation (Table 1).

Most of the factors might keep changing with the development of society. But one factor is stable. That is the relationship with nature. It is the most stable influencing factor and never be affected by different culture or regional tradition. As Alvar Aalto said, architecture can never exist without nature and human, on contrary, it should make the human has a closer

relationship with nature [7]. Therefore, how to develop the relationship between tropical residential building and the natural environment would be one direction.

The other one, as a global society, the tropical residential building has come into a new stage. This stage is not only focused on image which the building tends to express but will pay more attention on kind of emotion and experience they can have [4]. With interpenetration between different regions' tradition and culture, the characteristics of local area are not clear as before. The new architecture should have the power that endows the different cultures in the world with distinct character. The way that expresses the local distinct character would be the other one direction that the tropical residential building should develop.

The third one: memory. A scientist has recorded some psychological phenomena which relate to memory that can affect judgement [8]. Each person has his/her own experience and custom, each culture has its own tradition and history. This kind of accumulation of memory can have influence on the evaluation of tropical architecture. Therefore, how to fit the architecture with personal custom or experience is also can be considered as the direction that the tropical residential building followed.

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URBAN LANDSCAPE: FROM URBAN BEAUTIFICATION TO SUSTAINABLE LANDSCAPE DEVELOPMENT

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ABSTRACT

Increase in public awareness toward high quality living environment led landscape being seen as the important component of urban environment in Malaysia. The landscape beautification projects of protocol roads, pocket parks, urban squares, promenades and urban woodland were found to give positive impact on the quality of life of the urban area. However, issue of green space availability in urban area requires new approach. The landscape beautification project has been now changed into more integrated Urban Landscape Program (ULP). The ULP emphasizes regeneration of urban green spaces to ensure sustainability. This paper will further discuss the way forward in sustaining the urban landscape development program in Malaysia as part of the effort to create sustainable cities through effective landscape planning.

Keywords: urban landscape, landscape planning, urban green space, Landscape Master Plan, policy.

1 INTRODUCTION

The image of the city with adequate basic infrastructure, opportunity for employment and efficient administration attracts many inhabitants. It is expected that by the year 2030; 75% of the earth's population is urban population. Drastic growth in urban population will create higher needs to quality living environment and the need to uphold the concept of sustainable urban development [1]–[4].

The evolution of urban community needs towards urban green spaces for a quality living environment was started with the development of Central Park as the green heart of New York [5]. Central Park success stories increase the global public awareness towards the importance of urban green spaces. Since then, urban green spaces became the indicator for the sustainable and liveable city [4]. With this regard, Malaysia as a member of Group 1 developing countries in Southeast Asia with urbanization rate more than 70% [6], is no exception. Rapid migration of rural population to urban areas is expected to create cities as the habitat for 2/3 of Malaysia's population in the year 2030 [7]. This phenomenon has increased the urban built-up area and cause impact to the existing urban green spaces. As for example, the capital city of Malaysia; Kuala Lumpur with 92.6% built-up area is now facing a critical problem of inadequate urban green spaces [8]. Similar situation has also happened in most town and cities in the country.

2 LANDSCAPE DEVELOPMENT IN MALAYSIA

The landscape evolution in Malaysia could be divided into three phases, namely the pre-independence era, the post-independence of the 60s and the 90s era.

2.1 Landscape development of the pre-independence

Prior to independence Malaysia known as Malaya was colonized by the British who brought together their way of life that emphasizes the need to urban green areas for outdoor and social recreation. The development of the Taiping Lake Garden (1880) and the Kuala Lumpur Lake Gardens (1888) by Charles Compton and Penang Botanic Gardens in 1885 by Charles Curtis



stamped out physical evidence of their passion. These parks were exclusively used by the colonial officers as their leisure and recreation ground [9], [10].

2.3 Landscape development in post-independence and 90s era

After independence, Malaysia focuses exclusively on physical development. According to Hadi [11], Malaysia urbanization process was accelerated with the implementation of the New Economic Policy in 1971. Since then, green vicinity within the urban area has gradually been turned up into a built-up area to accommodate new sites for industry, commercial and settlement. Land use data showed that in Peninsula Malaysia, built-up area increased by 271.57%; from 437,090.00 hectares in the year 2001 to 1,187,003.59 hectares in the year 2012 [12].

However, the global awareness towards the need to implement sustainable development's concept has changed Malaysia perspectives. The urban green space becomes an important component in the urban physical development. The era of the 90s was the starting point in which landscape has officially adopted as an important component in the physical development. It was accepted as criteria in the development approval.

In the year 1997 a dedicated department namely National Landscape Department (NLD) was established at federal level to oversee national landscape development in the country [13]. Since then, the Department has formulated various guidelines and procedures to be used by local authorities for effective green and open space planning and management. Various programs have been implemented in order to improve urban living quality. Among other Landscape Development program has been implemented to boost out greenery in the urban setting.

Later in the year 2010, a comprehensive National Landscape Policy has been formulated. It was approved by the government as a mean to guide all parties to contribute and venture toward making Malaysia a Garden Nation. One of its action plans is to ensure that 30% of the built-up area of towns and cities to remain green, of which 10% of the green area is to be function as open spaces.

2.4 Landscape development program and its impact

Landscape development program comprises of landscape of protocol roads, development of pocket parks, city squares, promenades and urban woodlands. As the main objective of the program was to increase greenery and beautifying the urban area, each project was actually localised in nature. By 2010, eighty-three projects under the program have been completed. Aiming to identify the effectiveness of the program, outcome study has been carried out [14]. A sample of thirty-three projects consist of 21 protocol roads, 5 pocket parks, 2 urban squares, 4 promenades and 1 urban woodland were selected as the study area. 8,832 users of the Landscape Development program were randomly selected as respondent. The objectives of this study were to identify (i) the level of user's satisfaction (ii) the function of the green spaces, and (iii) the user's perception towards the healthy living environment created by the projects. The findings are shown in Table 1.

The outcome of the study proves that the Landscape Development program gave positive impact to the user. In average 70.95% of the respondents says that the landscape development projects have contribute well to improve urban area by were improving environmental quality (68.43 %), as functional open spaces (70.25%) and satisfy user's need to the green spaces (74.09%).



Table 1: The finding of Landscape Development program evaluation study. (Source: National Landscape Department, 2010.)

Indicator	Protocol Roads (%)	Pocket Parks (%)	Urban Squares (%)	Promenades (%)	Urban Woodlands (%)	Total (%)
User's satisfaction	65.36	76.60	76.64	73.88	77.98	74.09
Function of urban green spaces	52.04	72.78	71.50	72.46	82.46	70.25
Environment quality	71.34	63.72	48.84	71.22	87.02	68.43
Total (%)	62.91	71.03	65.66	72.52	82.62	70.95

This finding also shows that the urban woodland was perceived by the users as the project that give highest impact to the user (82.62%). Despite some achievement there were some issues and challenges to be solve in order to improve the program.

2.5 Issues and challenges

Even with an overall satisfaction score of 70.95%, the Landscape Development program has faced challenging issues to ensure its sustainability. Three major issues identified were as follows:

1. Inadequate urban green spaces.
The rapid growth in the physical development of major cities of Malaysia has given impact to the existing status of urban land use. A significant number of existing green and open grounds were transformed into settlement, commercial and industrial land use. It resulted with a critical issue of inadequate urban green spaces [15]. The study by Ngah [16] found that Kuala Lumpur could only capable of providing 0.4 acres of Public Park per 1,000 urban populations; while the study by PEMANDU [17] showed that one individual of Kuala Lumpur residence could only access to 12-meter green spaces. Both of these studies proved that the inadequate urban green spaces in the Malaysia capital city, with a ratio far below the standards set by the National Physical Planning Council [18] and the World Health Organization [19].
2. Piecemeal development.
Due to nature of the landscape projects of protocol roads, pocket parks, urban squares, promenades and urban woodland, they were perceived by many as a piecemeal development which mainly for greening and beautification purposes. This perception was quite true, as the selection of the landscape development site was totally depends on the existence and the available urban green spaces. It does create an image of patching and none integrated urban fabrics.
3. The changing needs of the community towards high quality landscape development.
Increasing awareness of the urban community toward the importance of external spaces as part of their living environment has made landscape being chosen as a tool to achieve high quality of life. There is a rising needs to developed urban green spaces as an integrated area for a specific urban development [14]. It means no more piecemeal projects for beautification purposes.



3 URBAN LANDSCAPE – CHANGING FABRIC IN LANDSCAPE PLANNING

Aiming to address the three main issues identified, the Urban Landscape program was initiated in the year 2014. Urban Landscape Program is an integrated development project aimed to connect the urban nodes, green areas, and recreational areas through green linkages. The implementation of the Urban Landscape program changes the landscape planning pattern within the urban area. This impact derived from the compliance of:

1. Landscape Master Plan (LMP)

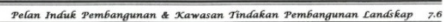
Landscape Master Plan is a landscape planning document developed by the NLD for the Local Authority in Malaysia. It covers the entire administrative area of the Local Authority, especially the city centre and its urban area. It is to ensure that the particular Local Authority will have a unique and distinct identity, capable to preserve and conserve its natural resources and landscape character. The proposed landscape development will contribute beneficial value to the economic, social and environment. In simple words, Landscape Master Plan is a translation of sustainable development and sustainable city concepts based on the Malaysia's perspective through efficient landscape planning. Based on the LMP, the Local Authority will be able to identify potential areas for Urban Landscape program. As for example - the Tawau Municipal Council Landscape Master Plan (Fig. 1) has identified three main recreation nodes which located at the northern, central and eastern zone. Through proper design of green linkages, these three nodes can be used to create a potential area for various purposes.

2. Current policy

It is very important for any development programs to be accepted by the stakeholder to ensure its sustainability [21]. Due to this fact, the Urban Landscape program is designed, implemented and regulated by the current Government's policies such as the National Landscape Policy, the National Urban Policy and the policy of the National Physical Planning Council. Thrust 3 the National Landscape Policy states the need to 'create landscape development programs to provide functional and sustainable green infrastructure' [22]. Meanwhile the importance to provide adequate provision of urban green spaces was stated in Trust 5 National Urban Policy in 'creation of a liveable urban living environment with its own identity' [23]. Both of these policies were the reflection of Malaysia vision toward achieving the Garden Nation. This vision is in line with the decision of the National Physical Planning Council as to provide 2 hectares of open spaces per 1,000 urban populations [18].

To comply with the National Landscape Policy and the current approach of implementation, the National Landscape Department is in progress of completing six Urban Landscape projects. Urban Landscape of Cameron Highland, Pekan, Batu Pahat, Tawau, Bintulu and Alor Setar will be completed by the year 2018. Every project has been designed to address pertinent issues of the Particular Township and urban community such as urban heat island, scarcity of green and open spaces, recreational access, and connectivity and walk ability. The design of the Urban Landscape project has also aims to uplift community socioeconomic and culture. This is to gain ownership of the urban community as to ensure the sustainability of the project.





4 WAY FORWARD – SUSTAINABLE URBAN LANDSCAPE DEVELOPMENT

5 CONCLUSION

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LET IN THE WIND: A PASSIVE DESIGN PARADIGM FOR LARGE BUILDINGS IN THE INNER CITY OF SHANGHAI AND SINGAPORE

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ABSTRACT

The paper presents a critique on the challenges arising from a prevailing Asian Compact City syndrome featuring a shared mission to build bigger, larger and taller, and discusses plausible remedies. The massiveness and increased building heights in close proximity suffocate the natural ventilation and create urban heat islands, which leads to increased energy demands during the summertime in the Asia mega cities. CITIC Plaza in Shanghai, Westgate and the Education Resource Centre in Singapore are selected as case studies for discussing the potential and possibility of natural ventilation strategy in the urban complex of the inner-city area to archive “green”. Compared to the traditional layout with air-conditioned atrium, the public space of these selected buildings is naturally ventilated, making the most of the prevailing seasonal wind. The results of both simulations and field measurements indicate that it is possible and feasible to apply natural ventilation within high-density urban areas. Pedestrian-friendly wind environment can be archived inside the complex by prevailing wind-driven design planning strategy for mega building, which is cost-effective and eco-friendly. The practical experiences of the passive design paradigm for large, big and tall buildings in the inner city could serve as references for other Asian mega cities.

Keywords: thermal comfort, natural ventilation, passive design, Urban Heat Island, green building.

1 INTRODUCTION

Currently, the compact cities in Asia is an inevitable trend. This overwhelming tendency has caused heated debate. The critiques are on these challenges for a prevailed Asian Compact City syndrome featuring a shared mission to build bigger, larger and taller, and discuss plausible remedies. Within this context, the architects are bounded to pay more attention to figuring out proper and optimized design strategies for these bigger, larger and taller buildings.

2 LITERATURE REVIEW

2.1 Urban Heat Island (UHI) effect and energy demands

In recent decades, an increasing number of researchers, experts, and the public have been concerned about the phenomenon of urban heat island (UHI) effect. This well-studied phenomenon indicates that the temperature of a compact urban area is higher than that of its surrounding undeveloped space and the difference will increase with urban development [1]. This heat island phenomenon has boosted a significant stress on the thermal environment of developed urban areas. How to deal with this phenomenon during the rapid urbanization in Asia has been a heated topic. Although the reasons causing the significantly higher temperature in developed urban areas are complicated, the UHI effect follows a fundamental rule. This rule is the first law of thermodynamics, stating that within the energy transformation from one form into another, the total energy will remain the same. No energy will be created nor will it disappear. During the urban development, this fundamental law indicates that all the heat produced by human activities, building operation and maintenance



will be conserved in the inner urban systems and thus the temperature of the inner-city area will increase.

To alleviate the UHI effect, building energy consumption should be reduced, and building performance and efficiency should be improved. Since all actions taken will influence thermal comfort, green technologies are needed to be introduced into the building system to maintain the thermal comfort.

2.2 Urban Heat Island (UHI) effect in Shanghai and Singapore

In Shanghai, the research on Urban Heat Island effect started in the 1950s [2]. The Urban Heat Island effect has existed in Shanghai for an extended period, and it tends to be more severe and intensive as time goes by [3]. The relevant research of this effect in Singapore was first conducted by Nieuwolt in 1966. The result showed that the maximum Urban Heat Island effect caused 4.5 C difference at night [4]. Since then, similar findings on Singapore Urban Heat Island effect are pointed out by quite a few studies, such as the study from SMS in 1986, Goh and Chang in 1998, Wong and Yu in 2005, etc. [5].

2.3 Wider range of comfort zones in naturally ventilated areas

Indeed, thermal comfort can be 100% fulfilled in the air-conditioned environment [6]. However, is the air-conditioned environment the best choice for designers and building users? Is it possible that dynamic environment with proper air movement superior to the stable and steady spaces? Human factors are rarely taken into consideration in the former studies. To some extent, the needs of humanity towards nature are ignored in the standards and practice of green buildings. The survey indicated that appropriate wind velocity contributes to enhancing the thermal comfort condition for some outdoor activities [7]. This study implicates that the thermal comfort improvement also exists in the semi-outdoor space with natural or hybrid ventilation systems. Another survey conducted by Wong in 2003 focused on the thermal comfort in classrooms under the tropical climate, and the results pointed out though the objective data indicate the building areas “uncomfortable”, the subjective questionnaire shows the thermal conditions are quite acceptable. Students adapt to the dynamic environment, and they are more accustomed to it than the universal regulations expected. Similar outcomes were also noticed in natural-ventilated public houses in Singapore [8]. The residents regard the thermal conditions acceptable when the analyzed data indicates that they should feel too hot and be thermally uncomfortable. Even more than 20 years ago, the research launched by de Dear in 1991 pointed out that both international and local benchmarks of thermal comfort have underestimated the range of comfort zones in naturally ventilated indoor climate. All these previous research studies are implicating that the predictions of thermal comfort models are likely to be too conservative and there are potentials to introduce more passive ventilation strategies into the indoor or semi-open spaces to lower the air-conditioning energy consumption while still keeping the users feeling thermally comfortable.

3 CLIMATE FEATURES

3.1 Climate features of Singapore

Singapore is located near the Equator and has a typically tropical climate, with abundant rainfall, high and constant temperatures, and high relative humidity all year round. Air



temperature, relative humidity, and some other climatic variables are consistent and remain quite stable in different months and seasons throughout the year.

The prevailing seasonal winds of Singapore are from north, northeast (N - NNE) and south, southeast (S - SSE), where the monsoon flow dominant the wind sources. In details, the seasonal wind conditions are divided into the Northeast Monsoon Season (from December to early March), the Southwest Monsoon Season (from June to September) and two Inter-Monsoon Period between them (from late March to May, from October to November).

3.2 Shanghai

The climatic feature of Shanghai is relatively more complicated than that in Singapore. In the classification system from the China Academy of Building Research, the climate in Shanghai is defined as “hot-summer and cold-winter”, where the weather is hot and humid in summer while cold and moist in winter. In this study, summertime and transition seasons (spring and autumn) are involved due to the fact that naturally ventilated strategy to deliver thermal comfort is not applicable for the humid and cold winter in Shanghai.

According to the software WeatherTool, the psychrometric chart indicates that the range of “feeling comfort” field can be enlarged by natural ventilation evidently in Shanghai. The points with different colors in the graph represent different months. Integrating green concept while regenerating the compact urban areas in Shanghai with natural ventilation is possible and effective.

Meanwhile, the chart Comfort Percentages figures out that the improvement of individual comfort percentages caused by passive design strategy of natural ventilation in Shanghai is evident especially during the transition seasons, namely spring and autumn. In the hot and humid summertime, especially July and August, the improvement exists but not as significantly as that in transition seasons. The potential design strategies are proposed to mitigate UHI, including manipulating building layout and mass to improve shading during the day while facilitating site ventilation at night [9]. Natural ventilation in the night-time provides cooler air to help remove heat contained in the building structures, making contributions to energy savings by reducing active cooling in the daytime.

4 METHODOLOGY

4.1 Site selection

In this study, the architectural spaces are classified into three categories, namely the air-conditioned indoor space, the hybrid space (natural+mechanical ventilation) and semi-outdoor space (natural ventilation). This study is mainly of the latter two kinds of space. Two commercial complexes one educational building with the feature of passive ventilation design in compact urban areas are selected. One commercial building located in Shanghai while the rest two sites selected are in Singapore.

4.2 Measurements

TES-1341 Hot-Wire Anemometer is selected as the measuring apparatus in this pilot experiment.



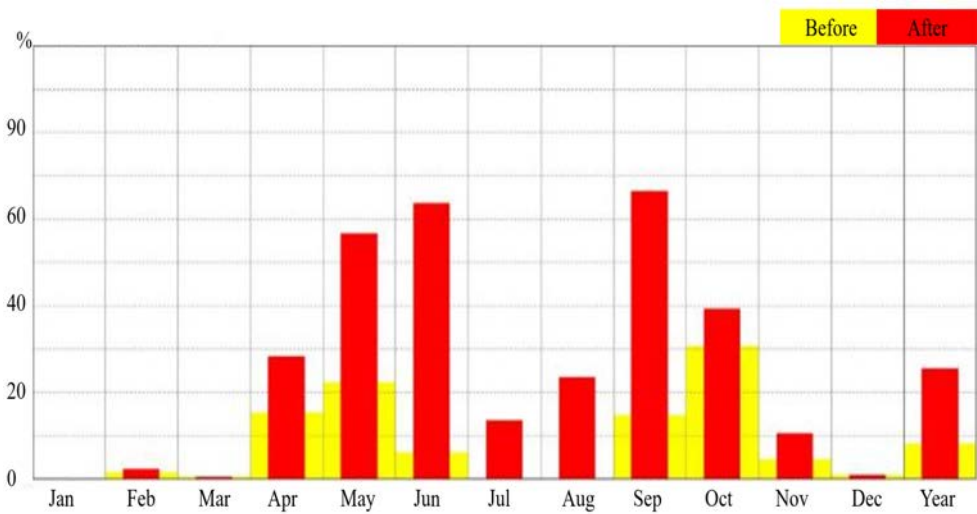


Figure 1: Comfort Percentages enhanced by Passive Design Strategy of Natural Ventilation. (Source: WeatherTool.)

The open spaces of the selected projects are naturally ventilated. All the wind tunnels are measured, and the measured spots are at the beginning, in the middle and at the end of each wind corridor. For the measurement of each wind corridor, the data were recorded at three spots every 10 seconds, lasting 10–15 minutes.

4.3 Simulation

Since all the measurements are conducted in Singapore, and there was no field trip in this semester to Shanghai. The natural ventilation at the Living Style Mall, the podium of the CITIC Plaza, is simulated by the software Airpak to simulate the wind velocity and wind pressure on different floors of the CITIC Plaza.

Natural ventilation is significantly positive during those transition seasons in Shanghai, and prevailing wind direction during these periods are east wind and southeast wind. A southeasterly wind is the prevailing wind in the summertime of Shanghai, in which the wind frequency of east wind is more than 416 hours at the wind speed of approximately 15–20 km/h per year and there is annually more than 250 hours' south wind according to the weather data provided by Energy Plus. The weather data is collected in the district of Hongqiao, Shanghai.

The wind simulation and analysis indicates that the layout of small volumetric blocks in the Living Style Mall is reasonable for natural wind ventilation under the condition of prevailing east and south wind. The wind velocity is enhanced in the gaps of the small blocks. Meanwhile, different wind pressures on building façades lead to the possibility of effective indoor natural wind driven ventilation.



Figure 2: The measuring points in the Westgate (left) and the Education Resource Center (right).

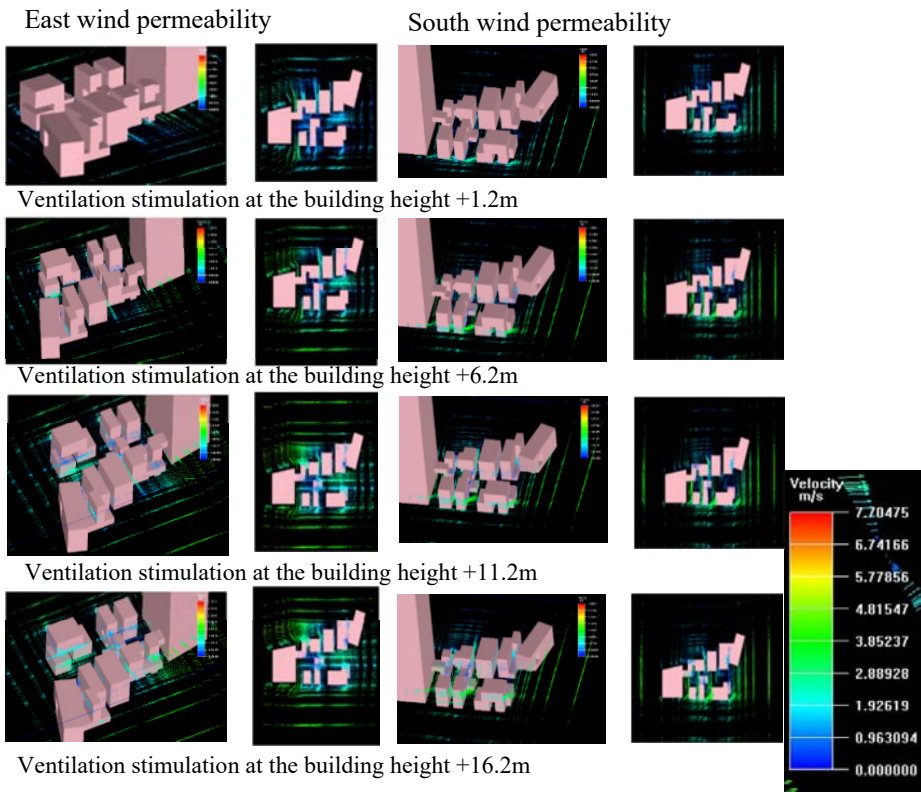


Figure 3: Ventilation simulations at different building heights.

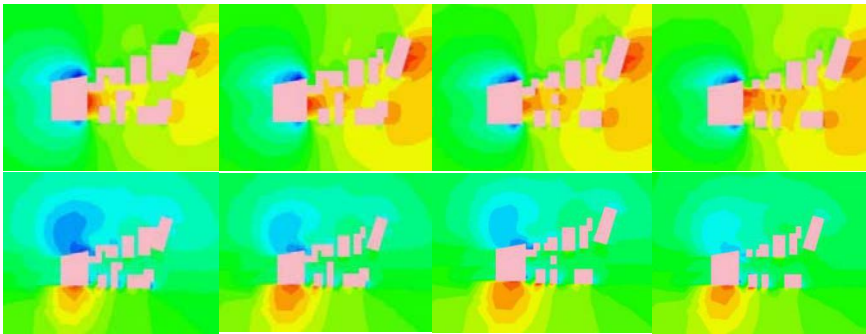


Figure 4: Wind pressure stimulations at different building heights, red areas indicating positive air pressure while blue areas indicating negative air pressure.

4.4 The preliminary findings

1. The wind velocity is significantly increased in the junction of wind tunnels. This phenomenon can be observed in the Westgate. For example, in the Fig. 5, the wind velocity is significantly enhanced due to Point B is the junction of two wind tunnels.
2. The wind velocity is strengthened in the gaps of small blocks and wind tunnels. For example, the vertical points D and E in Westgate are located near each other. The differences are that Point E locates in the middle of the atrium and Point D is located in a narrow corridor surrounded by building blocks on two opposite sites. The results indicate that the wind velocities in Point D are significantly higher than those in Point E on Level 1 and Level 3 (Fig. 6). Meanwhile, in the simulation of the CITIC Plaza, the result also indicates that the wind velocities are enhanced when the winds go through the narrow gaps between two blocks.
3. The location of wind harvesting ports should be designed to capture the prevailing seasonal wind. The measurements were recorded in August, which was during the Southwest Monsoon Season of Singapore. In the experiment, all five wind harvesting ports are spotted and measured. The results verified the influence of monsoon. Point I and Point H are located on the north side of the building. The winds in these two points are significantly stronger than the other wind corridors (Fig. 7).
4. Different wind pressures on the building façades lead to the possibility of effective indoor natural wind driven ventilation. The results indicate the small volume of each block improves effective natural wind driven ventilation. The depth of each block becomes small, and it enhances the natural wind driven ventilation. For example, the simulation results of CITIC Plaza show each small block of the project has significant wind pressure difference on opposite façades. Hence, the draughts can flow through the indoor space of each small block to naturally ventilate.

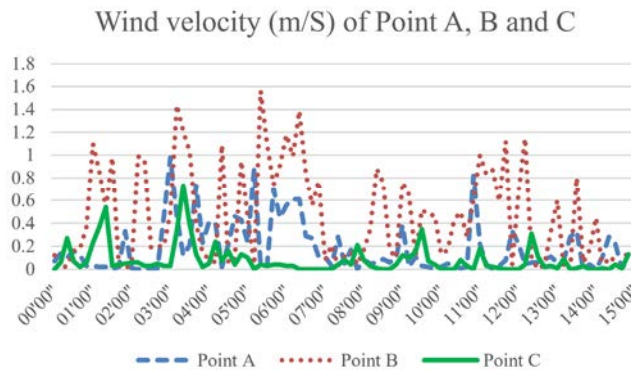


Figure 5: The wind velocity is significantly increased in junctions of wind tunnels. The records of wind speeds from Point B are relatively higher than those from Point A and Point C (Level 2 Westgate).

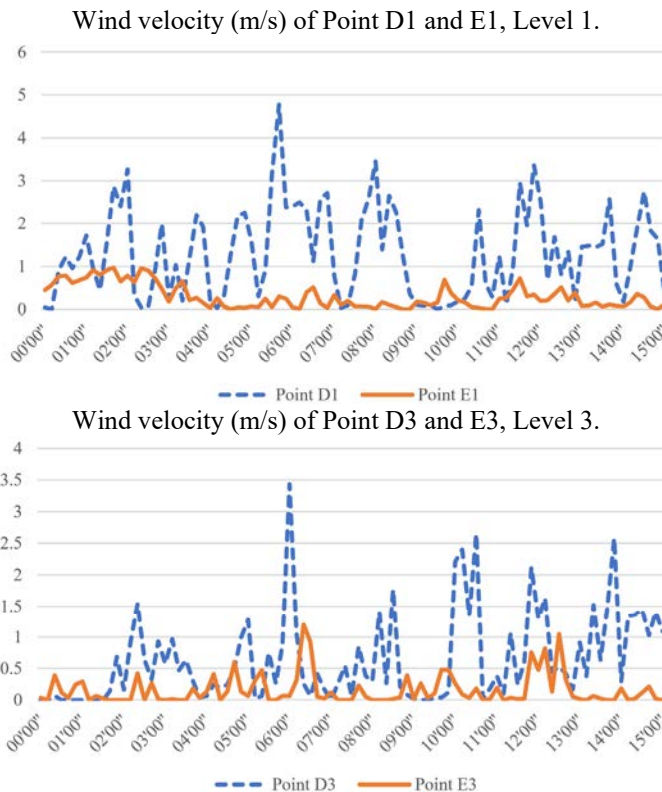


Figure 6: The wind velocity is enhanced in the gaps of small blocks and wind tunnels. Fluctuations of wind speeds and the records of wind speeds from Point D are higher than those from Point E.

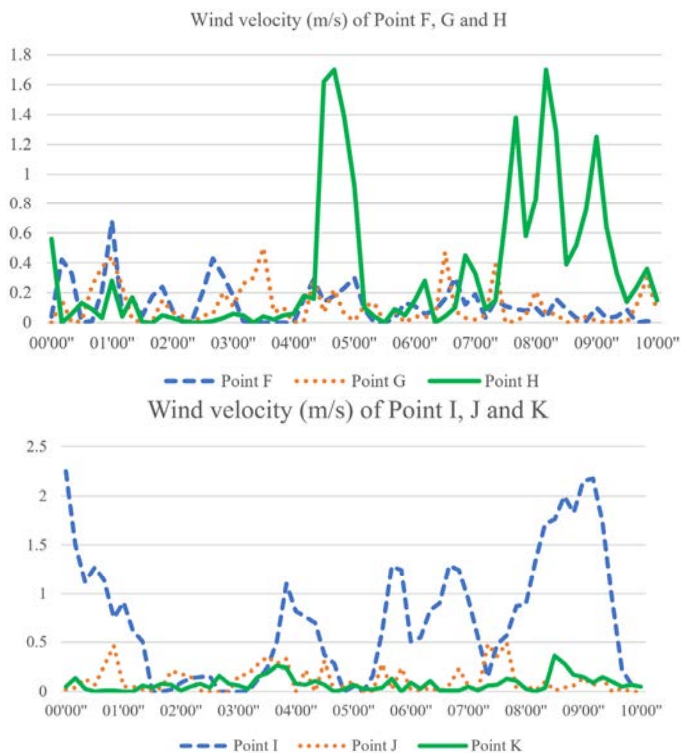


Figure 7: The locations of wind harvesting ports are designed to capture the prevailing seasonal wind. Fluctuations of wind speeds and the records of wind speeds from Point I and Point H are higher than those from other points.

5 DISCUSSION

The discussion will engage, under the notion of a passive design paradigm for large, big and tall buildings in the inner city of Shanghai and Singapore, on the possibility of passive design features, their design strategies, the combination of various green technologies, the social responsibility of architects and city fabric and patterns.

5.1 Passive design features – natural ventilation is practicable

The outcomes of both simulations and field measurements indicate that it is possible and feasible to apply the natural ventilation in the podiums of a compact urban area. The temperature will be out of the comfort zones indicated by the standards, but the thermal adoption, a wider range of “feel comfortable” by building occupants and their tolerance to a green building with passive design features will help to increase the acceptance of naturally ventilated environment and thermal conditions. Meanwhile, air flows strengthened by well-designed building gaps, wind corridors, wind harvesting ports, etc. contribute to providing a pedestrian-friendly wind environment. The pilot experiment and simulation both indicates that the cost-effectively and eco-friendly passive design of natural ventilation for large, big and tall buildings in the inner city is practicable.



5.2 Design strategies: orientation and layout

While the ventilation of a building would be influenced by its adjacent surroundings and the micro-climate, the urban-scale factor, regional and urban wind environment, should be paid attention to. In Shanghai and Singapore, making the most of the prevailing seasonal winds is a key strategy. The orientations of wind tunnels and wind harvesting ports should be consistent with the strong seasonal wind directions. In both selected cities, the wind tunnels or corridors generally ought to face south or north to capture more wind in the strong monsoon seasons. By doing so, natural ventilation inside the complex by prevailing wind-driven design planning strategy for the mega building is possible to be archived.

The layout is another key point to make natural ventilation possible. Compared with traditional layouts of the commercial complex and campus buildings, the selected projects with passive ventilation strategies have more flexible layouts. The traditional layouts of a large volume with an air-conditioned atrium in the middle of it are commonly seen in developed and developing urban areas. This kind of design blocks the wind for its interior space and also suffocates the wind for the surrounding buildings. The new paradigm with separate volumes, smaller blocks, and wind corridors introduces the wind inside and creates a better wind environment for adjacent buildings by its permeability.

The Education Resource Center is a good example for successful passive ventilation strategy by proper orientation (North-South) and layout (interpreting the building into small volumes by inserting several wind corridors and wind harvesting ports). The challenge on this is integrating environmentally sustainable designs into this building while maintaining its architectural intent for an open-air layout. The outcome of this project is amazing since students are willing to sit in naturally ventilated spaces during self-studying. This proved that open and comfortable public areas could be achieved even amid the tropical climate of Singapore.

5.3 Combination of various green technologies

Some natural resources will be exhausted, and human activities have left a huge carbon footprint on this planet. Though there is a critic that engineers are doing the more significant part on green technologies to bring about higher building energy efficiency and lower environmental impact, the architects can play a crucial role as well by integrating various green strategies from the beginning of the concept stage.

The water feature and greenery in semi-open natural ventilated space not only reduce the public's reliance on air-conditioning systems but also provide entertainment and pleasure for the building occupants and passersby.

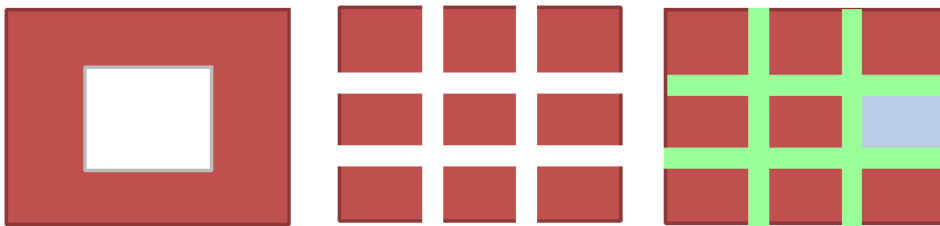


Figure 8: The flexible layout of passive design paradigm.

When the traditional layout being turned into the new paradigm with natural ventilation, the flexible layout provides various possibilities to integrate different sustainable features.

The exemplary performance of the Education Resource Center is a naturally ventilated space for studying, and the building performs well on providing thermal comfort for its occupants and students. It indicates that capturing the wind from the North and South should be the primary objective to use natural ventilation to cool the environment in Singapore. At the same time, a major challenge addressed is making the naturally ventilated retail network comfortable for shoppers. Therefore, to archive thermal comfort, a series of passive designs constitute the system to provide a more comfortable thermal environment. A blend of passive and active designs, from the use of wind corridors and water features to vertical planting and lush landscaping, shows the possibility of a new kind of retail typology in the tropical climate.

5.4 Social responsibility – open space and livability

One of the social responsibilities of architects is to improve the livability of the public through their design. While designing a green building, following all the standards of green building rating systems to archive the goal of being labeled is much easier than integrating all the green concepts and technologies appropriately and efficiently. Each well-designed green building with passive strategies is an inherent showcase to raise the public's green awareness, to tell people how a building could be eco-friendly and improve the livability even in a compact urban area. A sustainable building communicates with its visitors directly with its green features. A green building should not only be tied to the checklists in green building evaluation systems but towards a more comprehensive understanding of the sustainability. In recent years green buildings are more focused on building performance and the new technologies. Engineers are sometimes taking over the architects when dealing with the green design part of the buildings. The new wave of green buildings in Asia should be sensitive to the local context, human wellness, eco-friendly sustainable development and be connected with their surroundings, even with the environmental network.

The passive design paradigm with natural ventilation is one way to achieve this. The wind tunnels can be integrated into greenery or water features, connect to the civil space inside the bigger, larger buildings. The open space design concept is extremely compatible with the passive ventilation systems.

6 CONCLUSION, LIMITATION AND FUTURE STUDIES

Compared to the traditional layout with air-conditioned atrium, the public space of this selected building is naturally ventilated, making the most of the prevailing seasonal wind. The general paradigm of these projects is to insert natural wind corridors among small blocks inside a building with a large volume. The results of both simulations and field measurements indicate that it is possible and feasible to apply natural ventilation within high-density urban areas to reduce the UHI effect meanwhile to ensure the thermal comfort. Meanwhile, thermal acceptance and tolerant of the public is higher when they are in the natural ventilated environment. Thus, pedestrian-friendly wind environment can be archived inside the complex by prevailing wind-driven design planning strategy for mega building, which means that the passive design paradigm for large, big and tall buildings can be one of the solutions to reducing the UHI effect in the inner city. These practical experiences are cost-effective and eco-friendly and could serve as references for other compact cities in humid and hot climate zone.



Furthermore, the ambition of architects and green technologies are highly compatible with each other. This coexistent can benefit all relevant factors in the life cycle of a building to some extent, such as financial, cultural, social, human, architectural or reputation factors.

One limitation of this study is the lack of measured data in Shanghai. The analyses for the CITIC Plaza are based on simulated data by software due to the lack of measured data.

The research methodologies of this pilot experiment are mainly measurement and simulations. For the further study, subjective surveys, such as the questionnaires, the interviews, etc. should be conducted to analyze the human behaviors, customs, acceptances and activity patterns.

ACKNOWLEDGEMENTS

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SECTION 5

SPATIAL CONFLICTS

IN THE CITY

CULTURAL CONFLICT AND PUBLIC SPACE: A NEW CONCEPTUALIZATION

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ABSTRACT

Since the definition of the global city in the 90s, our understanding of the generic city has been that of a formless, diluted, urban mass ineluctably moving towards complete homogenization and the subsequent dilution of character. However, cultural positions on how city spaces are lived in today seem to be more polarized than ever. The increasing mobility of population transnationally has emphasised this polarization, and is mainly seen in large, global metropolises. Today, cultural conflicts are not happening between regions and nations, but are unfolding at the scale of the city. In opposition to ideas that understood cultural conflict as either an increasing revelation of an abstraction that alienates subjectivity - as suggested by Marxist critics - or a tumultuous path before the triumph of the generic and homogenous city - as in the 90s - this paper will explore the concept of “transculturation” and navigate through this new socio-cultural and spatial situation in cities. According to the concept of transculturation, taken from the Latin-American critical theory tradition as an alternative tool to analyse cultural conflict in the city, the cultural reality of the city is always defined by specific and concrete truths through a relentless process of contrast and debate and by power relations that are continuously defined and redefined at various scales. Focusing on the notion of public spaces and its production as a critical means of exploring urban cultural conflict today, this paper will examine the theoretical bases for a culturally sustainable public space, taking as precedents both the square under the Museum of Art of Sao Paulo designed by Lina Bo Bardi and the more recent and collectively designed Gillet Square in Dalston, London.

Keywords: transculturation, sustainable public spaces, transcultural collective urbanism.

1 INTRODUCTION

In his canonical text about the generic city, architect Koolhaas [1], offers us blurred images of urban landscapes, amid an implicit apology for the emptying of cultural identity that the contemporary city was witnessing. Questioning the *contextualism status quo* of the early 90s, as evinced in the *Anywhere Conference* [2], and in relation with his personal experience and life with hotels and airports, Augé [3], offers another facet to Marc Augé’s pessimistic view on contemporary “non-places”, precisely exemplified by the hotel, the shopping mall and the airport. In this way, the Dutch architect presents the advance of the generic as the advance of the equitable, common, or what might be the real embodiment of the modern dream of egalitarianism. As Koolhaas states [4]: “what if this seemingly accidental-and usually regretted-homogenization were an intentional process, a conscious movement away from difference toward similarity? What if we are witnessing a global liberation movement: “down with character!”

However, if seen from today, the results of modernization seem increasingly more tangible than those described in Koolhaas’ early reflections on the generic city. In Koolhaas’ text, we can still recall Virilio’s [5], warnings on the disappearance of the object that was so persistent in the Anglo-Saxon academia of the 1990s. But the reality is that in a generic downtown, a commercial pedestrian street, a shopping mall or an airport, we just need to move a bit to their backstage, or a couple of blocks away, to be exposed to very specific spatial experiences that never truly repeat. Therefore, the place later defined by Koolhaas [6],



as “junk space”, where the escalator intersects with the air-conditioning duct, where urbanity is established as a mantle of internal security and where conflict, intermittency and even the outside seem eradicated, is today full of particularities when looking at what is hidden in its interstices.

Globalisation can be seen as the dissolution of tangibility, but also as the movement that lead us irremediably towards a less critical reality; a reality void of coherence and consistency, and instead to one prodigiously leaking authenticity, and where reality and simulacra are indistinguishable –leading to a complex and alienating experience for the ordinary citizen. However, this reading preached by various cultural critics, such as the very popular reflection by Baudrillard [7], in the 90s, is useless today. The criticism based on the lack of authenticity appears absolutely reactionary, fed more by fear than by facts. In fact, was it ever possible to define essences of the authentic without it being an authoritarian imposition on the real? What other purpose could the definition of the essence of being have but that of imposing a canon of its reading?

Actually, the experience of globalisation is not only that of a city composed of suburban housing and shopping malls, but also, one of another kind. We are referring to a reality that can be observed any day in a London neighbourhood such as Whitechapel, where Caribbean, Central African, European, Indian, Bangladeshi and Middle Eastern people live together creating one of the liveliest and most diverse neighbourhoods in the city today. Examples like this reveal that globalisation happens not so much through generic objects and experiences, but through very real elements arriving from different cultures and ethnic groups, frugally finding each other in different parts of the globe. One of the consequences of this phenomenon is that culture is no longer fixed to a territory or region, but has become a patrimony of these individuals or communities’ practice in the urban space. To understand these dynamics from a new perspective, one that is different from that prevailing since the 1990s, we will introduce to this text the concept of transculturation.

2 THE TRANSCULTURAL TRADITION

The assimilation of the cultural experience in the contemporary metropolis and how it challenges our traditional understanding of identity it is still an on-going debate. Throughout the 90s, the discussion of a new emerging cultural reality in the global metropolis centred the debate around two alternatives: multiculturalism and multi-communitarianism. Multi-communitarianism would foster cultural isolation in homogeneous communities within heterogeneous urban territories, producing ghettos and tensions between different established communities. Multiculturalism, on the other hand, would promote a new type of cultural snobbery that superficially flirts with different cultural idioms from the dominant, central, and stable cultural preconceptions [8].

In contrast to these perspectives, this essay presents an alternative concept, that of transculturation. Following this concept, the cultural reality is not understood as this evasion towards a generic nebula described by cultural critics of the 90s, nor towards the absolute abstraction that preached Marxist criticism - aligning itself towards individual subjectivity. The concept of transculturation understands that specific and defined entities always determine the city’s cultural reality - although in a continuous two-way process of contestation. In fact, the displacement and resettlement of different particularities is what shapes most of the urban environments in which we live in today.

The concept of transculturation was first coined by the Cuban anthropologist and intellectual, Fernando Ortiz in 1940, in his book *Contrapunteo Cubano del Tabaco y el Azúcar* [9] and has since been used by other Latin-American cultural critics. In his book,



Ortiz begins his cultural critique by explaining two agricultural holdings of different economic, cultural, and social characters in which Cuba had been involved in since the beginning of its colonisation. On the one hand, there is the sugar trade -considered as something alien and imposed by its colonisers. In fact, the sugarcane is an imported plant, which has always been exploited by foreign control -first by the Spanish and later by American patrons. On the other hand, tobacco production represents the vernacular in Cuba. In contrast to sugar, tobacco is the native plant that Europeans discover thanks to indigenous customs. This was the contribution of native Cubans to Western culture. Despite the cultural differences between these two forms of production, for Ortiz the cultural interpretive horizon of Cuba lies precisely in the dialectic (or *contrapunteo*) between them. The dialectics between the sugar business imported by Europeans and the local Cuban use and customs of tobacco exported by Europeans is where postcolonial Cuban identity exists.

Throughout the second half of the twentieth century, the term transculturation has been used by two of the most important critical voices in Latin-American thinking: Peruvian writer and ethnologist José María Arguedas and literary critic Ángel Rama. For Arguedas [10], the notion of transculturation serves to penetrate deeply into the Peruvian cultural reality. One of Arguedas' most interesting findings was the realisation of how natives who had remained isolated from the colonisers' influence peculiarly suffered more disintegration and chaos because of new technological expansions and the countries progressive stride towards modernisation. Meanwhile, the natives who remained in prolonged contact with their colonisers somehow developed certain antibodies that constituted a mechanism of adaptation to this new wave of modernisation. In his reflection, Arguedas tries to demonstrate, beyond essential or foundational coherences, that cultural interaction is what arises critically and thus ensures survival, whilst isolation on the other hand, is what weakens and mitigates populations.

On the contrary, Rama [11], appropriates the term transculturation to explain the narrative practices of certain Latin-American novelists situated in a complicated intersection between different linguistic, ethnic and social realities. More interestingly, Rama brings back this transcultural criticism to reflect on Latin American urban practices in his work *La ciudad letrada*. According to Rama [12], following the logic of colonisation, Latin American cities emerge as lettered -as the letter fixates on the norm upon which colonial cities were founded. According to Rama, these letters that appear as a delimiting judicial stipulation at the beginning, is later assimilated into a literary tradition of living in the city.

3 A CRITIQUE TO HYBRIDISATION

In Post-colonial studies, especially derived from French and British practices of colonisation, the concept of hybridization has been frequently referred to as a way to critically position oneself towards certain colonisation processes. The value that theoreticians in this field, such as Homi Bhabha, Gayatri Spivak and Nestor Garcia Canclini, most commonly attributed to hybridisation is its ability to act as a mechanism of liberation from colonial power. Particularly, Bhabha [13], argues that the assimilation of metropolitan works, traditions and genres in colonial contexts ends up hybridising, defiling and displacing them. Therefore, this assimilation dissolves and undermines the authority and coherence of the colonising processes, with a far greater effectiveness than even that of open resistance to the coloniser.

For Bhabha, the colonial relationship entails the dissolution of Western discourses by their continuous and inevitable interpretation in an alternative and diverse social, religious and cultural context. In this way, this dissolution becomes a two-fold process by which, the coloniser not only discursively conceives the colonised, but somehow the colonised in turn,



also conceives the coloniser. The analysis of colonial discourse should also be a two-way process, able to both continue a resistance that rejects the fictionalisation of nationalist ideals and to infect impurity and propagate contamination to cause the progressive displacement of colonial authority.

In recent years, an extensive dissemination of Bhabha's critique to a multitude of distinct intellectual fields has been triggered because of the ingenuity and novelty of his reflection. However, the application of Bhabha's studies regarding a specific Latin-American context - a colonial milieu with entirely different colonisation logic than to the one he based his studies on, is indeterminate. In this regard, philosopher Eduardo Subirats [14], explains that, "the anaesthetisation of Latin American social and linguistic landscapes under the category of hybridisation, besides being intellectually rude, has been politically ambiguous. This concept has often been confused as a semiotic exchange between cultures, languages and different understandings as if its practice had been the result of a horizontal dialogue between equal parts, not the consequence of a conflict mediated by colonial violence, and their industrial and post-industrial heirs".

According to Subirats, hybridisation was also the process by which colonial disarticulation of communities occurred, as the erasure and destruction of cultural memories was conducted through the creation of a biologically and symbolically homogenous individual, thus preventing any anti-colonial resistance. Consequently, for Subirats, colonial-guided syncretism and hybridisation guarantees a deeper rootedness of the colonial power.

On the other hand, for the sociologist Zygmunt Bauman [15], the idea of hybridisation starts from the false assumption that there are definable and original cultural realities, this is, a category of cultural reality that actually does not exist at the present. Therefore, concepts such as hybridisation, mixing, blending, or grafting of cultures would involve a cultural space neatly divided into separate parcels roughly marked by the clear differences between interior and exterior and with borders to control the traffic between them. Following this, Bauman points out that if these transfers could really happen, the analysis of what is outside, this is, external to the object study, would be the result of an endless negotiation -highlighting the improbability for it to be conceived as such. In other words, if the translation generates a translated text, this text in turn generates its translator as a necessary derivative and so on and so forth.

Following another perspective, some theoreticians have talked about an anaesthetisation of the term hybridisation. In some cases, this term is understood only and exclusively as a description of a formal configuration in which different influences, materials and procedures has been mixed. This criticism has been especially unfortunate in the field of architecture, where hybridization has often been confused with simple eclecticism. Architect Felipe Hernández [16], has highlighted the misappropriation of the term hybridisation in both the North-American and Latin-American academics. In many cases, the term hybridisation was equated with the eclectic postmodern of Graves or Venturi. For Hernández, a consequence of this misuse and misunderstanding of the term by certain architects has generated that "(hybridisation) has lost political efficacy and has been reduced to a problem of aesthetic syncretism, which is exactly what architectural hybridisation, as a cultural concept, is not". Considering these words from Hernández, for a productive use and with truly cultural and socio-political implications of the term, hybridisation must be separated from any type of aesthetic category. As the architect points out again: "buildings are not hybrid because they combine numerous architectural motifs, but because they emerge within and take part in the hybrid cultures where they happen to exist, and, as a consequence, they estrange the hierarchical structures that qualify them as inferior".



4 TRANSCULTURATION AS AN URBAN PRACTICE

Transculturation understood within the Latin American tradition and from a certain distance from the term hybridisation from the discipline of postcolonial studies allows us to approach a new cultural critique of architecture and the city. On the one hand, transculturation can only be understood as a practice of confrontation and constant contestation, as a counterpoint of multiple dialectics, and not as a fusion or aesthetic mix. Patching together memories, materials, symbols and various means, it is a practice of constant negotiation, where the different cultural enunciations cause different cultural responses and in turn call for new spatial articulations. Therefore, transculturation cannot be understood as temporarily delimited or finished object, but as a continuous flow of practices, their contributions and responses over time. Often cultural studies have wanted to find in absolute certainty a certain logic of transculturation, but it does not make sense to talk about transculturation in a finished object. Transculturation is always a cultural becoming, a process; a practice. There might be a symptom or a glimpse of it appearing in a particular work, but we can only talk about transculturation in a holistic sense when it is related to fluidity and change.

Consequently, all available models for an architecture of transculturation are quite fragile. Transcultural processes generate different cartographies, imaginaries and dispositions in their various modes of appropriation of the city, as it is only in these fragile practices that we can find something comparable to what would be transculturation in architecture and urban space. We would like to introduce the work of Lina Bo Bardi in Brazil, one of the few countries with a broader cultural and ethnic diversity, as a precedent of an architecture able to relate to transcultural processes. However, if we analyse some of the built work by Lina Bo Bardi, we observe that the construction itself is not what symbolically manifests transculturation. Differently, the architecture arises as a framework for transculturation to happen. The transculturation is not realized autonomously by architecture, but in the fluctuating relationship between the individual and the space, between architecture and our way of inhabiting it. This is evident, for example in Bo Bardi's experiments in her own house in Morumbi, Sao Paulo, 1949-51, where she applies onto herself a kind of cultural process of experimentation. When Bo Bardi built her house, also known as the "casa de vidro", she had just arrived in Brazil. The house thus had the essence of something resembling the transience of a camp, a provisional stage. Bo Bardi said once that that house was like a "backpack", as it is like putting together once and again all necessary stuff for an imminent trip [17]. Hence the glass envelope containing the house is continuously contaminated by fluctuating internal scenarios where indigenous, African, Italian and Portuguese memories continuously mix, never totally fusing into any new stable cultural expression (Fig. 1). Following the example of Bo Bardi, transculturation in architecture cannot be considered as mere eclecticism, exotic taste or surrealistic de-familiarisation. Transculturation as a cultural conflict must be precisely understood as a critical process that prevents a cultural homogenization into a single realm or reality.

As transculturation deals with continuous interactions between different realities, its architectural expression is that of everyday life and not of institutional representation. This understanding of cultural representation is opposed to other very relevant modern Latin-American traditions, such as Mexican muralism. Muralism was probably the most successful cultural movement in Latin-America in its ability to begin a dialogue about identity.

It quickly spread throughout Latin-America, whilst simultaneously developing and maintaining an extraordinary relationship with architecture. However, muralism determined





Figure 1: Two moments of the same space in Lina Bo Bardi's Casa de Vidro. (*Revista 2G2424*, 2002 and image by the author.)



Figure 2: Two moments of the same space in Lina Bo Bardi's Casa de Vidro. (*Revista 2G2424*, 2002 and image by the author.)

a fixed cultural image for the society being represented. This was the case for the celebrated UNAM library building in Mexico DF by Juan O'Gorman (1949–1951).

The formalisation of this building fully complied with international modernism, but its surface was covered by a mosaic of colour stones executed by O'Gorman himself representing a full cosmogony of Mexican culture [18]. But any attempt to establish a stable

cultural representation, as muralism tried to do, is always an act of discrimination, inevitably leaving individuals and groups misrepresented, excluded, outside, while annihilating the fluctuation and continuous cultural dialectics that transculturation implies.

In contrast, in Bo Bardi's architecture, the building does not claim any representational relevance, but it acts as an interface that makes inhabitants practices of exchange and counterpointing possible. In Bo Bardi's Museum of Art of Sao Paulo (MASP, 1958–1972), this attitude is taken to an urban scale. The building, located in the very dense area of Avenida Paulista is lifted over the ground to free a public square on the belvedere facing the back, accentuating the dramatic change in height. All the programme of the building is located either above the ground level or underground. Following this position towards the city, transculturation is not happening through the building, but through the practices of the citizens in that now liberated space for them.

In her drawings, Bo Bardi represents these practices as situations of a carnivalesque expression, where different unexpected performances arouse constantly (Fig. 2). In this manner, the cultural representation is transferred from the building to the inhabitant. This implies that it is in the practices of these individuals and groups of individuals in this public space that exchanges and counterpoints unfold in a conflicting and non-unitary way, preventing unification as determined by transculturation aspirations. The MASP urban space is thus a breath of fresh air in Avenida Paulista, where people crafting, organising informal markets, skating, dancing, playing music or performing in unsuspected ways can be found daily (Fig. 3). In a socially distressing city such as Sao Paulo, this is a space where culturally conflicting practices unravel and occur as a recognition of reciprocal difference.

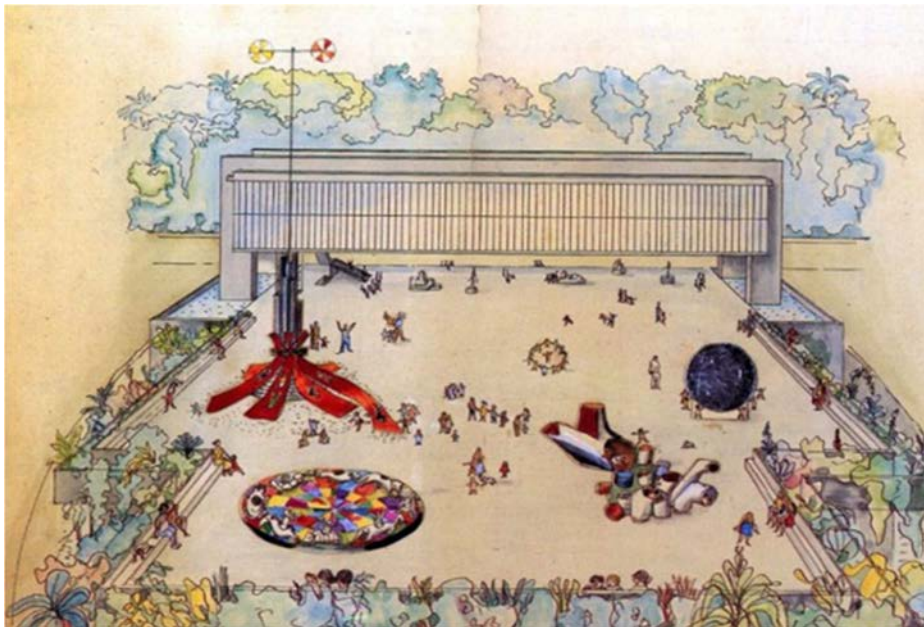


Figure 3: Lina Bo Bardi MASP. (*Fundación Lina & Pedro Maria Bo Bardi and photograph by Iñigo Bujedo Aguirre.*)



Figure 4: Lina Bo Bardi MASP. (*Fundación Lina and Pedro Maria Bo Bardi and Photograph by Iñigo Bujedo Aguirre.*)

5 TRANSCULTURAL COLLECTIVE URBANISM

A more contemporary example of urban action negotiating cultural difference and socio-spatial polarization is the small Gillet Square in the Dalston neighbourhood in East London. Unquestionably, London is one of the more culturally diverse cities in the world, and its public space is the place where cultural negotiation happens on the daily. However, the neoliberal consequences that permeate through all of London's urban fabric jeopardises these negotiations through the commodification and privatization of public spaces. The peculiarity that highlights this square from other public places is its ability not only to allow a dialogue between different ethnic groups and social strata in both its design, construction process and subsequent use, but also to introduce time as a factor that facilitates people's appropriation of the public space in their practices. But before going into details about this square, we need to better understand its location in the city and the processes it has been involved in.

Located in North East London, the Dalston neighbourhood is a residential area with eighteenth and nineteenth century row houses and mid-twentieth century housing blocks that have been inhabited for years by different waves of migrants. Firstly, by a large Jewish community from central Europe that settled in at the end of the nineteenth century that progressively moved to other city locations. Then by a large group of Caribbean migrants who arrived in the neighbourhood in the 50s and 60s to occupy the spaces left over. Later came the Turkish and Vietnamese and more recently the Polish. These different migrant flows, passing through this neighbourhood has gradually left in its wake, one of London's most ethnically diverse neighbourhoods -visually represented by a tradition of very unique shops and restaurants responding to all the different cultures that have been part of its evolving urban heritage. London City Council [19], aware of possible tensions in this very diverse neighbourhood decided in 2003 to support an old district project to regenerate an existing car park and transform it into the main public space for the neighbourhood.

The most attractive element in the initial public space design was the high level of participation in the decision-making process with various parties involved. This initiative started with the establishment of the district of Hackney in 1993, when a cooperative of builders and architects, the Collective Building Design (CBD), outlined the initial ideas for a new square in Gillett Street. After five years of meetings, mediated by the district board

for cooperative development, the Hackney Cooperative Development (HCD) [20], the proposal was outlined. One of the parking lots located in a leftover space between existing buildings was going to be converted into the main public space for Dalston (figure 4). This first led to the construction of ten market kiosks designed by architects Hawkins and Brown. Instead of a big intervention with a fully resolved design to be built on the city suddenly, the strategy in Gillett square was to articulate a series of minor progressive changes. These kiosks began the active character that would later define this public space without even changing the pavement, that remained as asphalt for a long time (Fig. 5).



Figure 5: Gillett Square as a parking and after its reconversion. (Source: *Black Stock* www.blackstockpr.com and *Hawkins and Brown* www.hawkinsbrown.com.)



Figure 6: Gillett Square as a parking and after its reconversion. (Source: *Black Stock* www.blackstockpr.com and *Hawkins and Brown* www.hawkinsbrown.com.)

Step by step other public and private interventions were promoted. The overall public space project increased in scale, and with it the number of parties involved. Following the first set of successful interventions, the HCD decided to extend the design scope by proposing to the cooperative to renovate a nearby factory to house a Culture Centre for the neighbourhood. Later on, a mix of public and private investment allowed for the construction of a mixed-use building in the north side of the square that would support the rest of the project. Among the section of new private investors, not only where private developers involved, but also several non-profit associations that would share the use of this building. The incremental development of the site allowed a better understanding of the project by the people, that found easy to appropriate the elements that little by little started to be available for them. This is also reinforced through different activities organised by HCD, *Groundwork East London* and the local networks, members of the Local Strategic Partnership and the neighbour's forum. The aim was to obtain the participation and opinion of all the social and ethnic strata that compose the neighbourhood before finalizing the final plan executed by landscape architects Whitelaw Turkington.

All this collaborative process of design and construction that united different participatory parts were not abandoned with the pass of the time and was later carried forward with the use of this new public space. The open possibility of renting projectors, movable elements, urban or sound furniture through the HCD facilitated diverse cultural practices to happen. All these activities help the interaction and negotiation between the distinct ethnic groups and social strata. Through playing, dancing, listening, tasting or painting, cultural frictions make a positive impact that attenuate social conflict.

Finally, in line with transculturation theory, what is common to Bo Bardi's MASP and the Gillet Square is the use of cultural conflict as a driving force to generate urban integration. Instead of rejecting this conflict and substituting it by a homogeneous cultural representation, whether multicultural or not, both projects work on exploiting this conflict by generating the right framework to showcase the diversity and plurality of cultural practices that exist in the city. It is precisely through the unveiling of these cultural practices, by building cultural awareness through active participation can we as citizens eradicate secular ignorance and establish a socially sustainable and truly democratic city.

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CONSIDERING PLANNING APPROACHES IN THE GLOBAL SOUTH AND LEARNING FROM CO-PRODUCTION IN SOUTH AFRICA'S INFORMAL BACKYARD RENTAL SECTOR

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ABSTRACT

The global South has traditionally been regarded as oppressed and subjugated, grappling to reach western ideals on the appropriate, desirable and modern. However, framing the developing world as such, fails to recognise that western norms may be neither feasible nor appropriate in these regions and discounts the value of alternative, mostly informal, approaches to provide outcomes more suited to the global South status quo. This paper aims to showcase how western standards and development mechanisms are still propagated in the developing world and how local populations adapt to the outcomes of such approaches to suit their needs and circumstances, in the process challenging western norms and shaping the city from below. The paper employs a qualitative research methodology based on a literature review of core concepts, including: the right to the city, spatial justice, co-production, modernism and neoliberalism; before turning to a case study of South Africa and its informal backyard rental sector to explore research objectives. The subsequent discussion frames the informal backyard rental sector as an example of the interface between the formal and informal; the state and civil society; and the global North and global South. Accordingly, presenting informal backyard rentals as a manifestation of co-production that provides fertile ground to rethink western ideals and reframe urban planning theory, policy-making and practice towards a more inclusive understanding based on lived experience. The paper concludes that such reconsidered approaches may hold potential for more sustainable and just settlements in South Africa and rest of the global South, but also for the cities of the global North, where issues like informality are increasingly imbedded in the urban landscape.

Keywords: global South, co-production, formal-informal dichotomy, informal backyard rentals, South Africa.

1 INTRODUCTION

Urban planning is unavoidably context defined. As a consequence, planning ideas cannot be imported and applied from one context to another under the pretext of universally held truths or based on general applicability. Varied socio-spatial, economic and environmental constructs demand equally varied planning theories and practical applications [1]–[3]. The western world, or global North, has historically played host to the development of the majority of the planning theories and urban models that continue to dominate the field of planning globally [4], [5]. However, it has become increasingly apparent that generalised planning theories and models from the North are often of limited relevance in the contexts of the global South [3], in Latin America, Asia and Africa. The global South often presents dramatic contrasts to the conditions that guide urban planning and development in the global North [5], personified by ethnically divided societies, poor infrastructure, poverty, political instability, weak public institutions, vast informal sectors and juxtapositions between the starkly modern and defiantly traditional. Such contrasting challenges have increasingly drawn the attention of the international planning community [4], [6] and form part of the rationale behind this paper. The paper is further motivated by the fact that 95% of urban expansion will concentrate in the developing world in the future [7] and the realisation that



planning will never succeed in its normative purpose to establish a ‘better’ future [2], [8], [9], if planners fail to register a sensitivity towards Southern contexts and act accordingly. In pursuing a ‘better’ future the paper also draws on established concepts and theories, such as spatial justice, the right to the city and co-production before confronting forces such as modernism and neoliberalism as part of the literature review.

2 LITERATURE REVIEW

2.1 The just city, spatial justice and the right to the city

The just city promotes equal rights rooted in a moral obligation based on the ideas of equity, diversity and democracy [10]. According to Rawls [11] the allocation of goods in society should follow the ‘difference principle’ through which the already privileged should only benefit when ‘doing so is to the advantage of those less fortunate’. Accordingly, advancing societal egalitarianism with the needs of the poor and marginalised equally articulated and met. Egalitarianism is also a cornerstone in French philosopher Henri Lefebvre’s work. Lefebvre’s ‘right to the city’ slogan has gained broad academic recognition [12]. Today the idea of spatial justice and the ‘spatialisation’ of issues on democracy and human rights revive Lefebvre’s right to the city [13] as he defined space according to its social relations, as an alternative to the physical, demographic and territorial parameters traditionally used to define it [14], [15]. As such, space becomes a principal of production and reproduction, understood as contributing to inequality and injustice [16]. Spatial injustice can manifest in various ways, through locational discrimination and enduring spatial structures that empower privilege and oppression, often in pursuit of progressive and modern development aspirations.

2.2 Modernism

Urban planning in many parts of the world is still closely linked to Modernism and its ideals on a superlative end state that would deliver the ‘good city’. The modernist city is largely based on harmony, formality and symmetry, the functional specialisation of areas and movement, the free flow of traffic, connectivity, vertical building, open space development and slum removal [17]. The last is especially significant in terms of this paper, with the will to order and formalise cited as part of ‘high modernist ideology’ intended to arrive at ‘the rational design of social order commensurate with the scientific understanding of natural laws’ [18]. Modernism is touted as a western concept [19], imagined by masters like Le Corbusier who conjured visions of modern skyscrapers and European promenades and boulevards [17]. Modernism entered the global South on the heels of colonialism and later globalisation, augmented in a stubborn confidence that progress towards the modern is desirable and possible [20].

Whilst the fall of colonialism and the rise of independence across the global South ushered in new liberties and freedoms to do away with unsuited western prescripts and development trajectories, most post-colonial governments were inclined to maintain and entrench colonial era spatial plans and land management tools, sometimes in more rigorous terms than under colonial occupation [21]. Through such trajectories the modernist vision was kept alive, fuelled by the ambition to ‘catch up’ and ‘match’ the global North economically and culturally with cities administrated by resilient and stable municipalities, populated by formally employed households who own cars and are moderately well-off [17]. Today, the new master plans for some of Africa’s largest cities continue on the course and seem to depart even more radically from Africa’s urban realities than before. These master



plans propose urban utopias that rely on the continent's imminent 'rise', reflecting references to India and China. Accordingly, African master plans now conjure visions of Shanghai, Singapore or Dubai [22]. However, conceptualising Africa as a place of struggle and failure, trailing behind the rest of world in desperation to reach western ideals is ignorant and patronising, reflecting outdated outlooks on the recognition of the Southern world in grand human history only if these regions convert to Northern modernity [19]. The persistent obsession to force Africa and the rest of the global South into the 'modern age' has not served it well, with the neoliberal development philosophies that have accompanied such attempts having been absolutely destructive [23].

2.3 Neoliberalism

Neoliberalism is a theory of political economic practice that purports the liberation of 'individual entrepreneurial freedoms and skills within an institutional framework characterised by strong private property rights, free markets, and free trade' [24], with a benign yet frequently directive state needed to incite competitive, entrepreneurial, acquisitive and commercial behaviour [25]. For the neoliberals privatisation becomes central [26] with the emphasis placed on profit and serving the greater good efficiently and effectively on the basis of cost-benefit analyses [16]. As an acute example of the outcomes of neoliberal approaches, certain residents may be displaced if the result benefits the majority even marginally, regardless of the impacts levied on those who are displaced who may already come from disadvantaged groups. In certain cases, such outcomes may benefit the already advantaged elite and further disadvantage those truly in need of aid [16], [26], with ramifications for spatial justice and their right to the city.

2.4 The formal-informal dichotomy

Modernist ideals in chase of the 'good city', often pursued through failed colonialist and post-colonial efforts to reach western development standards through neoliberal mechanisms have often clashed with a reality that is not as easily ordered or coerced. The modern is expressed in the formal, whilst the 'anomalies' that oppose it is framed as the informal [27]. It is important to note that the binary is defined according to what the west describes as 'normal' [17]. Within the dualistic classification the formal is implicitly cast as positive, whilst the informal is expelled as a problematic symptom relegated to the developing world [28]. In expression of the distinction, the informal is often described in terms of 'slums', suggesting the illegal, irrational, disordered and unwanted, an irritation or urban pathology to be cured [29]. Accentuating only the negative consolidates the notion of opposition between the formal and informal, and of the latter as an entity found far removed from the formal, planned and modern. In reality, the informal finds itself both within and outside the system [30]. Formal planning elicits the informal by distinguishing between activities as formal or informal, or indeed as more or less legal, by authorising or denouncing activities from one sector to the other [31]. Classifying activities as either formal or informal can also be used as a mechanism of control to contain the 'ungovernable' and condemn entire communities to the urban fringe, veiled behind the pretence of a civil and democratic urban governance system [17]. In such cases placing informality 'central to the urban planning regime' [32]. Furthermore, informality may be used deliberately as political leverage when support is exchanged on the promise of service delivery [30] or protection from eviction and eradication. In such cases informality is actively employed for political control or economic



gain to the benefit of select interests [17], in what is known as the ‘dark side of planning’ [33].

Dark planning motives take advantage of vulnerabilities that are often created by the formal system itself, as informality is commonly accessed as a deliberate choice or last resort in the absence of alternative formal shelter or commercial options or because formal provisions are too costly or rigid [34]. Consequently, the informal primarily meets basic human needs [27] or secondarily responds to the restrictions imposed under formalised systems, often in reaction to or in conjunction with state-driven practices [30]. The latter may be termed co-production.

2.5 Co-production

Co-production is traditionally defined as: ‘a process through which inputs from individuals who are not ‘in’ the same organisation are transformed into goods and services’ [35]. In the context of this paper, co-production signifies the joint production of land and services by the state and citizens, with elements of the process shared amongst both. As such, both actors fulfil a role in situations where the state does not have the capacity to deliver or regulate independently, and low-income citizens cannot depend on their own systems or resources either, thus necessitating hybrid forms of production [6], [36], [37]. Co-production is often an organic manifestation in such circumstances, expressed clearly through unplanned and unsanctioned practice in the informal sector. It is important to recognise the role of hybridised forms of service delivery for the poor and disenfranchised who may use services delivered by the state to survive, even when these services are not directly intended for them. In such examples the formal, as the state and its services, and the informal, as those disadvantaged groups that utilise those services without permission, meet one another and often intersect. In these grey areas spaces and actors are established that blur the line between the formal and informal, being neither completely integrated nor eradicated [38]. Through such co-productive practices citizens may exercise an appropriated right to an often-unjust city. Whilst informal practices may be somewhat tolerated in such circumstances, informality is rarely officially sanctioned, as official recognition or endorsement would oppose the ideals of progressive modern development (see section 2.2).

The following segment introduces the paper’s empirical research section, opening with a brief positioning of Africa in the global South, laying the foundation for the case study of South Africa’s informal backyard rental sector and the discussion of the sector as an example of co-production that follows.

3 EMPIRICAL STUDY

3.1 Methodology

This study makes use of a qualitative approach, drawing on a desktop analysis and theory based sampling, incorporating key elements discussed in the literature review to link a case study of South Africa’s informal backyard rental sector to co-production and highlight the significance for future planning endeavours for the global South. As in the literature review above, the case study and subsequent discussion rely on a variety of sources identified using electronic databases and academic search engines, with search queries related, inter alia, to the global South, planning theory, informality, informal backyard rentals, co-production and transferability.



3.2 A perspective on Africa and South Africa

Africa has been singled out in debates on the global South, as the continent especially faces acute challenges [34]. Africa displays vastly uneven patterns of urban and economic development across its immense landscape [39]. Accordingly, generalisations on Africa will likely be confronted with contradictions from specific non-conforming instances from one African case to another [1]. Yet, it would also be negligent to assume that different African countries, and countries throughout the global South, do not share certain characteristics given the histories and contemporary challenges they may have in common. The danger of irresponsible generalisation is ever present, but is partially surmounted by a communal history of colonialism that continues to unite much of the African continent and developing world. It is also within this shared history that scholars may confront and overcome the notion of South African exceptionalism, with the country often referenced as a marginal member of the western world [40], and may include South Africa in African and global South scholarship [23]. It is from this understanding that this paper focuses on South Africa as case study.

Though an extensive period of colonial rule features in South African history, the policy of apartheid is most synonymous with western domination in the country today. The apartheid city model entrenched colonial values on the control of native populations according to modernist principles for urban design and housing [41]. As a system of race based planning and development, apartheid left a heritage of significant housing shortages for the Black population in its wake in the early to mid-nineties. The post-apartheid government responded with a constitutionally mandated commitment to housing, resulting in housing delivery at an unprecedented scale and pace in pursuit of restorative justice. Despite valiant efforts, the housing backlog has continued to expand as approaches have resulted in large, but dwindling numbers of uniform units that disregard beneficiary needs [42], [43] within a neoliberal policy framework aimed at developing internationally competitive cities [1], [12]. Despite a fixation on eliminating informality through extensive slum eradication programmes in accordance with international norms, informal development practices have intensified [44], [45], signifying a renewed struggle for Lefebvre's the right to the city [12]. Informality has strengthened its presence in the South African shantytown and increasingly in low-income suburbs and the state's subsidised housing projects, evidenced by an overwhelming number of illegal electricity and water connections, informal businesses and informal backyard (rental) structures [46].

3.3 South Africa's informal backyard rental sector

An informal backyard rental structure is defined as: 'An informal structure erected by a recognised property owner or tenant within the boundaries of a formally registered property that contains at least one formal dwelling unit. The materials and construction practices used do not comply with National Norms and Standards with the structure constructed attached or adjacent to an existing formal dwelling. An oral or written agreement or 'understanding' may be negotiated that provides permission for settlement and may include terms of rental remuneration, conditions of service access, eviction procedures and other landlord and tenant rights' [47]. The number of informal backyard rental structures in South Africa was estimated at a conservative and questionable 756,000 households in 2014 [47]. These structures address the need for affordable rental housing neglected by official policies, accommodating those who would otherwise settle in shantytowns, often in convenient locations, densifying suburbs, capitalising on existing infrastructure and housing investments, providing landlords



and tenants with financial benefits and building social capital. Conversely, informal backyard rentals also pose several health and safety risks, may introduce overcrowding, overburden infrastructure networks and degrade the environment (For detailed discussions, see [47]). Despite the informal backyard rental sector's ubiquity, potentials and challenges, the segment is not yet addressed by any national policy [48]. The neglect of the informal backyard rental sector symbolises a system unable to respond to the context-specific challenges it faces, preoccupied with reaching a western development ideal and disregarding reality. Through the exclusion of the informal backyard rental sector [49] and blunt housing policy unable to respond to housing needs either sustainably or at scale [50], South African planning continues to fail in its normative purpose.

Although conflict and the threat of eradication remain (see Section 3.2), backyarders have carved out their own niche in the South African housing market through persistence and constant defiance of building regulations, zoning requirements and density guidelines based on conventions more appropriate to western contexts. As such, backyarders force the state to accept their presence and gradually adapt the official response from one of total indifference focused on eradication to increased recognition, legitimisation and future support. The gradual shift is demonstrated in the South African state's commitments to produce national policies on back yarding in the future [51], not intent on eradicating the sector, but on agonistically supporting and encouraging the informal rental market as an autonomous people-led response to the housing backlog based on co-productive relationships.

4 DISCUSSION

4.1 The informal backyard rental sector, co-production and related significance

It is in providing a real-world example of co-production that South Africa's informal backyard rental sector is especially significant. Informal backyard rentals are not the result of deliberate state-led attempts to encourage self-help housing or hybridisation in acknowledgement of its own shortcomings. Instead, the sector originates at grassroots level within a culture of informal development established during the later years of apartheid [52], and maintained as an unintended by-product of formal housing delivery outcomes [53], in the democratic era [50]. Informal backyard rentals are produced as the current government remains unable to meet the extreme housing backlog [54] and the poor are incapable of accessing housing without drawing on some form of support. Within this context, informal backyard rentals bridge shortfalls for both the state and destitute, accordingly meeting the definition on co-production provided earlier [55]. This paper further posits that the informal backyard rental sector provides an example of co-production in service delivery, but also within the North-South debate. It is within these often-hidden backyard spaces that western inspired modernist aspirations of control embodied by housing development schemes, meet an opposing South African reality. In these spaces attempts to order and rationalise according to western conventions are confronted by and amalgamate with an indigenous system based on survival. It follows that the informal backyard rental sector establishes an intriguing interface between the formal and informal and the global North and global South. The interface presents a struggle in which unpredictable and diverse forms of engagement are established, with both positive and more negative results [17]. As such, it is important to note that co-production may not be exclusively positive, but as with the informal backyard rental sector, may exhibit 'mutually enhancing and mutually corrupting' properties [37]. Yet, it is within these conflicted spaces that the most thought-provoking opportunities for learning and understanding are presented to produce effective new planning ideas [3], [17], that recognise



the indifference and limits of official approaches and the ingenuity found in ground level responses. In the case of the informal backyard rental sector's co-productive continuation, these deficiencies and responses are evidenced physically in great numbers and provide ample opportunities for future planning strategies to capitalise on existing potentials and mitigate risks and challenges towards improved quality of life. Recommendations in this regard are captured in the Conclusions section below.

Examining varied cases of co-production from the global South may furthermore advance the internationalisation of planning by recognising forms of alternative development and planning engagement already established across varying global contexts [6]. In working transnationally, global influences and experiences may constantly inform and challenge perceptions on how the world works and develops [2]. This is important in challenging dominant perceptions about the struggles and opportunities presented outside the global North and in accepting that experience from Euro-America may not apply universally and may more likely be exceptional in the international context [56]. As such, opposing the idea of informality as the exception and not the norm [37] and as problematic entity found outside and far removed from the formal is especially significant. In advocating a shift from Northern dominance, theorists have called for a departure from the frequently uncontested image of the African, or any other Southern city as a place of failure, perpetually in need of intervention from the North [3]. In heeding, this call the planning community at large might start to view these places not as instances of deteriorated modernity, but as examples both part of and separate from conventional interpretations of the modern established through the resourceful responses of citizens to their own vulnerabilities. In this regard, accepting and exploring a new kind of Afro-modernity [19]. Such interpretations may allow for more positive conceptualisations that acknowledge successes or potentials despite structural constraints [4]. Delivering this message and garnering support for the cause will require a shift towards an appreciation of a real-world perspective based on empiricism, everyday experience and indigenous knowledge (see [3], [34]). A legitimised focus on the everyday may confer a level of respectability to modes of local knowledge and practice dismissed as irrationalities or irrelevancies in the past [4]. These sentiments are supported by Watson [57], for whom the local empirical holds substantial value. She calls on planning research to re-establish its foundation in the empirical, not as a return to the critiqued empiricism of the past, but in order to relate theory to practically viable applications. Through such a reconsidered emphasis, contemporary research focused on the global South may elaborate on how regionally bound local experiences can contribute to planning thought at a broader global scale [58], placing a responsibility on the shoulders of those planners who find themselves in western contexts to learn from experiences in the global South [2], [4]. Accordingly, ways of thinking and theorising in Africa, based on phenomena such as co-production, may show the way to the North [59], where issues such as informality are increasingly becoming part of the daily urban experience [30], [60] strengthening arguments that the North and South and all peripheries in-between might exist within each other [30]. Comaroff and Comaroff [19] summarise the sentiment aptly by stating: 'In short, there is much South in the North, much North in the South, and more of both to come in the future'.

Yet, such realisations should not convince planners that inter-contextual, transregional work will come without limitations, or that academics should promote simplistic 'best practice' ideals from one region to the other [17]. In the endeavour to generate Southern-based approaches, planners should be cautious of establishing artificial binaries between the global North and global South, and even from in-between Southern contexts. Whenever ideas are transferred it is vital that a contextual common ground be established that underpin the concept and may hold elsewhere [17]. This paper affirms the responsibility



of planners to recognise and address potential distortions that may develop as ideas travel over time and become institutionalised or part of politicised attempts to dominate [2]. As such, Healey [2] emphasises the value of an 'origin narrative' that identifies the situation in which a concept was developed, describes its specific history and examines how it travelled from its site of origin to assist in identifying what can be learned from it of bearing to other contexts. An origin narrative may be useful in establishing a body of international research that circumvents the propensity to generalise based on 'best practice' and pursue decontextualized models that ignore the significance of place in shaping planning thought and practice [6]. In the same vein, planners should be wary of labelling all Northern-based concepts as irrelevant or unsuitable for the South [61]. As examples of promise, paradigms focussed on developing new urban forms such as compact city concepts with infrastructure-led spatial plans and new urbanism provide important spatial principles that present alternatives to the spatial and urban forms propagated under urban modernism in much of the global South [17].

5 CONCLUSION

This paper strengthens the argument to abandon the notion of universal field theories and urban models that ignore contextual variances and are applied unilaterally across the globe, especially from North to South. The paper reinstitutes the need to acknowledge multiple rationalities and concede to alternative forms of modernism that may promote justice outside western prescripts on orderly and progressive development. The dominance of Northern influences, including colonialism, modernism and neoliberalism and examples such as South African apartheid, have stood in the way of planning to truly serve as a vehicle of justice towards a 'better future' in the global South. There is a need to establish a cadre of planners that can recognise misconceptions and prejudices, willing to learn from real-world experiences outside the confines of the global North. Overcoming the idea of Southern ineptitude will require a planning community situated both within and outside the global South that values grassroots experience and prioritises the normative purpose to 'better' the future, regardless of the ways in which such endeavours may correspond or clash with western conventions. In South Africa, planners need only notice what is happening in their own backyards, recognise local responses and respect the rights of insurgents who oppose plans to sweep them away and deny their right to the city. This will require out-of-the box thinking in two respects. Firstly, by confronting the relevance and sovereignty of the standard subsidised housing product provided under national housing programmes, as a physical box intended to enforce a very westernised way of modern living. Secondly, by planners becoming advocates for the marginalised, encouraging grassroots participation and taking outcomes on board in future policies and planning decisions. As such, planners and policy-makers may acknowledge the benefits and challenges encapsulated in the informal backyard rental sector by recognising the sector officially and facilitating informal backyard renting in partnership with landlords and tenants. Accordingly, policies may shift away from eradication objectives, introduce larger stand sizes to accommodate informal backyard rentals, consider informal rental subsidies, support programmes, targeted stakeholder engagement platforms, conflict mediation services, building training programmes, fire and health checks, revised zoning and building restrictions, all mandated at local level and based on local needs. It is within such a framework that planners can show support for Southern potential and the kind of Afro-modernity established through co-production exemplified by the informal backyard rental sector. Through such shifts and based on the argument for responsible transnational and interregional theorising and practice a planning community may be established in which the world is equally represented, localised work is appreciated



and contextual relevance guides how planning ideas are generated, imported, exported, accepted and institutionalised towards more sustainable and 'better' futures in both the global North and global South.

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SECTION 6

INTELLIGENT

ENVIRONMENT

THE IMPORTANCE OF DESIGN IN HELPING HUMANITY BECOME A MULTI-PLANETARY SPECIES

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ABSTRACT

The United Nations projects that the world population will likely reach 10.9 billion by the end of the century on a planet ill prepared to provide shelter, health care and food and water for its inhabitants. To decrease the planets population, ensure the long-term continuation of our species and the survival of our evolutionary branch, humanity needs to become a multi-planetary species. By going off world to colonize the solar system, the first explorers and the later colonizers will need to inhabit environments designed specifically to preserve their psychological wellbeing. Developing design parameters based on psychological factors will be of paramount importance to help humans deal with long journeys through space, and to create relaxing habitats to help decrease the stress that planetary explorers will be subjected to. The design community needs to become a participant in this process because solely engineered spaces are not enough to develop a good mental and physical quality of life for space exploration. There has been a tendency, with few exceptions, to not include design as an important aspect of the development of the government funded space programs all around the world. It was not until private capital started participating on the field and saw the opportunity to involve the public, that designers were invited to help sell the ideas of space exploration. In the future, the participation of the designer will need to transcend the role of the beautifier and we will need to become involved in all aspects of design that relate to the psychological wellbeing of the explorers. The development of off-planetary architecture will help humanity transition and mentally adapt to foreign environments. We need to understand that off-world habitats will require design that conveys familiarity to aid with our survival and prosperity, but more importantly, to remind us where we came from.

Keywords: sustainability, multi-planetary species, mars colonization, space exploration, off-planet design, quality of life, mental health.

1 INTRODUCTION

“Since, in the long run, every planetary civilization will be endangered by impacts from space, every surviving civilization is obliged to become spacefaring--not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive... If our long-term survival is at stake, we have a basic responsibility to our species to venture to other worlds.” (Sagan [1]). And to do so, humanity will need habitats designed to help with the mental stress presented by the detachment from the planet that protects us. As humans leave home, we will need to be mentally prepared to endure the journey. This paper is a manifesto of ideas on the importance of design, in helping humanity become a multi-planetary species. In it I will be discussing interior architecture; designed around the systemic interdependence of four concepts: The psychological effect of color and light, collective memory in smart design, virtual reality immersion and mindfulness meditation. These four ideas will be the basis for a symbiotic hybridization in the creation of habitable environments designed for the purpose of calming the mind of the explorers that will spend a lot of time surrounded by none earth like landscapes or the vacuum of space. The habitable environments for space exploration and planetary colonization will need to stop resembling engineering labs like the international space station. Instead, they will need to look a lot like movie and TV science fiction sets, because we have become habituated to the stylistic representations created by the science fiction genre of what space design should be. Habitable



space will need to be designed to calm the mind by developing familiarity and reminding us of home.

2 THE PSYCHOLOGICAL EFFECT OF COLOR AND LIGHT

In the post-industrial era color and light have become important elements of design, helping; offices be more productive, fast food restaurants less appealing to linger in, emergency rooms less stressful, etc. But now, that man is starting to think about building habitats in outer space and other planets, the urgency of understanding the effect of artificial light becomes a necessity. Scientists have become convinced that light has a far greater impact on health and behavior than previously thought, making of it the most important environmental input, after food, in controlling bodily function. The use of color and light will be of special importance when dealing with life in other planets in helping us adjust our circadian rhythm (the Martian day is 24' 40", in Ceres it is 9'). The circadian rhythm is a roughly 24 hours cycle in the physiological processes of living beings, including plants, animals, fungi and cyanobacteria. It is important in determining the sleeping, feeding, brain wave activity, hormone production, cell regeneration and other biological patterns of all animals, including human beings. Because of this, the spaces we inhabit will need to be designed to help us cope with adapting our earth day to the new environments. This adaptation is paramount for our mental wellbeing and ultimately our capacity to travel to and colonize other planets. 'Architectural lighting must be redesigned to account for its biological and behavioral impact on humans, ultimately improving people's health and well-being in the built environment' (Holzman 2010 [2]). The habitats we design will need to have color changing light-emitting diodes (LEDs) serving as a natural stimulant which have the capacity of directly improving alertness, performance, and also helping reset an astronaut's circadian rhythm if it gets out of sync. The light in all sleeping habitats will need to be shifting from blue to white to red helping simulate the typical day to night cycle. The blue lighting is meant to stimulate the retinal photopigment melanopsin as well as the hormone melatonin, which helps a person feel alert and awake. The shift to red lighting will reverse the process and help encourage feelings of sleepiness. The rest of the habitats will be flooded with white light making the spaces easy to interact with. The versatility of the LED in color changing will also allow for other types of phototherapy to be implemented as needed. Green as an example, is said to lessen depression, anxiety, and nervousness. It relaxes both body and mind, and is both soothing and refreshing.

3 COLLECTIVE MEMORY AND SMART DESIGN

When we look at the international space station (ISS) or any of its predecessors we are confronted with utilitarian design constrained by budget, trade-offs, and practicality. We don't yet have the technology to do construction in space, so we have to assemble a large vehicle from launch able components. The components size and shape is dictated by the type of delivery vehicle. In the case of the ISS, all the components needed to fit in the Space Shuttle Orbiter or the Russian Proton rocket. The result is a series of very pragmatic exterior and interior design choices. But as we embark on long term exploration and the possibility of long term colonization, we need to consider the psychological effect of engineered spaces in the astronaut's mind. The interior design of this habitable spaces will need to answer to the collective memory of humanity. It will need to play with our nostalgia. And to do so, it will need to attach itself to universal interpretations of our understanding of what life in space should be like. This universal understanding comes from science fiction. Since Jules Verne, humanities collective memory has been creating an idea of what space inhabitation should be. This idea has evolved into the stage design of the movies and TV shows we watch. And



it is these multiple representations, that make our generic collective understanding of interior environments something we find familiar. The interior design of our inhabitation modules and interior spaces will benefit from using this familiarity as a design tool that through association can generate spaces subconsciously acceptable to all. We need to make our habitable spaces look like our science fiction because it is this science fiction that has sparked in humanity the craving for exploration.

4 VIRTUAL REALITY IMMERSION

For explorers and colonizers open space will always be a luxury. In the colonial habitats and the spaceships, it will be impossible to physically reproduce the feeling of openness that we experience on earth. Psychologically, this feeling of constrain created by small spaces or being inside an environmental suit will eventually have a toll on the human mind.

A solution to this issue can come from the use of 360 virtual reality immersion as a tool for relaxation. For the purpose of this argument we will define VR as “an advanced form of human–computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion” (Schultheis and Rizzo [3]). Presently this technology is applied in the treatment of phobias, anxiety, depression, PTSD, obesity and eating disorders, and also purely for relaxation purposes.

Off earth, this tool would present an easy way of dealing with our nostalgia for the world left behind. The technology is small, which allows the user to get immersed anywhere. But most importantly, the immersion scenarios are unlimited: These include landscapes, video games, tutorials or personal interactions with family and friends. Because the technology is therapeutic, didactic and entertaining, it will end up as a participant in space exploration helping define quality of life in all off world endeavors.

5 MINDFULNESS MEDITATION

“Although the practice of meditation is associated with a sense of peacefulness and physical relaxation, practitioners have long claimed that meditation also provides cognitive and psychological benefits that persist throughout the day” (Lazar [4]).

Studies have found structural differences between the brains of experienced meditation practitioners and individuals with no history of meditation, observing thickening of the cerebral cortex in areas associated with attention and emotional integration. The study by



Figure 1: VR immersion headset will allow the user to escape the isolation of their physical situation.

Lazar and associates shows that the brain's plasticity under meditation can play an active role in changing the brain. By doing so, increasing our well-being and quality of life, results which would be psychologically beneficial to off world explorers and colonizers. A controlled mind would minimize mental health problems and would allow for social harmony and adaptability to the new environmental constraints. Tibetan Buddhist monks go on three-year retreats to caves on the side of mountains in the Himalayas, not leaving the cave for the extent of the retreat. This level of mental control has the potential to define the success of space exploration. In my mind, astronauts will need to be good meditators before going off world, and their meditation practice should be carried through the extent of their deployment. A focused and balanced state of mind would allow for a level of behavioral equanimity necessary in the social interaction of small communities that have to function together for extended periods of time.

6 METHODOLOGY

In the study of interior architecture for the exploration and colonization of our solar system, a series of interior space related proposals were designed as an attempt to provide a basis to address all the issues covered previously. These proposals will be explained in point 8. But it is important to note that the research of this subject has been an ongoing process which as a side effect has produced an independent study course at an undergraduate architecture program. The course was developed to test some of this research in an academic context but the ultimate goal of this work is implementation. To explain the research process, the following methodology was produced:

- An ongoing analysis of different literature sources was established to define trends and features related to the influence of psychology in the development of interior design for off planet habitation, focusing on design approaches taken by NASA, ESA, Virgin Space and Space X.
- Case studies of previous design proposals produced by other designers were studied.
- An independent study was set up with a fifth-year undergraduate student at the American University of Sharjah. The research project carried on for two semesters and was presented as his final thesis. Point 7 will explain the independent study.
- By defining possible micro sites, questions of; the psychological effect of color and light, collective memory smart design, virtual reality immersion and meditation, were studied and assessed.
- A series of design were proposed so they could be reviewed by peer designers.
- 3D Models were produced to help convey some of these ideas representationally.

7 STUDENT WORK: INDEPENDENT STUDY

To further explore some of the ideas presented on this paper a one-year independent study was approved by the American University of Sharjah with the aim of implementing this research in a design studio. Some samples of the work generated by the student are presented below. The studio was set up as an alternative to the typical fifth year studio. In it one student would work with a mentor to implement faculty research. The studio was set up as an end of degree thesis in which the fall semester would be used by the student to produce research. The research would be presented at the end of term in front of a jury that would determine if there was enough merit for the project to continue during spring semester. The final thesis project was presented in the form of a comic book that explored through a narrative all the material researched over the year. While the level of development does not take into



consideration a lot of the constraints presented by the task of creating habitat for mars colonization, the studio was successful in opening a dialogue on the subject at an academic level. It also was successful at helping clarify a path for the research that came after the independent study. That research is being presented in this paper.



Figure 2: Work produced by Al Chawa [5].

8 CASE STUDY: MARS COLONY HABITAT SPATIAL DESIGN

The main premise of the case study was to hybridize the conceptual elements previously presented: The psychological effect of color and light, collective memory in smart design, virtual reality immersion and mindfulness meditation, into interior architecture proposals. All the proposed spaces will deal directly with design elements that will have a psychological effect on the user. Plants for the production of oxygen and food will also add a visual component to the habitats linking the astronaut to earth while also offering activities like gardening as a distraction or hobby. Together with the plants, a water element is always part of the habitats, the water will be in motion for filtration purposes, allowing the design of the spaces to use the sound of water in specific locations to sooth and relax the users mind.

The first space is the connector hallway (Fig. 3) which is composed of a spinning hydroponic bay inside a circulation hallway. The modular ring is able to be expanded as needed altering the length of the hallway. Because of the lack of space, hallways need to serve more functions than just being circulation elements. That is why the interior of the walls are used for insulation, electric and life support systems. As the hydroponic bay spins, holes on the bottom of the hydroponic cylinders allow for the nutrient solution to be in contact with the plants. The hydroponic bay's speed cycle and type of nutrient solution are adaptable. And at any point, the nutrient solution can be filtered for water consumption. The proposal allows for all circulation hallways to also function as hydroponic farms, producing food and cleaning the air of the colony, while creating a visual relationship with the plants. The later one is important because maintaining a connection to nature, either through the presence of plants or artwork depicting the natural environment, has been shown to decrease stress levels and stimulate healing. The presence of plants in interior spaces has also shown to: Improve reaction times, attentiveness, attendance (at work and school), productivity (at work), well-being, perceptions of the space around you, lower blood pressure, lower levels of anxiety while recovering from surgery and better job satisfaction.

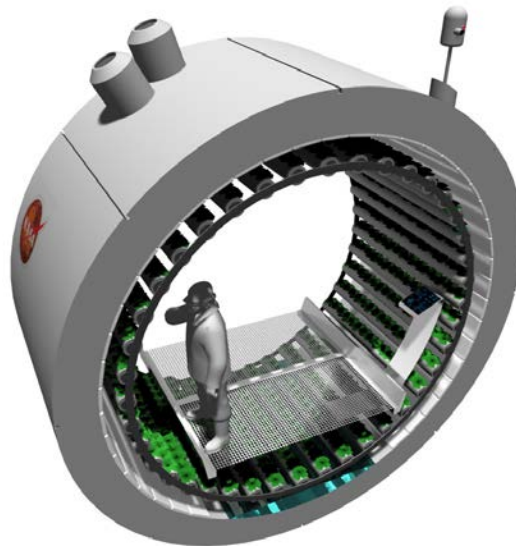


Figure 3: Connector hallway with hydroponic bay and LED growth lights.

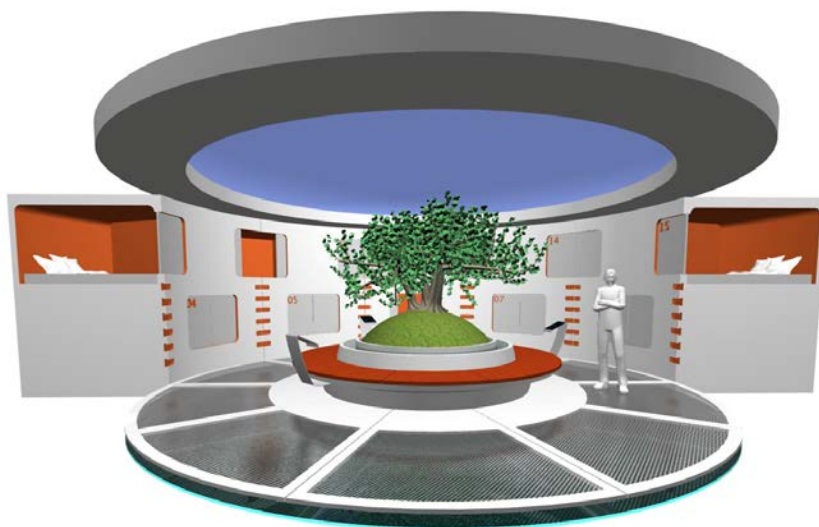


Figure 4: Sleeping and relaxation module with plants, water storage under main floor, circadian rhythm dome and private bunk beds for sleeping and meditation.

The second space is the sleeping module (Fig. 4), designed as a panopticon system of bunks that open to a shared central space. The bunks are designed to close off the central space to provide privacy. Each bunk has space for a bed that fits two, plus shelving and storage for personal items. The space functions similarly to a micro hotel. Opposite to the bunks the astronauts would have a shared bathroom and locker spaces. Each bunk cubby will have an illumination system that will link to the user's circadian rhythm, changing colors to simulate sun rise and sun set. The central space will also be linked to the stations general circadian rhythm to serve as an internal clock shared by the whole facility. The central shared space is composed of a seating area designed on top of a see-through floor system that covers one of the water holding units. The users will be able to see and hear the water. In the middle of the room a tree serves as a center piece to be seen at the beginning and end of each astronaut's day. The tree, the water and the light are specifically designed to produce psychological reactions that associate these lives bringing elements with the collective memory of the crew to subconsciously make them feel at home.

The third space is the food court (Fig. 5) which is designed around a central element that holds three stacking tables. The tables can move around the central element and because they are designed at different heights, they are capable of stacking together to allow for the space to have other uses. There is a hydroponic farm surrounding the main space which links to a water reservoir below the floor. The dome is designed to work around the stations general circadian rhythm.

You might have noticed that the interior surfaces of most spaces are white, this has been done to allow the light to control the coloration of the spaces instead of the surfaces. In a white surface, the light will reflect the given color manifested by the LED, instead of blending with an existing color. The purity of the color produced by the light will allow for the photobiology (color therapy) to function better by controlling the exact wavelength of the color needed.

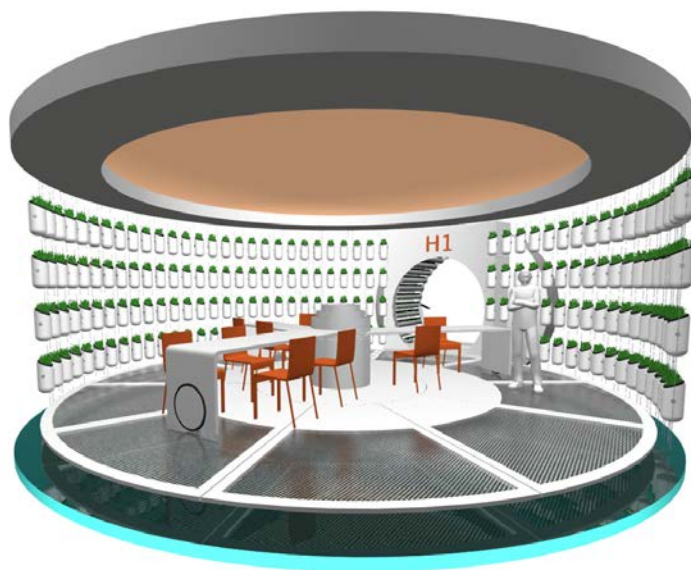


Figure 5: Food court with hydroponic food production, water storage under main floor, circadian rhythm dome and overlapping movable tables for adaptable space.

9 CONCLUSION

The aim of this project was to start a discussion about the role of psychological based design in the exploration and colonization of the solar system. By developing spatial proposals that deal with the psychological effect of color and light in habitats designed to engage humanities collective memory, we find an architectural framework that has the potential to create healthy environments to help resolve questions of quality of life while living away from earth. And by doing so, creates spaces where non-architectural psychological elements like virtual reality immersion and mindfulness meditation, can manifest. The spatial proposals offer:

- Inhabitation in spaces designed with an understanding of the psychological effects of color and light, which will produce less oppressive interior architecture and will help keep the astronauts in synchrony with their circadian rhythm.
- An architectural typology of designed spaces to serve the collective memory of humanity through the creation of familiar spaces that evoke a nostalgic memory of the home planet.
- The use of virtual reality immersion to help the crew relax and or to deal with mental health issues like depression or phobias.
- Sleeping spaces designed to provide some level of privacy and for the practice of mindfulness meditation.

When the four subjects explained in this paper develop a systemic interdependency, we end up with a series of proposals that manifest the importance that interior architecture has in helping us become a multi-planetary species.

ACKNOWLEDGEMENT

This research was used to produce and independent study course at the American University of Sharjah. The course was divided into two semesters: The design studio course that took place in the Fall of 2015, had as a goal to produce research on possible landing sites, emerging technologies, existing designs, ergonomic design, energy, food, and transport. In Spring of 2015, the design studio course dealt with implementation. The studio had a single thesis student; Mohamad Al Chawa.

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IMPLEMENTATION OF AUGMENTED REALITY AND LOCATION-BASED SERVICES TO REGIONAL DEVELOPMENT

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ABSTRACT

This article discusses an innovative concept of augmented reality and location-based services in regional development. The aim of this article is to present the approaches that led to the creation of dynamic data of the strategic parts of community development strategy in the local action groups of the Zlín Region in the Czech Republic. In total, data from 18 local action groups, which are located in the territory of the Zlín Region, were collected. These data were transformed into a tabulated form, and a web platform (developed by the Institute of Geonics of the Academy of Sciences of the Czech Republic) was used to dynamically transform static data into dynamic ones. The output from this web platform is data that are ready for implementation into augmented reality applications (such as Layar or Wikitude) and can serve not only local action groups. Other potential subscribers are regions, micro-regions, as well as developers or citizens themselves.

Keywords: augmented reality, dynamization, location-based services, conception, regional development, tools.

1 INTRODUCTION

We can define augmented reality (AR) as an integrating certain digital information in real time and space. It can capture existing image and combine it with the information and inserts into it. Technically speaking, it is still a new system that allows us to insert virtual content into the material world and use it for real-time presentation (Gregor [1] or Maad [2]). Location-based services (LBS) can be viewed as services that enable users to find out where they are, what are the opportunities around them or all information about services and shops (Zelenka and Kysela [3]).

The tools of augmented reality and location-based services use a lot of users almost everyday. For example, viewing the land register or notifying your location on the social network. It is specific to them that they are running in a real time. Augmented reality tools, respectively location-based services represent the use of tangible elements in the landscape and their interconnection with the virtual world. The tools for this link are especially AR-based mobile applications – such as freely available Layar or Wikitude applications. The goal of the paper is to explore the possibilities of user-friendly dynamization of static data of conceptual development documents into the environment of extended reality.

2 THEORETICAL FRAMEWORK OF LOCATION-BASED SERVICES AND AUGMENTED REALITY

Anchorage of this problematic is based on a study of virtual space (Trojan [4]), wherein the object of the solution is based on networking of digital nodes. Thus, it completes Aristotle's concept of place (Lang [5]) with Euclidean geometry and Descartes's coordinate system. With the formulating concepts of space and place (Tuan [6]), it raises a discussion about the functioning of material perception of space in virtual space. Increasing users' interests of cyberspace and the availability of appropriate technology forcing virtual space service providers to adapt trends and innovations very quickly. There are only a few areas where the



development is as dynamic as in the case of mobile services and AR/LBS. Users, who are largely content-conscious, enter the virtual reality due to its availability practically anywhere. Access to places in cyberspace is then realized through the interface of the physical world (mobile phones/tablets with touchscreens, keyboards, joysticks, etc.). Dodge and Kitchin [7], based on their earlier study (Dodge and Kitchin [8]), offer a typological overview of virtual sites through software code, time independence, and (geographical) localization of creating such a place. Typical for this classification is the heterogeneity of sites and the tendency to rapidly change the internal structure.

The tendency to shift activity from material world to virtual space is visible in many industries. (Zipf and Malaka [9], or Trojan [10]), where a wide range of AR applications (mainly guides) are created. An augmented reality is an environment through which spatially localizable information (created e.g. in geographical information systems) can be presented to the public. A mobile device to use this concept needs only a positioning tool (most commonly implemented with a GPS/GLONASS/Galileo chip integrated into the device) and camera, through which it is possible to identify objects' contours of the real world. With the simultaneous connection to the Internet, virtual world information stored on remote servers can be downloaded. For its features and widespread use, the augmented reality (also due to a wide range of free applications) is dynamically evolving concept. The importance of augmented reality and location-based services documents several sources. On the one hand, the growing publishing activity (especially Anglo-Saxon) researchers, for example, published in the *Journal of Location Based Services* (ISSN 1748-9725), as well as mass expansion in the gaming industry (see *Pokémon GO!*). On the other hand, support from research agencies (e.g., Project TD03000079 Web application for the dynamics of spatial data of industrial sites in the form of location-based services). However, concrete realizations are lacking in the level of regional development, e.g. through the dynamization of regional conceptual documents. And usability exists here – surveys among potential users indicate a relatively high demand if the barrier of know-how adaptation goes beyond (Trojan and Šinogel [11], or Trojan et al. [13]).

3 METHODOLOGY AND DATA SOURCE

To illustrate the data collection, we used an extensive database of community-led local development strategies (SCLLDs) of individual local action groups (LAGs) in the Zlín Region (a total of eighteen subjects). The advantage of using SCLLD is the structured and methodically clearly anchored content and clarity that each LAG has in this strategy elements listed in the strategic section, divided precisely into key elements, strategic objectives and individual measures (in line with the methodological recommendation for creation of SCLLD issued by the Ministry of Local Development, closer to e.g., Binek et al. [12]). An overview of the local action groups used to dynamize the SCLLD is shown in Fig. 1.

In order to implement the data into the web interface, it was necessary to collect the data presented in the SCLLD prepared by the local action groups of the Zlín Region. These were always key elements and individual measures that could be used to determine positions by coordinates (latitude and longitude). From the point of view of precise localization, the measure "Develop knowledge and skills of employees and employers" was evaluated as unsuitable. Measures that had a clearly identifiable position were rewritten into tabular form. For a significant part of the measure (e.g., "Building pedestrian crossings" from the LAG strategy of Hornolidečsko) it was also necessary to identify the critical points in the village where such construction is necessary (for example in Prlov village /49.2433233N, 17.960721E/ on the traffic hub missing the transition for pedestrian between the bus stop and the local food restaurant). In addition to the location, other relevant information was searched

for each measure, which could be a reasonable demand from users (for example, a more detailed description, a website, a telephone number/e-mail to the LAG office, etc.) and which are applications of the augmented reality suitably used – see illustrative example in Table 1.

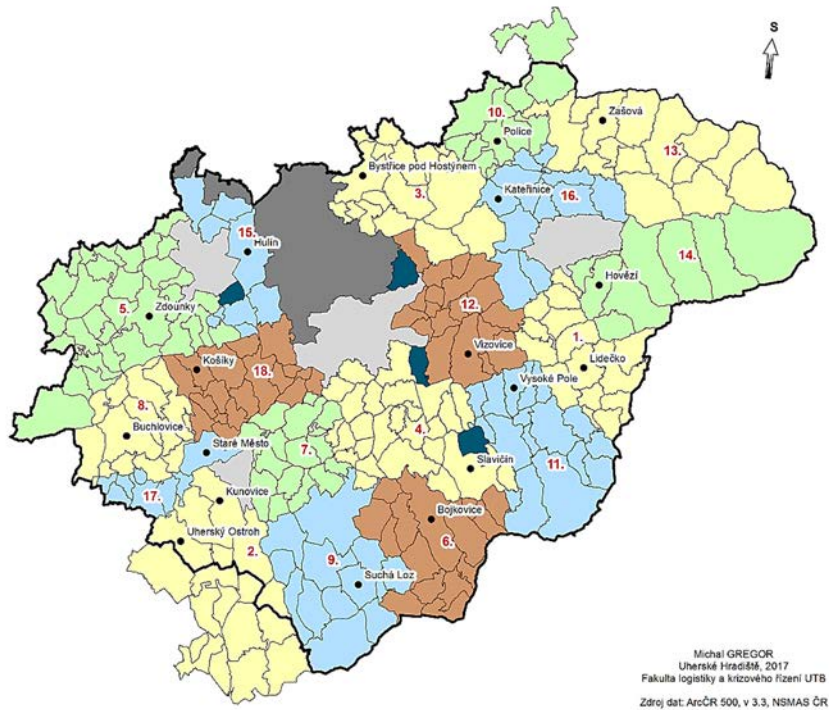


Figure 1: LAGs in the Zlín Region and their residency for the period 2014–2020.

Table 1: An illustrative example of a table.

Name of the object	Short description	Long description	GPS	GPS	WWW	Mobile	E-mail
Bystřice pod Hostýnem	Life in villages	Reconstruction of school buildings	49.399 565	17.669 7242	www.mas-podhostynska.cz	420 728 085 301	slovak@mas-podhostynska.cz
Hošťálková	Life in villages	Reconstruction of school buildings	49.356 9383	17.873 4747	www.mas-podhostynska.cz	420 728 085 301	slovak@mas-podhostynska.cz
Chvalčov	Life in villages	Reconstruction of school building	49.394 0814	17.703 5061	www.mas-podhostynska.cz	640 728 085 301	slovak@mas-podhostynska.cz



The name in the table represents the name of the member of the LAG. A short description is the short name of the priority, and the long description is the specific name if the measure listed in the strategic section of the SCLLD. Modelling from Table 1. Was “Reconstruction of school objects”, ie. The user’s coordinates will be directed to individual elementary schools in LAG municipalities.

The table containing the translated strategic parts of the SCLLD of the individual LAGs of the Zlín Region then enters the process of dynamization through the web interface developed by the Institute of Geonics of the Academy of Sciences of the Czech Republic under the project TD03000079 Web application for spatial data dynamics of industrial sites by location-based services (see e.g., Trojan et al. [13] or Malý et al. [14]). In this interface, static data is converted into dynamic data that are suited for augmented reality applications – specifically Layar and Wikitude.

3.1 Superstructure

The information shown in Table 2 are only basic information. Each LAGs who will decide to use this tool can add their superstructure information (for e.g., for buildings area, year of construction, appropriate future use etc.). This superstructure part should ensure greater demand for this tool from the side of LAGs, regions, micro-regions etc.



Figure 2: Implementation of dynamized layer SCLLD LAGs of the Zlín Region in Wikitude application.

Table 2: An illustrative example of superstructure table.

Name of the object	Napajedla
Short description	Life in municipalities
Long description	Conversion of brownfields
GPS	49.399565
GPS	17.6697242
WWW	www. http://masschp.cz
Mobile	420 604 366 154
E-mail	manager@masschp.cz
Size	2 ha
Year of construction	1932
Future use	Shopping centre

4 RESULTS

The result of the research is a dynamic set of strategic parts of the SCLLD of all local action groups of the Zlín Region. This is the first use of a web platform to dynamically build static data from a non-tourism are (the TD03000079) platform originally designed for industrial sites). Structural homogeneity of community-led local development strategies is an ideal model case in which the dynamics of static elements is useful and relatively easy. For a large part of the measures, additional data are easily traceable, after the outputs are demand (from the LAG population, but also developers or entities operating on the LAG and beyond) and a result is a functional tool in the context of regional development.

The concrete implementation is illustrated in Fig. 2. for capturing a user tablet (analogously for a mobile phone). Individual actions are displayed to users when they are moving in space using the freely available Layar or Wikitude application (in the picture), and additional contextual services (such as the ability to navigate to a location, direct dialling of the responsible person's telephone number, sending an e-mail, opening a web page, running an add-on app, etc).

5 CONCLUSION

The paper demonstrated the possibility of dynamizing static data reflecting measures in strategic parts of the SCLLD of the local action groups of the Zlín Region. This region served as a model example for the development of information related to regional development. Into the process of dynamization were implemented key aspects of SCLLD which reflects the potential demand for data from users. Besides the inhabitants of the LAG, there are also potential developers, tourist, and representatives. Dynamization can thus contribute to raising public interest in urban development and improving the interaction between the inhabitants and the city administration. It is not excluded that the citizens themselves would get on their hands a tool, that would allow them to comment on the individual plans of the municipality. In addition to the core methodological page, the article also presented the results of a particular dynamization of data and its implementation into an augmented reality environment using Layar and Wikitude applications. For this purpose, a locally installable web platform was used to enable rapid and efficient data dynamization. The actual process of dynamization is based on the partial results of the research of the Institute of Geonics of the Academy of Sciences of the Czech Republic within the project TD03000079 Web application for the spatial data dynamics of industrial sites in the form of location-based services supported by Technology Agency of the Czech Republic (see e.g., Trojan et al. [13]).



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SECTION 7

QUALITY OF LIFE

LIVEABLE PUBLIC URBAN SPACES: CRITERIA FOR ASSESSMENT AND DESIGN

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ABSTRACT

Human needs range from subsistence and protection to affection, understanding and participation and finally to leisure, creation, identity and freedom. An essential part of these needs is satisfied in public urban spaces where we watch, communicate, play or just enjoy life. As part of a university course, master students of architecture and urban planning evaluated public urban spaces, which they perceived as positive as well as negative. The goal of this investigation was to identify the specific qualities which create a successful urban space where people love to stay. What qualities do the positive spaces have and what is missing in the negative ones? The students became also aware of the importance of urban spaces and their impact on communities. The results of the analysis of some hundred (mainly European) places are summed up and generalized in a list of criteria for successful urban spaces. This list can be used for assessment and improvement of existing spaces as well as for the design of new ones. It is presented in this paper and explained with the help of some examples and pictures. The list differentiates between primary criteria, the ones that have to be fulfilled as a precondition, and supplementary criteria, the ones that increase the attractiveness of the space. Such a list should be much more focused on social criteria and human needs – what do we want to do and to experience in open spaces? The necessary design to satisfy these wishes will then come as a natural consequence. Furthermore, the list is completed with contemporary criteria like enactment of illumination, events, social media etc.

Keywords: design of public open spaces, livability, human scale, protection, comfort, enjoyment.

1 INTRODUCTION

Being outdoors is a central part of being human. We enjoy nice weather and adapting to different changing conditions [1]. Public spaces are areas that allow us to communicate with our fellow human beings; to exchange opinions, and to stay for leisure, etc. (Fig. 2).

But who cares for an appropriate design about public spaces in our cities? Architects plan at building scale, while urban planners concentrate on a larger scale. The design of public open spaces is somewhere in between the two of them. As a consequence, the potential of public spaces is often overlooked and they are more or less reduced to (automotive) traffic zones.

Well-designed urban spaces are nowadays not in the focus, whereas modern cities concentrate on real estate. Building construction process is rationalized, the size of buildings grows exponentially and parallel to that the number of unattractive and dysfunctional public spaces. Finally, there are communities where inhabitants spend most of their time indoors and live isolated in their apartments (Fig. 1).

About 1970 first opposing movements and investigations started to bring human scale back to public spaces. A pioneer was Jan Gehl who created a list of 12 quality criteria for good design of public spaces [4], [5].

This paper reports about the use and further development of these criteria in a master course for architecture students. Chapter 2 describes the general task of the students' work. Chapter 3 is about the Gehl's criteria with the original rules for what to do and how to design.



A very important part of the task was the assessment of the criteria and consequently their further development step by step with each semester.

At the beginning the updated criteria list had the same structure and number of criteria as the original one, but the list of what to do and to design became more and more extended. That version was part of an earlier publication [6].

Thus, during that process it was noted that the structure of the criteria is design oriented and that important social aspects (like access to sanitaria's, possibility to buy food and drinks etc.) are not part of these criteria. A look on the basic human needs appeared as logical, the list created by Max-Neef [7], is presented in chapter 3, too.

As a consequence, the criteria were structured differently in this paper and are based on the human needs. This new list of criteria for assessment and design of public open spaces will be presented in chapters 4 to 8, supplemented with some selected examples in chapters 9 and 10.



Figure 1: Layout for a complex of apartment towers in Chaoyang District, Beijing, China, leading to dead public spaces, dedicated only to pass through [2].



Figure 2: Piazza del Campo in Siena, Italy as an example for a liveable public urban space, full of people enjoying the situation (own photograph) [3].

2 TASK FOR THE STUDENT GROUPS FOR THE ASSESSMENT OF PUBLIC SPACES

2.1 Task for the assessment of public urban places

Students were asked to analyse different public open spaces of their choice. They were to use a given list of criteria (see chapters IV to VIII) as an assessment tool.

- Create a sequence of at least 6 photographs, which represent situations in outdoor urban spaces, on which you react spontaneously very positively or negatively.
- Describe why you perceive the situation as positive/negative. Assess these situations according to the given list with criteria for assessment and design of public urban spaces.
- Derive proposals for improvements of the chosen urban spaces, especially for the negatively felt of course.
- Does the space allow these improvements or does it elude such changes?

2.2 Task for the assessment of the list of criteria for the assessment of public urban places

A second task was to assess the criteria itself and to give proposals for further improvement.

- Are these criteria correct/complete?
- Which one you would delete/change/add?
- Would you use these criteria in your own work?
- Which other experiences you made during the analysis should be mentioned?

Like this, the list was further and further developed over generations of students. Thus, the students started with a previous one that was further developed with their own proposals to the actual one (December 2016).

3 PRIMAL SOURCES OF THE CRITERIA

3.1 Jan Gehl's 12 quality criteria for good design of public spaces as starting point

Initially the process started with Jan Gehl's 12 criteria [4], [5], Fig. 3.

3.2 Human needs

The list of criteria can be better developed if social criteria and human needs are taken as basis.

Following Max Neef [7], the human needs range from subsistence and protection to affection, understanding and participation and finally to leisure, creation, identity and freedom. They can be satisfied by having qualities and quantities, having things, doing actions and social interacting (see Fig. 4). The stay in public urban spaces is connected to a lot of these satisfiers, especially the ones on the lower right section. That helps to understand what we want to do and to experience in public spaces. The necessary design to fulfil these wishes is then a consequence of that.

3.3 Further sources contemporary life and different cultures

Furthermore, the list is completed with contemporary criteria like enactment of illumination, events, social media etc. Since the student's groups consisted of several international students, they contributed not only with experiences from local (German) urban spaces but also from other urban spaces mostly in Europe but also around the world.



4 LIST OF CRITERIA FOR ASSESSMENT AND DESIGN OF PUBLIC URBAN SPACES – OVERVIEW

The criteria are a support tool for the analysis and the design process, yet not a universal, strictly to be followed from beginning to end course of action. The underlying social behaviour is therefore too much complex.

The criteria have a different value depending on the analysed rooms, some of them don't even need some criteria (e.g. seats, if the people are standing in front of a bar). Some people can perceive one room as safe, other ones as unsafe. A space can be safe during the day, but unsafe at night, etc. Thus, these criteria are not meant to be static and uniform, but dynamic and to be used each time adapted to the specific situation. Rooms are in an urban and social context, which can contribute crucially to their successful functioning or can also prevent it.

Every space has a more or less sharply defined target group (from a commonly used place, like a harbour pier with excursion boats, to fans in a soccer stadium), on which its efficiency depends. In reverse, a place will have much more success, the better it is specifically designed to fulfil the needs of its target group. So, there may be places which despite negative aspects (e.g. traffic noise) have a high identity and attractiveness for limited target groups and times of the day (night bars at a noisy crossroad, but under a bridge, skate parks, etc.).

P R O T E C T I O N	1. Protection against traffic & accidents <ul style="list-style-type: none"> - traffic accidents - fear of traffic - other accidents 	2. Protection against crime & violence (feeling of safety) <ul style="list-style-type: none"> - lived in / used - streetlife - streetwatchers - overlapping functions in space & time 	3. Protection against unpleasant sense experiences <ul style="list-style-type: none"> - wind / draft - rain / snow - cold / heat - pollution - dust, glare, noise
	4. Possibilities for WALKING <ul style="list-style-type: none"> - room for walking - untiring layout of streets - interesting facades - good surfaces 	5. Possibilities for STANDING / STAYING <ul style="list-style-type: none"> - attractive edges »Edgeeffect« - defined spots for staying - supports for staying 	6. Possibilities for SITTING <ul style="list-style-type: none"> - zones for sitting - maximizing advantages primary and secondary sitting possibilities - benches for resting
	7. Possibilities to SEE <ul style="list-style-type: none"> - seeing-distances - unhindered views - interesting views - lighting (when dark) 	8. Possibilities for HEARING / TALKING <ul style="list-style-type: none"> - low noise level - bench arrangements »talkscapes« 	9. Possibilities for PLAY / UNFOLDING / ACTIVITIES <ul style="list-style-type: none"> - invitation to physical activities, play, unfolding & entertainment – day & night and summer & winter
A M E N I T I E S	10. Scale <ul style="list-style-type: none"> - dimensioning of buildings & spaces in observance of the important human dimensions related to senses, movements, size & behaviour 	11. Possibilities for enjoying positive aspects of climate <ul style="list-style-type: none"> - sun / shade - warmth / coolness - breeze / ventilation 	12. Aesthetic quality / positive sense experiences <ul style="list-style-type: none"> - good design & good detailing - views / vistas - trees, plants, water

Figure 3: Jan Gehls quality criteria for good design of public spaces, protection, comfort and amenities.



Fundamental Human Needs	Being (qualities)	Having (things)	Doing (actions)	Interacting (settings)
subsistence	physical and mental health	food, shelter work	feed, clothe, rest, work	living environment, social setting
protection	care, adaptability autonomy	social security, health systems, work	co-operate, plan, take care of, help	social environment, dwelling
affection	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
understanding	critical capacity, curiosity, intuition	literature, teachers, policies educational	analyse, study, meditate investigate,	schools, families universities, communities,
participation	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	associations, parties, churches, neighbourhoods
leisure	imagination, tranquility spontaneity	games, parties, peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
creation	imagination, boldness, inventiveness, curiosity	abilities, skills, work, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences
identity	sense of belonging, self-esteem, consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
freedom	autonomy, passion, self-esteem, open-mindedness	equal rights	dissent, choose, run risks, develop awareness	anywhere

Figure 4: Human needs chart following Max Neef.

Many places have one or more defined functions, which influence their use. These can also change, depending on daytime or on the season. A space can mainly be a completely abandoned car park, which, for a few hours per week, turns into a very lively mart. It does not require any seating furniture; all the people are just standing in front of the stands.

The criteria also change by the subjective perception of each individual person. The tightness in a shopping street during Christmas/in a restaurant street during the summer, can be perceived as negative as well as positive.

The list of criteria derived from the student's contributions is now presented here. It consists of four sections:

1. To feel safe and be able to concentrate on the positive side of life.
2. To take advantage of the offers – requirements for the appropriation of the space.
3. To experience – passive and active appropriation of the space.
4. To enjoy.

Each section is separated into different subsections ranging from A to K and these contain the intrinsic criteria, summing up to 79.

Another finding was that there are different qualities of criteria. Some were recognized as necessary, without them the space would not (or hardly) be possible to function.

Complementary criteria can increase the liability of some spaces remarkably but are not a general precondition for all spaces. They are added in italics.

Table 1: First section of criteria list: to feel safe and be able to concentrate on the positive side of life.

Feel safe against traffic and accidents	
1) Protection from all kind of transport traffic (cars, bikes, pedestrians)	2) Clear partition of the recreational areas
A. Feel safe against robbery and violence	
3) Busy public space (“many eyes on the spot”)	8) In case of emergency other people are reachable
4) Clearness of the personal safety-zone	9) <i>Video cameras</i>
5) Means of escape	10) <i>Police station not far away</i>
6) Equal use during day and night	11) <i>Emergency call station</i>
7) Good lighting at night	
B. No unpleasant perceptions	
12) Wind, rainfall, (too much) sun	17) Noise, glare
13) Dust, odour, dirt	18) Lack in the connection to sun and sky
14) Garbage	19) Crowd
15) Wild urination	20) Aggressive hawkers, beggars
16) Drug consumption and dealing	

Table 2: Second section of criteria list: to take advantage of the offers – requirements for the appropriation of the SPACE.

C. Accessibility	
21) Easy to reach for everyone (location and transport) and accessible	24) Level, grippy flooring
22) Bike racks	25) No obstacles
23) Enough space to walk	26) <i>Disability friendly</i>
	27) <i>Signage</i>
D. Offers for a longer stay	
Generic	
28) Good speech intelligibility (no noises or echo)	32) Defined recreational areas (<i>different flooring as grass, pavement, ...</i>)
29) Food and drink stalls	33) <i>Good state of preservation of the space</i>
30) (free) Access to restrooms	34) <i>Space with many variable functions</i>
31) At darkness, too (lighting)	35) <i>At all times, at day and night, all seasons</i>
Places to stand, sit and lie	
36) Places to stand for small groups	40) Objects to lean on, rest on (<i>handrails, bollards...</i>).
37) Defined areas to sit	41) <i>Seats' material not too hot or too cold (no steel or concrete).</i>
38) Primary and secondary sitting accommodations	42) <i>Lying surfaces</i>
39) Benches	

Table 3: Third section of criteria list: to experience – passive and active appropriation of the space.

E. Places for undisturbed observations	
43) Observe without having the feeling to be seen 44) One or more vertical shielding surfaces (“wall in the back”)	45) Visual axes and outlooks 46) <i>“Forbidden” places (not made for observation: quay walls, rooftop terraces....)</i>
F. Places for communication	
47) Offers for socially different groups 48) Offers for different times of the day and of the year 49) Communicative collocation of the seats (large benches, collocation around corners, etc.)	50) <i>Topographic situation (terraces, dams, little slopes)</i>
G. Places for active and passive appropriation	
51) <i>Movable elements to sit or lie on, to shadow etc. self-defined arrangements</i> 52) <i>Sufficient space for moving</i> 53) <i>Architectural elements as incentives for creative activities, movement, games and sports</i> 54) <i>Offers for children</i> 55) <i>Places for playing, physical (chess board on the square, on tables) or virtual</i> 56) <i>Street-art: theatre, concerts, performances, artists</i>	57) <i>Weekly market, flea market</i> 58) <i>Places which permit the residents’ and users’ initiatives (chair in front of the door, own pillows, barbecue, planting flowers, drawing playgrounds, neighbourhood parties, etc.)</i> 59) <i>Places for education: bookshelves, static or interactive info-boards</i> 60) <i>Staging of an attractive lighting at night</i> 61) <i>Open-air cinema, big video screens</i>

Table 4: Fourth section of criteria list: to enjoy.

Human scale	
To find one self’s measurements in the surrounding space and buildings	To feel secure
Pleasant climatic situation	
Be able to enjoy the pleasant side of the prevailing weather conditions Sun or shadow	Sheltered from the wind or light breeze Warmth or cold
Positive sensory impressions	
Nice views Haptically and visually pleasant materials Well-made design People playing or talking to each other (children and adults), “Human Theatre” <i>Natural and local materials</i> <i>Trees, green areas, (burbling) water</i>	<i>Fragrance (flowers, sea....)</i> <i>Particular historical / urban context</i> <i>Identity, uniqueness of the space</i> <i>Artworks</i> <i>Animals</i> <i>Education and entertainment</i>

5 EXAMPLES FOR SELECTED CRITERIA

5.1 Crowd – Nr. 19

A public space can be influenced negatively by its own success, attracting large crowds (see Fig. 5).

5.2 Offers for children - Nr. 54 and places for playing, physical (chess board on the square, on tables) or virtual - Nr. 55.

A public space, a stick of chalk - and children can play hopscotch (see Fig. 6). Observing adults would enjoy watching them play.



Figure 5: Calle Florida in Buenos Aires, crowded by its own success [8], [9].



Figure 6: Children playing hopscotch in Havana, Cuba [10].

5.3 Topographic situation (terraces, dams, little slopes) – Nr. 50

A smooth topographical design and layout allows the possibility to watch from the top or to be protected (from wind, views of other people, sun etc.) in lower levels (see Fig. 7).

5.4 Staging of an attractive lighting at night - Nr. 60

A public space is more attractive during night if an interesting illumination is enacted (Place Massena, Nice, Fig. 8).



Figure 7: Park fiction in Hamburg, Germany. A smooth topographical situation invites to stay and to watch [11].



Figure 8: Sculptures on Place Massena in Nice become lively during night, they change colors.

5.5 Sun or shadow – Nr. 65

Especially in hot and sunny locations, shading devices are used as protection elements from the heat (see Fig. 9). Shadow is an important aspect, mentioned as a central criterion to enjoy the weather. Otherwise sunny and wind protected places would be preferred in colder climates.

5.6 Water – Nr. 73

Water is a highly desired attraction for children and adults. Especially if it is lively and walkable (see Figs 10 and 11).



Figure 9: Pedestrian zone in Nikosia, Cyprus. Fabrics cover the street to spend shadow and protect people from sun [13].



Figure 10: Wasserspiele, Luebeck, Germany [15].



Figure 11: Promenade de Paillon, Nice, France [14].

6 FURTHER ASPECTS INFLUENCING THE ATTRACTIVENESS OF A PUBLIC URBAN SPACE

6.1 Dominant positive aspects

A positive perception can dominate a negative one. For example, sites like airports, railways and industrial facilities can become attractive when negative aspects such as noise and smell are not perceived because of a great distance.

Fig. 7 shows a typical situation where the view to a port becomes attractive because of a bigger distance protecting from unpleasant sensual perceptions.

6.2 Other cultures

The presented criteria are a product derived from investigations in developed ‘western-oriented’ countries. Unconsciously it is a mirror of this culture.

In order to apply it to other cultures the rules must be adapted respectively, especially in regard to communication, safe distances and enjoyment.

For example, drivers of vehicles with different velocities communicate with each other as well as they do with pedestrians. They create a safe atmosphere on the base of bilateral respect, even without a clear separation of traffic zones and areas to stay. The aspect of speed is much less important here.

7 CONCLUSION

The criteria are highly recommended for further use in designing and planning of urban places. Thus, the list should be further developed, basing on own experiences. The criteria should also be adapted to different conditions in regard to location, climate, culture.

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QUALITY OF URBAN LIFE AND ITS RELATIONSHIP TO SPATIAL CONDITIONS

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ABSTRACT

Based on a literature review on the concept of *quality of life* within sociology, psychology, human geography, as well as the environmental design fields, it becomes apparent that some factors are particularly relevant to environmental designers and urban planners. Places ranging in scale from the individual dwelling or local neighbourhood, to the city and region, and even the state or nation, influence people's lives and, thus, their overall *quality of life*. In environmental design and urban planning, a fundamental assumption is that places have environmental attributes that can be designed to enhance the quality of individual lives. Investigating this assumption becomes increasingly important as urban areas and their populations grow. This study therefore explores definitions of *quality of life*, sustainable urban development and urban planning, in order to define the concept of *quality of urban life* more precisely. Elements of *quality of life* and *quality of urban life* are presented in a comparative model where five dimensions are explained in detail (physical, environmental and mobility, social, economic and political, psychological). Consequently, an indicator set, that combines objective indicators of the urban environment with subjective evaluations of individual behaviours and perceptions, is proposed. The study concludes with an evaluation model that serves as a basis for further investigation of the relationships between the urban environment and *quality of urban life*, as well as interrelations between the dimensions and corresponding indicators. Thus, the *quality of urban life* in specific neighbourhoods can be identified.

Keywords: *quality of life, quality of urban life, spatial conditions, indicator development.*

1 INTRODUCTION

Quality of life is a notion that has been discussed in many studies as a response to problems facing the urban areas, such as traffic, crime or social segregation [1]. Due to the overarching paradigm of sustainability, much effort is put into providing for sustainable urban development. Particularly social sustainability in cities, including social equity and balance, has fostered a growing interest in urban life and its qualities.

Urban sustainability and *quality of urban life* share the subject of investigation, i.e. urban environments. Thus, it is natural that urban planning, generally seen as implementing physical and administrative measures with the objective to obtain certain goals, is one of the academic disciplines that views *quality of urban life* as an integral concept. However, urban designers are often preoccupied with physical attributes of a space or neighbourhood, whereas *quality of life* includes a wider range of factors, such as social activity and perception of the individual inhabitant. For the design disciplines, it is therefore particularly important to understand and study the relationship between physical conditions, their quality (often measured in resulting behaviour) and the user's perception. Observing which urban environments allow individuals and households, neighbourhoods and communities to achieve high *quality of life* is therefore a topic worthy of further investigation [2].

This paper sets out to establish an operational concept of *quality of urban life* that allows to investigate it under specific conditions, such as for a certain neighbourhoods and groups of inhabitants. This is done with the help of a literature survey and review of other empirical studies on the topic. An indicator set for empirical evaluation of *quality of urban life* is also developed.



2 QUALITY OF URBAN LIFE: CONCEPTS AND DEFINITIONS

Quality of urban life does not have a unified definition, since different disciplines, such as sociology or geography, are using the term differently [3]. While the quality of life in cities obviously relates to the quality of life in general, it also needs to be seen in the light of sustainable development, because it bears resemblance to aspects of social sustainability in terms of social justice and equity. It is further important to understand how the ambition of providing high quality in cities is related to the physical aspects of the urban environment; i.e. the strong focus on liveability and liveable communities [4].

2.1 Quality of life

The interest in *quality of life* began to rise in the 1960s, when it became a concept used in areas such as health, education, economics, politics and services in general [5]. During this period, the growing interest in human well-being led to the need to measure this subjective reality through objective data.

In addition to referring to physical, economic and social conditions, *quality of life* also includes personal satisfaction (or dissatisfaction) with the physical, socio-economic, and cultural conditions under which a person lives. It is a complex, multidimensional construct, which combines multiple theoretical perspectives and methodological approaches. There have been many attempts to define what constitutes *quality of life* in the different disciplines, such as sociology or psychology. Some authors use the term interchangeably with other concepts such as *subjective well-being*, *happiness*, *life satisfaction*, the *good life* and *liveability* [3]. Adopting the definition of the Australian Major Cities Unit [6], liveable cities are socially inclusive affordable, accessible, healthy, safe and resilient to the impacts of climate change. They have an attractive built and natural environment. Liveable cities provide choice and opportunity for people to live their lives and raise their families to their fullest potential [4].

Quality of life includes the full range of factors influencing what people value in life, beyond the purely material aspects [7]. According to the Centre for Health Promotion at the University of Toronto [8], the term includes three main areas: being, belonging and becoming. *Being* represents who one is, with physical, psychological and spiritual components. *Belonging* concerns connections to one's physical, social and community environments. *Becoming* refers to activities carried out in the course of daily living, including those to achieve personal goals and aspirations.

Schalock [9], considers the concept of *quality of life* as an organising principle that can be applied in the improvement of society through social, political, technological and economic transformations. However, the usefulness of the concept is mainly related to human services, used to assess people's needs or their level of satisfaction with different services.

Due to the diversity in the definition of *quality of life* there is still a lack of consensus on this concept and its evaluation [10]. There are two basic approaches: one that conceives it as a unitary entity, and one that considers it a construct composed of a series of dimensions [11]. For this study, the latter perspective – that of a compound concept – was fruitful. The review further shows, there was and is little concern for spatial features in the definitions of *quality of life*, something that can be considered lacking in the design and planning disciplines.

2.2 Sustainable urban development

While the WCED definition of sustainable development [12], stands strong, together with the consequent use of the trichotomy of environmental balance, economic feasibility and



social equity, there seems to be a lack of common definition for sustainable urban development, particularly with regards to its qualitative aspects [12], [13]. There is no doubt that the fulfilment of physical, social, intellectual and psychological needs of the individual is not only a precondition for social sustainability but also for individual well-being and thus for high *quality of life*. The traditional focus on mediating environmental impact of urban life has recently grown into a wider discussion on healthy and liveable urban environments and *quality of urban life* in general.

The *quality of life* and the liveability of areas have previously been studied in relation to physical features such as mixed use, compactness and densification [14], [15]. Quality of urban life can thus be interpreted as an integral part or goal of a holistic urban sustainability framework. It might be that it is an extension of the concepts of social sustainability, social justice and equity within sustainable development; and it seems that the recent focus on *quality of life* and liveability is a symptom of a more holistic approach to creating more sustainable and liveable urban environments. It is therefore important to study the relationships between sustainable urban development and *quality of urban life*, to develop a better understanding and monitoring both.

2.3 Urban planning

Urban planning refers to a range of activities relating to urban society, political reality, economic conditions, physical environments, technological approaches and administration. It is generally described as technical and political processes concerned with the welfare of people, control of the use of land, design of the urban environment including transportation and communication networks, and protection and enhancement of the natural environment [14]; i.e. means to an end. One particular end is urban sustainable development, including the achievement of individual *quality of urban life* [5].

Other objectives of urban planning are maximising productivity, redistributing resources and avoiding dispersion; further providing public urban space, strong infrastructure and services, as well as protecting cultural heritage are goals of planning endeavours [15]. All this is done in order to enhance and secure high *quality of urban life* for urban inhabitants.

2.4 Quality of urban life

Benavidez Oballos [16], defines *quality of urban life* as “the degree of satisfaction with the possibility to fulfil needs and aspirations by individual’s occupying an urban space” [translated]. Similarly, Maldonado [17], defines the concept as “optimal conditions that combine and determine sensations of comfort in the biological and psychosocial within the space where the man lives and act” [translated]. These optimal conditions in the urban environment are intimately linked to the degree of satisfaction with services, as well as the perception of the habitable space as healthy, safe and visually pleasing.

It can be inferred that the physical environment has an evident impact on the urban individual’s *quality of life*. This correlation, while one of the underlying premises for all planning and design activity, is often tacitly assumed without further investigation, or follow-up monitoring. An exploration of this relationship is therefore prerequisite for providing urban planners with a good tool for evaluating the effect of their actions on the resident’s *quality of life*.



3 DIMENSIONS OF QUALITY OF LIFE VS. QUALITY OF URBAN LIFE

Eurostat, together with representatives from the EU Member States, has designed an overarching framework in order to analyse the *quality of life* through dimensions such as material living conditions (financial situation and housing conditions), natural and living environment, social relationships and leisure activities, economic and physical safety, governance and basic rights, health, education and employment [7]. All these dimensions relate to people's capabilities to pursue their self-defined well-being, according to their own values and priorities. The subjective dimension, overall experience of life, refers to the personal perception of life satisfaction.

The nine dimensions that define the concept of *quality of life* can be viewed from two perspectives: first, all dimensions are aggregated and the sum of all of them represents *quality of life*; second, the eight objective dimensions affect the subjective overall experience of life; i.e. they are correlated.

Quality of urban life on the other hand is a concept that places aspects of *quality of life* directly within the urban context, i.e. physical; mobility, environmental, social, economic, political and psychological conditions.

Fig. 1 compares the dimensions of both concepts and shows that five are common. However, there is a key difference between the two concepts: while *quality of urban life* is strongly connected to the urban environment, *quality of life* focuses on the individual. *Quality of life* includes the dimensions of employment, education or health [7], which do not directly relate to the urban context. 'Overall satisfaction' and the 'psychological quality of urban living' are subjective dimensions, focusing on the personal perception and satisfaction of the individual.

For further exploration, the dimensions are clustered into physical aspects [18], mobility and environmental aspects [19], [20], social aspects [21] and economic and political aspects [22]. Finally, psychological aspects [5], [23], [24], are presented.

3.1 Physical quality of urban life

This dimension covers land use, services, facilities, infrastructure, housing and buildings characteristics, as well as the urban layout.

The urban layout describes the spatial arrangement and configuration of elements of streets, blocks and buildings. Well-designed urban layouts can influence the livelihood, the

DIMENSIONS OF QUALITY OF LIFE	DIMENSIONS OF QUALITY OF URBAN LIFE
Material living conditions	Physical quality of urban life
Natural and living environment	Mobility and environmental quality of urban life
Social relations and leisure	Social quality of urban life
Economic and physical safety	Economic quality of urban life
Governance and basic rights	Political quality of urban life
Overall experience with life	Psychological quality of urban life
Health	
Education	
Employment	

Figure 1: Dimensions of quality of life based on *Eurostat (2015)* and quality of urban life based on *El Ariane (2012)*.



use of space and thus *quality of urban life*. Streets, homes, gardens, places for leisure and parking must be carefully arranged. An accessible network of interconnected streets that define blocks of housing, open spaces and other uses should characterise a successful layout [2]. Land use describes the different functions of the urban areas. Within an urban context, the dominant land use tends to be residential, but a complete urban area requires industry, retail, offices and infrastructure, i.e. mixed use [25]. The quality of built environment refers to constructed surroundings that provide the setting for human activity, ranging in scale from personal housing to neighbourhoods and cities. The urban built environment contributes to the way people feel about where they live and impacts strongly on the sustainability of the natural environment [2].

Neighbourhood services and facilities such as accessibility to open spaces, access to daily amenities, social services or access to recreational activities are considered one of the main components of urban community, and their quantity and quality can have an impact on people's *quality of life* [25]. Public services, such as educational, health, administrative, cultural, religious and social services, are also indispensable elements that can contribute to urban qualities [26].

Another concept that is included in the physical aspect is the quality of housing. Living in poorer quality housing has been associated with poorer mental health and higher rates of infectious diseases, respiratory problems or injuries [27]. Satisfactory accommodation is at the top of the hierarchy of human needs, before physical safety, love, esteem and self-actualization, according to Maslow's hierarchy of needs [28], thus having a strong impact in *quality of life*.

3.2 Mobility and environmental quality of urban life

Environmental conditions affect human health and well-being both directly and indirectly [7]. Environmental protection is very important, with air and water pollution being the most worrying issues [29]. Indeed, pollution has direct adverse effects on fundamental resources such as clean water, but also indirect effects on ecosystems and biodiversity. Most residents think that environmental issues have a direct impact on their daily life and on the economy [29].

In urban terms, environmental quality refers to the natural aspects of the neighbourhood, i.e. quality of air, water and the local environment in general. Rapid urbanisation generates challenges such as loss of green space and natural habitats, increase of air, water and noise pollution, traffic congestion and high energy consumption [30]. Green areas in a city, such as parks and gardens, help to protect and enhance urban ecology and promote physical and mental health [31]. They also help mitigate the CO₂ emission and provide residents with opportunities for recreational activities. Provision of green space can also help foster a sense of community and pride.

This dimension also refers to mobility, including traffic safety, traffic noise, accessibility and public transportation. Transportation is necessary for today's urban society as it enables people to access employment, education, food, health and social services, and meet with family and friends [4].

The concept of accessibility is often used in human geography for the evaluation of spatial distribution of facilities and functions; it denotes the ease with which any land-use activity can be reached from a location, using a particular transport system [32]. The frequency and modes of travelling may have important consequences for quality of life, as the time spent travelling cannot be used for other aspects of life.



3.3 Social quality of urban life

A social life, where people can enjoy a balance between work and private interests, spending time on leisure and social interactions, is strongly associated with life satisfaction [33]. Carmona et al. [34], confirm that urban space and society are clearly related, it is difficult to conceive a space without social content and, equally, to conceive society without a spatial component. The individuals within a society need to work together and interact in order for societies to be sustained [35].

The concept of community is fundamental to people's overall *quality of life* and sense of belonging, as social relationships are important for strong fellowship and social cohesion. Social quality is catered to by the built environments that facilitate social activities and human interaction building upon social ties and cultural communities [2].

Cities are homes to people from diverse cultures and lifestyles. Social diversification and a mix of housing and services can be promoted at the local level in order to meet the diversity of user needs and expectations and cater towards social inclusion and integration. Consequently, this dimension is closely related to the concepts of integration, both social and spatially [36]. Neighbourhoods must provide spaces for socializing, meeting, temporary activities and events. The quality of the built environment has an important role in creating public spaces that are safe and welcoming and that provide focal points for people to experience community interaction [37]. Therefore, social dimension has a direct relationship with the physical one.

This dimension includes also the concept of physical safety, including all the external factors that could potentially compromise the individual's safety. Danger of any kind, such as natural hazards or crime, can be a source of fear and worry which can have a negative impact on the general *quality of life* [7].

3.4 Economic and political quality of urban life

This dimension is divided into the economic perspective and the political one. The economic perspective characterises the neighbourhood as a place of economic activities, whereas the political dimension describes the individual's relationship to political and institutional entities.

Economic development enhances prosperity in urban communities and, thus, underpins *quality of urban life*. People's ability to purchase goods and services, obtain adequate food and housing, are some of the most important factors for life quality [2]. A concept related to the individual is economic security, which is a crucial aspect of citizens' functionality. Being able to plan and overcome a sudden deterioration in economic and wider environment has an impact on *quality of life* [7]. The concept of economic security covers aspects such as wealth, debt and job security. It also embraces aspects, such as the current situation of a household or individual and the expectations on how the situation will evolve in the future.

The political dimension encompasses trust in institutions and satisfaction with public services, as well as aspects related to discrimination, equal opportunities and active citizenship. National policies play a big role to support *quality of urban life* through the development of urban policies, strategies, laws, legislations and promoting the creation of urban design codes and guidelines. In addition, such policies can promote the participation in the civil and political life [2].

3.5 Psychological quality of urban life

The psychological dimension is subjective. It refers to the personal assessment and perception of the physical, environmental, social, economic and political dimensions. The city is both a spatial and social structure, which affects individual and social behaviour. The urban structure and its morphological and spatial changes are related to changes in lifestyles and social experience. Different lifestyles and social conflicts are linked to the processes of structuring the urban fabric. This explains the significance of the urban context in social life.

It should be noted that this is an individual dimension. Depending on time and place, the perception and satisfaction of the person in relation to the area where the person resides can vary [38]. It is therefore important to understand the way people react to places and be aware of the factors involved; such as which spaces can generate happiness, satisfaction, dissatisfaction or unhappiness. The individual's perception of a space affects thus the individual's *quality of life*.

4 ASSESSING QUALITY OF URBAN LIFE

The development of indicators that allow measuring data related to the social welfare of a certain population began from the social sciences [5]. These indicators had their own evolution, being at first a reference of the objective conditions, from an economic and social dimension, and later on including subjective elements [39]. The development and improvement of qualitative indicators, in the mid-70s and early 1980s, led to a differentiation between objective and subjective, and qualitative and quantitative indicators. Thus, *quality of life* became a concept that integrates all of these components [40].

Considering the difficulty of measuring the concept of *quality of urban life*, most studies rely on a set of qualitative and quantitative indicators as a tool for assessment. A concern is, whether these indicators are universal or differ from place to place or from individual to individual. Both subjective and objective indicators are therefore necessary to produce a holistic framework and yield reliable results [5].

4.1 Operationalising a qualitative concept

It is evident that the relationship between *quality of urban life* and the urban environment is complex. Personal characteristics, such as values, expectations and perceptions, as well as demographic and socio-economic characteristics can influence the satisfaction with the residential buildings, neighbourhoods or cities people live in. Individuals consider different aspects as important when judging their satisfaction with life [41]. Studying the complexity of the relationships between urban characteristics and the subjective perception can grant a better understanding of spatial-psychological relationships on a more general scale [42].

The links between objective dimensions and subjective evaluations of the urban environment confronts researchers with a challenge. The nature and strength of correlation between them (usually referred to as 'congruency') need to be tested as understanding them may be important for how planning and policy interventions can contribute better *quality of urban life* [5]. It also needs to be tested in order to avoid simple assumptions being made, e.g. changes in the physical dimension will result in significant and direct changes in subjective *quality of urban life* [42].

4.2 Indicators

When choosing indicators, they need to fulfil certain criteria; for instance, how significant and useful they are for assessing quality of urban life, as well as how specific and quantifiable



they are. It is also convenient to use indicators than can be measured at different scales, so comparisons across cases becomes possible. Therefore, this particular research focuses on relevant indicators for which data is readily available and easy to compare (Fig. 2).

Depending on the indicator, there are two approaches for data collection. Collection of *secondary data* usually reports on objective indicators, e.g. existing aggregated data at different geographic or spatial scales (population data or number of building type). Sources can be official governmental data collections, including censuses and other geographic information systems (GIS). *Primary data* is generated for both objective indicators, i.e. field surveys and analysis of urban areas and places, and subjective indicators, i.e. social survey (questionnaires/interviews) of individuals where the focus is on people's perception of *quality of urban life* dimensions.

Much of the quantitative secondary data, such as in the physical dimensions, can be collected through desktop-research. This is true for the number of educational institutions [45], quantity of public open space, distance to and number of various services for a given population [46], number of different types of food and shops, population density and housing tenure density [46], [47]. For the mobility dimension, pollution rates [46], [48], travel times and distances, or fares of public transport [23], [34], can be found through online data collection. For the social dimension, the number of cultural and leisure facilities [45], [46] and crime and violence rates [49], can be obtained from online maps and databases. The same accounts for economic growth [25], unemployment rates [50] and participation of residents

OBJECTIVE DIMENSIONS		INDICATORS
Physical Quality of Urban Life	Number, distance to different facilities (education, health, leisure centres)	
	Amount of, distance to green space	
	Walkability/accessibility of built environment	
	Population density, housing tenure density	
Environment and Mobility Quality of Urban Life	Pollution rates: Air and water quality	
	Travel times (of the different transport modes)	
	Transport affordability	
Social Quality of Urban Life	Use of social and leisure facilities	
	Number of cultural and leisure facilities	
	Spatial integration and segregation	
	Crime and violence rates	
Economic and Political Quality of Urban Life	Economic growth	
	Unemployment rates	
	Participation of residents in representative governance and decision making	
SUBJECTIVE DIMENSIONS		INDICATORS
Psychological Quality of Urban Life	Feelings about neighbourhoods	
	Housing satisfaction	
	Social integration and segregation	
	Life satisfaction, overall happiness	

Figure 2: Indicator set for assessment of quality of urban life based on El Ariane (2012).



in representative government and decision making [45], representing the political-economic dimension.

Spatial analysis also uses secondary data (e.g. for air and water quality [46], [48]), but in situ observations can supply primary data that the researcher himself generates based on observation (e.g. for use of social and leisure activities [45], walkability and accessibility of the built environment [51]).

Nowadays, much of this information is registered and presented with the help of digital mapping (GIS).

Questionnaires and interviews are methods for collecting primary data for subjective indicators such as perception of personal safety [45], social inclusion, social integration and segregation [38]. Satisfaction with the neighbourhood, housing satisfaction, life satisfaction and overall happiness [4], [26] are also covered in these methods.

5 MODEL OF RELATIONSHIPS

In spite of the number of studies carried out on the concept of *quality of life*, not all are explicit about its relationship with spatial conditions. This is probably due to different approaches and focuses in social disciplines versus design disciplines. The concept's overlap with sustainable urban development contributes to the emerging focus on quality and liveability in urban areas. Since urban planning can have an impact on the individual's life, and it is crucial for design and planning disciplines to improve their understanding of the relationship between spatial conditions and *quality of urban life*.

Based on this, an evaluation model is presented in order to describe/explain the impact of urban planning and the urban environment on the *quality of urban life*. Also, internal relationships between the dimensions of the *quality of urban life*, and the objective and subjective correspondent indicators are become apparent. The use of objective indicators can help planners and designers to determine possible weaknesses and strengths of an urban area, and the subjective indicators explore individual perceptions of the urban environment. This

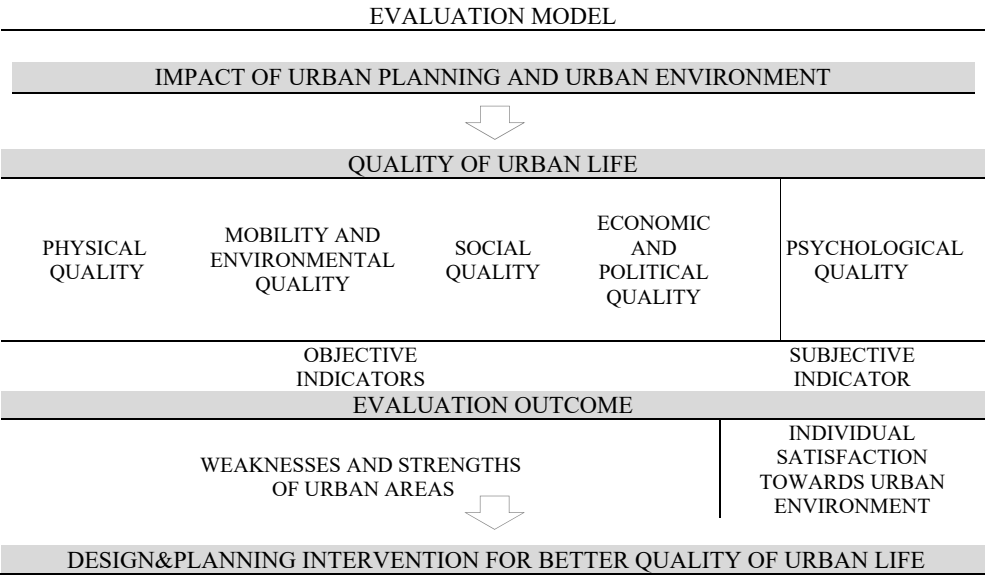


Figure 3: Evaluation model.



evaluation model can serve as the basis for deeper investigation of the relationship between the physical environment and *quality of life*. When applied in concrete cases, the results of such an assessment can help designers and planner to tailor spatial interventions toward the achievement of a better *quality of urban life*.

6 CONCLUSION

The purpose of this study was to create a holistic conceptual framework for *quality of urban life*, exposing all of its dimensions and accounting for them with corresponding indicators. The commonly used dimensions (physical, environmental and mobility, social, economic and political, psychological) reveal that some of them are dependent on each other, e.g. the physical environment and the psychological satisfaction. However, quality of urban life encompasses all dynamics and interrelations that exist among the different dimensions.

The choice of relevant indicators is important, and Fig. 2 proposed a set of indicators for empirical investigation of *quality of urban life* as a whole. However, it is particularly interesting to study the relationship between the physical and environmental aspects and the individual perception. This exploration can help planners and designers to explore possible weaknesses and strengths of an urban area, and propose corresponding interventions.

A further investigation, based on a series of case studies employing the above evaluation model and corresponding indicators, is launched in order to gain a better understanding of the reliability of the model. Case studies will focus on the immigrant population and the impact of their residential conditions and spatial integration on their *quality of urban life*, thus, give a deeper insight into spatial-perceptual relationships in general.

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THE ROLE OF THE PEOPLE'S PARK IN PROMOTING CONVIVIALITY AND QUALITY OF LIFE IN INCREASINGLY DIVERSE URBAN NEIGHBOURHOODS

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ABSTRACT

Particularly in Europe, which has long struggled to accept a diversifying population, urban neighbourhoods are increasingly heterogeneous. Change is accelerating as the crisis in the Middle East drives refugees to European cities. This current diversification has tremendous implications for the ways people use urban public places. The typology of the people's park is one of the contexts where this will play out. The people's park, characterized by an intent to design spaces for and with all members of a community, is an everyday space with potential to promote social well-being. In this research conviviality is understood as a social condition contributing to everyday quality of life. In defining conviviality, we have gone beyond the English definition, "to live together and/or dine together," incorporating other meanings such as the French, "ability of a society to promote tolerance and mutual exchange of ideas among the people and groups that compose it." Our research examines the people's park as an institution for fostering convivial behaviour in public life. The ultimate goal of this research is to inform urban planning policies addressing social life in the public realm, with a focus on peacebuilding and conflict prevention in multi-ethnic communities. The means to that goal is the development of a methodology for studying the relationship between design and convivial behaviour, that can guide the design of parks to promote peaceful coexistence and can assist communities in assessing and improving existing underperforming parks. The objective of this paper is to trace the development of the research methodology from the main findings of the literature review of conviviality in the urban realm.

Keywords: conviviality, quality of life, research methodology, peace-building, immigration, diversity, behaviour.

1 INTRODUCTION

How can a society that has traditionally been perceived as homogeneous make space for difference and deal with cultural diversity in a peaceful way? As the crisis in the Middle East drives an increasing number of refugees to the European Union, debates about integration, multiculturalism and ethnic relations have become central in immigration policies and public opinion [1]. These debates are heated and polarized [2]. After 9/11 there has been an increasing tendency to interpret our world in terms of a clash of cultures, more specifically between the *west* and the *world of Islam*. This perceived division has generated hatred and violence, [3], with conflict playing out in public space.

Parks have traditionally been places for social activities in the "public" [4]. They are also places that promote health and high quality of life in cities [5]. Ideally, parks can serve as powerful tools for multi-ethnic integration. Research evidence shows, though, that in traditional parks, even those located in mixed communities, each ethnic group tends to dominate its own section of a park, resulting in very little inter-ethnic interaction [6]. We are interested in studying the potential for a particular type of park, the people's park, to foster convivial interactions among diverse users.

This study forms one part of a larger research project. The ultimate goal of this research is to inform urban planning policies addressing social life in the public realm, with a focus



on peacebuilding and conflict prevention in multi-ethnic communities. The means to that goal is the development of a methodology for studying the relationship between design and convivial behaviour, that can guide the design of parks to promote peaceful coexistence and can assist communities in assessing and improving existing underperforming parks. The objective of this paper is to trace the development of the research methodology from the main findings of the literature review of conviviality in the urban realm.

We begin by defining the people's park typology as an everyday space for the purpose of this research. We identify an appropriate people's park as a case study for testing the methodology. Next, we discuss conviviality as an everyday social practice, identifying three key categories of convivial behaviour. Then, we examine the literature review for markers of convivial behaviour in those three categories, as well as settings for those behaviours. We build a research tool that incorporates those convivial behaviour markers along with design features that represent the behavioural settings. We conclude by presenting and discussing our contribution, the resulting methodology that operationalizes these findings.

2 CONVIVIAL BEHAVIOUR IN THE PEOPLE'S PARK

This research expands upon the meaning of *conviviality*, developing and incorporating it as a new concept for the study of social life in urban space, and more specifically in a people's park located in a socially diverse urban context. The layers of meaning embedded in this new concept will inform the design of the methodology.

2.1 The people's park as an everyday space

Our research focus, the people's park typology, is a very particular type of park, motivated by an intent to design spaces *for* and *with* all members of a community. We draw from the Scandinavian meaning *Folkets Park*, usually established by local residents [7]. It is seen as an everyday space with potential to promote convivial behaviour that can help prevent violent conflicts and foster tolerance and mutual respect among multi-ethnic groups. Education through cognitive sources is an essential piece towards interethnic tolerance [8]. This strengthens the potential of the people's park as a place where local multi-ethnic groups socialize and get to know each other, fostering a neighbourhood's quality of life.

We have chosen one particular people's park, Superkilen, in Copenhagen's Nørrebro district, as the case study for this research. According to the Danish statistical office, population has shifted in Denmark in the past years and Nørrebro is a good example of this trend. In 2015, 26% of Nørrebro's residents were immigrants. Denmark's official website advertises it as one of the most ethnically diverse and socially challenged districts [9]. In Scandinavian societies – especially Denmark – lower classes and minorities, have been historically mobilized in political movements, such as grass-roots organizations, which served as educational and empowerment tools [10].

Nørrebro has been the setting of recurrent riots from the 1980s until the opening of Superkilen in 2012. The park resulted from a local grassroots effort that claimed a community green space. The park design project was launched six months after the Mohammed cartoon crisis [11]. The designers' point of departure, following the commission's brief, was to deal with the district's diversification and ameliorate the resulting conflicts through park design. Superkilen was conceived as a multi-cultural space. The design concept organizes the park into three zones containing artefacts characteristic of the multiple countries represented in the immigrant population of Nørrebro. Recently the park was awarded the Agha Kahn Award, as a public space promoting integration across lines of ethnicity, religion and culture.



2.2 Conviviality as an everyday social practice

Our research is designed to test whether the people's park serves as an institution for fostering convivial behaviour in public life. To do so, we first have to define conviviality and convivial behaviour. In this research, conviviality is understood as a social condition in the urban realm contributing to everyday quality of life. More commonly used terms in peacebuilding terminology or urban studies, *coexistence*, *sociability*, or *liveliness* were studied and later rejected due to their baggage, ambiguities and connotations. Conviviality, on the other hand, is a less frequently used term in urban studies. It is more specific and can be re-defined and given form for the purpose of this research. The term is more commonly used in sociology to characterize relationships between individuals [12] and there is no evidence of urban research-based studies that use it. In defining conviviality for urban research, we have gone beyond the English definition, "to live together and/or dine together" [13], incorporating other meanings such as the French, "ability of a society to promote tolerance and mutual exchange of ideas among the people and groups that compose it" [14].

Certau has written on everyday social practices, arguing that they should be considered part of the "everyday", or ordinary human experience [15]. Conviviality, as it is understood in this research, is an ordinary and everyday social practice, as Peattie puts it, "Urban conviviality is about evanescent, sociable pleasure, reflected in the daily physical and social recreation of the self" [16]. There is a wealth of literature on the health benefits associated with physical and social recreation.

Caring is a human ability that needs to be nurtured and developed if it is to thrive, and as Andrews [17] points out, caring and feeling cared for are at the heart of well-being. It is easier though, to care for those that are like us. Nurturing the ability to care for those that are different is more challenging, but also more important, especially in terms of conviviality and peace-building goals. Korten [18], says we are hardwired to care and connect: "For all the cultural differences reflected in our richly varied customs, languages, religions and political ideologies, psychologically healthy humans share a number of values and aspirations." (p. 242) [18]. Maslow [19], defended a similar thesis: all needs surrounding human actions and behaviour are met through relationships (we need other people if we are to feel safe or accepted). This research proposes the people's park as the place to nurture conviviality among diverse people.

Some authors have paired the concept of conviviality with another term, to explain very interesting ideas related to everyday interactions among people. Gilroy [20], talks about "vernacular conviviality" and employs the term conviviality in a way that foregrounds openness between people. In the book *Market Place: Food Quarters, Design and Urban Renewal in London*, Parham explains the expression 'convivial ecologies', referring to the sociable that revolves around everyday food activities in public places [21]. Later, Pennycook and Otsuji write about the "ethics of conviviality" in "Metrolingualism: Language in the City" [22].

Shaftoe [23], talks about conviviality as an everyday, quotidian matter intimately connected with the design of the public realm and that most times operates beyond institutionalized economic exchange. "Convivial urban spaces are more than just arenas in which people can have a jolly good time; they are at the heart of democratic living" [24] and "are one of the few remaining loci where we can encounter difference and learn to understand and tolerate other people" (p. 12) [25]. Convivial urban places are spaces that are sociable and liveable, where people enjoy spending time. But they must also be places where difference can exist, where we tolerate those that are different from us, and we all share a common space.



Some authors, although not using the word conviviality per se, are actually describing very similar phenomena to the ones explained above. Bauman's "modus conviviendi" refers to how people accommodate one another in the everyday business of living together and what contextual features, projects and everyday tactics are involved in shaping these relationships [26]. Marcus and Francis use the expression 'street democracy' to describe those streets that have meaning for people, that invite access for all, and encourage use and participation. Already in the 1980's, they pointed out that these basic qualities may be vanishing from our towns, cities, and neighbourhoods [27].

Gehl unites the terms social sustainability and democracy in his studies and discourse. After observing public life in the squares of Italian cities, Gehl developed his methods for interpreting human behaviour in relation to spatial configuration. "Cities must urge urban planners and architects to reinforce pedestrianism as an integrated city policy to develop lively, safe, sustainable and healthy cities. It is equally urgent to strengthen the social function of city space as a meeting place that contributes toward the aims of social sustainability and an open and democratic society" (p. 6) [28]. Even though our cities are experiencing a gradual privatization of the public realm [29], places that are not fully public may still remain equitable. More than just the possibility for a discourse or debate (the Greek definition of public space), the level of "equity" of a place can be measured according the active participation of its users and residents, as well as by how accessible it is to them, both physically and psychologically.

We have looked at a range of meanings of conviviality in different languages and disciplines. We also find the Scandinavian interpretation of conviviality and the social practices associated with it particularly relevant since this investigation is focused in a park in a Scandinavian city. Conviviality, in its ordinary and everyday dimension, is related to the Scandinavian terms *lagom* (Swedish) and *hygge* (Danish). *Lagom* is used to describe when something is "just right" or exactly the right amount (very connected to Scandinavian design). More interesting, *lag* means "team" in Swedish and *om* means "around", so embedded in the concept in a sense of togetherness or "social solidarity" [30]. The Danish term *Hygge* is used to describe a good social atmosphere or coziness [31]. In Danish it means to find happiness in small things. *Hygge* seems to be an intrinsic part of the Danish national character. According to Linnet, the evolution of the concept leads us to a melting pot where Danish climate, the history of a small autochthonous culture, the welfare state and an idea of equality, all blend together [32]. According to Söderberg and Lynggaard, *hygge* can involve a variety of activities related to different fields, such as conversation, social bonding, food or interior design [33].

The findings we extract from this literature review are numerous and varied. Especially relevant is the fact that convivial behaviour can be appreciated more easily when associated with certain everyday activities. This research defines three main categories of activities that can occur in a people's park, in which conviviality can be recognized and measured: eating and drinking (food), playing (play), and communicating (conversation). This informs the methodology and the investigation to be carried out in the research case study of park users' behaviour at Superkilen.

3 METHODOLOGY: HOW TO STUDY CONVIVIAL BEHAVIOUR

In order to find out exactly what role the people's park plays in promoting convivial behaviour among its users, we have developed a methodology that will help us identify, record and analyse, convivial behaviour across the three categories of activity identified in the literature review.



Post-occupancy evaluations are essential to discovering whether design interventions have the desired impacts. Our methodology, a form of post-occupancy evaluation, will serve the critical function of assessing the degree to which the government's social objectives for Superkilen have been realized in the lived experience of the park. Using a mixed-methods approach [34], we will collect quantitative and qualitative data, since the research goals are a mixture of social and physical inquiries into the effects of design on the conviviality level of park users.

The research methodology has two instances of data collection and metrics. The first step defines the design variables through an inventory of design features present in the park, through maps, drawings and photographs. The second step identifies markers for convivial behaviour using two methods: observation of park-goers' behaviours, and a short survey to gather park-goers' characteristics. At the end, we will code and analyse both sets of data, to find out which design variables explain variation in convivial behaviour level. We will use the findings to define urban planning policies and design principles that foster convivial behaviour in multi-ethnic park users.

The literature review will inform the definition of the design variables by providing information on the types of places in which convivial behaviour occurs. From the literature review, we will identify the design features present in those types of places. The three categories of activity identified in the literature review enable us to identify 3 sets of study sites within the park that are characterized by design features associated with the three types of convivial behaviours. The study sites and their design features will be documented in maps, drawings, and photographs. The maps will guide the researchers to specific locations for data collection. The drawings and photographs will indicate the particular views that will form the basis for photographic data collection capturing specific behaviours in relation to specific design features.

We will define markers for convivial behaviour by analysing the types of interactions characterized as convivial in the literature review. The three categories of activity identified in the literature review help us to organize the markers for convivial behaviour into three types and to associate these types of behaviours with the selected study sites.

In order to determine whether the park goers' interactions are truly convivial, we must measure them against our definition of conviviality, that brings together the English meaning "to live together and dine together" with the French meaning "ability of a society to promote tolerance and mutual exchange of ideas among the people and groups that compose it." The markers for convivial behaviour will measure behaviours that characterize living together and dining together. In order to measure the extent to which tolerance and exchange are occurring among the people and groups that compose the park's users, we must learn the extent to which these behaviours involve heterogeneous actors. To this end, we have developed a brief survey that asks respondents to identify with one of the park's artefacts characteristic of the multiple countries and cultures that represent the population of the surrounding Nørrebro district.

3.1 Conviviality as associated with food

Related to spatial arrangements and design elements: In "The Table in Space: A Planning Perspective", Parham pointed out the important connection between street outdoor dining spaces and a sense of conviviality [35]. In her recent book, *Food and urbanism: The convivial city and a sustainable future*, Parham explains some of the relationships between design arrangements in spaces for eating, and expressions of convivial behaviour among those using them [36].



The interaction between people and food, promoting expressions of convivial behaviour, can be strengthened at many different scales from city planning to interior design: from metropolitan policies, to kitchen layout. The table, where we enjoy food, is one of the key elements in designing for conviviality. A table can be individual or for groups –encouraging sharing food. It can be private or public. The absence of tables can undermine conviviality [36]. For example, Alexander et al. [37], points out the quality of light, a sense of protected enclosure or communal eating space, as key ingredients for convivial behaviour (p. 844) [37]. The kitchen (or barbecue) is another key element in designing for conviviality [38].

Based upon this literature review of conviviality related to spatial arrangements and design elements associated with food, the following have been identified for study and incorporated into the methodology:

- Spatial arrangement used for eating and drinking (designed or spontaneous)
- Chairs, benches or tables
- Kitchen/barbecue
- Character (private or public)
- Use (individual or communal)
- Lightning (adequate or not according to climate)
- Sense of protected enclosure

Related to sharing behaviour or commensality: For Grignon [39], conviviality arises out of terms such as commensality. Many cultures have institutionalized *commensality* in spatial ways, such as eating from the common pan [40]. Commensality is defined by Grignon as “the gathering aimed to accomplish in a collective way some material task and symbolic obligations linked to the satisfaction of biological, individual need” (p. 24) [39]. Merriam-Webster Dictionary defines *commensality* as “the practice of eating together” or “a social group that eats together” and *commensalism* as “a relation between two kinds of organisms in which one obtains food or other benefits from the other without damaging or benefiting it.” Commensality means, literally, “eating at the same table” [41], or “eating with other people” [42] and in most cultural contexts it signifies unity and sharing [43]. Many sociologists speak of the social importance of commensality [44]. Eating together has gained sociological interest particularly in its capacity to solidify social groups and reinforce cultural identities [44]–[48].

In the “Anthropology of Food”, Tierney and Ohnuki-Tierney describe food’s central place in anthropology from its earliest days. They examine food as an important tool through which cultures and societies connect and view commensality as both a source and an expression of group identities [40]. Peattie also defends these ideas and explains how sociable activities that are somehow related to the act of sharing food make a mundane event special, for example the act of sharing coffee or enjoying a meal together [16].

Some literature defining conviviality in relation to food emphasizes joy gained from sociability rather than the sensory pleasure of eating [49]–[52]. Simmel defines sociability as a democratic, playful association in which an individual’s pleasure is contingent on the joy of others. Therefore, sociable interactions require a group of interdependent individuals that are all equal. By this definition, for meals to be sociable or convivial, those present must be motivated by a collective desire for amicability and cordiality [50].

Based upon this literature review of conviviality related to commensality, the following convivial behaviour markers have been identified for study and incorporated into the

¹ Mensa means table or canteen in Italian.

methodology:

- Size of groups that are eating or drinking
- Sharing of food and drinks
- Attitude: smiling and/or joyful
- Position: Standing, sitting or lying down
- Use: places specifically designed for eating or other spaces

3.2 Conviviality as associated with play

Related to spaces for physical activity, sports or games: Merriam-Webster Dictionary defines “play” as: “a particular act or manoeuvre in a game: such as (a): the action during an attempt to advance the ball in football (b): the action in which a player is put out in baseball.” Another strand of meaning is “recreational activity; *especially*: the spontaneous activity of children” or “the moving of a piece in a board game (as chess)” and “the action in which cards are played after bidding in a card game” [13].

In line with these definitions, Huizinga asserts that play is more than a purely physical or biological activity. It is a *significant* function – there is some sense to it. In play there is something “at play” which transcends the immediate needs of life and imparts meaning to the action. This explains why we often understand and experience sports as competitions (at one level or the other). In his book *Homo Ludens*, Huizinga explains his study of the play element in culture, defending that almost everything (culture, arts, weapons...) developed in history because of humans’ instinct to play. His discourse revolves around the claim that play is the most important thing in life [53].

Often, playing is associated with physical and mental health. *Homo Ludens* describes psychology and physiology studies that deal with the observation, description, and explanation of the play of animals, children and grown-ups. Some studies describe playing as a discharge of superabundant vital energy, others as the satisfaction of some “imitative instinct”, or the “need” for relaxation. According to some theories, play might go beyond health and even constitute training of the youngest for adult life. According to others, it serves as an exercise that is absolutely necessary for the individual. Yet others regard play as an “abreaction” – an outlet for harmful impulses, as a necessary restorer of energy, as wish-fulfilment, or as a fiction designed to keep up the feeling of personal value [53]. Most of these clearly relate to health and wellbeing and “in this intensity, this absorption, this power of maddening, lies the very essence, the primordial quality of play” (p. 2) [53].

Based upon this literature review of conviviality related to spaces for physical activity, sports, or games, the following design features have been identified for study and incorporated into the methodology:

- Spatial arrangements used for physical activity, sports or games (designed or spontaneous)
- Game tables, courts, gadgets
- Types of games or sports designed for
- Materiality of the spaces (hard/soft, concrete/grass or sand)
- Character (private or public)
- Use (individual or team)
- Lighting (adequate or not according to activity)
- Accessibility: presence of fences, ramps

Related to leisure and atmosphere: Andrews explains the importance and many benefits of play in terms of a child’s development and adjustment to the world [17]. But like we see in

the studies collected in *Homo Ludens*, play goes beyond childhood, extended throughout adult life [53]. Play is “an approach to life in which everything is done purely for its own sake, purely for the joy of it ... it should be purposeless ... not done for money or status or health ... It’s something done for the pleasure of the experience ... it is absorbing (opposite to today’s more common multitasking); it is time away from ordinary life.” (pp. 117–118) [17].

But today, Andrews asserts, we don’t really “play” anymore; we don’t do things for the joy of it and we always rationalize our recreational activities by focusing on secondary benefits (for example, we tell ourselves that we walk for fitness rather than enjoyment or develop contacts rather than friends). In her book, *Slow is beautiful: New visions of community, leisure and joie de vivre*, Andrews makes a connection between the lack of playing in our contemporary societies and the lack of leisure time, and she explains how this is having a negative impact on our communities and social relations [17].

Andrews shows how significant and important leisure is. He mentions how academics in the 1950’s talked about the importance of educating people for leisure, but their voices were ignored over the years, people had lost their traditional communities and pastimes, and did not know what to do anymore [17]. The people’s park might be a space that brings back the importance of play in adult life. Some of us would include in leisure activities such as reading, sitting in the sun, gardening, walking. Others, though, might include shopping or watching television, primary non-working activities. But Andrews makes an important distinction between escape activities and leisure activities. Escape activities get our minds off our problems, but they do nothing to deepen our ideas or our experiences. Leisure activities, on the other hand, are reflective and joyful. We are interested in the potential of the people’s park to engage users in leisure activities.

Play can also be related to mood or atmosphere. Another definition for *play* in Merriam-Webster Dictionary is “the state of being active, operative, or relevant; brisk, fitful, or light movement; scope or opportunity for action”; such as “a move or series of moves calculated to arouse friendly feelings.” This definition clearly relates to conviviality. Merriam-Webster Dictionary defines *playful* as, “full of play: frolicsome, sportive; humorous, jocular; happy and full of energy; eager to play; showing that you are having fun and not being serious” [13]. This is very connected to Andrews’ notion of *joie de vivre* (or the state of feeling vital and alive). Laughter is a bond with other people, she explains, helping form relationships as the best way of all to improve your health [17]. One study found that humour may significantly boost a person’s level of hope, which in turn, researchers feel, stimulates a person’s ability to solve problems creatively. and laughter, a tension-reliever, is also a gesture of conviviality.

Based upon the literature review of conviviality related to spaces for physical activity, sports, or games, the following convivial behaviour markers have been identified for study and incorporated into the methodology:

- Size of groups that are playing games or sports
- Types of activities: football, basketball, reading, sitting in the sun, gardening, etc.
- Individual or collective playing
- Attitude: smiling and/or laughing
- Designated Use: places specifically designed for playing or other spaces

3.3 Conviviality as associated with communication

Related to spatial arrangements of conversational encounters: Whyte conducted a seminal experiment on street conversations. Using focus time-lapse cameras on several street corners,



he recorded activity for two weeks. On each corner, he and his research team plotted the location of conversations taking place, and how long they lasted (they only noted those lasting a minute or longer). The results of the activity were not at all as expected. It showed that people who would stop to talk did not move out of the pedestrian flow; and if they had been out of it, they'd move into it. Whyte observed that most of the conversations took place directly in the middle of the pedestrian flow, which he calls the "100% location." So, why do most people engage in conversations in the middle of a crowded area? According to observers in different countries they noted that we have a tendency to self-congest ourselves [54].

Ciolek Eisler [55], has studied self-congestion and also found that the great majority of people in his studies selected their sites for social interaction within or very close to the traffic lines intersecting the plazas; and relatively few people formed their gatherings away from the spaces used for navigation. In his article, "The social life of small urban spaces," Whyte also states that the best places to look at people for his study are street corners. As a general rule, almost 100% of all conversations are spotted most often at the busiest crossroads locations. Whyte mapped 133 conversations, over a period of several days, and found out that 57% of them were concentrated in the highest-traffic locations. He also noticed that one of the most noticeable rituals is schmoozing (nothing talk), political opinions or sports talk. Basically, it means idle gossip. Whyte noted that schmoozers are fairly consistent in choosing locations, showing a preference for well-defined spaces, such as curb or ledge. According to Hollingsworth Whyte, back and forth movements in street encounters have their parallel to speech [54]. Goldman-Eisler has found that in her studies, 40–50% of spontaneous speech is silence, which might mean that we very often use gestures to aid, reinforce, and sometimes also replace speech [56].

Based upon the literature review of conviviality related to spatial arrangements of conversational encounters, the following design features have been identified for study and incorporated into the methodology:

- Location and number of street corners, benches and main paths
- Street corners: size, spatial arrangement, material, characteristics
- Benches: individual or collective
- Main paths: with number of benches and street corners linked to them
- Lightning (adequate or not according to climate)

Related to social behaviour and conversation: As social creatures, we have a need to be around others, to see and be seen. Oldenburg describes the home as the first place where we socialize and work as the second place. He then claims it is essential to have a third place, a place to gather and talk and just hang around. Oldenburg states that societies with a third-place culture are less affected by advertising, since there is less television watching. But the third place, he asserts, also inoculates people against the need to impress others because they feel accepted for who they are. A third place has variety and diversity; it is usually non-commercial, informal and casual and enjoys political freedom. It also acts as a social leveller. It is an inclusive place that is accessible to the general public and does not set formal criteria of membership and exclusion. There is a tendency for individuals to select their associates, friends, and intimates, from among those closest to them in social rank. When formal associations tend to narrow and restrict social gathering, third places serve to expand possibilities. People usually act being open to all, no matter the status [57].

Simmel would describe this phenomenon as "pure sociability," the opportunity to get together for no other purpose, higher or lower than, for the "joy, vivacity and relief" of engaging others' personalities beyond the contexts of purpose, duty or role. Simmel describes



this as a unique occasion, a truly democratic experience that we can all have to be ourselves [51].

Convivial behaviour can also be associated with conversation and dialogue among people. “Laughing or smiling is a gesture of conviviality – an invitation to approach, a promise to be hospitable” (p. 122) [17]. Andrews puts an emphasis on the power of conversation. “In conversation humour is worth more than knowledge” (p. 122) [17]. Sociologist Etzioni says that we bring about social change by creating a national conversation. He calls it “metalogue” [58]. Oldenburg speaks of the playful mood of third places. “Those who would keep conversation serious for more than a minute are almost certainly doomed to failure. Every topic and speaker is a potential trapeze for the exercise and display of wit. Sometimes the playful spirit is obvious, as when the group is laughing and boisterous; other times it will be subtle ... joy and acceptance reign over anxiety and alienation” [57].

Putnam discovered that neighbourhoods where people talk to each other over fences tend to vote more. (pp. 192–202) [59]. This proves that conviviality feeds civic life, making people talk more about social issues. This also implies that you can create opportunities for people to enjoy each other’s company. Promoting places for convivial behaviour can lead to sociable experiences. Creating opportunities for convivial conversation might be a vector of social change.

Based upon the literature review of conviviality related to social behaviour and conversation, the following convivial behaviour markers have been identified for study and incorporated into the methodology:

- Number of people having a conversation on street corners / benches / main paths
- Duration (length of conversations)
- Position: walking, standing, sitting or reclining.
- Size of groups
- Character of groups (heterogeneity or homogeneity)
- Attitude: smiling and/or laughing
- Simultaneity: conversation while doing other activities

4 CONTRIBUTIONS

Conviviality is a wonderful holistic term that encompasses many other terms typically used in urban studies. It also pertains very specifically to the everyday context of the people’s park. As the literature review demonstrates, convivial behaviour can be recognized in everyday activities, such as the ones identified in this methodology: eat, play, communicate.

The contribution of the present study is a methodology for studying the relationship between design features and convivial behaviour in a people’s park. The following chart organizes the design features found in the people’s park typology and behavioural markers for conviviality across the three categories of food, play, and communication.

Table 1 codifies the elements of the proposed methodology for measuring the level of conviviality in a people’s park. Used as a tool for post-occupancy evaluation, the methodology can provide fine-grained information on the relative success of specific design features in providing appropriate settings for convivial behaviours. Once the methodology has been put into action and a body of data collected, the results can be interpreted to inform the design of new people’s parks in order to realize their potential as places for building peaceful multi-cultural societies.

Change is accelerating in Europe due to the influx of refugees to towns and cities. To avoid conflict in integration processes, it is essential to educate people for tolerance and peaceful interaction. In order to learn, one needs to experience multi-cultural interaction in everyday settings. The people’s park represents a type of environment where adult society



interacts and where children become socialized to see diversity as ordinary. Educating European societies in the ordinariness of a multi-ethnic reality should be a primary goal in integration policies and planning. The people's park can become a useful resource for increasing communities' peacebuilding capacities and thereby preventing conflict, both in the the European context and in other places facing similar problems around the world.

Table 1: Elements of the proposed methodology for measuring the level of conviviality in a people's park. (Source: done by the authors for the purpose of this study.)

Mark the ones that apply	FOOD			PLAY			COMMUNICATE		
DESIGN FEATURES									
Spatial arrangement	designed spontaneous			designed spontaneous			street corners #__ paths #__		
	Furniture #__ #__ #__ #__			benches chairs/tables #__					
Materials	hard / soft cold / warm rough / smooth			hard / soft artificial / natural			hard / soft artificial / natural		
Character/use	private public individual communal			private public individual communal			private public individual communal		
Lightning	poor adequate too much			poor adequate too much			poor adequate too much		
Enclosure/ Accessibility	sense of protection completely open visible hidden easy access poor access			sense of protection completely open visible hidden easy access poor access			sense of protection completely open visible hidden easy access poor access		
CONVIVIAL BEHAVIOR SIGNS									
Group-size	#__ #__ #__ #__ #__ or +			#__ #__ #__ #__ #__ or +			#__ #__ #__ #__ #__ or +		
Activities	[Icons: person sitting, person standing, person sitting at table]			[Icons: person sitting at table, person on swing, person on slide, person on merry-go-round, person on bike, person on bench, person on bench with dog, person on bench with child, person					

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CRITERIA FOR SUSTAINABLE INTERIOR DESIGN SOLUTIONS

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ABSTRACT

Interior designers around the world have developed a greater awareness of sustainable strategies as the demand for sustainable interior design solutions has increased. Most traditional interior design construction processes have an adverse environmental impact due to the significant consumption of natural resources during manufacturing and installation. In this context, interior designers have the opportunity to adopt sustainable design practices and enhance healthy indoor air quality. They can adhere to sustainable solutions through their choices during the design realization phase, including decisions on materials selection, construction methods, furnishing, and lighting. Despite the abundance of sustainable design research, few studies have addressed the criteria for interior design sustainability. Determining selection criteria for sustainable interior design solutions is important in assisting responsible interior designers. Hence, the objective of this research is to propose a set of criteria for selecting sustainable interior design solutions based on a comprehensive literature review. The paper concludes by reinforcing the importance of having a functional and effective set of criteria to ensure consistent sustainable interior design solutions.

Keywords: interior design, sustainability, sustainable interior design, sustainable solution criteria.

1 INTRODUCTION

The world has limited resources and has experienced steady population growth for centuries. Recently, climate change concerns have grown tremendously across the globe alongside scientific evidence on the effects of greenhouse gases on the environment [1]. The situation paints a negative future for our environmental resources; consequently, an awareness of the importance of sustainable practices is needed [2]. Conserving environmental resources has social, cultural, physical, and economic impacts, including the ability to sustain lifestyle requirements, a healthy economy, reduced global warming, and decreased toxic gas emissions [3]. This has led to dialogues with the aim of saving our planet by controlling consumption and sustaining natural resources [4].

Sustainability has been recognized as a significant issue across a variety of fields including interior design. Interior designers have a moral responsibility to help protect, preserve, and restore the global ecosystem [5]. Sustainability in interior design is becoming a vital concern due to the extensive resources needed for interior use. Sustainable interior practices are actions that lessen environmental impacts and create a healthy environment [6], [7]. In this context, sustainable interior design can be defined as the rationalization of natural resources used in a manner that sensibly addresses the impact of all design aspects on the environment [8]. Although the cost efficiency of sustainability is a challenging issue, interior designers who focus on environmentally responsible design plan, specify, and execute solutions for interior environments that reflect concern for both the world's ecology and the inhabitants' quality of life [9]. Sustainable interior design solutions can be achieved by following interior design practices such as creating design spaces that can easily adapt to changes in the spaces' activities, efficient energy conservation and materials management, and giving occupants access to thermal comfort controls and outdoor views [10]. Interior designers can effectively contribute to the sustainability effort by specifying durable local materials, selecting rapidly



renewable materials, and using energy-efficient lighting and plumbing systems [11], [12]. Interior designers should embed smart technology that promotes highly efficient spaces while significantly minimizing operating costs through the accurate monitoring and intensive control of resource consumption and the facilitation of renewable energy usage [13].

Interior designers juggle clients' desires and concerns, cost factors, time restraints, and technology; sustainability adds yet another factor to this mix [14]. A successful project will blend sustainability into each phase of the design process, its execution, and post-occupancy [10]. Many interior designers around the world have developed a greater awareness of the need to integrate sustainable strategies into their design solutions; they consider sustainability as inherent to their work and no longer an added value [15]. This attitude has been supported by increased demand for sustainability in recent years that encourages and accelerates the shift of materials and producers toward sustainable principles and practices during the manufacturing process [16]. International and local sustainability associations have also helped to adopt and standardize sustainable practices worldwide; they offer rating and certification systems that help the industry and designers evaluate product and system sustainability [5], [17].

Sustainable interior design should ignite the spirit of sustainability and be a catalyst for change. Interior designers need a clear selection criteria for sustainable treatments and products, as well as benchmarks for high-performance sustainable interior design solutions to achieve integrity in their design solutions. Thus, this paper explores the selection criteria for sustainable interior design solutions.

2 SELECTION CRITERIA FOR SUSTAINABLE INTERIOR DESIGN SOLUTIONS

Sustainable design solutions differ from conventional design solutions by supporting healthy environments as well as rationalizing resource and energy consumption [18]. Responsible interior design solutions should present a logical and sequential process for creating healthy, functional, comfortable, and sustainable interiors without compromising aesthetic factors, while meeting the clients' needs, budget, schedule, and design vision [19], [12]. Designers should articulate sustainability in all aspects of their design solutions and ensure healthier indoor air quality by choosing materials and construction methods that prevent indoor air pollution, harmful chemical reactions, and gas emissions [8]. Designers should be mindful about providing ecologically intelligent solutions for energy efficiency that can reduce the rate of energy and water consumption while providing a comfortable space [20]. They should encourage the use of durable products that do not require an inordinate amount of maintenance and replacement [21]. Designers should support the reduction of construction waste to lessen pollution and environmental damage [22]. They should ensure that specified solutions and materials are from local or international certified sources [5]. Thus, interior designers need a clear selection criteria for sustainable items to achieve integrity in their design solutions [1]. They also need benchmarks for high-performance sustainable interior design solutions. In this study, a literature review was conducted to identify the selection criteria for sustainable items that can be employed in interior design solutions. Candidate criteria were identified through a thematic analysis. The following sections present the suggested criteria that can support interior designers in monitoring their design solutions and in their research, selection, and specification processes for fixed interior finishes, furniture, furnishings, or equipment.



2.1 Manufacturers' selection criteria

2.1.1 Identify and evaluate sustainable manufacturers

This criterion requires searching for manufacturers and suppliers that have adopted sustainability as a corporate priority and committed to environmental values [17]. Interior designers should actively track and review the operations and policies of companies that declare their products as environment friendly and should evaluate their effort to improve health and environmental consciousness. This can be achieved by analyzing data from the Global Reporting Initiative, which provides manufacturers with guidelines on reporting their level of sustainable stewardship [23]. Interior designers should study the following to ensure the companies' commitment to sustainability: First, interior designers should study companies' plans and evaluation systems for energy optimization, usage of renewable energy and materials, management of production waste, reduction of raw materials and product transportation, use of recyclable packaging, and any other environmental initiatives [4]. Second, interior designers should study companies' reduction or avoidance of any chemicals of concern in their product treatment that might lessen the product's biodegradability and harm users' health [8], [25]. Third, interior designers should ensure their products' ease of disassembly for the purpose of reuse and recycling [14], [26].

Interior designers should rely on trustworthy information to meet this criterion and successfully select sustainable products for their design solutions. They should know the product's complete ingredients and impacts on health and the environment before specifying it in order to honor their commitment to deliver safe, healthy, and high-performing interiors [2]. Designers need comprehensive, truthful information from a third party to rate the sustainability of manufacturing interior products and systems [9]. Product declarations and certifications lead to consistent product sustainability evaluations [2], [5].

2.1.2 Sustainable product declarations

The main goal of product declarations is to standardize reporting to make it easy to understand; product declarations provide consistency within the industry, allow the comparability of products, and support designers' decisions [3], [17]. There are two types of product declarations that categorize products by defining environmental performance through specific rules for different product types. First, an Environmental Product Declaration is based on a life-cycle assessment (LCA) that aims to measure the product's impacts from the extraction of raw materials until the end of the product's life [27]. Second, a Health Product Declaration is based on the transparency of product ingredients; it aims at comparable evaluation and identifies how a product affects users' health. Support for this criterion will be from proactive manufacturers who share product information by providing a summary of the product's environmental characteristics [28].

2.1.3 Sustainable product certifications

Sustainable standards are essential to creating benchmarks through a set of criteria for determining the quality, safety, value, and health impact of a product or service [14]. These standards are used to scrutinize the environmental and health claims of sustainable products based on their impacts on humans and the environment. A sustainable product certification confirms and validates that a product meets certain outlined sustainable standards [17]. A certification should be transparent about the product's use of environmental materials in accordance with precautionary principles to reduce or eliminate suspicion regarding harm to humans or the environment. Such certifications encourage transparency in the building products industry from extraction until the end of the product's life [9]. Certifications provide



systems-based guidelines that can further empower designers to make informed decisions about specifying, maintaining, and disposing building products [3]. These decisions are based on the following principles: taking precautionary actions and measures, seeking out and evaluating alternatives, and shifting burdens of proof [5]. Interior designers should review different certifications issued through multiple regulatory entities to ensure that this information is reliable, and they should be updated as new, relevant data emerges [29]. This will help designers classify green chemicals, sustainable substances, and environmentally preferable products to avoid harm to the health and environment [3], [19]. Numerous certification bodies are working to advocate and implement sustainable precautionary principles through comprehensive product databases. The types of certification include the following:

1. *Multi-attribute certifications* distinguish products based on an assessment of the products' full life cycle to help identify excellent products in key areas such as material composition, manufacturing impacts, energy use, and emissions [2], [3].
2. *Single-attribute certifications* describe the majority of sustainable product certifications. They focus on one area of performance, such as water/energy efficiency or product/material emissions [17].
3. *First-party or self-certification* is a manufacturer's marketing claim for its own products or operations as set forth in product brochures, specifications, and material safety data sheets. None of this information is confirmed, validated, or independently tested by other parties [5].
4. *Second-party certification* is based on the level of standards set by an industry trade association or an outside consulting firm for a certain group of manufacturers. In this process, manufacturers regularly supply documentation and evidence that certain levels are adhered to and maintained, although there is no guarantee against potential conflicts of interest [17].
5. *Third-party certification* is a comprehensive process by which a product, process, or service is reviewed by a reputable, independent, and unbiased third party and meets an established set of criteria and standards. It is the most rigorous tier of certification; it involves an impartial and transparent review process that includes documentation of the review method and gives equal treatment to each product reviewed. An independent third party leads the product testing and awards the certification. In certain cases, as an additional layer of quality control and to ensure objectivity, the certifier may be evaluated by another association such as the International Standards Organization or the American National Standards Institute (ANSI). Recently, third-party certifications have been focusing on multi-attribute certifications by analyzing a single product through multiple lenses [3], [17].

2.1.4 Sustainable product life-cycle assessment

Designers should use finishing materials and products that have minimal environmental impacts throughout their entire life cycle [12]. An LCA is a quantitative and qualitative assessment of all phases of a product's life, including raw material harvesting/extraction, manufacturing, installation/assembly, transportation, usage, and post-use or end of life [30]. Manufacturers must assess a product's impacts and components to understand its full cradle-to-grave impacts [16]. Companies must adopt LCA's holistic approach and share the results with the rest of the industry through transparent reporting [29]. It is challenging to interpret and calculate the environmental and health impacts for every input and output of a product throughout its life [19]. A product may be harvested sustainably but treated with harmful



chemicals during the manufacturing process. For example, unfinished wood can be treated with preservatives containing biocides to ward off fungal staining. These toxic chemicals attack living organisms and expose them to reproductive and developmental toxicants plus carcinogens, which are then released into the air, compromising air quality [1]. In addition, although a product may be sustainably manufactured, transport over a long distance will lead to high energy consumption [5]. LCA strives to evaluate a comprehensive list of impacts, including environmental toxins that compromise ecosystems, reduction of natural resources, freshwater stewardship, degradation of ecosystems and habitat destruction, social responsibility, and toxic chemicals affecting human health [19]. Scientifically rigorous and analytical LCA results will empower designers, manufacturers, and consumers to make more fully informed decisions [3]. Therefore, manufacturers must transparently communicate the results relevant to their manufacturing processes and account for their product's impact on people and the planet [1], [14].

To meet this criterion, interior designers should identify reliable LCA methodology and select products that have been compared and certified by a third-party organization relying on similar standards. The following third-party certifications can support interior designers' decisions. First, a Cradle to Cradle certificate requires the attainment of multiple attributes related to safety for human health and the environment through all use phases: product and system design for material reutilization, the use of renewable energy and carbon management, efficient use of water and energy associated with production, and company strategies for social fairness [31]. Second, SMaRT Certified Products is an ANSI-accredited standard. The rating system has multiple attributes and four tiers covering all product stages. It includes environmental, economic, and social criteria for building products, fabrics, textiles, and flooring [32].

2.2 Health criteria

2.2.1 Indoor air quality performance

People spend an average of 90% of their time indoors; thus, indoor air can be a greater health hazard for building occupants than outdoor air [2]. Indoor environmental quality refers to all the factors that contribute to how occupants experience, interact with, and are affected by the built environment [18]. These factors include indoor air quality (IAQ), lighting and day lighting, connection to nature, thermal comfort and control, and electromagnetic fields [1]. The objective of this criterion is to identify assessment tools that can be used by interior designers to measure the IAQ of any building against government guidelines that establish baseline efficiency for air purification and filtration systems. IAQ assessment covers microbial contaminants (e.g., mold, bacteria, dust, and particulates), chemicals (e.g., carbon monoxide and radon), allergens, fibers (asbestos), and any mass or energy stressor that can affect the occupants' health [33]. Interior designers can employ tools such as the Indoor Air Quality Building Education and Assessment Model for the design and construction phase. Although it is challenging to measure the toxicity of a building's interiors and its environmental impacts, there are some methods to determine IAQ. Interior designers, in collaboration with scientists, can collect and analyze air samples and can use computer software simulating the airflow inside buildings [8]. Smart IAQ devices are effective technical tools for collecting and analyzing data about the unwanted components of indoor air [13]. This analysis can lead to an understanding of the sources of the contaminants and guide designers in developing strategies for removing the unwanted air elements and determining the balance required for ventilation and filtration for the effective exchange of indoor air [1].



2.2.2 Control chemical emission

The Intergovernmental Panel on Climate Change reported that the buildings sector is responsible for 40% of global energy consumption and 25% of global carbon dioxide emissions [25]. Emerging chemicals of concern (ECCs) can cause adverse effects on the environment and health. They are generated within the interior environment through irresponsible usage of combinations of materials and/or adhesives [18]. Examples of ECCs are nitrosodimethylamine, bisphenol-A, phthalates, perchlorate, arsenic, synthetic musks, nonylphenols, industrial chemical additives, adjuvants, brominated flame retardants, stabilizers, and nanoparticles [33]. Smog-causing pollutants and particulate matter also have serious health and environmental impacts.

One of the responsibilities of interior designers is to provide interiors that promote the health, safety, and welfare of a building's occupants [1]. Therefore, designers must research and thoroughly vet the materials and products they specify and warn their clients of potential enduring health risks. Moreover, designers should analyze the feasibility of substituting a product with a safer alternative [34]. Designers can eliminate the risk of ECCs by analyzing marketing claims about the product's impact on health. They should dive deep into the information on products such as paints, adhesives and sealants, waterproofing, textiles, furnishings, insulation, drywall, and substrates to ensure that everything has been evaluated to deliver the highest quality interior environment [21]. They should determine the level of toxic gas emissions, whether generated during production or during product usage [35]. Interior designers should specify natural sources such as wood, plant products, and mineral products (e.g., natural stone and slate shingles) after evaluating the impact of their extraction on the natural environment [26], [34]. Natural sources are low emitting, durable, require less energy to make a usable product from, and are less likely to off-gas chemicals or volatile organic compounds (VOCs) during manufacture or disposal [1]. When interior designers specify manufacturing materials, they should look to manufacturers that comply with standards and testing by reporting their VOC emission levels [35]. They should ask for information on suspended VOCs (SVOCs), carbon-based substances that become gaseous under certain conditions and are released through particulates in the air. SVOCs include glycol-based solvents, nonylphenol surfactants, phthalates, and some flame retardants [34], [35].

The following two tools guide interior designers in selecting manufacturing materials and products that have zero or low impact on occupants' health or the environment. The first tool, GreenScreen for Safer Chemicals, is a comparative process that includes standards, scorecards, and eco-labels. It uses chemical hazard assessment to identify chemicals of particular concern and safer alternatives. It is a valuable tool for assessing whether materials and products meet regulatory requirements, supporting healthy and responsible design and development, defining materials procurement that meets client demand and eliminates chemicals of concern, and finding safer alternative chemicals for product formulations [5]. The second tool is the amended Clean Air Act of 1990, which established standards issued by the Environmental Protection Agency to control emissions and toxic pollutants. These standards strive to reduce the emissions of more than 100 airborne toxins. When fully implemented, these standards will reduce toxic emissions by about 1.5 million tons per year—almost 15 times the reductions achieved prior to 1990 [17].

2.2.3 Carbon footprint

Interior designers should specify products and materials that help decrease carbon impacts and offset emissions [35]. They should select items manufactured in response to the uptick in dramatic weather events and changing climatic patterns [34]. They need to look for



manufacturers that examine the greenhouse gas emissions generated by their products [21]. To meet this criterion, designers can rely on the Climate Neutral Business Network as a third-party certification body that measures products' impact on climate change; the network aims for net-zero greenhouse gas emissions associated with a product's life cycle and works to reduce products' potential contributions to climate change [17].

2.2.4 Biodegradable products

A biodegradable product is capable of being decomposed by biological agents or being broken down, especially into harmless products, by the action of living things [3]. Anything that decomposes without polluting the area or leaching toxins is biodegradable, such as all-natural materials including wool, jute, and biodegradable adhesive [5]. Interior designers should look to a viable certification program such as the Biodegradable Products Institute, which recognizes that products must disintegrate quickly with no residue, convert to water and biomass, support plant growth, and not introduce high levels of metals into the soil. Such products include food service items, packaging, and compostable resins [36].

2.3 Reduction of consumption

2.3.1 Design adaptability

To meet this criterion, interior designers should challenge their capability to design spaces that adapt to clients' needs with the minimum usage of area and resources [12], [24]. Responsible designers should invest their time in producing innovative and flexible solutions [37]. Design adaptability can be achieved, for instance, by designing multipurpose spaces and multifunction furniture as well as relying on smart technologies that provide spaces with the flexibility to change their design atmosphere through smart materials and lighting to fit different activities [10], [38]. Interior designers should utilize the attributes of a material for more than one purpose, resulting in the reduced use of materials [3], [26]. Concrete, for example, can be used as both the structure and finish of flooring.

2.3.2 Regional design solutions

Interior designers should encourage vernacular design solutions that support the usage of regional products and materials [3]. This trend will help lessen the significant environmental impact of the energy needed to transport products over a long distance [25]. The natural harmony between the materials and their environment will increase their durability as well as support the local economy and design identity [39].

2.3.3 Durability

Interior designers should specify durable, low-maintenance products and materials for their design solutions while considering efficient installation methods and the suitability of their application [11]. These solutions can be considered environmentally friendly because they have longer life cycles and need to be cared for and replaced less frequently [21]. Durable products may cost more up front, but they will save money in the long run [40]. Tile, stone, and concrete are examples of products that can be considered durable [34].

2.3.4 Reduce packaging

Packaging waste represents as much as a third of the non-industrial solid waste stream. Therefore, responsible design practice requires asking manufacturers to package their products in an environmentally accountable fashion [5]. Specifically, designers can request minimal packaging, the use of only recycled-content materials that are diverted from disposal at the landfill, biodegradable plastic, materials free from toxic components, and packaging



materials that can be returned for reuse or recycling [24]. The associated reduction in waste and disposal cost translates into cost savings for the contractor and owner. Interior designers can employ different associations' standards to meet this criterion; for instance, they can select products holding the Blue Angel Mark, an environmental label system that is promoted by the German government for numerous products, including furniture and finishes [2], [17].

2.4 Sustainable design components

A comprehensive and successful sustainable design solution requires diligent planning and incremental implementation; it should be capable of being disassembled, refurbished, reused, or recycled, and its return should be incentivized.

2.4.1 Reusable design components

Interior designers should specify materials and components that have the potential to be reused or recycled after their useful life [21], [26]. Designers should encourage the use of repurposed or refurbished furniture whenever possible to extend material life [10]. Antiques and collectible furniture exemplify the beauty of repurposing and refurbishing. Designers should rely on contemporary mechanical solutions as interior design finishing and construction methods that will minimize wasted material because the construction can be disassembled in a suitable condition that allows for materials to be reused in different locations [18], [22]. Interior designers can introduce the reuse and recycle water system and convince their clients to maximize water management efficiency within buildings by reducing water consumption and reusing wastewater [4].

2.4.2 Recyclable design components

Recycling is the process of collecting, processing, marketing, and ultimately reusing materials that have been discarded [6]. Interior design waste management is an example of recycling in which construction waste is collected from the renovation process and then transformed and remanufactured to produce new construction materials [21], [22]. The life cycle of interior materials should involve the frugal use of natural resources and contribute to addressing environmental issues such as global warming and acidification [12], [18]. These benefits associated with recycling cannot be realized unless a market exists for recycled-content products. Therefore, interior designers should specify products with recycled content to ensure that the recycling movement continues [10], [24]. Creating a demand for recycled content can transform entire manufacturing markets. Products made with recycled resources offer countless benefits, including reusing design components, reducing the volume of waste sent to landfills and incinerators, and decreasing the demand for raw materials, thereby lessening the environmental impacts associated with material extraction and harvesting and resulting in business expansion and additional jobs as new product technologies emerge [2], [3].

2.5 Efficient design resource management

2.5.1 Selecting renewable resources

Renewable resources are defined as those naturally replenished or grown at a faster rate than their usage lifetime and human consumption [7]. Renewable resources are materials that consume less energy in their preparation, are capable of being reused or recycled when disposed of at the end of their life cycle, and have lower VOC emissions [26]. Renewable materials should have less environmental impact associated with their cultivation, should be grown without pesticides, should not be invasive to the growing area, and should not deplete



topsoil or contaminate waterways; they are biodegradable and require minimal machinery to harvest [3], [11]. They should be able to replenish themselves through short harvest rotations—typically less than 10 years. Therefore, renewable materials are considered one of the factors that can positively reduce the environmental impact of interiors. Bamboo, wheat board, wool, cotton, coir and jute fabrics, linoleum, and cork are examples of self-sustaining material; they can be harvested every five to 10 years [2], [21].

2.5.2 Effective plumbing systems

Interior designers should specify sanitary equipment to reduce water consumption, such as water-efficient sinks and smart faucets [2]. They should advocate plumbing systems that encourage graywater reuse for toilet flush or irrigation systems [4]. In the long term, this will reduce the energy and transportation required for water purification and conserve potable water [24].

2.5.3 Effective energy performance

Interior designers should work closely with project team members such as electrical and mechanical engineers to optimize energy use and minimize energy consumption while meeting the clients' needs [3], [18]. Architects and interior designers should begin with a computer-generated energy model to determine how various design elements will affect the project's energy efficiency [25]. This stage will help them set the threshold for design performance toward an energy-efficient building envelope including windows, doors, walls, insulation, roof assemblies, appliances, systems, and equipment. Designers should distinguish their designs by balancing the high-performing envelope with renewable on-site energy like solar or wind power [20]. Interior designers should also specify systems that can rationalize interior resource consumption using smart equipment that monitors space conditions and occupancy, and then implement strategies for limiting energy use to the occupied areas [41]. Ultimately, they should work toward net-zero energy whenever possible. Another aspect of achieving effective energy performance that designers should consider is the amount of energy required to produce design components. Natural resources have lower amounts of embodied energy, while synthetic materials such as concrete, steel, and acrylic require higher levels [10].

2.5.4 Efficient construction methods

This criterion aims to encourage the specification of furniture and finishes that are processed minimally and inherently part of the construction. Interior designers should specify simple construction methods with minimal installation processes [26]. They should choose durable fixtures, joints, and fittings for assembly, as well as rely on innovative technologies and creative mechanisms to assemble different items based on a shared installation application that will present a stronger and less material-intensive option than using individual components for each particular item [3], [24]. This process will reduce assembly fixtures, resulting in the decrease of needed natural materials and resources as a whole, in addition to easing the maintenance and repair process. Another example of sustainable construction is utilizing the inherent strength of wood with a system of self-locking joinery to hold furniture components that will slide and lock into one another, allowing for the seasonal movement of wood with minimal warping or loosening of the structure; this is an alternative sustainable solution to utilizing screws, nuts, bolts, or other fasteners for assembling furniture pieces that loosen with age [17].



3 CONCLUSION

Interior designers should recommend and specify only earth-friendly and healthy materials and products. They should challenge their design capabilities, determine the appropriate innovative solutions to achieve energy efficiency, and eventually aim for net-zero-energy interiors that are truly restorative for both clients and the environment. Interior designers and contractors should integrate sustainable practices into all of their interior design solutions and lead their teams to seamlessly and routinely practice sustainability principles.

This paper explored and identified selection criteria for sustainable interior products and materials. It proposed five criteria covering manufacturer selection, health, reduced consumption, sustainable design components, and efficient design resource management. These criteria can effectively support responsible interior designers in specifying and selecting sustainable design solutions. Interior designers should have a complete understanding of these selection criteria to fully incorporate them into their project specifications.

Meeting just one or two of the criteria does not mean that the product is sustainable. Designers should work on balancing the scale, evaluating the pros and cons, and selecting the appropriate solution to meet the sustainable project's objectives and ensure the effectiveness of the selection criteria.

Appropriate quantitative methods can be used to translate the selection criteria into a mathematical evaluation system and develop a scoring system based on the extent to which each criterion is achieved. Such a system can reinforce interior designers' efforts to evaluate project sustainability and ensure that they achieve consistent sustainable interior design solutions.

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CONVENIENCE STORES AS AN URBAN CULTURE SPACE FOR YOUNG PEOPLE IN WEST JAKARTA, INDONESIA

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ABSTRACT

A convenience store is a small retail business that stocks a range of everyday items, such as groceries, snacks, foods, confectionaries, soft drinks, tobacco products, magazines, and newspapers. However, since 2009 it has become a new space to hang out for urban youth, especially in Kemanggis area, West Jakarta. The shift has turned a convenience store from a commercial into more public space. The aim of this paper is to understand the role of a convenience store as a public space and the behaviour of consumers in utilizing it. Data were collected using a questionnaire distributed to the people who purchase goods at a convenience store and use its area to hang out. The result of the analysis shows that a convenience store has become a space for people to interact with each other, do some chores, or spend some time alone. A variety of facilities are offered, such as affordable foods and beverages, WiFi, toilets, and a bright place, to make a taste of urban house linger there. Moreover, in terms of its role as a destination, the convenience store is a commercial space crowded with its customers who spend their time in the lounge provided.

Keywords: convenience store, lifestyle, public space, leisure time, city, urban culture.

1 INTRODUCTION

A city can be described as a living place if it is able to give the people that live inside opportunities to express themselves [1]. The importance of the social public space that is naturally created by its citizen is the representative space produced by social activity such as hangout. Indonesians are common to the culture of hangout. In everyday language, the word “hangout” carries with it the meaning of “meeting up and chatting, which sometimes include smoking or drinking together.” Initially, the habit has been made popular by the traditional coffee shops that have long existed throughout Indonesia.

Currently there has been a change in lifestyle as an impact of the industrial expansion in the forms of restaurants, cafes, fast food outlets, and convenience stores. Departing from the phenomenon, this paper studies the correlation between the stall (*warung*) culture and the convenience stores. The concept of a convenience shop in Indonesia adopts the generally known stall culture. The friendly stall model with affordable prices has shifted to the more modern form, which is in line with Indonesia’s newly rising middle class, namely more global and commercial space.

It is considered commercial because basically it is a commercial space that functions as a modern place where buying and selling transactions take place and the hangout culture is one of the most desirable forms of a leisure time activity for young adults. Since the availability of sitting areas at a convenience store provides an opportunity for a hangout activity, hanging out at a convenience store can be seen as utilizing a space for a social place or placemaking. Placemaking comprises activities, management, community, and sociability. Moreover, another important factor to determine the interaction place is *access* (achievement) and *fit* (compatibility) [2]. The same concept is also offered by convenience stores throughout Indonesia for the urbanites living in big cities, especially the city of Jakarta, which is the focus of our research this time. The research was conducted in two



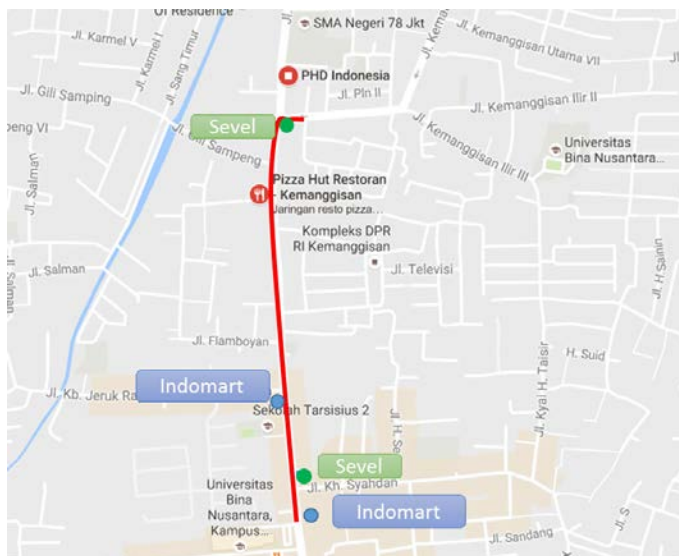


Figure 1: Kemanggisian neighborhood, West Jakarta.

outlets, namely Indomaret and 7-Eleven in Kemanggisian neighborhood in West Jakarta as seen in Fig. 1.

2 RESEARCH OBJECTIVE

With the seemingly unstoppable growth of convenience stores, many young urbanites make them as their hangout place. The cosy nature of the place, the availability of several facilities, and the affordable foods and drinks are the reasons for urbanites to spend their leisure time at convenience stores.

Convenience stores have some significance for urbanites: This research tries to find out how significant convenience stores are for urbanites, the reasons for them to go to convenience stores, the length of time they spend in convenience stores, and whether convenience stores address the people's needs for a space to interact.

3 LITERATURE REVIEW

The English word "leisure" comes from the Latin word *licere*, which means "to be allowed to" or "to become free." However, there are some people who believe that it comes from the French word *loisir*, which means leisure [3].

In his book *Leisure and Recreation Management* George, Torkildsen [8], explains the meaning of "leisure" as follows:

3.1 Leisure as time

Leisure is a spare time that someone has after s/he has done all that s/he needs to do. The spare time is then used to do positive things that the person really wants to do.

3.2 Leisure as activity

Leisure time is used to do various activities as desired, either to rest, look for some entertainment, enrich one's knowledge, or develop skills.



3.3 Leisure as mood

In this context leisure is understood as something that is related to the soul or attitude that is related to everything that deals with all matters concerning religion. This is something that comes from within oneself and not from an external factor [5].

3.4 Leisure time as something with a broader meaning

Leisure time is relaxation, entertainment, and self-development. In this context, someone will recover from exhaustion, escape from boredom, and be free to do something that may even lead to producing something. In this case, leisure time is defined as an expression of someone's whole aspiration in searching for happiness, a new mission, a new policy, or even new culture [6].

4 LEISURE TIME AS A WAY OF LIFE

Leisure time is a life that is free from pressures coming from outside one's culture and environment. With leisure time, one is able to do things that are fun and proper.

There are many locations where people can go to spend their leisure time. "The third place, the people's own remedy for stress, loneliness, and alteration seem easy to ignore" [4]. The "third place" is a place for people to relieve stress, loneliness, as well as alienation, and where one easily gets ignored. The "third place" is a place where people go to escape from their life's obligations and boredom [7]. From the two definitions, one can draw a common thread that the "third place" is space that enables people to escape or be free from their life's problems and daily routines. Additionally, it also promises relaxation, entertainment, and peace. Normally the "third place" is a place to escape from the "first place" (home) and the second place (the office).

In recent times, the "third place" is highly identical with a "shopping center". This place is used by many people to relax, escape from their daily routines, search for entertainment, and even find fresh ideas. Taking the idea of shopping center and making it into a smaller scale, the rapidly growing convenience stores have also become the "third place" for many people in the community.

5 RESEARCH METHODS

Data collection was gathered through interviews, direct observation, and surveys. Direct observation was carried out in June 2015 and May 2016 to observe things that convenience store's customers usually do at a convenience store in the research location.

The questionnaire was distributed to have a broader picture about the kind of people who come to the convenience store and the reasons why they go there. The aim of the questionnaire was also to find out about the background of the people who come to the convenience store in the research location, the activities they do, and the length of time they spend there.

Interviews with customers were also conducted to find out more accurate reasons why they chose to hang out at a convenience store. By interviewing visitors, a better understanding was obtained about the comfort they get from a convenience store which making them feel content when hanging out there. Interviews were conducted with visitors who came alone and in groups.

An analysis was carried out by digging for information from respondents using a quantitative approach to understand the use of convenience stores in West Jakarta. A quantitative approach was conducted to see the general trend or inclination of the use of

convenience stores by interviewing 80 respondents who know about or have visited convenience stores located in West Jakarta.

Based on the findings, the discussion is divided into several aspects, namely purpose, comfort, time, duration, frequency, reason, colleague, and activity. The aspects will show the shaping of a new commercial space at a convenience store.

6 RESEARCH RESULTS AND DISCUSSION

6.1 Purpose

The purpose to visit a place may vary, depending on the benefits that people expects to get from their visit. Similarly, visitors who go to convenience stores in West Jakarta also have various purposes in mind. They want to find a comfortable and easy place to access as they are usually located on main roads, or offers reasonably complete facilities that affect the visitor's comfort.

The aspect of comfort is the main consideration for the visitors to come to the convenience stores (52.5%). In addition, there are also some other aspects such as the completeness of facilities (33.7%), cheap prices of food and beverages (27.5%), and easy access (27.5%). Another factor that drives many of them to visit convenience stores is the availability of facilities that make them comfortable. Indeed, convenience stores are designed in such a way that visitors are comfortable by placing tables and chairs inside and outside the outlets.

6.2 Comfort aspect

The many available products for visitors to choose from have led to an increasingly stringent competition in the marketing of certain products. In the end, not only do the producers or service providers have to focus on the quality of their products, but they also have to join the race in the packaging competition and providing the best service for the customers.

Recently there have been convenience stores that do not only sell products but also provide adequate and comfortable facilities for their consumers. The presence of convenience stores both directly and indirectly "threatens" the function of both the stalls and mini markets at the same time. Convenience stores sell goods in a self-service style like the mini markets, but at the same time the former ones also offer hangout places like the traditional stalls, albeit with designs that are far more comfortable for the visitors.

Results of the surveys show that 55% of the respondents chose convenience stores as a comfortable place to hang out or to gather, whereas 30% of the respondents chose cafes and the remaining 25% chose coffee stalls. The comfort they feel is associated with the facilities provided by the convenience stores for visitors, such as air-conditioned rooms, a reasonable number of tables and chairs, and other supporting facilities such as various banks' automated teller machines (ATMs).

Besides the aspect of comfort, another factor that affected the visitors in choosing which convenience stores to go to was the cleanliness of the premises and food.

6.3 Time aspect

This research maps the longest time spent by visitors to hang out. When respondents were asked about which day they usually come to a convenience store, they normally answered that they do not usually come based on a certain day.



For instance, 75.9% of the respondents said they do not come to convenience stores based on a certain day, but it depends more on their desire to do so, while 16.87% come on work days (Monday–Friday), and 7.23% of the respondents said they come to convenience stores on weekends (Saturday–Sunday).

As for the choice of time for visitors to come to convenience stores, 54.95% said they come between 19.00 and 22.00 WIB (Western Indonesia Time), 15.38% come between 12.00 and 16.00 WIB, and 8.79% said they come between 22.00 and early morning.

In regard to the respondents' profile, the majority were between 17–25 years old, and their professions were university students and private employees: therefore, it is not surprising that convenience store outlets are always packed in the evenings because the visitors come there after working hours or lecture hours for socializing, refreshing, or fulfilling the visitors' other needs.

6.4 Duration aspect

The availability of facilities that are reasonably complete at convenience stores also affects the amount of time that visitors spend there. Based on the survey result, 38% of the respondents spend about two hours at convenience stores, whereas 19% spend about 1 hour, 18% spend more than three hours, another 18% spend half an hour, and 15% of them spend three hours at convenience stores.

Respondents said they could spend hours in convenience stores when they are waiting for a friend or they have an appointment. In addition to the availability of food and drinks, another reason for the consumers to willingly spend hours at the convenience stores is the free WiFi access which make them easily surf the internet. On the contrary, the factor that prevents them from spending long hours in convenience stores is the huge number of people that hang out there. For some visitors, such condition makes the place too crowded and hence uncomfortable. Many buskers that flock the stores make consumers reluctant to come to the convenience stores. Another factor that prevents visitors from coming is the limited number of electric plugs that makes it difficult for them to recharge the batteries of the gadgets they bring.

6.5 Frequency aspect

Another interesting thing to find in relation to the visit to convenience stores is the frequency of their visit in a certain length of time, for instance in a week or a month. It was previously mentioned that the length of time spent by visitors at convenience stores is between one and three hours. When questioned further, the visitors mentioned that the length of time they spend at the outlets do not always correlate with the frequency or the number of their visit.

When respondents were asked about the frequency of their visit to convenience stores in a week, 44.83% of the respondents answered three times, 29.31% answered two times, 14.66% answered four times, 8.6% answered more than four times, and 2.59% answered only once a week. When accumulated, the respondents who said they come to convenience stores three times or more in week are 68.1%.

During the interviews with open questions, another option chosen by respondents in terms of the frequency of visit to convenience stores is monthly, which means that the informants might come more than once in a month. One informant mentioned that he comes once or twice in a month. Two other informants said that on average they come twice in a month.



6.6 Colleague aspect

With whom do visitors usually come to a convenience store? Normally that depends on the purpose of the visit to the place. The survey result shows that the majority of visitors going to convenience stores come with friends. It reflects the fact that convenience stores are a cool place for young adults to hang out and gather with their friends or co-workers.

The survey result shows that 71 times (71.72%) the respondents stated that they come with friends, whereas 13 times (13.13%) come unaccompanied, 10 times (10.10%) come with a business partner or co-worker, and 5 times (5.05%) come with their families. The result shows that the issue of with whom the visitors usually come to a convenience store depends on their needs to go there.

6.7 Reasons for visit aspect

Reasons for visitors to come to a convenience store, as with any other place may vary. The main reason is because they want to interact with their friends or they are comfortable with the outlet. Furthermore, it is certainly related to the consumptive needs, such as buying food and beverages.

The results shows that 52 times (53.06%) respondents said they come to a convenience store because it is a nice place to interact, 20 times (20.41%) the respondents said because the location is good, and 20 times (20.41%) the other respondents said because it is a nice place to relax, whereas 6 times (6.12%) the respondents said because it is a green open space, there is a limited number of parks in the city, or it is not very comfortable to spend time at those parks.

Besides the consumption issue, when interviewed or given open questions, an informant claimed that he visits convenience stores as a form of expression, a way for him to follow the up-to-date trend currently happening.

6.8 Activity aspect

What activities do visitors do when they come and hang out at a convenience store? Based on the survey, 52 times (39.1%) the respondents stated that the activity they do at a convenience store is chatting with friends, whereas 34 times (25.56% of the respondents) said they finish their work or did lecture tasks, 17 times (12.78% of the respondents) answered relaxing and using the internet, 10 times (7.5% of the respondents) said killing time, and 3 times (2.56% of the respondents) said reading a book.

7 DISCUSSION

7.1 Convenience stores fulfilling urbanite's needs

Like people in any other big cities, people in Jakarta are extremely busy. They need a public space for refreshing or taking a short break from their routine. Attributable to the easy access and comfort it provides to visitors, a convenience store is considered by the general public as an alternative place to fulfil the needs of city dwellers. Convenience stores that offer facilities such as tables and chairs equipped with free WiFi and air-conditioned rooms are perfect places as alternative places to hang out for Jakarta dwellers.

Previously people in Jakarta used to hang out in cafes or stalls, but now they have an alternative, which is convenience stores. The adequate facilities, the easy access because of



their strategic location on the main roads, and the prices that are generally cheaper than the prices of foods and drinks people buy when they go to cafes and not much more expensive than the prices at street stalls make convenience stores more alluring for people in Jakarta, especially the young adults, to hang out.

The presence of convenience stores fulfils the needs of urbanites for a place where they can shop for goods without having to go to a mall. People may fulfil their shopping needs here both directly and indirectly. In this case, shopping directly means they can come to a convenience store outlet and buy goods they need at that place, whereas shopping indirectly means they can do online shopping through their gadgets with the availability of the free internet connection there.

7.2 The addition of a convenience store as commercial space

Convenience stores are a current trend for the capital city's young adults. One can find convenience store outlets almost in every place in the capital city, and the majority of them are always fully packed with visitors at rest breaks and night. However, has the number of the currently existing convenience stores already met the needs of the consumers for cool places to hangout, or do the consumers even feel that more convenience stores are needed?

The result of the interviews with the informants shows that several informants stated that the number of convenience stores in their neighbourhood needs to be added. However, according to them the addition should be based on two categories: an addition in the number of the convenience stores and an addition that focuses more on adding the facilities in the existing ones.

On the other hand, some other informants stated there is no need to add the number of convenience stores in their neighbourhoods, and in average the reason given is that the current number was already adequate enough. Furthermore, there are even some who stated that the current number of convenience stores is too high, while some others think that there is no need to add more convenience stores since the current number is sufficient. Instead, what needs to be done is to reorganize the existing convenience stores so that they do not disturb the environment of the residential areas nearby.

7.3 Hangout activity as a form of the shift of commercial space

For the majority of the young adults, hanging out in certain places like malls, parks, cafes, or others has become a lifestyle and those places have become spaces for them to socialize. In addition to the above-mentioned places, the currently developing trend for them is to hang out at convenience stores. Convenience stores have been designed in such a way as accommodate the visitors to feel pampered and hence spend longer time there. However, this research also tries to find out, aside from convenience stores, which other places that are considered comfortable places to hang out. Each individual has a different way of hanging out there. The majority of the activities undertaken when people hangout involve sitting down, chatting, joking, and sharing snacks.

The trend of utilizing convenience stores as a place to gather and spend time is another reason. In the end hanging out and gathering in convenience stores offer a new identity for the visitors. By going there, they feel that they belong and become cool people. The previously mentioned conditions show the shift of space within convenience store's commercial space. Transaction activities take place because there is a purpose of utilizing the place for hangout activities. The space that was previously commercial in nature has then shifted to be a place that is more public with the hangout activities.



7.4 Placemaking in the formation of convenience store's commercial space

Hangout activity that is performed at a convenience store is a signification of the commercial store. Visitors as a group of individuals have direct participation in utilizing the commercial space through their activities. The activity has become a process of how visitors interpret the commercial space as a place where they usually live providing comfort when they do their activities there. For instance, visitors have the freedom to arrange the tables and chairs in the convenience store's commercial space. Such condition signifies that there is a process of signification to turn the space into a place. Hangout activities in the commercial space of every convenience store have turned it into a place with an additional meaning for its visitors.

Based on the result of the observation and survey as previously explained, on average, visitors can spend more than three hours there and, in the end, they choose convenience stores as their hangout location. Furthermore, the process of placemaking is also signified by stages of the flow of activities while hanging out in the provided sitting area. In general, visitors do not only buy and sit, but they also seem to repeatedly leave their seats to buy more food and drinks, and return to their seats with their new purchase.

Moreover, based on the observation result, male visitors tend to hang out outside more because they choose to hang out while sitting down smoking. The activity is a process of signification that is carried out by the majority of the male visitors who do hangout activities in the commercial space of a convenience store. However, something different is indicated by the female visitors. They generally come in groups and sit in a circle to enable them to chat more easily. In addition, female visitors also seem to sit inside more.

Based on the explanation above, it is fair to say that through their hangout activity visitors of convenience stores have performed placemaking. It is through such activity that visitors perform the process of signifying the commercial space of a convenience store, which is done by taking over the activity that is happening in the space. For example, placemaking is performed when visitors can freely rearrange the chairs and tables to turn the place to make it more comfortable for them.

The shift that has occurred at a convenience store has not only turned a commercial space into a more public one, but the process of signification has also been carried out by the majority of the visitors turning it into a destination, especially a destination for hanging out.

7.5 The typology of hangout in a convenience store

Based on the observation, it is found that visitors of the 7-Eleven outlet in Kemanggis mostly come by car. By observing the cars, they drive, it can be deducted that they come from established economic background. They also wear nice and neat clothes. Even at night time between 19:00–21:00 WIB they still wear office clothes. They come either unaccompanied or with some friends.

At the Indomaret outlet in Batusari, however, the situation is different. Here most visitors come by bike. Their activity is also more homogenous, which is having a chat with friends, or if the visitor is unaccompanied, s/he will only enjoy the drinks and food. Those who come alone usually open their cell phone. Very rarely do they come and then open their laptop. Their clothes are also ordinary, and there is no indication that they are office workers or students.

Meanwhile, visitors of the Indomaret outlet near Bina Nusantara (Binus) University, which is about 300 meters away from the Indomaret at Batusari intersection, is very

different. At the outlet near Binus University the majority of the visitors are students. In terms of appearance, they are very different compared to the visitors of the outlet at Batusari intersection. Despite the fact that they come by bike, their fashion style is different.

A similar condition occurs at 7-Eleven outlet in front of Binus University. The majority of the visitors are also students. The shape of the two places is also almost similar. Both are two-storied buildings. The first floor is for the merchandise whereas the hangout area is on the second floor. Cable TVs are provided in both floors. With such facilities, certainly the place is more crowded on weekends because visitors want to watch the European Football, which is not broadcast for free by Indonesian television stations.

7.6 Conclusion

Hangout activity is a process of signification that is performed by visitors on the commercial space of convenience stores. Hangout activities in commercial space that are carried out for several hours provide visitors with an opportunity to signify the commercial space.

Placemaking in the commercial space of convenience stores is performed by visitors through their hangout activity that dominantly takes place there. The creation of placemaking in the commercial space through hangout activities has made convenience stores become visitors' destination to hang out. Convenience stores become hangout destinations that are visited by many individuals from different walks of life. In other words, business has fulfilled the needs for relaxing and trendy spaces. This is reflected by the fact that the majority of the respondents stated that they go to convenience stores because the places are comfortable to spend time to interact with their colleagues.

7.7 Recommendations

The rapid growth of convenience stores still needs to be controlled by the government. In our opinion, to provide a fair chance for small and middle scale businesses to grow, the government needs to obligate convenience stores to partner with small and middle scale businesses. For instance, the government can issue a regulation that necessitates convenience stores to sell products of small and medium businesses. It could be snacks or other kinds of food.

The government also needs to extend the green open space or parks. Based on the survey, some respondents mentioned the importance of parks as a space for interaction for urbanites. Indeed, a convenience store has become another option as a place to conduct one's activity; however, dwellers also need a comfortable park for them to kill their time. The limited number of parks is one of the reasons why many people go to convenience stores.

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SECTION 8
CULTURAL
HERITAGE SITES

URBAN TRANSPORT VIBRATIONS AND CULTURAL HERITAGE SITES IN ROME: THE CASES OF THE TEMPLE OF MINERVA MEDICA AND OF THE CATACOMB OF PRISCILLA

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ABSTRACT

The coexistence of modern transport systems with the presence of cultural heritage sites in urban environments is a very crucial issue in sustainable city planning. In particular, in the historic centre of cities with plenty of scattered archaeological sites, such as Rome, urban traffic vibrations must be monitored to assure the conservation of ancient monuments. In fact, cultural heritage sites may suffer from traffic vibration impact in terms of aesthetical damages even in cases in which the structural health is not compromised. In such context, the present paper focuses on the impact of traffic vibrations induced on two monuments studied within the CO.B.R.A. project (aiming at developing advanced technologies and methods for the conservation of cultural heritage). The so-called Temple of Minerva Medica and the Catacomb of Priscilla are exposed to different types of traffic vibration sources and are characterized by different structural conditions. Besides the ambient vibration monitoring, several non-destructive tests (NDTs) and noncontact investigations were conducted at the two sites in order to study the state of damage and the structural conditions of the two monuments. In particular, the ambient vibration monitoring gave remarkably different outcomes in these two cases and provided objective data for interesting observations on the sustainability of tramways, railways and road traffic near such diverse archaeological assets.

Keywords: urban transport vibrations, archaeological sites, structural health, non-destructive investigations, 3D reconstruction.

1 INTRODUCTION

Urban transport sustainability is one of the most crucial issues for contemporary cities planners. It implies the solution of typical problems related to people and freight mobility in urban areas, such as reasonable travel time and economic feasibility of transport infrastructures. As a general consideration, any relationship between the city parts and their connections with urban anthropic activities should be taken into account. Thus, the dynamics of its networks and infrastructures, such as the urban transport systems, are fundamental to assess the sustainability of modern cities.

In the latest decades, also growing environmental challenges became more and more decisive for the definition of urban sustainability. In fact, recent studies focused on the impact of transport systems in social and economic terms [1], as well as on the human health (especially in terms of safety, pollutants emissions and traffic noise) and on the overall environment (especially in terms of energy consumption and climate changes) [2]. As a consequence, urban transport sustainability indicators and indexes were recently proposed with particular emphasis on *climate friendly travel choices* by urban travellers and commuters [3].

On the other hand, other authors [4], propose that a more generalized definition of *sustainable transport* should be considered, in accordance with the Brundtland Commission



[5], stating that *sustainable* means meeting the needs of the present without sacrificing the ability of future generations to do the same in terms of economic, social and human development, including environmental and ecological health. From this point of view, the historic centres of ancient cities, like Rome, often present archaeological assets and cultural heritage sites, whose maintenance and preservation for the next generations are of primary importance. In many cases, archaeological monuments suffer from aesthetical and structural problems that can be worsened in urban environment for the presence of a variety of vibration sources, such as traffic vehicles, that can induce dangerous fatigue and resonance phenomena to the structures [6]. In such contexts, the sustainability of transport systems should be evaluated also in terms of potential impact of their long-term traffic vibrations to the structural and aesthetical health of the monuments.

In the present paper two cases of archaeological sites located in Rome are illustrated. They were studied within the CO.B.RA. project, which aims at developing advanced technologies and methods for the conservation of cultural heritage [7]. The first case is represented by the so-called Temple of Minerva Medica, while the second one is the Catacomb of Priscilla. They are both exposed to traffic vibration, but of different source types, and are characterized by different structural conditions. The vibration sources were classified as tram, train and road traffic in order to assess the different impact of different transport systems.

2 VIBRATION ASSESSMENT IN ARCHEOLOGICAL STRUCTURES

Vibration data were collected and analysed according to the recommendations indicated by international and national regulations. In particular, the potential impact of vibrations on the structural stability of urban constructions encouraged the development of specific standards and regulations in several countries. They are substantially coherent in their indications about the methods for the measurement procedures (type and location of the instrumentation, data processing and analysis, etc.), which mostly comply with internationally widely accepted ISO 4866 standard.

The key parameter considered for assessing the intensity of vibration is the Peak Particle Velocity (PPV), that is the maximum value of vector velocity recorded in triaxial acquisitions. Alternatively, other standards consider the Peak Component Particle Velocity (PCPV), which is simply the maximum value of velocity recorded in each triaxial direction. Vibration intensity limits are generally differentiated by essentially two possible typology of duration, which can be summarised in short-term (occasional or transient events) and long-term vibrations (permanent or continuous events that might cause fatigue and resonance in the structure). As long-term vibrations are considered potentially more dangerous, standards designate stricter limits independently on the vibration frequencies. More specifically, the limits for historic buildings subjected to long-term vibrations are comprised between 1.5 and 3.0 mm/s in terms of PPV or PCPV in most international standards and recommendations. The Italian standard UNI 9916 provides no specific limit, but cites several foreign standards, some of which do state the following specific limits for historic buildings: German DIN 4150 indicates PCPV should be limited to 2.5 mm/s [8], while Swiss SN 640312 a) prescribes PPV < 1.5 mm/s [9]. Vibration data in the two cases illustrated in the following were acquired using the same instrumentation, comprised of digital recorders equipped with triaxial velocimeters provided with a GPS antenna for time synchronization.

3 CASE 1: THE TEMPLE OF MINERVA MEDICA

The first case study that we describe is related to the traffic vibrations induce to an ancient ruined building located in the historic centre of Rome. It is erroneously called Temple of Minerva Medica since the 16th century, because it was then thought to be a temple dedicated



to the ancient deity of Minerva Medica ("Minerva the Doctor") and is still today widely known through such appellation, even if archaeologists presume it should have been an ancient nymphaeum built in the early 4th century A.D of Imperial Rome, probably part of the Horti Liciniani [10].

During the centuries, the structural damages concentrated on the south side, which resulted in eventual almost complete collapse of this portion of the building by the 17th century (Fig. 1(a)). This could be due to the presence of weaker foundations on the south side, as recent investigations highlighted [10]. After major restoration interventions were conducted in 1846 (for the reconstruction of first floor arcade) and more recently in 2012–2013 (reconstruction of upper floor arcade), the south side was reinstated to its substantial integrity giving the visitors a sense of completeness and magnificence of the monument (main hall diameter is 25m), though some parts are still missing, especially in the dome, leaving the overall height reduced to only 24m instead of the originally 32m.

3.1 Impact of tramways and railways

The location of the monument is very critical in terms of interaction with the surrounding urban traffic. Since the early 20th century, the adjacent Via Giolitti was provided with urban tramways, which are still regularly working, so that heavy modern trams pass by very close to the west side of the monument. On the opposite side of the monument, a few meters from the building to the north-east, several railway tracks serve the main railway station in Rome, the Termini station, which are there since pope Pious IX started the first railway line in Rome (Rome-Frascati), in 1856 [11], as testifies the photo in Fig. 1(b).

3.2 Vibration measurements

Traffic vibrations were monitored at the monument foundations in four different sessions: on July 4th, 2016 [12], February 1st, 2017, April 19th, 2017 and July 13th, 2017. The measurements were carried out from 9.00 a.m. to 2.00 p.m. in order to assess the vibrations induced by nearby rush-hour traffic (road, trains and trams), (Fig. 2(a)). Several positions were acquired at the bases of the 10 pillars both at inner and outer sides, as well as at the bases of other walls, in order to map the base excitation to the structure (Fig. 2(b)).



Figure 1: (a) View from East of the temple of Minerva Medica, painting by Bartholomeus Breenbergh, 1627. (b) Railway tracks of the Rome-Frascati line in 1856.

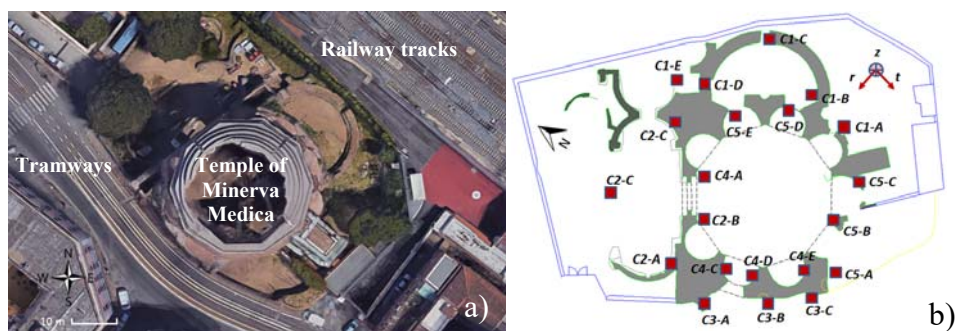


Figure 2: Road with tramways and railway tracks near the temple of Minerva Medica (a). Positions acquired at the base of the monument (b). Recorded components are r for radial (toward the centre of the hall), t for tangential and z for vertical.

The instruments for vibration acquisitions were oriented so as to measure the radial (toward the centre of the decagonal hall), the tangential and the vertical components (r , t and z respectively in the following). Each position was acquired for at least 20 minutes at a sampling frequency of 200 Hz. During vibration acquisition the time and type of vehicles passages were also noted.

4 CASE 2: THE CATACOMB OF PRISCILLA

As a second case, we illustrate the traffic vibration monitoring we carried out at the Catacomb of Priscilla. It is situated just a few kilometres outside of the historic centre of Rome, at a place on the Via Salaria, where an ancient quarry was used for Christian burials (from the late 2nd century to the 4th century A.D.).

This catacomb is very important both from an archaeological point of view and from an artistic one, as some of its walls and ceilings display fine decorations illustrating Biblical scenes [13]. In fact, the main artworks in the catacomb are concentrated in the area of the cryptoporticus, which is where the investigations here described are focused on. In particular, the so-called “Greek Chapel” is the most renowned and notable chamber of the catacomb, presenting remarkable architecture decorated with 3rd-century frescoes.

4.1 Current state of damage of the “Greek Chapel” and structural problems

In the cryptoporticus area a variety of Non-Destructive Tests (NDTs) and investigations were carried out within the CO.B.R.A. project in order to assess the current state of damage of its structures and artworks. Subsequently, the most damaged or potentially vulnerable points of the catacomb were identified and the ambient vibration monitoring was concentrated on verifying their exposure to traffic or other sources vibration.

With particular reference to the “Greek Chapel” locally some preservation problems were identified, such as superficial biotic aggression, extreme moisture conditions and local detachments from the bearing walls (Fig. 3).

Moreover, not far from the cryptoporticus some walls present signs of structural degradation, such as cracks, which in some cases appear quite evident.

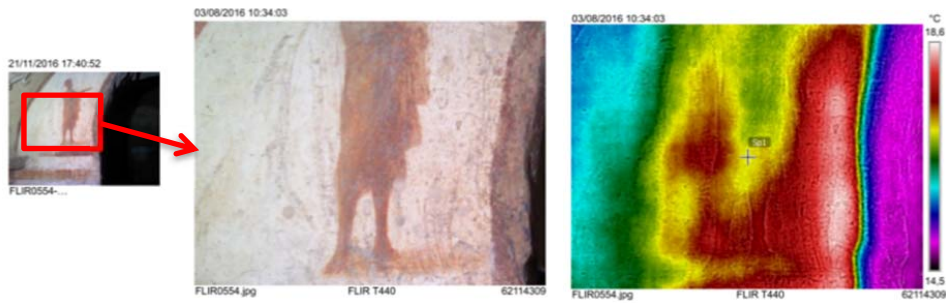


Figure 3: Detachments of the plaster from the bearing walls (red areas in the right box) of frescoes in the Greek Chapel.

4.2 Impact of road vehicles in via Salaria

The potential impact of urban transport vibration on the studied section of the Catacomb of Priscilla was essentially due to the road traffic in modern Via Salaria.

As shown in Fig. 4 the studied section of the catacomb is close to the most congested stretch of this road, partly due to the presence of a crossroad at Piazza Priscilla (Priscilla Square). No other urban transport types (trams, train, underground, etc.) are present close to the studied area.

4.3 Vibration measurements

Ambient vibration was monitored on 29th July from 8.00 a.m. to 13.00 a.m. The positions of sensors are depicted in Fig. 5 on the map of the tunnels and chambers of the Catacomb of Priscilla level located approximately at the same elevation of the entrance at Via Salaria 277 (47–48 m a.s.l.). The sensors were positioned at the doorstep of the entrance at Via Salaria 277 (position 0), in the cryptoporticus (position 1), near the “Greek Chapel” (position 2), and near the wall displaying the most evident cracks (positions 3 and 4). The sensor located near the entrance was used as reference to assess the traffic vibration near the source (the road vehicles passing by) and as a base for calculating their transmission/amplification to inner monitored measurement positions.

5 ANALYSIS OF VIBRATION DATA

From the vibration data acquired in all four monitoring sessions carried out at the temple of Minerva Medica the PCPV values for each monitored position at the base of the monument were obtained. In Fig. 6 the PCPV values are mapped with different colours in four classes as follows:

1. PCPV values < 1.5 mm/s (this value corresponds to the strictest limit prescribed by the Swiss standard for archaeological structures);
2. PCPV values comprised between 1.5 and 2.5 mm/s (the latter value is the strictest limit prescribed by the German standard for archaeological structures);
3. PCPV values comprised between 2.5 and 5.0 mm/s (the latter value is the limit prescribed by the German standard for residential buildings);
4. PCPV values > 5.0 mm/s.

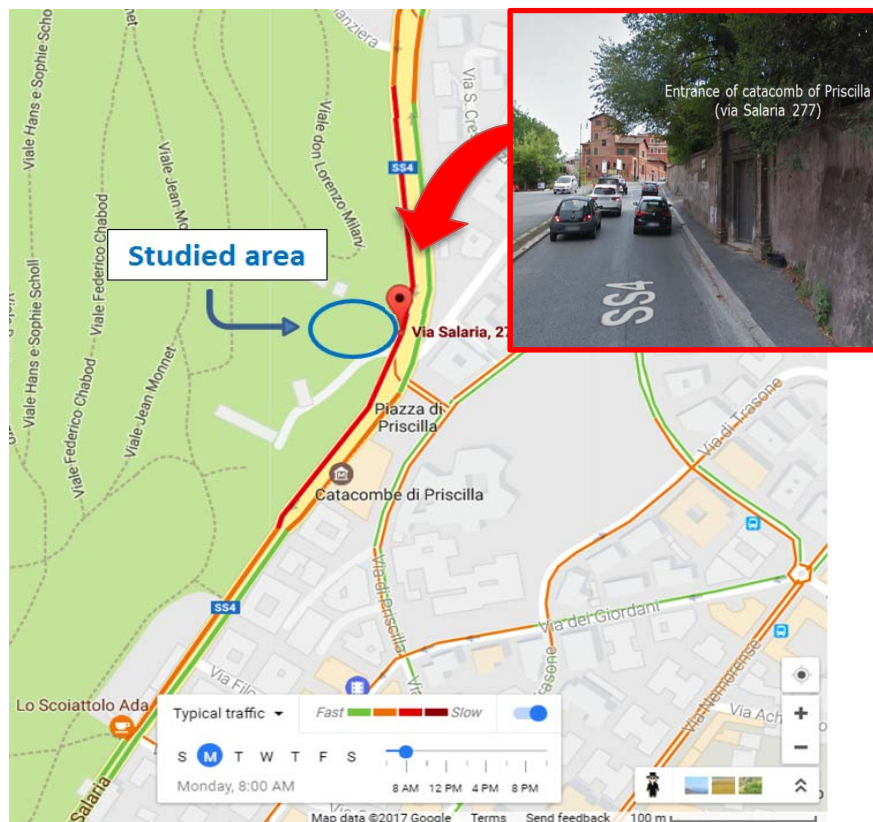


Figure 4: Typical traffic conditions in rush-hour (8.00 a.m. of working day) in via Salaria near the studied section of the Catacomb of Priscilla.

Taking note of the passage time of the several traffic vehicles (road traffic, tramways and trains) the different impact of each type of traffic source could be assessed. In particular, common road traffic originated vibrations with PCPV lower than 0.2 mm/s in all acquisitions. Train passages gave higher vibration levels, but PCPV was never greater than 1.5 mm/s. Train and tram passages produced similar values of peak velocity on the north-east side, near the railway tracks. In all other positions, tram passages induced the strongest vibrations.

In particular, the highest PCPV values were recorded at the positions closest to the tramway, reaching almost 20 mm/s, which would be over the limit even for industrial constructions according to the German standard (10 mm/s). In addition, several points of the pillars in the southwestern side of the monument gave PCPV values comprised between 1.4 and 1.5 mm/s, so they are lower but very close to the Swiss limit.

On the contrary, in the catacomb of Priscilla PCPV values were always lower than 0.1 mm/s in all recorded positions, which is a very low-intensity level. Traffic vibration transmission to each monitored position with respect to the entrance at Via Salaria 277 was also evaluated in terms of ratio between the root-mean-square velocity (VRMS). As depicted in Fig. 7, the traffic vibration was almost halved in the cryptoporticus, and furtherly reduced to about one third in all other monitored positions.

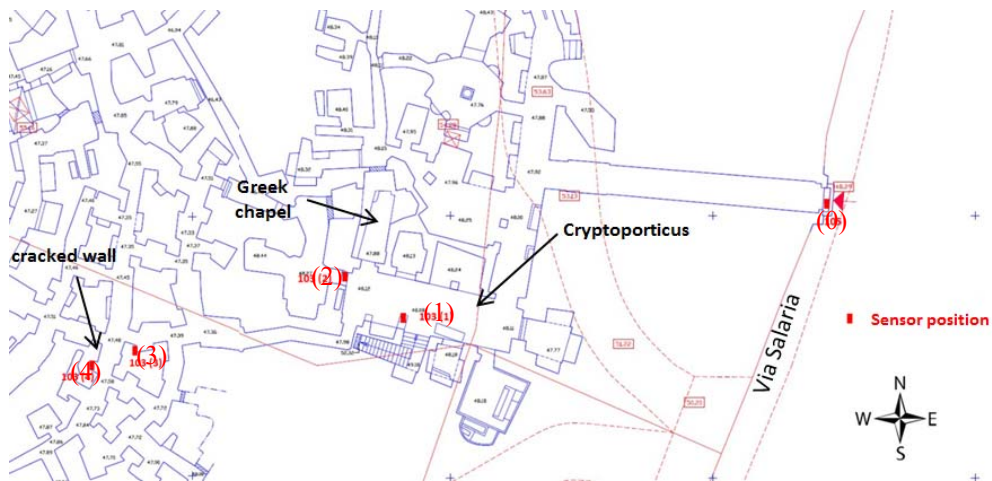


Figure 5: Positions of the sensors (in red with numbers in brackets) for the ambient vibration monitoring with respect to the main features of the cryptoporticus area of the Catacomb of Priscilla.

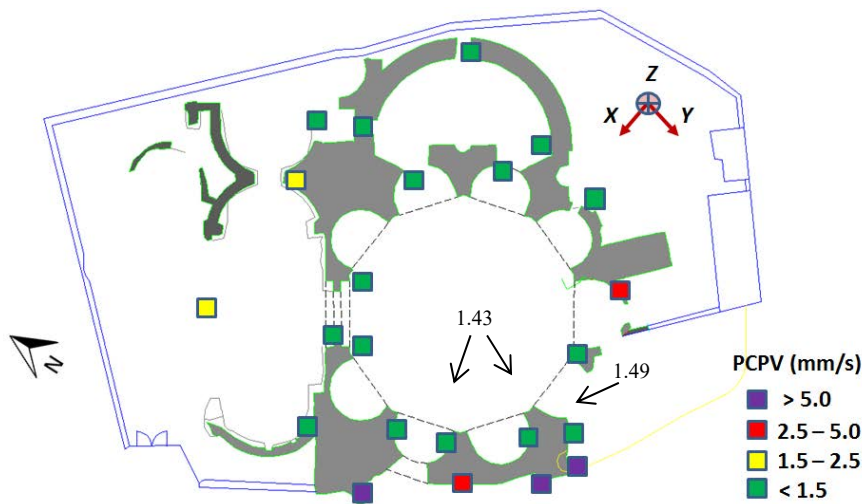


Figure 6: Peak Component Particle Velocity (PCPV) measured at each monitored position at the base of the Temple of Minerva Medica.

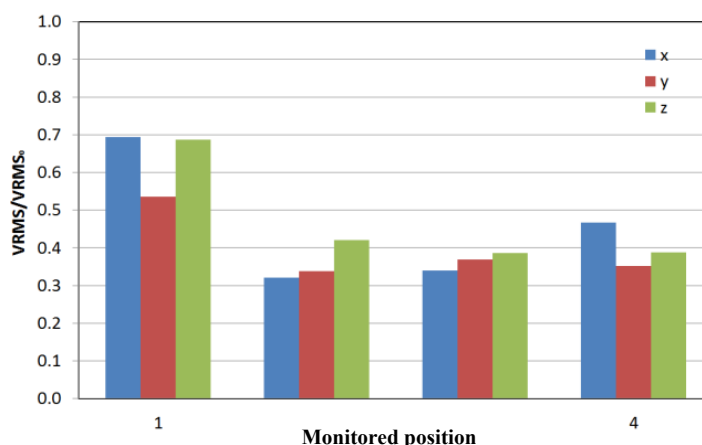


Figure 7: Traffic vibration transmission in terms of ratio between the root-mean-square velocity (VRMS) of each monitored position of the Catacomb of Priscilla and of the entrance at Via Salaria 277. Position numbers are illustrated in Fig. 5.

6 CONCLUSIONS

In the present paper, the traffic vibrations induced on two archaeological sites located in Rome were studied. On the one hand, the so-called Temple of Minerva Medica resulted subjected to strong vibrations induced essentially by the trams passing very close to the southwestern side of the monument. On the other hand, the Catacomb of Priscilla is exposed to road traffic vibrations of one of the most congested stretches of Via Salaria. Nonetheless, the recorded vibrations in the most valuable and significant points of the catacomb resulted of practically negligible intensity.

The above results demonstrated that the sustainability assessment of urban transport systems should include the impact of traffic vibration, especially in sites with the presence of constructions with relevant structural vulnerability, such as the archaeological sites. All the more so, since it can potentially lead to surprising conclusions in contrast with the common perception of urban sustainability. In fact, in the two described cases we found that commonly perceived sustainable transport systems, like trams, had much greater impact than road traffic, which is widely considered more unsustainable from other points of view.

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PROGRESS, MOBILITY AND URBAN REGENERATION IN A TRADITIONAL NEIGHBOURHOOD: EL ENCINO, MEXICO

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ABSTRACT

During the second half of the 20th century, the cities in Latin America began to grow rapidly, and the historic built environment has changed since then. Some of them preserved historic architecture, some others changed dramatically, and a few combined historic buildings with factories and the dynamics of new ways of mobility. This is the case of the neighbourhood: El Encino in Aguascalientes, Mexico. The factory: JM Romo was established in 1957 in El Encino. It pursued welfare and prosperity in the neighbourhood, helping with economics sustainability, such as a theme park development, building an indoor basketball court and schools for its workers. Somehow a social sustainability was achieved, but there was a loss of the historic buildings that were bought by the factory –and then they were torn down, and trucks changed the mobility on the narrow streets of the historic neighbourhood. So now the urban image of El Encino is a combination of the factory facades, parking lots and historic buildings. To find out about the social benefits to the factory workers and the opinion of the inhabitants of the neighbourhood two different surveys were conducted. Some of the results showed that the factory has pursued facilities for their workers, but not for the whole neighbourhood. Also, some residents built a garage in their houses because of the increasing traffic. Fortunately, the city planning has considered in the last years restoring the facades of the main houses, also changing the pavement, and building a new museum. Besides, the Guadalupe Posada Museum preserves the famous printings of this Mexican designer. It is through the analysis of the factory impacts (social and mobility), the developing of the neighbours to improve their own resilience and the late urban planning that the site can be preserved as part of a sustainable city.

Keywords: urban image, cultural heritage site, mobility, city planning, sustainable city.

1 INTRODUCTION

A sustainable city should consider the preservation of its cultural heritage sites. The main objective in this paper is to evaluate the social and mobility impacts of the JM Romo factory in *El Encino* neighbourhood. Also, to study the way the inhabitants of this neighbourhood improve their own resilience. The examination of the recent urban preservation in the site is convenient to understand the divergence between progress and historic preservation.

Since the JM Romo factory was established in the year of 1957 in the neighbourhood: El Encino in Aguascalientes City, a steady expansion of the factory started to disrupt the original historical urban core. The owners of the factory bought many of the private properties, no matter their historic values. The lack of a regulatory agency made the acquisitions of lands and old buildings easier. It is worth to mention that the delegation of the National Institute of Anthropology and History (INAH) didn't establish their agency until 1989. Nowadays, houses and factory – one next to each other – share the old neighbourhood. Also, there is a reduction of urban basic services. In contrast with the urban alterations, the factory began designing and creating services to its workers, for example: an amusement park, apartment buildings, schools and spaces for sport activities, among others. In fact, the company used some of the properties acquired to build warehouses, parking lots, and truck parking spaces. The industrial expansion faced an opposition from the neighbourhood that refused to sell all their houses next to El Encino church, because people identified themselves with the



traditions and symbolisms expressed on the old neighbourhood and the emblematic garden. The old and new building contrast gave place to a sui generis urban landscape, including some objects in the amusement park –with imaginary connotations of distant cultures, like African masks, American old west towns, medieval castles, etc., in total difference to the original architecture of the neighbourhood. The monumental factory and its mobility resulted in diverse contents – in aesthetics terms. A survey was applied to identify the impact of the industrial mobility, and another survey was applied to identify the social benefits in the neighbourhood. The research concluded in two different aspects: Social benefits and mobility, including social resistance – which stopped the advance of the building chaos in the neighbourhood. Therefore, the changing urban landscape became recognizable through the study of urban history. In recent times, the government tried to preserve the remains of the convent of the temple – that became the Guadalupe Posada Museum, including a new contemporary façade. Also, the government remodelled sidewalks, streets and some buildings. The valuable architecture of the Neighbourhood: El Encino can be identified thanks to the analysis of social aspects but including elements of the historic urban landscape.

2 METHODOLOGY

I started this research determining the social benefits of the JM Romo factory to its employees, and exploring the impact of the factory mobility to El Encino neighbourhood. It was convenient to design two surveys for this paper: one about mobility and another one about the social benefits. With the purpose to design the surveys of the first case (mobility) the following objectives were established to: 1. Identify the daily mobility mode of the respondent, 2. Inquire about the effects caused by vehicles of the factory in neighbouring streets, 3. Identify if the vehicles of the factory use the neighbourhood streets to park, 4. Determine if mobility of the factory causes house alterations, 5. Identify possible environmental problems caused by the mobility activities of the factory, 6. Inquire about the impact the activities of the factory have on the urban mobility (vehicular) of the area, 7. Inquire about the impact that the activities of the factory have on the urban mobility (pedestrians) of the area, 8. Inquire into the perception of safety/insecurity associated with the daily mobility of the inhabitants of the area, 9. Inquire into the degree of recognition of the inhabitants related to the characteristics of the urban space in the neighbourhood (streets). This is linked with: assess of pertinence of the location of the factory, 10. Inquire about the correlation between vehicle activities of the factory and the perception of insecurity related to the mobility of the inhabitants of the area, 11. Recognize the opinion of the inhabitants of the neighbourhood about the mobility alternatives in the area, 12. Inquire into some difficulties of mobility of the inhabitants of the neighbourhood related to the activities of the factory, 13. Inquire about the degree of recognition of the inhabitants related to alternative and sustainable ways of urban mobility, 14. Inquire about the degree of recognition of the inhabitants related to the efficient/inefficient infrastructure oriented to the use of sustainable means of mobility in the neighbourhood, 15. Inquire about the degree of social recognition of the inhabitants of the neighbourhood towards the factory, 16. Identify the urban transformations in the neighbourhood as a result of the arrival of the factory, 17. Inquire if the inhabitants of the neighbourhood take advantage of the theme park owned by the factory, 18. Identify the urban transformations in the neighbourhood as a result of the factory facilities and mobility.

In the survey of social benefits, the following objectives were established to: 1. Identify if the respondent is an employee of the factory or a retired worker, 2. Inquire about the social recognition of the factory, regarding the provision of health facilities, housing, education, etc. 3. Record if the factory has facilitated housing loans for its employees. 4. Identify if the



factory offers social insurance and benefits to its employees, 5. Inquire into the employees' perceptions about the attention of the factory to their needs, 6. Determine if the factory promotes improvement of training programs for the employees, 7. Inquire if the factory provides proper working tools and support to the employees, 8. Identify whether there is an incentive model in the factory, or any scheme of job growth that would allow employees to move up to better job levels, 9. Inquire if the factory provides basic education for its employees' wives and children, 10. Inquire about the employer-employees relations and identify the mechanisms of conflict resolutions in the absence of a union, 11. Identify the infrastructure of the factory built for basic social benefits, 12. Recognize the infrastructure of the factory related to basic social benefits, 13. Determine if the factory allow employees and their families access to leisure areas, 14. Inquire if the factory encourages the practice of sports among its workers and families, 15. Identify if the factory provides additional benefits to the employees. Also, identify at what level of scale this kind of benefits are provided, 16. Recall if the factory provides additional benefits to the employees. Also identify at what level of scale this kind of benefits are provided, 17. Inquire into the employee's perception about attention and commitment the factory shows around their needs and those of their families.

The methodology used to resolve the scientific problem could be situated in qualitative research. Linda Groat and David Wang say that qualitative research deals in the interpretation of contemporary situations. It places particular emphasis upon the role of the researcher as a vital part of the research outcome [1]. The surveys were used to articulate the points of view of society with the research arguments and to analyze the results, according to urban preservation theories and history in the cultural heritage site.

3 THE SURVEYS ON MOBILITY AND SOCIAL BENEFITS

The questions asked on the mobility survey were: 1. What is your favourite mode of transportation? Select: Car or motorcycle or bicycle or public transport, other. 2. Do the vehicles of the J.M. Romo factory have a parking lot? 3. Do the factory vehicles park on the streets of the neighbourhood? 4. Did you have to build a garage due to the amount of vehicles parked on the street? 5. Have you ever been disturbed by the noise made by the factory vehicles? 6. Do you think the factory increase traffic in the neighbourhood? 7. Do you think the vehicles of the factory are a risk to pedestrians? 8. Do you feel safe walking on the streets close to the factory? 9. Do you consider the streets in the neighbourhood are suitable for the transportation of goods of the factory? 10. Do you consider that factory vehicles increase the risk of accidents? 11. Do you consider public transport is good enough around the factory? 12. Have you had any difficulty moving from one street to another due to the cargo vehicles of the factory? 13. Do you think bicycles or other modes of non-polluting transportation are a good option to move around the neighbourhood? 14. Do you think the streets in the neighbourhood are well designed for cycling? 15. Do you think the factory is valuable to the neighbourhood? Why? 16. Has the factory grown in recent years occupying more blocks in the neighbourhood? 17. Can you (and your family) enter with no restriction to the theme park development? 18. At some point the factory has shown interest in acquiring your property?

The questions asked about social benefits were: 1. Are you an employee of the J.M. Romo factory? 2. Do you consider the factory has taken actions to benefit the neighbourhood? 3. Has the factory supported you to purchase a house? 4. Do you have employment benefits according to labour laws and regulations? 5. Do you consider the factory is concerned about your physical, mental and economic well-being? 6. Does the factory often teach you the skills for the job? 7. Has the factory ever provided you proper equipment and tools needed to carry out the work? 8. Does the factory encourage you to improve your job through bonuses or



awards? 9. Has the factory provided education support for your wife and children? 10. Do you think the factory solve in a good manner the employer–employees’ conflicts? 11. Does the factory have dining services? 12. Does the factory have a transportation service? 13. Do they give you access to the recreation facilities in the theme park? 14. Does the factory have sports facilities for workers? 15. Does the factory provide benefits, such as food and groceries for employees, or free gasoline vouchers? 16. Does the factory provide you additional benefits such as life insurance or accident insurance? 17. Do you think the factory enhance your life quality?

4 RESULTS AND DISCUSSION

Based upon the results of the two surveys I identified that the results were opposite. This means that most of the people inquired about mobility accepted they were uncomfortable with the location of the factory inside the historic neighbourhood. But the survey about the social benefits of the factory to the workers demonstrated a general acceptance of the factory in the neighbourhood. The groups of ages of inquired people are shown in Fig. 1.

Young people (between 20 and 29) were more willing to answer the questions of the survey. Also retired people attended properly the inquirers. In order to examine the nature of the mobility problem inside the neighbourhood: El Encino, it became convenient for the research to know if the factory workers preferred to park on the streets or in the factory parking lot. 46% of the inquired people (Fig. 2) mentioned the workers preferred to park on the streets, causing a problem of street parking in the neighbourhood. This situation motivated some of the inhabitants to build a garage, altering their houses and their facades. As a result, the image of the cultural heritage site changed too. Furthermore, excessive use of cars in residential areas produces air pollution and modifies the inherent features of residential landscapes, especially in quarters without green areas.

In general, the results of the mobility survey showed the expansion of the factory that modified the urban landscape and the way people lived in the neighbourhood (Fig. 3). But also, it shows the factory decided to stop buying houses around to tear them down.

Examining the results of the mobility survey somehow it can be inferred the people who live around the factory are uncomfortable with it. During the second half of the 20th century there was a loss of the historic buildings that were bought by the factory –and then they were torn down. During this expansion of the factory the people faced the disadvantage and decided to stop selling their homes to the factory. El Encino became a resilient neighbourhood during the decade of the 1990s.

Recently the factory decided to build new facilities in Jesús María, away from the historic centre. But the factory in El Encino continues functioning regularly. So, the urban resilience in El Encino continues too. The clue to preserve the site is the inclusion of friendly urban

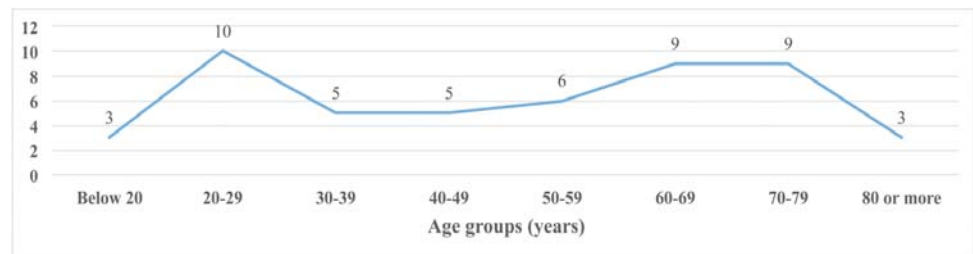


Figure 1: Mobility survey. Groups of ages of respondents. (Source: Acosta & Esparza, 2017.)



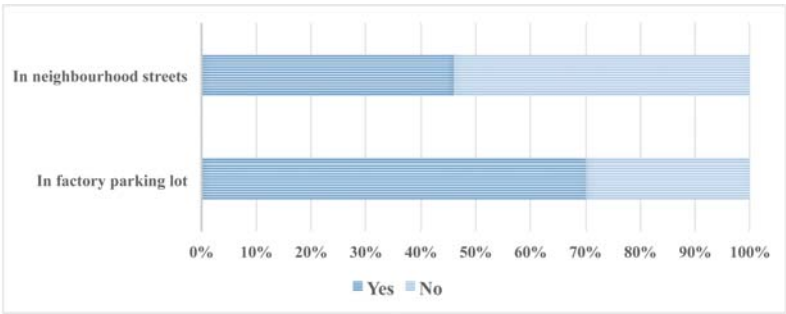


Figure 2: According to the mobility survey, 46% of the inquired people mentioned the employees of the factory parked in neighbourhood streets. Also, when people were inquired if the factory had a parking lot for employees, 70% answered affirmatively. (Source: Acosta & Esparza, 2017.)

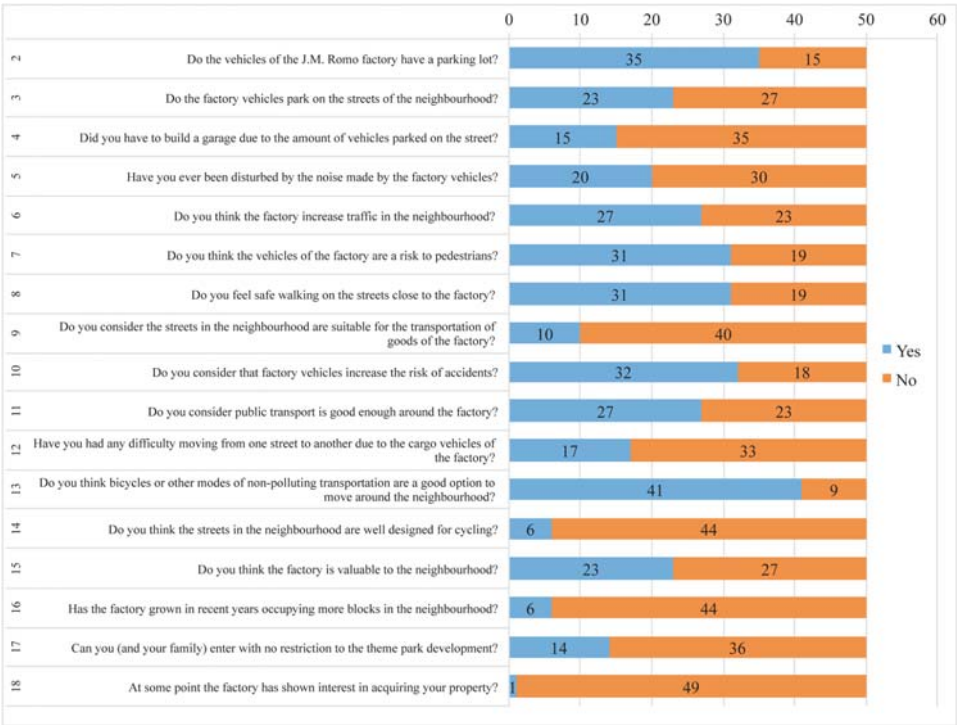


Figure 3: A global result of the mobility survey demonstrates the factory next-door neighbours are uncomfortable with the factory inside the neighbourhood. (Source: Acosta & Rodríguez Valdez, 2017.)

renovations in the city planning, in order to make the place a quieter place to live in, decreasing the context of vulnerability. Also, the main church, the square, the museum and the historic urban landscape should keep as a magnet for tourists and a cultural core for the neighbourhood.

The loss of historic architecture not only occurred in El Encino neighbourhood, but in the whole historic centre. Recent local researches have demonstrated the loss of historic architecture was about 79% from the original buildings the old city used to have in 1885. Once the delegation of the National Institute of Anthropology and History (INAH) established its quarters in Aguascalientes in 1989 the local regulation about tearing down historic architecture began.

The survey about social benefits was focused basically in the opinion of the factory employees. In order to relate the results with the mobility survey first of all they were inquired where they lived and the way to get to work. I found out that most of them lived in el Encino neighbourhood or in San Fernando (Fig. 4). This last place is a quarter built by the factory, specially designed for the workers.

Filtering the research results of the social benefits survey, it can be observed there are aspects in common like: proper equipment and tools, job training, bonuses or awards, support for housing, employee benefits according to labour laws and education support for wife and children (Fig. 5). The workers in general had the same opinion about the support of the company to them and to their families.

The results of the survey about social benefits of the factory to its employees showed positive opinions about the employer (see Fig. 6). Some of the older workers mentioned the first owner of the factory was almost like a mentor to them. This because he always tried to help the workers, he built a residential area for them and promoted employee benefits. The best evaluated queries were those related to recreation facilities of the factory – like the theme park, including sports facilities, specially built for the workers and their families.

The lack of development regulations during the second half of the 20th century in the city allowed the construction of the company in the core of the traditional neighbourhood: El Encino.

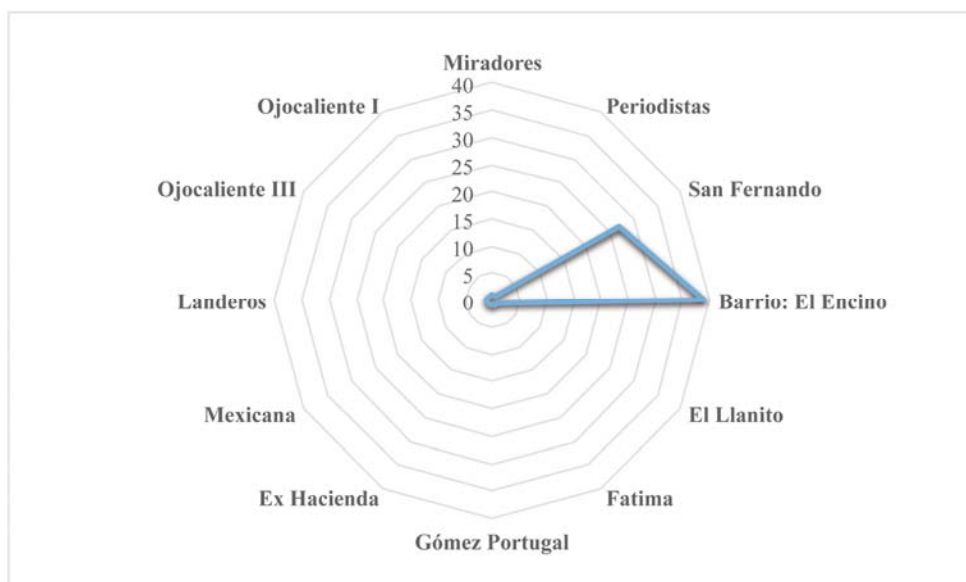


Figure 4: Most of the inquired workers in the social benefits survey lived in El Encino (39) and 37 lived in San Fernando, the residential area built by the factory for its workers. (Source: Acosta & Esparza, 2017.)

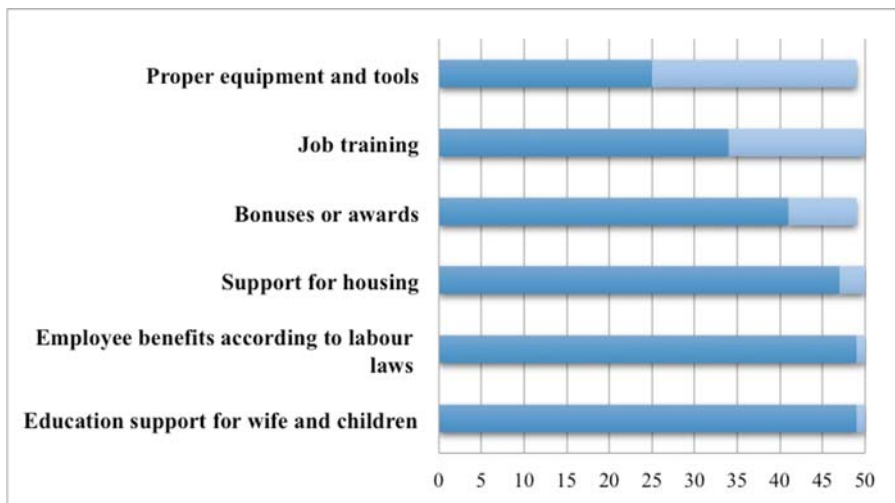


Figure 5: Employee benefits. Most of the inquired workers accepted the factory helped them with social benefits. (Source: Acosta & Esparza, 2017.)

There have been several city government administrators who tried to improve in land use planning, but the factory never gave up on moving somewhere else (including modern industrial parks). In the pursuit of a sustainable city it is necessary to promote healthy and functional neighbourhoods. This means residential neighbourhoods with a quiet nature. Inhabitants in El Encino weren't asked their opinion about the founding of the factory in the neighbourhood. Also, the delegation of the National Institute of Anthropology and History (INAH) didn't establish its agency until 1989, so there was no regulation of the factory heights. Heavy trucks have negative impacts in the residential area, including noise, pollution and vibration of the houses. In fact, when answering the queries, a person mentioned the machines they used in the factory would vibrate his house.

The image of the neighbourhood changed dramatically with the arriving of the factory facilities and especially with the theme park. The historic buildings and the permanence of the identity juxtaposed with the imaginary African culture symbols, American old west towns, medieval castles (see Figs 7 and 8), etc. So, the second half of the 20th century in the traditional neighbourhood was a period of change and permanence. Robert Ventury says: Las Vegas's greatest growth has been since World War II. There are noticeable changes every year: new hotels and signs as well as neon-embossed parking structures replacing on-lot parking on and behind Fremont Street. Like the agglomeration of chapels in a Roman church and the stylistic sequence of piers in a Gothic cathedral, the Golden Nugget casino has evolved over 30 years from a building with a sign on it to a totally sign-covered building [2]. So, urban architecture is always changing in not regulated sites. During the last decades, the government has been restoring a few historic buildings in the neighbourhood and included a contemporary building next to the old convent of the church and the J. Guadalupe Posada Museum (see Fig. 8). This Museum preserves Posada's famous printings. They remodelled a street around El Encino church and became fully pedestrian.

Also, they painted facades of historic houses and installed sculptures. Somehow the regeneration works have recovered the historic site and the main square became more pedestrian friendly. The community also has supported the painting restoration works inside

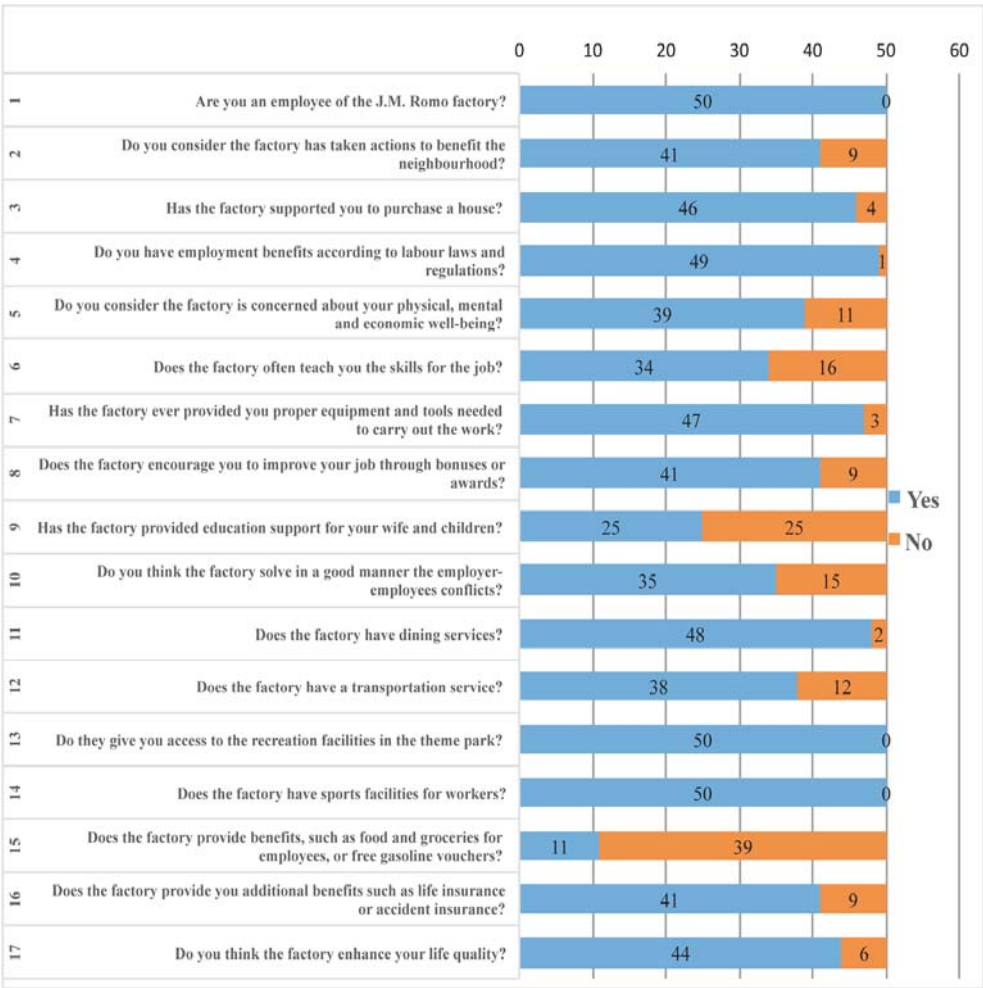


Figure 6: A global result of the social benefits survey demonstrated that employees agreed with the location of the factory in the neighbourhood. (Source: Acosta & Rodríguez Valdez, 2017.)

El Encino church and helped enabling access steps at the entrances of the church, including ramps for people with disabilities and older people.

The narrow streets of the neighbourhood don't allow too much room for new cycling routes, so there's still a lot to do in urban preservation activities. Miguel Ruano says sustainable urban development should focus primarily on restoring degraded sites rather than urbanizing precious and increasingly scarce natural or agriculture areas. Urban planners and designers are more often than not confronted with complex existing urban conditions, frequently in a state of decay, which public and/or private bodies seek to redress. 'Urban renewal', 'redevelopment' and even the vilified 'gentrification' are some of the more frequent approaches in such cases [3].



Figure 7: Incompatible land uses cause mobility problems in the traditional neighbourhood: El Encino. (Photo: Rodríguez Torres, 2017.)



Figure 8: The new hall of the Guadalupe Posada Museum accentuated the street corner. (Photo: Rodríguez Torres, 2017.)

5 CONCLUSIONS

Even though the results of the social benefits survey for the company workers were positive the progress in the neighbourhood was not that evident, but in a few houses and the same factory facilities. So, the pursuit of real progress to workers is not an ideal for the company. But it's interested in helping the workers with basic needs, and in recreational opportunities.



It surprises to know all the workers of the factory don't join a union. The causes were not identified in the surveys.

Why the neighbourhood: El Encino should be preserved? Even though the factory is in the core of this historic quarter, there are enough historic buildings to preserve. Philip Wilkinson says: Buildings from the past play a special role in the identity and pride of an area. Restore an old building, repair its broken roof or its cracked walls, or replace its peeling decoration, and you can give an immense uplift to a neighbourhood. First and fore, this uplift is psychological – people feel better about their area if the most important buildings are cared for and can be shown off to admiring visitors [4].

The problem of mobility in the neighbourhood produced by the factory requires consideration in the city planning. A hierarchy design of transit could reduce inner neighbourhood deterioration. Guy Battle and Christopher McCarthy mention: The key to a sustainable transportation system is the implementation of a transport hierarchy which gives priority to the pedestrian and public systems above the car. This does not necessarily imply positive discrimination against the private car: successful implementation of such a hierarchy can be achieved by merely creating an environment which does not cater for the car. This can be accomplished by limited parking spaces, traffic calming, cheap mass transit and by establishing a network of roads unsuitable for vehicular traffic: pedestrian, cycle based; mass transit (public); car. The hierarchy chosen will dictate which modes have 'design' priority over others [5]. So, these types of hierarchy could reduce nuisances in the neighbourhood.

Cultural heritage sites cannot be overlooked in the inclusion of sustainable development policies. The decline of cultural identity causes the social aspect to lose dynamism against the economics and breaks the balance in the sustainable development basic triangle model, thus the environment and society should not be subjected to the economy.

The problem is to find new ways to slow down and stop the decay of the quality of life of society; however, this action requires time. Sustainable development should not be managed in terms of what it implies, but in terms of its effective implementation. So adequate city zoning conserves land for appropriate uses.



Figure 9: The theme park offers recreational opportunities for the workers of the company. (Photo: Rodríguez Torres, 2017.)

Urban heritage needs a city planning strategy to protect valuable landmarks, without denying the historical time that is often changing and entering into a dialectic process that overcomes this encounter between inherent antagonisms of urban evolution, surpassing the limited role of the historical-cultural activities, such as the J. Gpe. Posada Museum. This perspective offers a possibility of preservation of monuments and cultural identity considering that the extinction of historical centres cannot be part of the evolution of cities.

It's useful to read the history in building (architecture itself contains history) that tells us what's happening in the city at certain moment of time – including social problems – in order to propose innovative, relevant and applicable urban designs with alternatives for the revaluation of urban heritage.

Perhaps it is time to consider most of the city as an urban heritage and not only the old significant areas. Even though the theme park of the JM Romo factory it's a new complex, according to the social acceptance demonstrated in the surveys applied in the writing of this paper, it could be considered as part of the local and regional identity.

In Aguascalientes there are buildings that should be considered as good architecture. Also, there are engineering works such as bridges, infrastructure and industrial buildings that can contribute to the current cultural integration. Maybe we need new ways to analyse the city because multiple aspects are part of the whole system. The streets, buildings, landmarks – even the infrastructure, are part of a social heritage and it's up to the governments and citizens to take care of them. From this particular standpoint it would be more affordable to have sustainable environments.

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URBAN PROBLEMATIC OF CULTURAL MANAGEMENT IN HISTORICAL FRAGMENTS IN ISTANBUL: A CASE STUDY IN FENER-BALAT AND SÜLEYMANIYE

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ABSTRACT

The aim of this study is to scrutinize cultural management in terms of control, regulations and sociocultural dynamics in the projects of urban transformation/gentrification including the historical and cultural areas in İstanbul. To analyze the cultural politics of urban transformation, along with the socio-spatial impacts of the process of gentrification, Süleymaniye and Fener-Balat have been chosen as two districts that were included in the World Heritage List due to the historical-cultural patterns they display. Evidently, the social ethos, created through Neo-Ottomanist approaches in urban renewal processes, is unregulated. Thus, it is necessary to examine the apparatuses of power in the matter of sustaining the representations of historical and cultural identity, which make up collective memory in terms of identity and space construction. It is assumed that the dynamics of urban transformation have also been transforming collective consciousness based on historicity. In this context, concepts such as urban alienation, mental unmappability, the emptying of minds and cultural uprooting, have enriched the theoretical construction of the study in analyzing the management of collective memory that is intricately tied to the process of global urbanization. With the institutionalization of centralized politics, we are witnessing the instrumentalization of urban space and the placement of urban transformation on a strictly market-based trajectory with no room for an alternative path. Moreover, the relationship between symbolic capital and collective memory as the basis of cultural heritage seems to have been ruptured. Ultimately, what is at risk is the ideal of a human-centered, democratic community, encompassing contrapuntal ensembles (different narratives based on historicity that could only be interpreted via each other and make sense related with each other in their own cultural representations/specifications) and polyphonic cultural constituents. Along with the paradigm of neoliberal urbanization came the new phenomenon of urban space design, mediatization of culture and collective memory. Expressed in the language of consumption, designed to fit packaged socio-spatial practices and emotions, it is argued that we now entered a post-emotional socialization stage.

Keywords: urban transformation, gentrification, cultural management, collective memory, post-emotionalism.

1 INTRODUCTION

This study's main point of departure is the contention that urban transformation is a highly complex process that goes beyond the realms of urban planning, architecture, landscape architecture, and civil engineering. Rather, it is intricately and increasingly linked to the political, economic, social, historical, and cultural contexts. The initial, unrefined questions that led to this research, therefore, are how urban transformation in Turkey is planned and carried out, and how it affects the residents of the transformed neighbourhoods as the major stakeholders of the process. Specifically, considering the complex demographic structure of the historical neighbourhoods in İstanbul, it is presumed that the polyphonic communities in such neighbourhoods undergo a number of dramatic changes throughout the urban renewal and gentrification processes. Thus, how these changes are perceived by and what they mean to these communities and various other stakeholders of the urban transformation process (such as architects, state officials, and representatives of NGOs working in related fields), in general, and what these changes imply for cultural heritage, identity, and collective memory of the city, in particular, is the research question of this study. To facilitate a fuller



understanding of both the phenomenon, the context, and the political, economic–social, and cultural implications of urban transformation in Istanbul, Süleymaniye and Fener-Balat are chosen as the two cases to be explored in this study since it was anticipated that these neighbourhoods would reveal the relations between cultural policies and public sphere in various ways.

Süleymaniye was declared a SİT area (protected area) in 1977 and was included in World Heritage List by UNESCO in 2006. This intensely historical area makes the dynamics of urban transformation clearly visible in the aspects of the cultural management and the impacts of renewals over the residents. At present, the neighbourhood is being transformed into something ‘re-historicised’ with a kind of neo-identity.

On the other hand, the Rehabilitation Project performed in Fener-Balat in the aftermath of the 1996 Habitat Conference by the support of European Commission and UNESCO is considered to be a significant case in urban planning despite the inadequacies and the political controversies it caused. This piloting performance particularly suggests an alternative to decreasing the house sales through pre-set regulations such as gifting. Clearly, it would rehabilitate the quality of life for the local people and the initiatives that preserve and sustain the historic-cultural identity of the urbanscape, instead of the rapid take-overs through enacted renewals in the *mahalles* (small-scale neighbourhood) such as Süleymaniye, Sulukule and Tarlabası. The reasons as to why such urban renewals initially performed in Fener-Balat as the prominent ones are not taken into consideration in today’s urban interventions are analyzed in this study.

2 METHODOLOGY

Analyzing how the “gentrifying” actors and the residents who are undergoing gentrification are positioned in the historical neighbourhoods, fieldwork for this study was carried out using direct observation, participant observation, and in-depth interviews as the data collection methods. Study participants have been asked open-ended questions. The instrumental case study design was followed for the study employing empirical approach and reflexive method. To analyze the cultural politics of urban transformation, along with the socio-spatial impacts of the process of gentrification, Süleymaniye and Fener-Balat have been chosen as two districts that were included in World Heritage List due to the historical-cultural patterns they display.

Interview data for this study were collected between April 2012 and January 2013. Throughout my fieldwork, I had 22 interviewees in Fener-Balat and Süleymaniye, 14 of whom are the residents and/or shop owners of the *mahalle* and 8 of whom are the authorities. At the beginning of my fieldwork, I had informal conversations in the areas while strolling and observing around and I met my contact people. Then, I adopted the snowball method to gather the necessary data in Fener-Balat and Süleymaniye. I also interviewed particular authorities, setting appointments with them. Dr. Halil Onur, Architect and the Head of Field Management of İstanbul’s Protected Areas, as well as the Head of KUDEB (Conservation Implementation and Control Bureau) was one of my interviewees. Dr. Halil Onur is a key figure in urban transformation in İstanbul. Onur not only leads the renewal projects but also makes architectural plans.

3 CONCLUSION

3.1 Globalization, culture and urbanization

Cultural management through urban transformation and gentrification in the historical areas is significant because the process of ‘gentrification’ indicates some kind of restructuring of



collective cultural references in social life. Besides, urban spaces have been replacing the states in their role of constructing social identities [1]. This fact clearly points out a renaissance, signifying neoliberal urbanization.

The social class has been reformed through the trajectories of neoliberal economy models, as globalization defines individuals by the way they consume, not produce, which results in the middle class being demoted to a lower class. Therefore, the gap between the lower and upper class has increased [2]. According to Hernandez and Marti [3], cultural homogenization and heterogenization manifest, having diversities in different global realms, differential characteristics of “deterritorialization” in contemporary cultural globalization.

Social space occupied by hegemonic relations, class clashes, class and culture shifts suggest some kind of urbanscape required to be read accordingly. As Deleuze and Guattari conceptualize, deterritorialization is one of the main issues subject to the process. Deterritorialization, considered a central feature of globalization, implies the growing presence of social forms of contact and involvement which go beyond the limits of a specific territory. Mediatization works as a preferential source of deterritorialization, while becoming a catalyst of other sources of deterritorialization (migrations, tourism, vast shopping centres, and economical transformations). Paradoxically, deterritorialization also includes reterritorialized manifestations [3].

As shown by Baudrillard, in a consumer society, identities are more precious than people [4]. People consume those images, ideals, fantasies hidden behind commodities rather than commodities themselves. Undoubtedly, urban space has become commodity, a kind of “fantasmagoria” [5] and new social ethos, then constructing new identities has been the drive of today’s urbanization. For this reason, the process of urban transformation, which also includes interventions that historical-cultural entities undergo, encompasses transformation of collective memory.

Rather, reconstruction of narcissism or the aspiration for nostalgia points out the concept of “simulacra” as Baudrillard terms [4]. The term simply depicts the copies of the things that had no reality to begin with, or that no longer have an original. The notion of circle of life containing life-and-death, which also indicates what Baudrillard conceptualizes as the order of symbolic exchange, vanished in modern society owing to the capitalist order [4]. Hence, narcissism has become a proliferous fact that is commercialized as meta by consumer society just like the aspiration for nostalgia [6].

In every aspect, cities, which are taken under control, ripped and destroyed in terms of socialization like argued above, are now the spaces of decentralised production via signs, means of communication and code [4]. Yet, the system cannot abdicate the urban structure as the space of reproduction. It is because a central code means power. At this point, Baudrillard introduces a striking parallelism between urbanisation and economy: “City offers a vertical and horizontal expansion just like economy...” (translated by the author from [4]). Apart from the issue argued above, as the controlling strategy of code, the main pattern of urban space does no longer consist of labour of force, but procedural signs, which do indicate every phase of urban reproduction and retransformation in an inextricable way. Deleuze and Guattari’s definition of the term deterritorialization is used and defined in a specific way. When referring to culture, anthropologists use the term deterritorialized to refer to weakening of ties between culture and place. This means the removal of cultural subjects and objects from a certain location in space and time. It implies that certain cultural aspects tend to transcend specific territorial boundaries in a world that consists of things fundamentally in motion.

Although this refers to culture changing, it does not mean that culture is looked at as an evolving process with no anchors. Also, often when one culture is changing, it is because



another is being reinserted into different culture. At that moment, the deterritorializing process begins as the local culture is enveloped by the global community. Here, deterritorialization and reterritorialization are seamlessly conjoined; reterritorialization occurring immediately after, as the local community becomes a part of the global culture. This relates to the idea of a globalization of culture [7].

However, the deterritorialization of localized cultural experiences does not indicate an impoverishment of cultural interaction, but a transformation produced by the impact of the growing cultural transnational ties on the local realm. The relations amid our environment and our cultural activities, experiences and identities are transformed by globalization. Therefore, it suggests that it is jeopardising collective memory in a multi-cultural human geography and a historical urban space as in İstanbul rather than helping it to sustain, so there will no longer be the texture of “contrapuntal ensembles” in the global space, but possibly the transformed space and memories.

Frisby also introduces the mechanism in urban space where “traces of the memories have systematically been deleted” by means of instant-spatial inferences and transformations disabling us to experience the past and the present of metropolises, that is, as a result of the problem of emptying memories [8]. It can be predicated on today’s urban interventions that the “chronotope” (integrated space-time in social flowing) of İstanbul, with the term Bakhtin introduces [9], and the ‘language’ coming to life through this chronotope will not only negate the logic of globalization, but also imply only the dystopia of that.

3.2 Legal perspectives and international regulations on capital

The concept of gentrification is also to be defined by the relation between the mediation of finance capital in the city and the social impact that the agents of cultural capital cause. Cultural possessions have now been commodified being transformed into symbolic capital through various historical narrations or “cultural capital” in Bourdieu’s terminology, in creating “the global city” [10].

On the protection through renewal and the sustainable use of derelict historical and cultural immoveables, the law 5366 is questioned with respect to the ‘real’ definition of ‘derelict’ and feasibility in the zone. Residents are compelled to leave their places as a requirement of expropriation, which, in turn, is rooted in the fact that housing is still mediated as an instrument of speculation.

By the 1980s, under the influence of global political tendencies, İstanbul has been transformed into “a huge physical and cultural construction site” as a part of the global landscape [6]. The history, the geopolitical and the cultural values of the city have been used and/or abused by the governments and the bourgeoisie and the elite to gain a significant status in the world economy by maintaining the global urban project [11]. This was undoubtedly the case because global capital has shifted to metropolises, and urban space and the sectors related to urban practices also gave rise to cultural industries [10]. The actors who did not prefer to lead their lives on the peripheries of the city or did not have the chance to move thereabouts rejected the complications of the period. Then they started to buy those buildings, most of which are from the 19th century. This was taken into consideration with the urban renewal movement in the city and called gentrification [6].

Migration is another factor that played a significant role in the process of gentrification in İstanbul. Districts such as Cihangir, Kuzguncuk and Balat are regarded as the areas that were mostly inhabited by the Roums, the Armenians and the Jews, who left or were obliged to leave their *mahalles* and migrated.



3.3 Residents perspective on what legal and socio-cultural practices

Connerton defined the term, “social memory”, as “our experiences relating present depend on the knowledge of past to a great extent and the images of past function to institutionalize present social order commonly. We position the behaviours of actors through the references to their places in the actors’ lifestories and position them according to their places within the history of that social environment” [12]. Connerton also puts forward the idea that individuals reproduce identity through these intricate narratives. Just like Halbwachs states, “Not only collective memory depends on social frames, the memories of individuals are also supported and defined by them” [12].

İstanbul, to Perouse [13], considered as a “world brand” by the empowered actors in a centralized status is being transformed into a stereotype object of tourism and a commodity instead of its urban spaces being preserved in their local patterns and their own characteristics (case in point: İstanbul being promoted as the Cultural Capital of Europe in 2010). In other words, ignoring the historical disposition of the city, a Disneyesque İstanbul is being produced.

We are witnessing the instrumentalization of urban space and the placement of urban transformation on a strictly market-based practice. Centralized politics are institutionalized. At this juncture, centralization of settlement projects and the recently founded ministry (Ministry of Environment and Urbanization), signifies the empowerment of singular state administration. Nonetheless, current trends and developments in Europe, the Council of Europe released a table in 2000 showing broad trends in cultural heritage management. Firstly, for a definition of heritage, there should be a contextualized approach for individual sites and monuments as part of a larger whole which should essentially be taken into account for sustainability. Further, changeable management practices breed the understanding of heritage resource management as “the management of change” (6).

What stands out is that the cultural resistance and collective identity in Fener-Balat seem to be much more vivid than in Süleymaniye. For instance; Fener-Balat-Ayvansaray Derneği (FEBAYDER) as a Non-Governmental Organization (NGO) has strongly been protesting against gentrification and renewal projects, resulting in the court case won in 2013. Strikingly, there has been a distinctive aspiration and hope on the part of the residents for their Roum neighbours to come back and enjoy all the *bayrams* (national or religious fests) happily together again after the restorations implemented by UNESCO, which reminds us of the concept, “contrapuntal ensembles” borrowing from Said. Yet, some *mahalleli* think of leaving their places because they feel frustrated by the urban changes imposed by obscure and oppressive state tactics, and the corruption. In addition to that, a cafe owner in Fener reveals the impacts of post-emotional responses, Americanization, cultural homogenization as part of cultural deterritorialization and urban alienation with her brief expression: “We have lost our culture. The later westernization comes, the better the place is preserved. Some people doing research or something in this *mahalle* treat the people in the streets as circus animals. That’s it.”

...The number of firm houses that are burnt has been on the increase since the renewals started and it is not only historical houses, but also large and firm buildings where a lot of people had worked together were demolished in order to be renewed...

We were invited to Eminönü Municipality. We were given information that the historical houses should be restored according to the plan given by them or sold to them. If no, there would be expropriation. I suggested that they should come and talk to the *mahalleli* (local



people living in the same neighbourhood). It wasn't something persuasive to us. There is no contact with the authorities. Some old *mahalleli* families from different cities had to leave their own *mahalle* holding their arms around me, weeping and saying, "I want to die here" while leaving..." [14].

Tarihi Süleymaniye Kurufasulyecisi (No. 25), Gazanfer explained "We become aware of the things only after works in renewal areas". Gazanfer also said he was so tired and sick of this restless waiting to be displaced sooner or later that he wanted to go somewhere just plain and peaceful, dramatically in a similar frustrated tone as Reşit Sarı, the owner of Tarihi Haliç İşkembecisi:

I have had enough of these uncertainties, I want to leave my hometown for Kazdağları or somewhere just to have peace of mind because I don't want to deal with these things in my mahalle anymore. So, I am selling my cafe, too, now. I was grown up with the Roum, we would go kiss hands and they would, too, during bayrams. No one feels safe and happy in Fener-Balat now. They give us too much stress even when there is a small usual problem like work license or something. For instance, my next-door friend had a problem with the officials from the municipality. Very soon, from Ministry of Finance to Ministry of Health, all the officials arrived there for a point check.

The process of gentrification in İstanbul has mainly been performed by means of ephemeral and instant spatial interventions as seen in Süleymaniye unlike the restoration / renewal works that suggest a preservation-based, integrated and sustainable project initiated by UNESCO in Fener and Balat. It is because, in a district like Süleymaniye, the old Ottoman Houses have been reimbued and reproduced with fully new interior decor and the architectural details apart from the facades which have been relatively preserved by retouches. Additionally, the *mahalleli* have had the experience of displacement, in other words, deterritorialization. The cultural pattern and the collective remembering peculiar to the culture of *mahalle* are enshrouded and deconstructed as well.

Süleymaniye Mosque and the complex of buildings adjacent to the mosque [külliye] built by Architect Sinan in the 16th century underwent inapt restorations and the acoustics was entirely damaged in 2012 [15]. On the other hand, "aesthetics of daily life" including the architectural style of the buildings, structures, as well as urban planning and designing was a public service for the Ottomans as Kafadar states.

According to 2012 UNESCO Report, there has been inadequate politics of tourism regarding integrity of the entity, main points of the outlook, and conservation of the silhouette for the Historic Peninsula. It was also stated that the fact reveals vague urban politics in the *mahalles*. Further, it was issued that there has been an uncontrollable expansion in the zone, but no management plan for the World Heritage as well as coordination among the national, local and administrative body [16].

Criticising the outcomes of 2008 and 2009 restorations briefly in the area, it was negatively reported by World Heritage Committee in 2013 that Süleymaniye in the protected zone could not be preserved following the renewals, also stating that it causes serious worries and most of the historic houses bought by a company did collapse (many houses burned down) and they were not restored. The ongoing restorations did not only offer a participation-basis performance but also many historic houses were not registered. Neither were the relieves and the structures. "The Mission concludes that despite much excellent repair and restoration of individual buildings and groups of buildings, the extent of deterioration, decay and demolition of İstanbul's Ottoman vernacular heritage is approaching crisis point. Formal Renewal areas as currently interpreted and implemented appear to be adding to the problem



rather than facilitating a solution. Significant adverse impact on the Outstanding Universal Value has already been caused by the redevelopment of Sulukule and demolition in Ayvansaray" [17].

Urban renewals meant 'displacement' in general sense in Turkey and historic structures as in *mahalles* should be preserved and sustained rather than decentralising work places and constructions according to the UNESCO Report [18].

Apart from the argument above, the discourse constructed in the media advertisements for the newly rising living arrangements is elaborated by indicating the new "gated communities", in other words, "impacted ghettos" through the definitions, such as "elite and prestigious" lives. Rather, in this post-emotional realm, the language used refers to the newly "promised holy land" and the standardized social practices with the standardized emotions "packaged" beside them. In constructing the policies of identity and space, the language itself has become the oppressive form of cultural praxis.

The new perspective that I would attach to the back of Riesman's insight is this: The language-as-consumer-good is no longer primarily the carrier of rationally intended meanings, but now carries standardized emotions as well [21].

Moving from the point here, the fact of today's Kafkaesque alienation might be considered, more intensely in urbanscape rather than collective sensations. The notion underlied here also brings to mind the Disneyesque lifestyles in terms of standardizing/controlling both collective and individual consciousness by ruling all forms of creative interpretation, which have drastic impacts on socio-cultural capital and the ethos of it. Closely, supporting the theory of post-emotionalism, it is necessary to define what is genuine, which was inquired during the anti-cultural movement of 1960s by the public.

An architect, urban theorist and planner, Korhan Gümüş was interviewed due to his urban projects performed and his self-presentation as the 'interface' between public voice and the institutional bodies in designing urbanscape. As an outstanding urban renewal case, according to Gümüş, an industrial region, such as Ruhr, could even be transformed into a metropolis by means of a local organization. Besides, a huge environmental rehabilitation is included within this organization as well. Actually, this huge and long-term project is performed by a local organization bringing such actors together who have very different priorities. What is aimed in Ruhr, which had been the most prominent industrial centre of Europe some short time ago, is not only a rehabilitating or a preserving project for industrial heritage, but also urbanizing an industrial area through a different urban semantics. Urbanizing, therefore, raises the issues of working on integrated and complicated spaces, refunctioning them, developing new architectural projects, establishing urban plans and making the relevant decisions, performing sub structural investments and managing all unlike what TOKİ (social housing construction company in collaboration with the government) does by cooping people up in hen-house like places.

However, safeguarding the diverse European heritage requires mutual understanding, respect and recognition of the cultural values of others, particularly in relation to the cultural identities and heritage of minority and vulnerable groups and the consideration of the common interest in European heritage [23].

For Pamuk, İstanbul, as a lost imperial capital, but not a lost cultural one, is full of the symbols and images of longing [24]. Apparently, it is a city of longing because of its past. The title of his novel also, 'hüzün' (sadness and melancholy) is that longing for the city. Having such an entrenched sensation and the identification peculiar to town, the city clearly becomes the very profound image in collective memory for İstanbulians to some extent. In reality, the city, at present, appears to be having a metamorphosis and transforming



into a construction site, rather than a “cultural capital”, owing to the process of gentrification and the architectural proposals.

3.4 Perspective from developers when dealing with intervention programs (regeneration or renovation)

Speaking of cultural management in urban renewals and transformations, Eyüp Muhçu (Chairman of Chamber of Architects) suggests local organizations that Aesthetical Board is included in [25]. It is because local organizations are rather significant in the restructuring that has some identity. “Our opinions were not inquired about risky areas in terms of earthquake. Consultancy firms have been given the authority of project making and auditing, but not building inspection firms. In fact, companies can not own the copyright for designing. Public opinion is not taken into consideration. We proposed a report about the subject mentioned above. There is a complication of authority in the aspect of planning processes” [25]. Pointing out the structural problem at the basis of urban transformation, Muhçu asserts that coordination, guidance and legal substructure are to be established and public opinion is to be considered rather than a centralized structure to be imposed [26].

Very importantly, to Muhçu, the matter is the right of property may be deforced by means of the law item, 6306, related to urban transformation. In case of the transformation for a building, these rights may currently be transferred to the constructors through TOKİ and so on [26]. Anything could be done to cultural entities and the silhouette of Istanbul could be removed according to that law to his remarks. “Taksim as a symbolic square is being lost. I agree that cultural entities can be nuisances in a way, but they could be restored and sustained according to today’s needs. I can say that there is this problem of legal organization. For instance; preservation board has neither enough permanent staff nor time to perform registrations. They do not own the necessary equipment as well” [25].

Muhçu emphasizes the fact that bureaucracy decreases the possibilities for registered historic buildings to be restored by the owners. On the contrary, to Muhçu, governmental bodies should provide leasing or feasible credits of which the payback will have no interest for 10 years or a lower amount of interest for 20 years, or the necessary equipment which has some certain discount price in it. “We had attempted to provide timber for registered cultural entities on 50% discount price via the ministries fifteen years ago, because it can be done. One can get the timber for a registered historic building to be restored in 15 days after applying for it. We completed legal arrangements related to the issue, but bureaucracy makes the things too hard to cope with” [25].

To Muhçu, depending on their significance, public and big scale projects are supposed to be performed after competition. Participation of relevant actors and community should absolutely be considered during the process as well [27].

Participants are obliged to act according to the competition regulations of the Chamber of Architects and the principles that International Union of Architects notifies. Whereas, Onur claims the issue of urbanization is under the control of the relevant governmental bodies [27].

“New urbanization is a must for UNESCO and SİT areas have been legalized for the first time for renewals (2004), which is included in Management Plan of Renewal Areas. It is also under our control to manipulate the item 5366 as it is a “lancet” and it is the fact that it offers not only opportunities, but also threats in urban transformation. There have been negative criticisms by academicians etc. and socio-economic impacts. There used to be no legal interventions before, but at present we can intervene and we have the chance to protect the building. Renewal Law enables us to adopt an ‘integrated/holistic’ approach. At present, 40–50-year disproportional growth has come to an end in the neighbourhoods. We can now



control the illegal income that *mahalleli* make by their property. Surely, they don't want to quit it, they don't want rental loss. Yet, let's say, a group of single people live thereabouts in very bad conditions. Headship has also a "go-between" mission. *Mahalleli* tend to be conciliatory in general, though. We can say 5366 has become a "milat" (the birth date of Christ)" [28].

It was strikingly proved that two First Drafts were performed in the same place and these kinds of interventions have constantly been seen around the urban transformation [29]. Fener-Balat-Ayvansaray Derneği (FEBAYDER) as a Non-Governmental Organization (NGO) has strongly been protesting against gentrification and renewal projects resulting in the court case won though.

The director of the French Institute of Anatolian Research (IFEA), Nora Şeni calls the whole formal discourse "langue de bois", like being taken for a ride [30]. Similarly, an official in Head Office of Foundation, Samet Ünal states that "Gentrification and the changes in urban space are "political issues" and Tarlabası is a fine example. The entire zone was issued to Çalık Holding. Those historical wooden houses are burned down by arson by their owners because they lack finances to deal with the building. There is such a gap between official bodies and volunteer people who could take the sponsorship for restorations and it could be reformed concerning with the relevant legal items".

A brief look at the present local architecture in town makes it clear to see that it can be absurdly cool and cybernetic to experience gentrification like that proposed in the Project of Haliç Metroway Construction by the architect, Hakan Kıran. It was already designed with its metal suspenses and the body that has no relevance with the visual integrity of this historical town as Prof. Cemal Kafadar strongly emphasized [31]. Also, he brings up the construction of the historical Taksim Topçu Kışlası (Taksim Military Barracks or Halil Pasha Artillery Barracks) criticizing the inappropriate architectural details in terms of the integrity again. Rather, he significantly reminds that subtle understanding in city planning during the Ottoman Period saying, "The aesthetics of daily life was a public service for the Ottomans" [31]. To conclude, it can undoubtedly be claimed that the urban interventions applied in the city today might imply only the dystopia of Ottoman urban politics.

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HISTORIC MASONRY MONITORING BY MOTION MAGNIFICATION ANALYSIS

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ABSTRACT

Vibration monitoring of historic structures in urban environment is a relevant issue for health survey and early damaging detection in sustainable and enhanced resilient cities. This study explores the potentialities of vibration monitoring by Motion Magnification Analysis. Motion magnification acts like a microscope for motion in video sequences, but affecting only some groups of pixels. The motion magnification uses the spatial resolution of the video-camera to extract physical properties from images to make inferences about the dynamical behaviour of the object, e.g. to visualize at least the first mode shape, no matter its dimensions, since any point on the surface of the object can be considered a virtual sensor. Recently, a number of experiments conducted on simple geometries like rods and other small objects, as well as on bridges, showed the reliability of this methodology compared to accelerometers and lasers. Researchers have been also very interested in assessing the method's feasibility, since conventional devices are surely more precise, but more expensive and much less practical. In this paper, we give an introduction to MMA and describe its application to the analysis of two full-scale historic masonry walls tested on shaking tables. This is an interesting point, because the size of tested walls is larger than usual small experimental set-ups implemented in MMA testbed until now. Results showed that MMA allowed a visual identification of fractures in advance. Moreover, we performed some conventional calculation for modal analysis of the walls, such as FRF and PSD, on MMA output data. Though the used equipment (camera, tripod and lighting) was of low quality, in order to test the methodology in an unfavourable environment with very high data noise, the estimate of the first modal frequency showed a good agreement with modal analysis by a more conventional optical system used as reference.

Keywords: monuments, monitoring, magnified motion, augmented motion.

1 INTRODUCTION

The historic masonry protection is a primary task in order to preserve monuments and the first step surely is to arrange a suitable monitoring. Besides the usual wear due to age, traffic, weather, we have also to face earthquakes as a major threat. Consequently, researchers are trying continuously to ameliorate the monitoring systems, hopefully in the sense of enlarging and extending their predictive capabilities. To support engineers, a variety of devices has been developed: capacitive sensors, contact accelerometers, optical sensors, lasers, global positioning systems, linear variable differential transformers and video cameras. Costs, dimensions (too small or too large), complexity of the associated electronics, energy requirements, specialized operators, are all disadvantages to be faced during measurement campaigns [1]–[3].

However, the most important problem is the number of devices needed to saturate the surface of the structure to be analysed, at least in some cases. To overcome this issue, optical tools named “motion capture” are available today. Working in the infrared range, these motion capture systems are able to measure displacements of small reflecting markers positioned on the surface of the structure; in this case the motion capture control may run up to hundreds of markers [4], [5]. The 3DVision optical system described in [4], was the first of the kind used in a laboratory to measure displacements of structures stressed by a shaking table, with good results. Clearly, in the outdoor environment things change, since boundary conditions are not manageable anymore, false reflections increase too much, and, of course,



the dimension of the structure simply can be too large to be included in the optical range of the motion capture cameras. Given these circumstances, we propose to resort to a new methodology called the motion magnification analysis (MMA) [6].

The analysis of image sequences in the field of civil engineering is not new. For many years attempts to produce qualitative (visual) and even quantitative analysis using high quality videos of large structures have been conducted, but with poor results. This was because of the resolution in terms of pixels, of the noise, of the camera frame rate, computer time and finally because of the lack of appropriate algorithms able to deal with the extremely small motions related to building displacements.

These and other limitations have restricted the applications of digital vision methodologies to just a few cases. Nevertheless, recently important advances have been obtained by Freeman and collaborators of the Massachusetts Institute of Technology (MIT) [2]. Their algorithms, named motion magnification, seems able to act like a microscope for motion and, more importantly, in a reasonably short computer time. The latter point is crucial, as it is well known that video processing takes a lot of time and resources. Therefore, any viable approach must consider the reduction of the calculation time as an absolute priority.

The basic MMA version looks at intensity variations of each pixel and amplifies them, revealing small motions which are linearly related to intensity changes through a first order Taylor series. To validate this new methodology also in the field of building monitoring, we compare its performance with the 3DVision measurements, obtained during the tests of a stone masonry subjected to a very weak artificial earthquake.

The experiments were performed within the CoBra Project, funded by the Regione Lazio, a program to support important monuments from Lazio. The main objective of the Project CoBra is to develop and disseminate methods, technologies and advanced tools for the conservation of the cultural heritage. The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) leads the project with its laboratories and several working groups.

2 THE EULERIAN MAGNIFIED MOTION ALGORITHM

Since our intention is only to give a general idea of the potentiality of the motion magnification we will not enter into the full formal description of the algorithms.

Videos are made up of a temporal sequence of 2D images, whose pixel intensity is $I(x, t)$. The 2D array of colour intensity is the spatial domain, while the time domain corresponds to the temporal sequence. Here, in order to describe the Eulerian version of the magnification algorithm, we consider only a 1D translating image with displacement $\delta(t)$. At the image-position x and video-time $t = 0$ it is: $I(x, 0) = f(x)$ (for the treatment of the general problem, see [2]). Translating for the quantity $\delta(t)$, we have:

$$I(x, t) = f(x - \delta(t)). \quad (1)$$

The final expression of the magnified motion by the constant α is defined as:

$$\Delta I = f(x - (1 + \alpha) \delta(t)). \quad (2)$$

Now, if the displacement $\delta(t)$ is small enough, it is possible to expand the relation (1) as the Taylor's first order series around x at the time t :

$$I(x, t) = f(x) - \delta(t) (\partial f / \partial x) + \varepsilon, \quad (3)$$



where ε is the error due to the Taylor's approximation. The intensity change at each pixel can be expressed as:

$$\Delta(x, t) = I(x, t) - I(x, 0) \quad (4)$$

that taking into account eqn. (3), becomes:

$$\Delta(x, t) = f(x) - \delta(t) (\partial f / \partial x) + \varepsilon - f(x) \quad (5)$$

and finally disregarding the error ε :

$$\Delta(x, t) \approx -\delta(t) (\partial f / \partial x) \quad (6)$$

meaning that the absolute pixel intensity variation Δ is proportional to the displacement and to the spatial gradient. Therefore, the pixel intensity can be written as follows:

$$I(x, t) \approx I(x, 0) + \Delta(x, t). \quad (7)$$

Magnifying the motion by a given constant α using eqns (3) and (4), simply means that pixel intensity $I(x, t)$ is replaced by the magnified pixel intensity $I_{\text{magn}}(x, t)$ according to the following:

$$I_{\text{magn}}(x, t) \approx I(x, 0) + \alpha \Delta(x, t) \approx f(x) - \delta(t) (\partial f / \partial x) - \alpha \delta(t) (\partial f / \partial x) + O(\varepsilon, \delta), \quad (8)$$

where $O(\varepsilon, \delta)$ is the remainder of the Taylor series. Then, the magnified intensity can be calculated as:

$$I_{\text{magn}}(x, t) \approx f(x) - (1 + \alpha) \delta(t) (\partial f / \partial x) \quad (9)$$

but eqn (9) is immediately derived from the first order Taylor's expansion of the exact magnified motion:

$$\Delta I = f(x) - (1 + \alpha) \delta(t) \quad (10)$$

and therefore:

$$f(x) - (1 + \alpha) \delta(t) \approx f(x) - (1 + \alpha) \delta(t) (\partial f / \partial x). \quad (11)$$

It is important to observe that (6) is obtained by a band-pass derivation, thus the process can be basically summarized as in Fig. 1. Therefore, we can say that to magnify the motion displacement it suffices to add $\alpha \Delta(x, t)$ to $I(x, t)$, as long as the Taylor's expansion (9) is valid, that is until its remainder $O(\varepsilon, \alpha)$ is small.

This limitation depends on the linear approach entailed in the Taylor's expansion, either if the initial expansion (3) or the amplification α are too large. In practice, to remain into the linearity bound, we need slowly changing images and small amplifications. Moreover, here we do not consider the noise of variance σ^2 to be added to the intensity, that is amplified too, resulting in an amplified noise variance $2\sigma^2\alpha^2$, thus the error to be evaluated should be $O(\varepsilon, \alpha, 2\sigma^2\alpha^2)$. Also, it should be noted that the calculation of $\Delta(x, t)$ implies the whole time span needed from frame 0 to the current frame at time t .



Figure 1: Temporal filtering applied to each pixel time history. Cut-off frequencies have to be chosen carefully in order to enclose the band of the phenomenon to be analysed and exclude other frequencies.

Therefore, if the video is a long-lasting one, the computational time may be a major problem. On the other hand, the Nyquist sampling theorem requires the frame rate of the video f_{fps} to be at least double than highest frequency of interest (f_{max}). In fact, to reproduce correctly a signal it is necessary that:

$$f_{sampling} \geq 2f_{max} \quad (12)$$

where f_{max} is the maximum frequency of the signal in the temporal domain, $f_{sampling}$ is the sampling frequency. Then (11) becomes:

$$f_{fps} \geq 2f_{max} \quad (13)$$

f_{fps} acting as a sampling frequency. Using a 28 fps video camera, the maximum frequency allowed is 14Hz: above this threshold it will be introduced spurious frequencies because of the aliasing. Furthermore, since in our elaborations the frequency resolution is 0.1Hz, the video duration must be at least 10 seconds.

Other physical limitations, such as illumination, shadows, camera unwanted vibrations, poor pixel resolution, low frame rate, presence of large motion, distance from the object, decrease severely the quality of the motion magnification and should be taken into account in order to achieve high-quality results.

3 THE GENERAL METHODOLOGY

The first step is to record a video of the structure we are interested in, taking good care to avoid large motions such as people passing by in front of the camera, swinging cables or non-fixed mechanical parts. The presence of large motions is the most significant source of noise for the MM, requiring the experimenter to isolate part of the image, although usually this is not a feasible option. The issue is still open.

In our case, we recorded by means of a commercial tablet, pixel resolution 720x1280, frame rate 28 fps, and then videos were processed by the MM algorithm [1]. The basic methodology is to take advantage of the large number of pixels contained in an image. Theoretically, we could have 921600 “virtual sensors”, meaning that each pixel has a time history of intensity variation (colour or grey scale), from the first frame to the last one. These time series contain the information about the displacements of the physical points related to the pixels (but they are not real displacements). Of course, it would be too cumbersome to analyse all the virtual sensors and moreover not all the surface of the structure generates useful information, therefore we identify a small area of the surface with high signal-to-noise ratio (SNR). On the left of Fig. 2 is showed the masonry, enclosed by safety beams to prevent risks for the operators, tested on the shaking table. We select a high SNR part of the image

(see Fig. 3) and follow its pixel variation along the video. Typically, an area of 19×78 pixel is selected as in Fig. 3, providing 1482 virtual sensors. Note on the right the small 19×79 pixels area (enlarged) and three markers of the 3DVision motion capture system. The system has available ten infrared cameras positioned around the shaking table to receive light reflection from markers arranged on the structure. Two cameras are able to triangulate and track the position of a marker with a precision of 0.01mm, therefore velocity and acceleration can be derived by numerical methods. These signals from the markers provide the reference for the comparison with the MMA.

It is also to be noted that usually the presence of edges or texture is helpful for the MMA, but unfortunately, the area in the red boxes of Fig. 3 is rather homogeneous. These circumstances produce a certain amount of noise, to be added to other disturbances. Signals from the magnified motion technique does not provide directly the displacements, although they could be recovered by means of the constant contours method [2]. On the other hand, they may be used to calculate the power spectral density (PSD) or the FFT, allowing the modal analysis and the calculation of the frequency response function (FRF). Hence, the 3D Vision system is a convenient reference to evaluate the MMA performance in the frequency domain.

4 MASONRY WALLS SHAKING TABLE TEST RESULTS

The optical movement detection 3DVision system tracks the displacements of selected points on the masonry in the dynamic laboratory tests at the shaking table earthquake test facilities of the ENEA Casaccia Research Center, located near Rome, Italy (Fig. 4).



Figure 2: The tested walls masonry, typical of central Italy, a region prone to earthquakes [8], [9]. On the left: lateral view with the safety framework, right: frontal view. The size of the two panels are 3.45m height and 3.31m width.

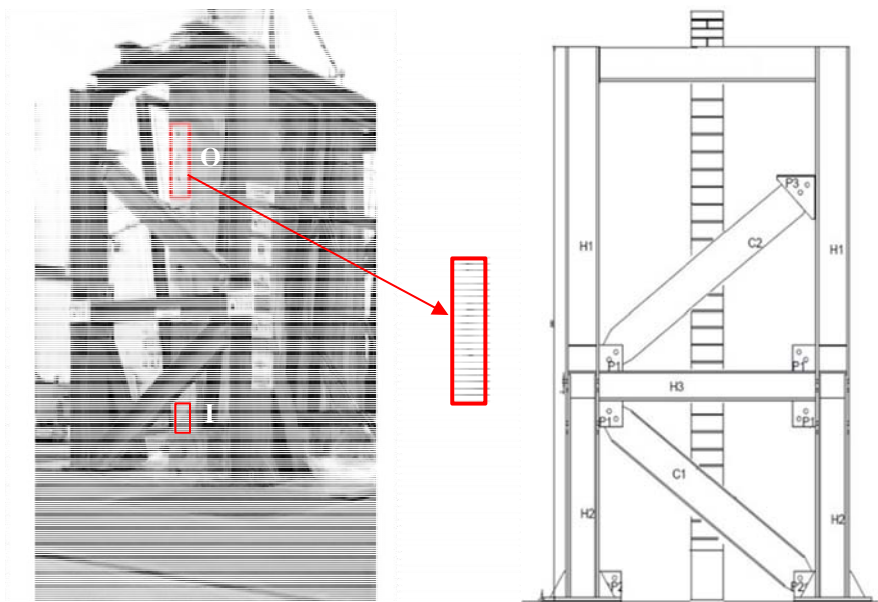


Figure 3: A frame from the magnified motion video (left): note how the image is blurred because of the noise. O: output markers, I: input markers of the FRF function. Right: the surface of the virtual sensors with some markers of the 3DVision system (red boxes) and the side view of the stone masonry.



Figure 4: The ENEA Casaccia seismic test facility: the two shaking tables.



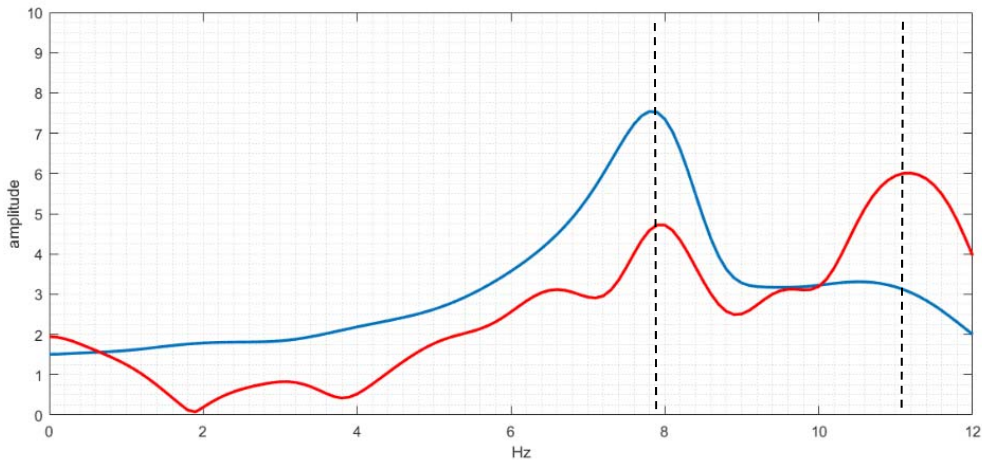


Figure 5: In blue the FRF from the 3D Vision, red the analogous from the magnified motion technique. Signals are averaged to produce just one signal, resulting in a low pass filtering action and successively normalized. The first peak is recovered within an absolute error of 0.1Hz and the second within 0.4Hz.

The object tracking and the 3D optical movement detection have been experimented to track the motion during the low frequency (up to 30Hz) vibrations typical of the shaking table tests. Ten high resolution (up to 4MPixel) infrared cameras are able to measure accurate 3D positions of hundreds of markers placed on the structure during the seismic tests [4]. This monitoring technique allows measuring 3 axial absolute displacements with easy and fast test set-up, high accuracy and the possibility to link the 3D-motion time histories of the tracked markers with CAD drawings of the structure and validate the finite element model (FEM) in real time experimental data assimilation [5].

The intensity variation of the 19x79-pixel area from the motion magnification (MM) and those of the 3D Vision are averaged to produce just one signal, in order to reduce noise, since the average is somewhat like a low pass filtering procedure.

At this point, we calculate the FRF for both the 3D Vision and for the MM signals. The frequency response function is a mathematical representation of the relation between two points on a structure (the input and the output) in the frequency domain. The 3D Vision output signal is indicated with O and the input signal of markers positioned at the basis of the wall is indicated with I in Fig. 3. Measuring the input and the output accelerations we describe a functional relation between these points. To calculate the FRF the experimental EMA SI-MO methodology was used:

$$H_I(\omega) = S_{io}(\omega) / S_{ii}(\omega), \quad (14)$$

where S_{io} is the FFT spectrum of the input-output cross-correlation function, S_{ii} is the FFT spectrum of the auto-correlation function. Modal parameters allow to evaluate the seismic vulnerability of a structure since a significant variation before and after a certain period of time may indicate a damage.

In Fig. 5 the first resonance peak at 7.9Hz corresponds to the 3DVision at 7.8Hz (up to the frequency resolution 0.1Hz), while the second peak at 11.1Hz is not aligned to the 3DVision at 10.7Hz.

However, it should be considered that the 3DVision has a sampling rate of 200Hz and the video camera has a frame rate of 28Hz. Moreover, the two signals are not well synchronized in time, meaning the start recording instants do not coincide exactly. In particular, the different sampling rate has introduced in the MM FRF spurious peaks below 8Hz and above 12Hz. To overcome this problem, it suffices a better recording device.

To confirm further the 7.9Hz (3DVision) and the 7.8Hz (MM) results, we compare them with an independent estimation of the FRF carried out in [8], by means of a standard accelerometer equipment, that is 7.89Hz for the first FRF peak. Considering reliable the accelerometer value, the 3DVision system yields an error of -0.127% and the MM an error of -1.141%.

Another interesting feature of the MMA is the visual detection of vulnerable points of the structure. In Fig. 2 the dotted red line in the frontal view indicates a crack produced by a strong simulated earthquake that occurred exactly where the MM video showed the largest displacements during a low-intensity identification test on the shaking table. In this sense, MMA provides a predictive capability.

5 CONCLUSIONS

The continuous developments in digital vision technologies are very promising. Even if till a few years ago such kind of methodologies were not viable, recent advances in the digital image and video processing have opened the door to applications to the analysis of vibrations, in particular by motion magnification strategies.

Actually, during our laboratory tests, MMA was effective in amplifying subtle motions in videos, making distinguishable the tiny displacements of structures exposed to mechanical disturbances and facilitating the evaluation of the building stability within a reasonable time. Advantages are many: a large number of “virtual sensors” available, no wires, reduced amount of data storage, no physical contact, simplicity, low costs and predictive capabilities. Unfortunately, for a number of reasons, noise is a pervasive obstacle to MMA, especially when the recording device is a low-quality video camera and indoor laboratory parameters are not optimal. Nevertheless, we showed that the frequency domain results obtained previously for small mechanical structures are extensible to masonry structures for seismic applications.

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EDITING THE ORDINARY: EXCEPTIONAL RENDITION OF NGO-KA-KI HOUSE

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ABSTRACT

The Chinese embodiment in most major cities in South-East Asia is widely being articulated through the existence of shop house. Its renowned status has overshadowed the “Attap” house that was built during the early Chinese migration. In Malaysia, evidence has shown that shop house was first derived as a simple “Attap” hut that was built by the Chinese merchant to service the tin miners. The “Attap” house is also said to lay the basis for shop house. This paper aims to explore the Chinese spatial and spiritual essence through the interpretation of the layering of the Chinese “Attap House”. Certain perspective of Chinese family structure and their perception on cosmological epitome, profitability and growth, and the concept of flexibility through the creation of ‘Kaki Lima’ are thoroughly identified. “Kaki Lima”, or five-foot way in English, is translated as “Ngo-Ka-Ki” in Chinese dialect. As such, the interpretations of the Chinese “Attap House” are edited and formulated into a scheme, which is not merely a house but rather incorporated as a manifesto. The “Ngo-Ka-Ki House” is a setting to investigate the paradox of Chinese essence that alters the spatial quality of a living quarter, thus anchoring the idea of Chinese living in a broader spectrum.

Keywords: chinese embodiment, shop house, five-foot way, spatial quality, living quarter.

1 INTRODUCTION

The Chinese form the world’s largest ethnic group with over 1.3 billion people [1]. In Malaysia, the Chinese is the second highest Overseas Chinese community in the world [2] and is the second biggest ethnic group after the Malays. Known as “orang cina” in Malay, most of the Chinese in Malaysia are of Han Chinese ancestry who, majority of them migrated to this country in the early 19th century to operate new tin mines. Their population are primarily urban with dominance in the business and commerce sector.

The Chinese in Malaysia are considered as one of the wealthiest ethnic groups with most of their income generated through market and trading activities. They are also a keen property investor, with strong desire in residential properties. One family is said to own multiple apartments [3]. In terms of architecture, the Chinese bring a form of art into their buildings that distinctively mark their strong Chinese essence.

Chinese in general, often maintain a close-knit family structure. Although the Chinese household is said to be large with extended families living under one roof, this conception however, was challenged by Fei [3]. According to Fei, on average, a Chinese family in the past did not have a dozen or five generations living together but rather more to 4 to 6 people per household. In the Malaysian context today, due to the process of urbanization, this household has somewhat become a nuclear, which is small in size, diverse in structure and possess strong individual interests.

The Chinese is relatively rich in its culture, tradition and superstition. Despite the modernized world of capitalist enterprise and technology, the cosmology of Chinese religion continues to thrive [4], which often creates tensions between logic and superstition. Houses are organized according to the principles of “Feng Shui” and business deals are carried out in correlation with the Zodiac calendar.



2 THE CHINESE DWELLING

The Chinese representations are concealed within the artefacts of their early arrival in South-East Asia. Some may translate the artefacts into an intangible embodiment that upholds the essence of the early Chinese. These artefacts are inculcated into their customs and traditions through art, culture, food, belief, lifestyle and architecture. In South East Asia, traded commodities were actively taken place in the 9th to 10th century in main entrepot cities such as Srivijaya, Champa, Palembang, Malacca, and Borneo. This period also marked the peak of the China maritime trade which led to the assimilation of Chinese artefacts. Following this, the advent of Chinese Diaspora during the colonial period in the 19th century, had witnessed a large number of migrations into South-East Asia, leading to the dissemination of Chinese artefacts in most of the South-East Asian cities.

2.1 The Chinese living quarters in the early days

Despite the assumption, whether implicitly or explicitly that the colonial town is wholly created by the colonizers, the early development of this town is said to be highly influenced by the Chinese. This is due to the fact that the Chinese are more urban-adapted and business minded people and needed a space where trading activities could take place [5]. As such, the concept of home working through living quarter cum working space, which is later known as the “Shop House” was established in this part of town (Fig. 1). This concept is believed to be the first of its kind and can be widely seen in most of the South East Asian cities today. The shop house consists of two floors, with living quarter or private residential on the first and working space or public family business on the ground (Fig. 2). This sort of arrangement allows direct contact between demand and supply, customers and traders and indirectly helps to generate the household income. In Java, the shop house acts as a stepping-stone for investment, where it is being applied by most families as a tool to accumulate sufficient capital to build a decent home [6].



Figure 1: The growth of shop houses in Penang in the 19th century. (Source: <https://www.ura.gov.sg/skyline/skyline11/skyline11-04/article-05.html>.)



Figure 2: The shop houses in Penang in 1888. (Source: <https://www.ura.gov.sg/skyline/skyline11/skyline11-04/article-05.html>.)

2.2 The “Clan”

Wealth is the main priority for the Chinese. In seeking prosperity, the early Chinese settlers formed an association called “Clan” which is a benevolent organization among the overseas Chinese communities who shared a common background or ancestral village. This association supports its members in overcoming economic difficulty, social ostracism, and oppression and provides facilities such as shop house, temple and dormitory which formed an ethnical enclave that strongly holds the Chinese essence [7]. The “Clan” enclave has a high value for the colonizers. Despite expressing authentic identity, the colonizers have taken advantage of this enclave to captivate a propaganda which aims at civilizing the locals [6]. By turning the enclave into a China Town, the colonizers are able to strengthen their power and yet, respecting the cultures and alluring prosperity among the locals. As of today, China Town has become a major economical enclave that generates profit for its city.

2.3 The “Attap” house

The shop house does not only represent the Chinese dominance but is an amalgamation of multiple influences that combines the western terrace house character and the southern China flavours. The essence of the shop house lies in its concept of home working, but the edifice is layered by the colonial envelope represented through the influence of Neo-classical, Art Deco, Victorian and International Style. Its oriental identity can be seen through its ornaments and the presence of the courtyard cum air well (Fig. 3).



Figure 3: The courtyard in a shop house. (Source: <https://ahtongtailor.files.wordpress.com/2012/08/r00106171.jpg>.)

Apart from the renowned shop houses, the Chinese are also often associated with the “Attap” house [8]. The “Attap” house is a typical farmhouse, which can be found in the remote areas of Indo-China, Borneo, Malaysia and Singapore. The dwelling has a unique structure and is made of indigenous materials with wide overhang “Attap” roof and walls. “Attap” in general is a thatch made from palm fronds and symbolises the typical attributes of a Malay traditional house. The difference with the Malay house is that an “Attap” house stood directly on the ground as opposed to stilts which is similar to the Chinese hut built in China. The “Attap” house is divided into three segments; the centre and both ends. The owner of the house will occupy the centre portion of the house while both ends are being rented out, either to a member of the family or other relatives [8]. The house can be suggested as socially less open, as openings are built only at the front and rear facades. Space arrangement of the middle house is based on three sides of walls; where the ancestral hall is being surrounded by the kitchen or the bedrooms (Figs 4–5).

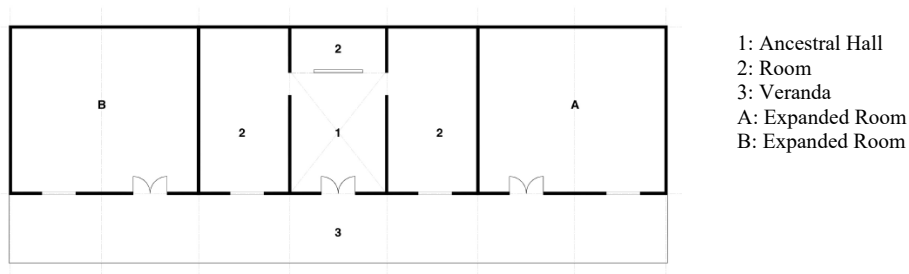


Figure 4: The “Attap” house in Singapore.

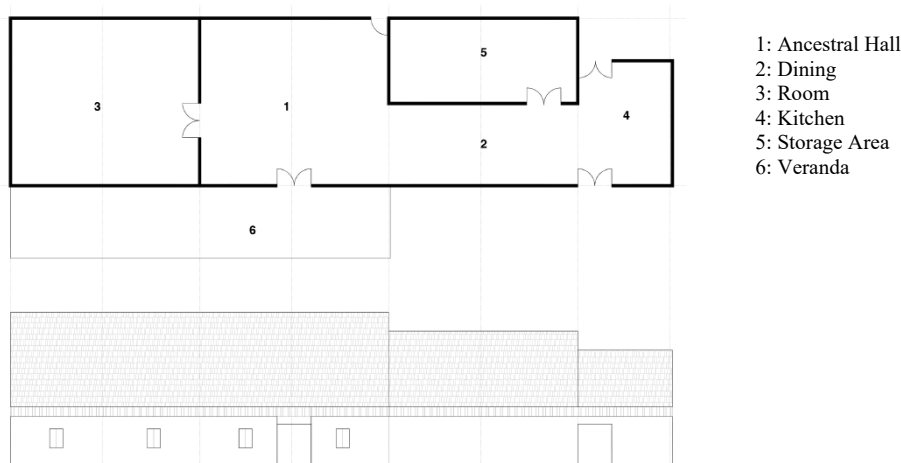


Figure 5: The “Attap” house in Sarawak Cultural Village, Malaysia.





The “Attap” House in the early days



The “Five-Foot Way” of a shop house

Figure 6: The “Attap” house in translation. (Source: Left: <http://ching-teoh.com/wp/wp-content/uploads/2009/04/P1070457.jpg>; Right: <http://3.bp.blogspot.com/>.)

A typical “Attap” house can be extended into a maximum of two rooms wide. This allows the house to be elongated, providing a wide frontage that normally faces the main road and the pedestrian path. A veranda is built to connect the entire frontage of the house and provides a social space for the owner and the rented families. This space is believed to influence the origins of ‘five-foot’ way in a shop house (Fig. 6).

2.4 The different representations of Chinese living

Family size and wealth are the important elements injected in the spatial arrangement of Chinese living. The space is organized in hierarchal manner, as the elders take their position in the centre, with the ancestral hall as the *locus* point of the main house. The “Attap” house for instance, allows both ends of the unit to be rented out, either for investment or family expansion. It also transcends the notion of flexibility as it resembles modular space that can be altered within the external frame of the house to fit the owner’s purpose. For some, these spaces are used to store machinery goods.

In closer look, the layout of the “Attap” house resembles the idea of the Three Bay house in China (Fig. 7). This type of house is often referred to as the basic unit of Chinese homes. Depending on the size and wealth of the family, the Three Bay house can be added on to, often in standard ways. One common extension of the Three Bay house is the creation of a courtyard dwelling which can be shared by the whole family. In Beijing, this concept has been translated into a courtyard house which is made of multiple blocks of the Three Bay house.

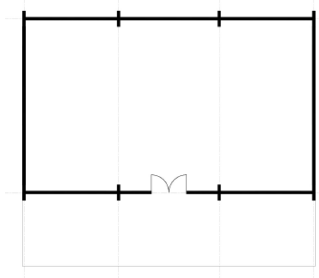


Figure 7: The Three Bay house in China.

According to Chinese context, three is an exemplar of Chinese preference in odd number. Based on the geomancy approach, symmetrical and balance are best achieved through an odd sequential rhythm. As such, Chinese dwellings can grow into five, seven or nine bays according to its preferences.

Kohl [9], argues that the architecture of the Chinese specifically in Singapore and Malaysia has not been altering its form since the Tang dynasty, as it satisfied with their fitness of purpose, serviceability and aesthetic. Thus, this argument has laid a strong basis to the well-known shop house as an adaptation of the “Attap” house.

3 THE “NGO-KA-KI” HOUSE

“Ngo-Ka-Ki” or ‘Five-Foot Way’ in English and ‘Kaki Lima’ in Malay, is a Chinese term that refers to a corridor or veranda measured in literally ‘five steps’ or ‘five feet’ in length. This term signifies certain typology of space, rather than spatial dimension [10]. The five feet as mentioned in some old Chinese and Japanese literatures, signifies a ‘*Byabu*’ which is a painted folding screen and ‘*Madokoro*’ which can be classified as the head of a ship [10]. This idea strongly defines the element of a certain typology of space through the presence of an envelope.

Rendering “Ngo-Ka-Ki” as a house creates a parameter into the study of this typology of space. A house is a basic space for living. It represents the closest connection between a man and a space. A house illustrates a manifestation of everyday life occurrences that might take place in between a “Ngo-Ka-Ki”; a tale between semi-public and semi-private, domestic and public realms, traditional and modernity, master and slave, and femininity and masculinity [11].

3.1 Defining the “Ngo-Ka-Ki”

Based on the essence of the Chinese “Attap” House, the “Ngo-Ka-Ki” House acts as a counterproposal to many housing projects, particularly high-rise residential in Malaysia. High-rise housing is the epitome of urban life. In many developing countries, the aim towards urbanizing the locals has become its main agenda. It is expected that in 2050, Malaysia will be transformed into a high-income nation. As such, living in urbanized area is inevitable. Living vertically is the future.

The “Ngo-Ka-Ki” House is explicated as the “other house”. This house is culturally influenced and provides an alternative to the generic layout (Fig. 8) of many current high-rise residential in Malaysia. It intends to translate and reinterpret the Chinese spatial essence into modern application by criticizing the ordinary living represented through the common high-rise residential layout. By transposing the spatial quality, the “Ngo-Ka-Ki House” aims to manifest a new dwelling or housing typology based on Chinese values and perceptions, within the living context of Malaysia.

3.2 The “Ngo-Ka-Ki” concept

The epitome of ‘Kaki Lima’ or ‘Five-Foot Way’ exists both in traditional Chinese “Attap” house and shop house schemes. This space acts as a catalyst that alters the program of a domestic sphere which can be seen in an “Attap” house, into a public-private sphere such as the shop house. In view of this, the invasion into an ordinary living is initiated through the advent of the presumably habitable space, which is the “Kaki Lima”. This concept is dubbed as “Ngo-Ka-Ki”, from this point onwards.



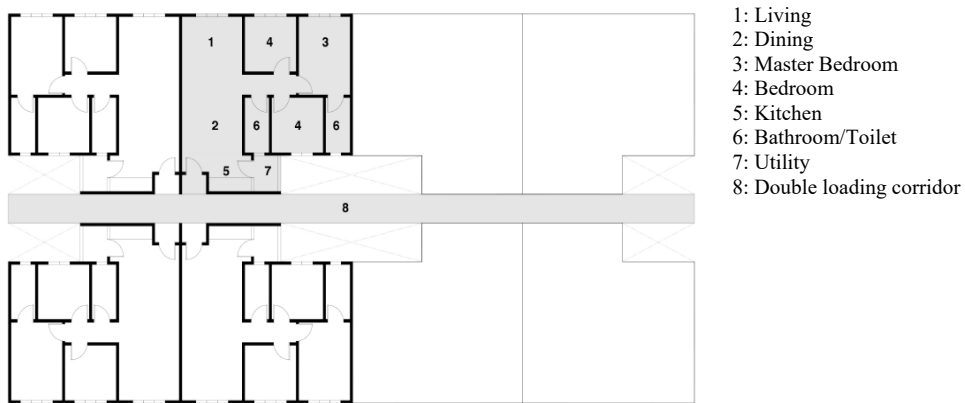


Figure 8: Ordinary apartment arrangement with double loading corridor in Malaysia.

In the modern context of a high-rise residential, the double loading corridor is thoroughly seen and given essence to Ngo-Ka-Ki (Fig. 9). As it is often defined, the function of this corridor has deprived its potentiality as it focuses only as a circulation medium. The idea of ‘certain space’ has been buried deep within its singular purpose. By challenging this paradox, its purpose is diversified to optimize its functionality. The significance of this diversification is clearly defined if the residential units acknowledge the multiplication. Approaching this, three elements are analyzed as strategies; threshold, flexible layout and service core.

3.2.1 Threshold

The introduction of Ngo-Ka-Ki as habitable space has transformed the orientation of a single unit house. As the elongated side is in parallel with the Ngo-Ka-Ki, this allows the threshold to have wider opening, giving more permissible light into the inner space (Figs 9–10). In conventional design, the opening is usually limited to a single door’s width. However, by injecting the Ngo-Ka-Ki, it defeats the corridor as a hostile space through blank wall on both sides.

3.2.2 Flexible layout

The Ngo-Ka-Ki House layout is constructed of 5 divisions of basic habitable spaces; living, kitchen and dining, master bedroom and two bedrooms. Each space is separated by a flexible wall, which can be removed and added depending on the owner’s needs and preferences. As such, in certain configurations, all spaces can be rented out in smaller units as each unit has individual access due to the elongated frontage along the Ngo-Ka-Ki. This layout contradicts the conventional method, which is fixed and less flexible. The frontage of the unit faces inwards to minimize security and surveillance issues (Fig. 11).

3.2.3 Service core

The success of the Ngo-Ka-Ki House scheme depends on the arrangement of the service core. To ensure that the frontage has a full-frontal opening, the service core is placed at the rear of the unit, in parallel with the Ngo-Ka-Ki. Consequently, the core is also divided into five segments serving each habitable space; figuratively expressing the relation between master and slave. The service core, which accommodates storage and toilets, is constructed

as an independent solid container cube and is attached to the main structure. This configuration makes it conveniently modifiable to fit occupants' requirements (Fig. 10).

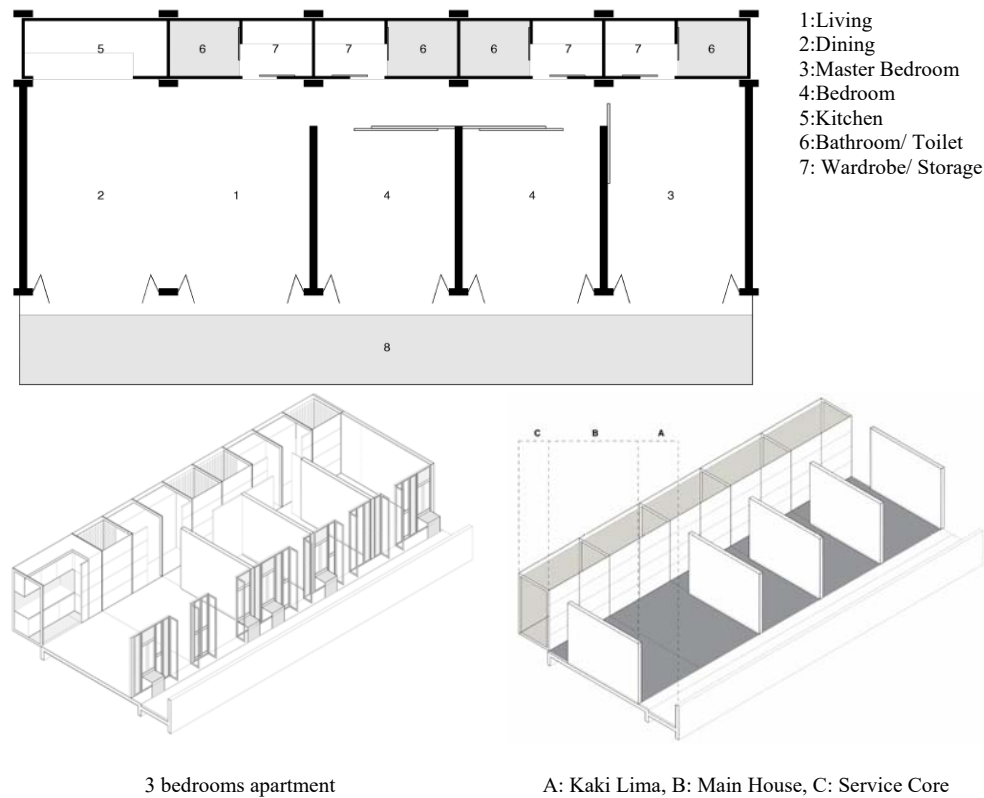


Figure 9: The Ngo-Ka-Ki concept.

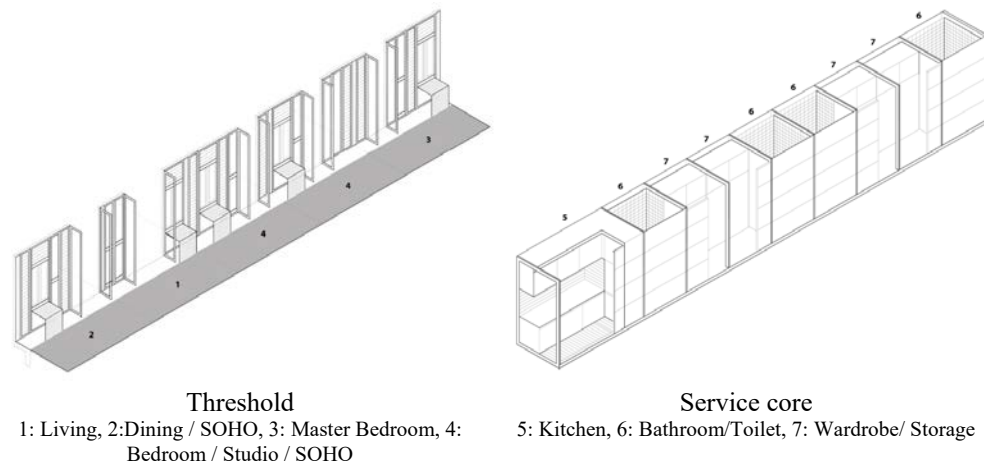


Figure 10: Threshold at front unit and service core at rear unit. Both are in parallel.



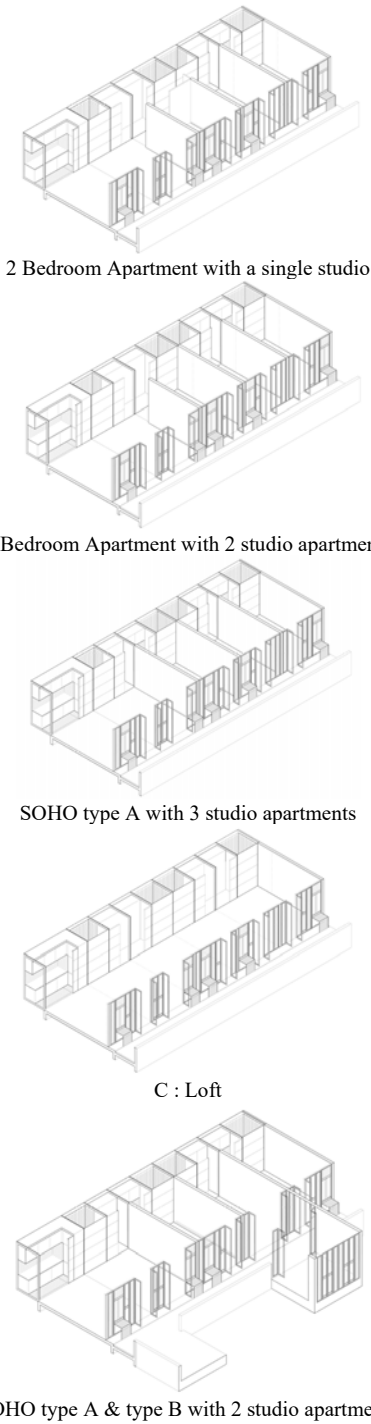
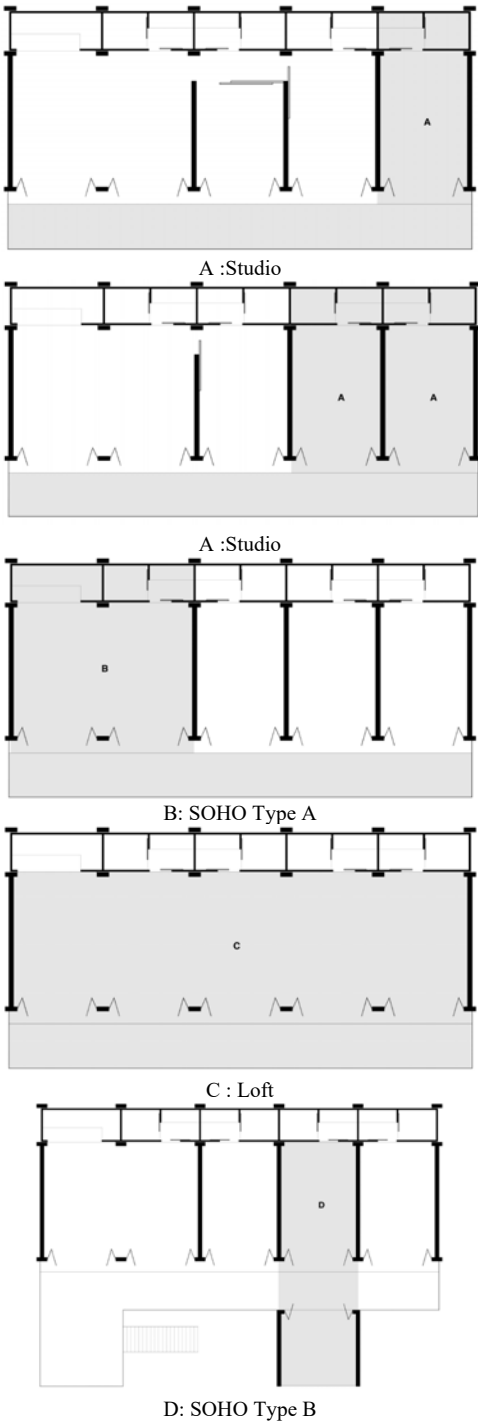


Figure 11: Various configurations of internal spaces are made possible with moveable walls and partitions.

4 THE RATIONALE BEHIND THE “NGO-KA-KI” HOUSE

The strategies are devised to address several issues in relation to Chinese values and perceptions in the context of living. These include geomancy and cosmological aspect, profitability and investment and flexibility and growth.

4.1 Geomancy and cosmological aspect

The proposed scheme challenges the optimization of space by omitting irregular shapes. It stresses on the idealistic rectangle form to balance the flow of Qi or the cosmic breath as suggested in Feng Shui [12]. Due to rigidity in layout, the interiors of a high rise residential are made flexible to maximize the values of geomancy. As such, the occupants must be able to relate the context of living with their belief and perception, which in this case, responds to the conflicts between facts and fictions.

The thresholds are made wider to ease the flow of Qi into internal spaces [12]. However, the width can be manipulated depending on the needs of its occupants. In the old days, the Chinese design their threshold with various forms of opening, ornaments and materials. By injecting the same ideas, the occupants will be able to enliven the Ngo-Ka-Ki.

The schematic configuration is in tripartite which includes the Ngo-Ka-Ki, the main house and the service core. The services are hidden in a huge container designated at the rear end. The placement of services in this container symbolizes a solid background of a mountain.

The layout of a unit is segregated in a sequence of oddities for a reason; to achieve the optimum symmetrical and hierarchical potentials. However, since the layout is flexible, the facade must be designed in such a way to suit the flexibility of its inner purpose.

4.2 Profitability and investment

The division between spaces permits indefinite expansion; spatially and economically. Each segment of the house is able to accumulate profit by the acts of rental, either among the family members or to outsiders, thus resulting in investment linkages within the personal sphere of influence [13]. The spaces can be converted into multiple units, a single-family house with two or three bedrooms, a studio apartment, a SOHO, or a loft. This sort of flexibility gives various kinds of profits through different modes of operation.

Integrating business and living under one roof is one of the important essences among the Chinese. Space becomes catalyst to stimuli business. This integration helps to visualize the concept of ‘Zero Work’ [14], where people are no longer dependable on a specific workplace but rather technological advancement to earn a living.

4.3 Flexibility and growth

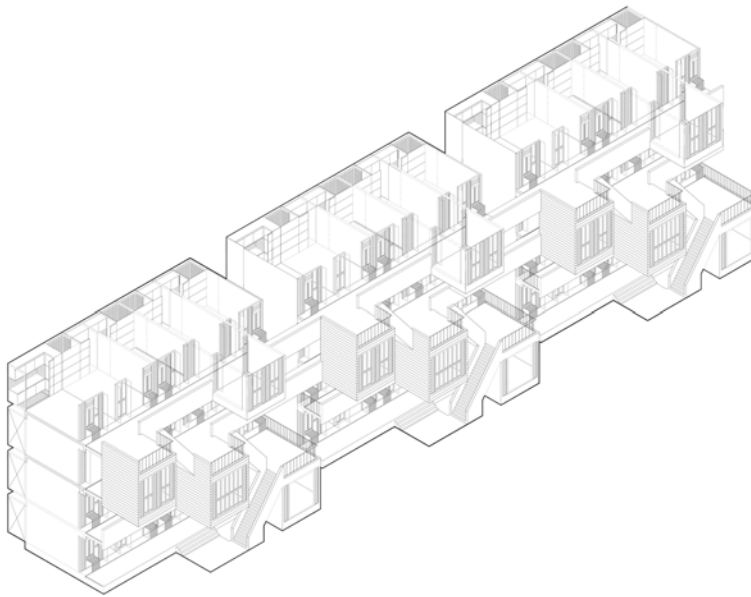
Flexibility is distinctively embedded in within the Chinese design philosophy. A flexible space is determined through a designated purpose or participation by choice [15]. For instance, most traditional Chinese furniture are designed with flexible attributes that provides the end users the freedom to construct the means of its utilization.

The Ngo-Ka-Ki concept is generated based on this idea. The layout can be arranged in accordance to the preferences of its occupants. Movable panels and thresholds permit family expansion, which give meaning to personalization.





Single block apartment



Multiple block apartments

Figure 12: Multiplication of units in various configurations.

5 CONCLUSION

The Ngo-Ka-Ki House explores the potentials of a culturally significant utilitarian space as a habitable space. It provides an alternative typology within the boundaries of Chinese culture living. In a broader viewpoint, this concept influences the property market landscape as individual property owners have more flexible options in diversifying the value of their assets. It is safe to presume that this new typology would also result in a new building image for high-rise residential. The reorientation of internal spaces such as the elongated facade that is expandable and enclosed service core at rear of units provide a new dimension and articulation to its facade treatment and site planning. Predominantly in the

case of high-rise residential, where aesthetics are a sellable factor, it is presumably said that the Ngo-Ka-Ki House concept could be well adopted into different dwelling typologies.

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SURABAYA OLD TOWN NEW LIFE: RECONSTRUCTING THE HISTORIC CITY THROUGH URBAN ARTEFACTS

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ABSTRACT

Architecture portrays the physical and visible image of a place. From these images, its meanings represent the transformation and development of a city over time. Architecture is continuously remodelled to adapt to the development and modernisation that a city and its society experience. The Old Town of Surabaya is well known for its cultural diversity with its distinctive six main district settlements along the Kalimas River namely the Arabic, Chinese, Javanese, Dutch, Industrial area and Business and Service area. In line with the government efforts to revitalise the old town, the architecture of this part of the city needs to be remodelled and altered to realize the government's vision and to revive the identity of this district. For example, the warehouse, which is an urban artefact and one of the most significant typology built along the Kalimas River during the era of Surabaya as an entrepot, is now neglected and portrayed a derelict image to the old town's identity and memory. This paper intends to explore how architecture expresses the identity and memory of the city of the Old Town of Surabaya. By investigating the experience in the old town, the typology of the town is defined and urban artefacts are identified. Then, the warehouse, which is one of the urban artefacts in the old town, is discussed in terms of its transformation, typology, memory, and how its existence can define the identity and memory of the old town.

Keywords: historic city, urban artefacts, architecture and the city, collective memory, typology, warehouse, transformation, identity.

1 INTRODUCTION

Surabaya is the second largest city in Indonesia and is the capital city of East Jawa. The city is famously known as the “City of Heroes” due to the historic battle during the revolution of Indonesia. Surabaya was once a trading centre and port rivalling Batavia during the Dutch era. The history of Surabaya, in general, can be categorised into three periods [1]; Surabaya as a Palace City, Surabaya during Colonization and Surabaya after Independence.

1.1 Surabaya as a Palace City

During the 14th century, the king of Majapahit decided to develop Surabaya as an entrepot which later became a major political and military power. In the 16th century, Majapahit collapsed and Surabaya was taken over by the Mataram Kingdom. During the Mataram ruled, a keraton (palace) was built on the southern part of the city. This ancient palace as a dominance of centralized sovereignty was then diminished by colonial insertion of foreign city planning models during the Dutch occupation.

1.2 Surabaya during colonization

Surabaya was colonized by the Dutch East India Company (VOC) from the weakened Mataram in the 17th century. It was during this period that Surabaya became a major trading centre and a naval base. As a centre for trade, foreign workers were brought in and



foreign traders that settled in Surabaya became the onset of the cultural and ethnics diversity in this city. VOC grouped the ethnic into four separate settlements along the Kalimas River [1], with Arabs in the north, Malay in the south, Chinese near Kembang Jepun and Dutch in the western part of the river. These strong characters of the four settlements became the main features of the Old Town of Surabaya. After the World War II, the Indonesian militants battled against the British armed forces to fight for independence. This confrontation or commonly known as the Surabaya Battle has popularized the identity of this city as the “City of Heroes”.

1.3 Surabaya after independence

Since then, Surabaya has continuously developed, transformed, flourished and modernised over time. Besides being called as the “City of Heroes”, Surabaya is also known as the city of Budipamarinda [2], which stands for the City of Industries, Commerce, Maritime, Education, Garrison and Tourism. However, due to the memory of the epic battle that is strongly being remembered by its society till today, the significance of Surabaya as the “City of Heroes” remains to stand tall.

2 THE OLD TOWN OF SURABAYA

The old town is the first inner district of Surabaya [1]. This area is formerly known as a port city and a trading centre during the Majapahit Kingdom. In the era of the Palace City, many foreign traders from the Middle East and China came to the old city to trade. Some of them even decided to settle down in Surabaya which, influenced the growth of the Arab Quarters and Chinatown in the inner city. It was during the Dutch occupation that trade and port function flourished causing the colonizers to reorganize the residential area based on ethnicity and building function. For this reason, the old town was categorised into six different districts namely the Arab Camp, Chinese Town, Industrial Area which consists of the warehouses, Dutch Kampong, Business and Service Area and Surabaya Kampong of Malay settlements.

The old town lost its centrality when the infrastructure developments and the city centre of Surabaya were shifted to a new area near Tunjungan [3]. The introduction of the Industrial Allotment Policy in the mid-70s has put limitations in the expansion of industrial activities that brought to the deterioration of this part of the city. However, with the current vision to revive the old town for tourism purposes, new initiatives such as bus tour that connects the House of Sampoerna that is located in the old town to the new city centre are introduced. This approach has allowed people and tourists to explore and experience the old townscapes.

In the historic city of Surabaya, the environment, streets, buildings and the architecture become the valuable artefacts that project the identity and narrate the memory of its inhabitants. Hence, in order to ensure the success of the revival of the old town, the identity, image and memory of the neglected and run-down facade and buildings of this part of the city must be revisited.

3 ARCHITECTURE AND THE CITY

Many theorists have explored the city in utilitarian, functional and to its constructional dimension. Mumford [4], discusses the idea of city as a work of art. Similar to Mumford, Aldo Rossi conceptualizes city as an artefact. Rossi’s theory of city goes beyond the urban pattern and meanings that enable exploration of architecture as the main construction of the city that serves beyond aesthetic dimension [5].



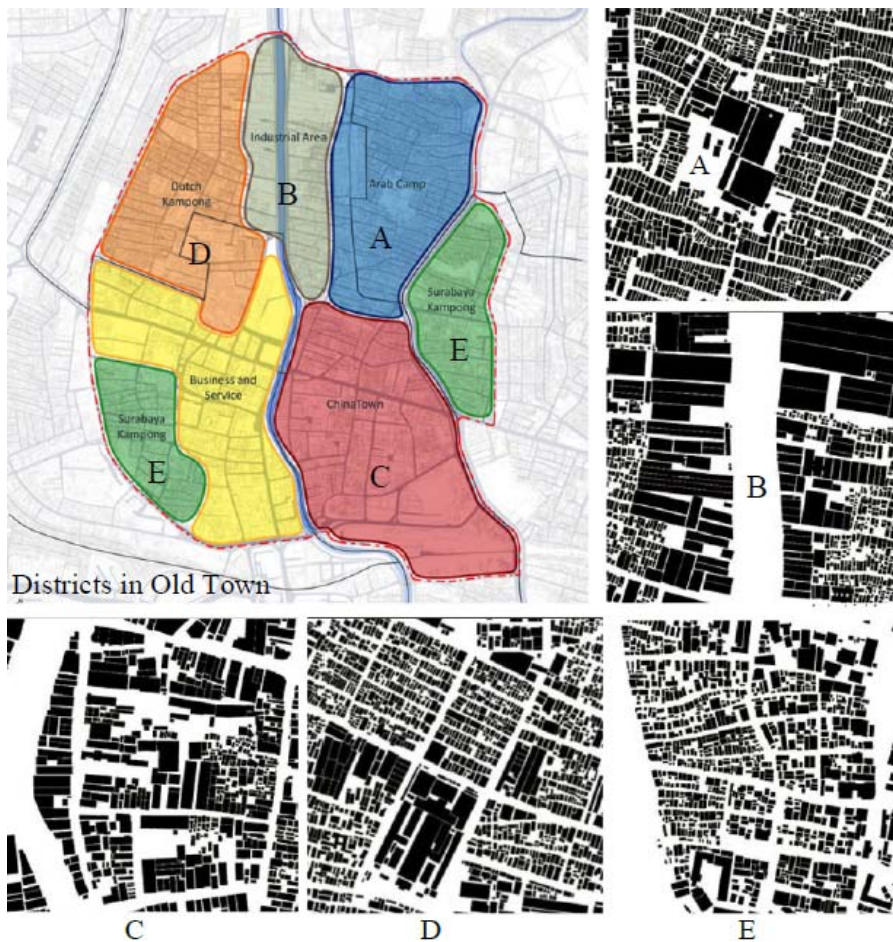


Figure 1: Districts and figure ground of the old town. (Source: Hadi, 2011.)

3.1 Theory of city

According to Blumenfeld [6], theory has tended to emphasize city into two poles; either as a whole or one big unit or a sum of many small units. Rossi [7], considers city as unified elements, a gigantic manmade object and a construction of different parts. Yet, he also recognizes city's singular places (locus solus), which he describes as elements of consistency and permanence among the process of urban dynamic. This includes monuments and the permanent, fixed points and signs of the collective memory. According to Rossi's idea of city evolution [7], "the form of the city is always the form of a particular time of the city but there are many times in the formation of the city". Rossi develops his understanding of the city by considering the relationship between the typology of building and city and views these buildings as monuments that form part of the city. Following this, Rossi explores the structure of the city where he then focuses on architecture as the main construction of the city.

3.2 Urban artefacts and the city

Urban artefacts as defined by Rossi et al. [7], constitute not only buildings but fragments of the city in which each of these elements have its own complexity that is possible to analyse but is hard to define. According to Eisenman [8], the physical context of a city together with the history, geography and structure, form part of the urban artefacts. As city grows within the physical, historical, geographical and structural context, these formation and transformation produce different artefacts that revolve over time.

Owing to these ambiguities, Rossi describes that the main characteristics of urban artefact lies collectively and permanence in its historical character of artefacts. Buildings with special character may transform into artefacts that specify certain typology. In addition, different buildings signify different characters or individuality that within time, may contrast in its existence [7]. A building may also hold multiple functions either independently or dependently from the changes in its form that influence the structure of a city. The development of the city about these artefacts as noted by Rossi et al. [7], defines the context of “urbanism”.

3.3 Collective memory and identity of the city

Cities experience events and acquire memory over time. There is always a sort of exchange between cities and its inhabitants; the interaction with its occupants and how architecture narrates the memory by simply dwelling in it, traversing it or looking at it [5]. Rossi believes that a city is the collective memory of its people, a stage where the human activities take place and the imprints left by these people.

Although Rossi does not distinctly discuss identity in his text, he however highlights the different factors and quality that give a city its distinctive identity such as permanence, urban artefacts, time, typology, collective memory and the *locus solus*; the singular component within a city. According to Lee [9], city is always considered as a man-made object and that the past will always be partly experienced and gives meaning to permanence. The experience of this permanence can be in the existence of form and its propelling and pathological elements.

A city can also be understood through its architecture [7]. Although architecture can be transformed, altered and remodelled through the development of a city, it provides evidence of the city’s survival and resilience. A city does not tell its past [5], but the memories are embedded within the urban artefacts. The identity of a city is dynamic and can be constantly changed to adapt to the changing nature of the city. In addition, the experience of a city is often narrated through its architecture. Despite the ability to transform, architecture can also be in a constant form of urban artefacts that bring the city to its past.

3.4 The city through its type and typology

The general understanding of type in architecture often refers to the usage of buildings. In theoretical context, Rossi et al. [7], defines type as “the very idea of architecture that is closest to its essence and always imposed itself on the feelings and reasons as the principle of architecture and of the city”. This principle that underlies type as noted by Rossi, can be found in urban artefact. According to Lee [9], the notion of type has commonly been linked to typology as a design method in the early 19th century.

The distinctiveness of a city lies in its typology, classification and characteristic. Similar to Rossi, Vidler [10], recognizes city as a whole and that all elements in the city such as



buildings, streets and urban spaces are connected by a chain of continuity and meaning. Vidler in his Third Typology divides typology into three categories. The First Typology describes the primitive hut; nature as origin, city as the forest and the built environment as a tree structure. The Second Typology is based on the industrial development in the 19th century where buildings are machine-analogous, and mass produced. The Third Typology is introduced to break the Modern Movement. It defines city as architecture, has permanence and collective memory of its inhabitants, an artefact and collection of types. There is no clear set of rules for the transformation of a city. The transformation in general rests within the demands of the present.

Neo-rationalists used types and typology to understand the historical aspects and inner structure of a city and improve design through continuity between the old and new designs of the historical city [11].

4 URBAN ARTEFACTS: OLD TOWN OF SURABAYA

According to Rossi et al. [7], the most significant urban artefacts are housing and monuments. Transformation of these artefacts symbolises the evolution in terms of time and collective memory of the city.



Figure 2: Map of the current boundary of the old town.

During the era of Palace City and Dutch occupation, Surabaya thrives as a centre for trade and port. Many foreign traders and neighbouring locals came to trade and some even settled in Surabaya. This caused the area along the port; the Kalimas River to expand and develop into six major settlements as discussed earlier in the old town [3].

These six residential areas form the most distinctive urban artefacts in the Old Town of Surabaya. The significance of these residential areas can be seen in its structural character, typology and repetition [12]. Each area has its own character, figure ground (Fig. 1), street and environment.

Unlike the repetitive character of housing as urban artefact, monuments owe their singularity to their character of permanence, acting as primary elements as fixed point amidst the urban dynamic [12]. To accommodate these neighbourhoods, infrastructures such as mosques, churches and town halls were built. These infrastructures provide symbolic anchor point for the religions and political identity of the urban areas. Due to its unique structural character and architecture, these infrastructures became urban artefacts to the current old town; manifesting the glories of the past trade and port city. Some of these artefacts were developed into monuments; some were transformed to hold different functions and some still served the same functions; bringing the current inhabitants to experience the lifestyles of the past inhabitants.

People visualize a city based on its dominant culture or architecture. The pictures above portray the unique identity of the Old Town of Surabaya through its different types of architecture and building typologies.

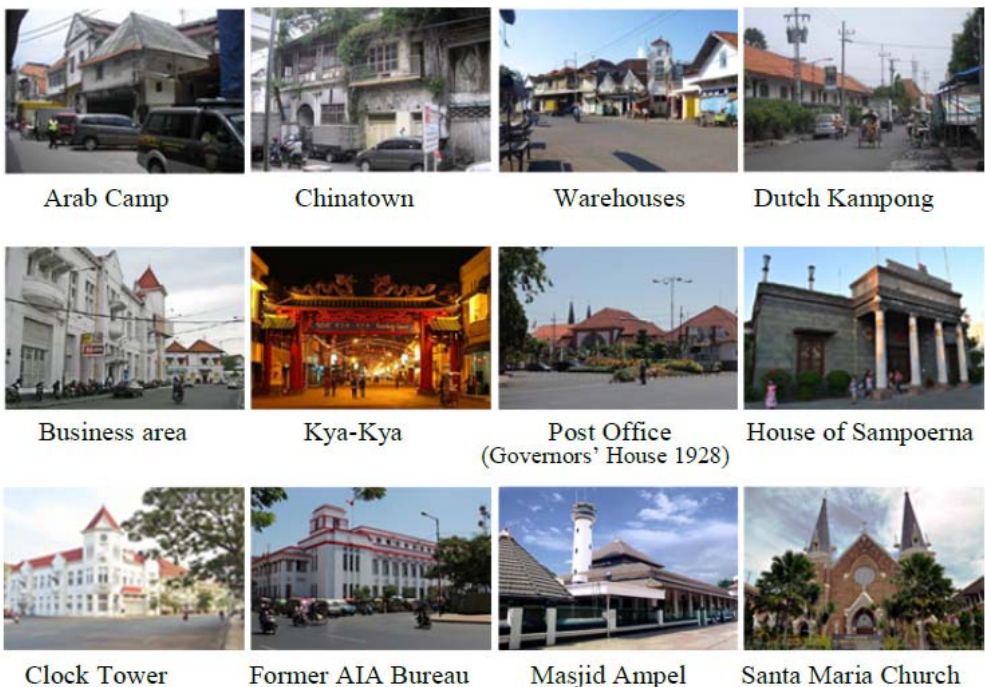


Figure 3: Urban artefacts of the Old Town of Surabaya.

5 THE WAREHOUSE

Kalimas River plays an important role in shaping the character of Surabaya City. Since the 18th century, the river holds the longest harbour equipped with thousands of warehouses and factories surpassing the numbers in Batavia (currently known as Jakarta) [13]. The remains of this triumph are reflected in the 19th century warehouses located in the industrial district of the old town of this city. These warehouses act as a physical memento of the economic growth in that era. Unlike the residential areas and shop houses, these warehouses have been neglected since the mid-70s due to the introduction of the Industrial Allotment Policy [3].

To realize the government's vision in reviving the identity and image of the old town for tourism, the neglected warehouses located at the upper middle of the town must be revitalised. These warehouses hold an important urban artefact that creates memory of the past trade and port.

Rossi et al. [7], describes that if the urban artefacts were constantly able to reform and renew by simply establishing new functions, its values as urban structure would be continuous through architecture.

The warehouses in the old town have strong structural character that differ from the Arab Camp and the Dutch Kampong located at the side of the river. The plausible initiative is to adaptive reuse the warehouses with different function as opposed to its original function as storage area.

The transformation of the urban artefacts which in this case, the warehouses, is needed to accommodate the city's vision and at the same time holds the memory of the past.

The uniqueness of its architecture needs to be identified to ensure that new designs do not oppose the permanence character of these warehouses.

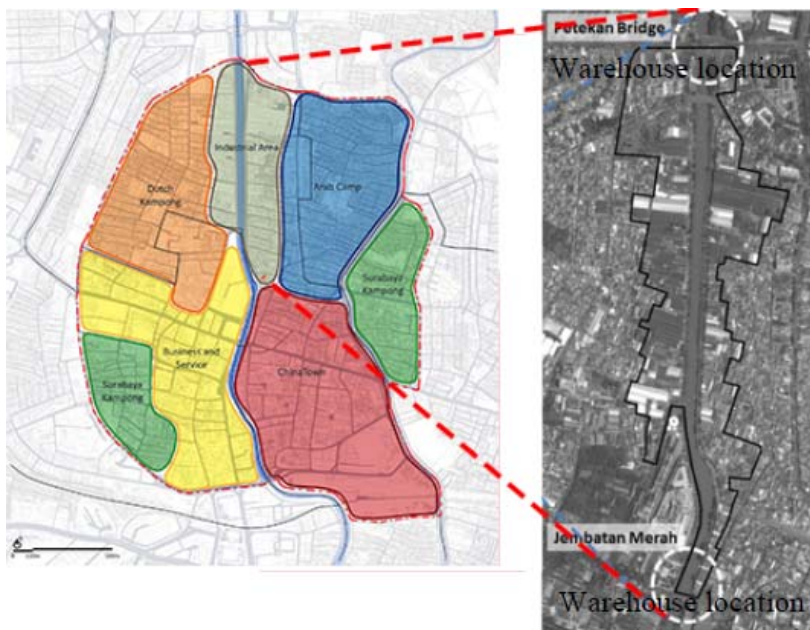


Figure 4: Location of warehouses in the Industrial District of the Old Town of Surabaya.
(Source: Left: Hadi, 2011; Right: Darjosanjoto et al., 2015.)

Table 1: Structural character of warehouses along the eastern Kalimas River. (Source: Darjosanjoto et al., 2015.)

Mark “A” in Segment 1, Fig. 5	Jengki architecture style that arose around 1950–1960.
Mark “B” and “C” in Segment 5, Fig. 5	The buildings marked are the historical harbourmaster tower. These buildings are prominent in scale as compared to others.
Segment “2”, “3”, “4” and “6” in Fig. 5	The warehouses have similar architecture elements to the Arab Camp.

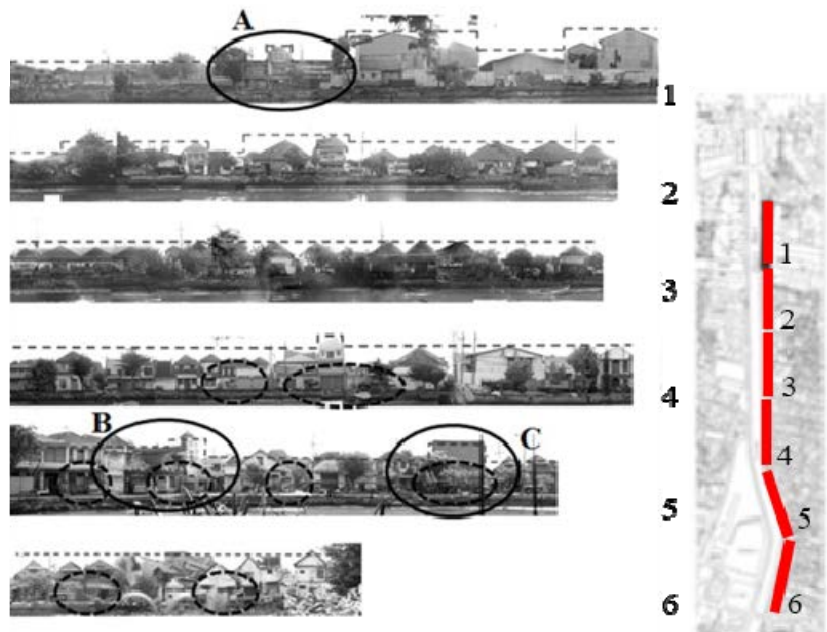


Figure 5: Street pictures of the eastern Kalimas River. (Source: Darjosanjoto et al., 2015.)

Table 2: Structural character of warehouses along the western Kalimas River. (Source: Darjosanjoto et al., 2015.)

Mark ‘D’ and ‘E’ in Segment 2, Fig. 6	The warehouses have no specific architectural style but the gable roof provides distinctive character along the street.
Mark “C” in segment 5, Fig. 5 and mark “F” in Segment 5, Fig. 6	The warehouses are run-downed. No clear structural character of these warehouses.
Segment 1, 3 and 4 in Fig. 6	Despite being located next to the Dutch Kampong, the warehouses show no distinctive character.

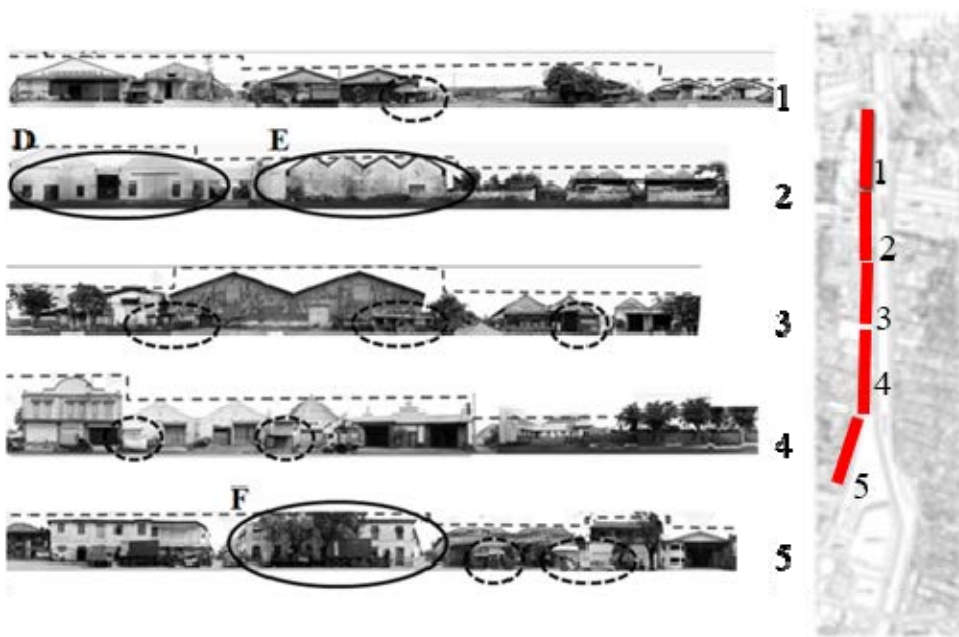


Figure 6: Street pictures of the western Kalimas River. (Source: Darjosanjoto et al., 2015.)

Different buildings possess its own identity and have different capacity that may transform and change over time [5]. The warehouses in the Old Town of Surabaya which were once served as a storage area are now long being neglected [13], creating a deteriorating illusion in this part of the city. Despite its dilapidated state, particularly on its architectural elements, these warehouses actually added to the unique character of this old town. It also expresses the glorious period of Surabaya during the 17th century.

Although the warehouses in the old town are obsolete for its original function, the permanence character of these warehouses remains significant. Set against the residential buildings, its prominence lies in its remarkable structures and huge volume and space [13].



Figure 7: The Dutch godowns on the western side of Kalimas River. (Source: Left: <https://dreamofacity.com/2012/09/23/colours-of-old-town-east-surabaya/>; Right: <http://www.skyscrapercity.com/showthread.php?t=1372277&page=19>.)



Figure 8: A drawing illustrating the godowns on the western side of Kalimas River during the 19th century. (Source: <http://surabayaenvironment.weebly.com/4/category/majapahit%20kingdom/1.html>.)

The warehouses in the Old Town of Surabaya have witnessed several transformations; from the era of Palace City to the modern era after independence [13]. However, when these buildings were left neglected, the memory of the city's past and events slowly diminished as it could no longer be narrated through its unique structural character and other distinguished urban artefacts (Figs 7 and 8) [3].

Urban artefacts may transform to accommodate the changing nature and demands of the city [7]. Hence, in order to revive the Kalimas riverbank in the Old Town of Surabaya, the symbolic nature of the warehouses in terms of its character, functions and architecture must be emphasized although at times, it may be remodelled and altered to suit the current needs. While adaptive reuse may be the best option, the typology of functions and programs to be injected into these warehouses must be appropriate to its context and identity of the old town to ensure continual memory of this historic city [10]. The transformation of these warehouses must also take into account the ambience of the past and the present. The neglected and slump like environment of the warehouses is needed to be revived up to the liveliness and busy atmosphere of once a port and trade centre. The act of revisiting these warehouses would help to alleviate the collective memory of the past. For instance, converting the industrial warehouses into public and commercial use to increase the vibrancy of public and commercial events, urban space and local growth [12].

6 CONCLUSION

By reconstructing and mapping the urban artefact of the historic city, the old town and the inner part of the city can be further appreciated [5]. The urban artefacts unveil the importance of collective memory throughout their survival and resiliency. Despite having great function and location, urban artefacts acquire strong collective memory in

shaping a city's identity. In other words, city is a depot of collective memory and identity [5].

As the city remodelled to suit the changing nature and current needs, reconciliation between the city and its inhabitants occurs. This can be verified through the city's architecture, which forms the basic component of a city [7].

In the case of the Old Town of Surabaya, the current government has taken initiatives to revive this part of the city. As such, the warehouse, which is one of the important urban artefacts in the old town, must be revisited. New functions need to be introduced into this building, giving suggestion that the identity of a city is never identical.

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URBAN STAGE TRANSCRIPT: MAPPING PERFORMANCE SPACES IN A HERITAGE URBAN PARCEL

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ABSTRACT

Performance and performativity are inherent to urban life and design. The idea of a city as “theatre of social action” according to Lewis Mumford has been contextualized through the roles of theatre and performance in urban life. The notion of theatre and performance here is more than metaphoric. In a parcel of Georgetown, Penang, the urban fabric provides historical spatial background as urban scenography; while in another sense, providing imagination of a performance through individuals’ routine that embodies the community’s collective values, desires, memories and aspirations. The deep-rooted existence of performing arts and cultural expression is now ploughed by the diminishing community that contributed to this scenario. This paper attempts to formulate strategies and tools of an urban catalyst that will revive the parcel into an area robust with business, religious and cultural activities that it once was. The potential of the site lies within its heritage cultural practices, heavily signified by its long-standing history of performance and artistic expressions in the urban parcel, which is now a host for the Penang Philharmonic Orchestra. Historical settings function as new imaginative performance spaces for citizens who assume the colliding and interchanging roles of both the performer and the audience. The new series of urban scenography become various nodes throughout the parcel, accommodating diverse typologies of “urban stage” and “micro theatres”. Subsequently, connectivity among these nodes is traversed by a network of “corridors”. As such, this plexus of urban performance ultimately encourages a certain level of culturally charged resiliency and rebrands the parcel as a sustainable entity thriving on creative economy. This formula aims to be a catalyst to a chain of reaction in rejuvenating George Town through new programs of cultural contextualisation.

Keywords: performance, routine, nodes, urban stage, micro theatre, urban scenography.

1 INTRODUCTION

George Town is the capital of Penang, situated on the island north-west of Peninsular Malaysia. With a long history from being a Malay fishing village to being one of the most important site of British colony to becoming a free state following the formation of Malaysia in 1963 [1], George Town has enjoyed economic growth due to its status as a port town and strategic location on the straits of Malacca. The town has received many migrants from China and India prior to World War I and since then became a successful trading post. These migrants would later create their own distinct settlements in the shop houses built by the British colony. Their culture and beliefs that would later assimilate into the local norms of George Town birthing its utter uniqueness [1], marking an important shift in the ethnic fabric of George Town and resulted in a revolution of the built environment. The migrants from China were mostly traders and have taken up the lifestyle of having both functions of a house and commerce under one roof—the shophouse [2]. The hybridity of building usage eventually impacted the urban environment by creating intensity and diversity that delineates a successful urban setting [5].

As a UNESCO World Heritage site, George Towns tourism economy sees an expansion of the city itself [1]. However, the subsequent lifestyle change due to economic pressures and vast technology has led to the disappearance of the traditional shophouse lifestyle. The



majority of shop houses are either overtaken by mundane generic commercial image or turned into offices. It is no longer the bustling urban centre, filled with diverse individualities that are unique to George Town. Gentrification slowly cripples the nostalgic liveliness and romance of the city with its crumbling rows of shophouses [7]. Ambitions of the younger generation, too, could not be contained in the narrow shophouses anymore. The fear of the shophouses becoming irrelevant in comparison to the ultra-modern developments in cities such as Kuala Lumpur may materialise if action to rejuvenate the city is not taken.

1.1 Site setting

The study is focused on a parcel (Fig. 1(b)) in the main masterplan of George Town (Fig. 1(a)), which was built on the original grid formed during the British colonial era. The internal road network marks its boundaries.

The parcel (Fig. 1(b)) in the early days is known as the Chinese enclave where Chinese settlers set up shop and live above the stores. Their presence is further solidified by the existence of one of the oldest temples in Penang, Kuan Yin Temple, abutting the parcel. In the heart of the study area also sits the infamous King Street Temples that have become a tourist attraction due to its richness in religious and cultural activities; occasionally a public affair. Following this, part of the road network becomes the main festival route for festivities such as the Chinese New Year parade, the Hungry Ghost festivities and Tua Pek Kong festivities [14]. The highlights of these festivities are often the cultural performances such as the lion dance, Chinese puppet shows and opera stage. While the performance settings are scattered all along the festival routes, the main stage would always be on Lebuhraya, with the signature shop houses as key urban scenography. Such idea of mapping traditional urban performance is adopted in the proposed Urban Transcript strategy.

Present-day gentrification has mostly eclipsed over the image and important roles that these historical shophouses had in their urban setting. With businesses either closing down or moving elsewhere, many storefronts and building frontages became dysfunctional and fail to attract users. The natural routine of the place is being broken by diverting urban dwellers to busier streets with more surveillance and security. Consequently, the habitable portion of these shophouses became vacant. As a result, the area became inferior due to lack of intensity, except during peak hours of the day or at times of festivities. This results in an unsafe public realm, especially at night.

Over the years, Penang Heritage Trust (PHT) and Think City has taken a step towards reinventing the parcel. One such effort is the building called The Star, Pitt Street.

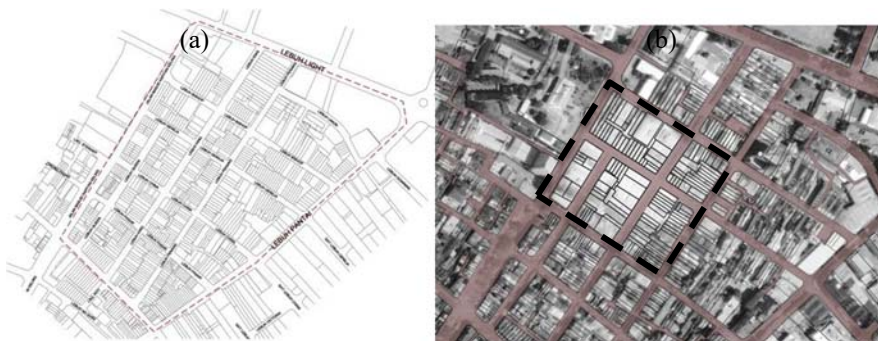


Figure 1: (a) The boundary of proposed master plan and (b) the studied parcel.

The refurbishment of the 3-storey historical building houses The Star's island office, the Think City office and an office for Penang Philharmonic Orchestra with several medium sized rehearsal spaces [15]. It also offers a book shop on the ground floor and several rentable spaces for private functions. As a continuation of such functional reinterpretation of the parcel in revolutionising George Town's masterplan, this study expands on the idea of cultural intervention as a potential urban catalyst to revive its robustness through cultural, business and religious activities.

The specified guidelines for developing George Town has set some constraints in terms of zoning and preservation, where four development categories are identified (Fig. 2) [7]:

- Category I: Historically significant buildings that must not be changed at any cost
- Category II: Historical shop houses where the façade must be maintained
- Infill: Vacant lots or buildings that are built with respect to the surrounding architecture
- Replacement: Buildings built without the consideration of the surrounding architectural context.

Only buildings in category II, Infill and Replacement may be reinvented with new programs. Within the parcel, 72% of the buildings are shophouses of category II, Infill and Replacement while only 20% are category I buildings, mainly comprising Chinese temples and *kongsi* - providing a lot of opportunity for physical intervention.

The opportunities and strengths in performance spaces have been identified as four site potential factors: permeability, nodes, building frontages and performance spaces (Figs 3–6).

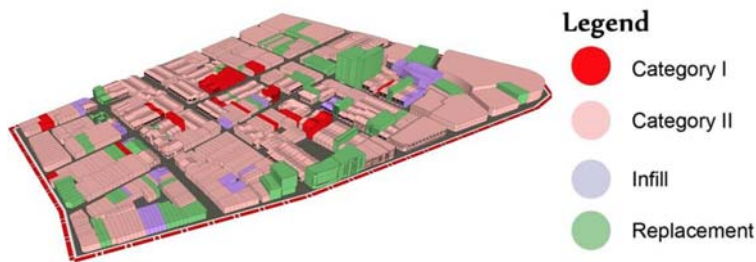


Figure 2: Building categories as stipulated in the George Town Development Guideline.

1.2 Site potentials



Figure 3: Potential open new connections + public ground floor (permeability).



Figure 4: Potential open public space (nodes)



Figure 5: Potential mixed-use shop houses (building frontages).



Figure 6: Potential performance spaces ("urban stage").

2 DESIGN THEORY AND CONCEPT

2.1 The parcel: a cultural quarter in a fine grain urban setting

Referencing “small is beautiful”, a term coined by Leopold Kohr, an economist, further refined by Madeleine Bunting, used to champion small, appropriate technologies that are believed to empower people [3]. The idea is to reinvent the historically small and narrow shop houses of George Town to be people-centred and having a more intimate approach that creates focus on human relationships. The aim is to achieve a “fine grain” urban setting that coincides with the size and emphasise the romanticism George Town is known for.

The idea of fine grain according to Jane Jacobs’ *Death and Life of Great American Cities* is to achieve the essence of urban life that lies in exuberant diversity. An urban quarter that consists of primary programs supported with secondary programs allows different types of people to utilize the area for different purposes at different times of day; thus increasing concentration of people on the street and in turn creates intensity in the quarter [4]. She further

elaborates on the need for permeability and places connected through streets with spaces for people watching are key to a successful urban quarter [4].

The notion of fine grain achieved through horizontal and vertical grain is discussed in Howard Davis' book *Living Over the Store: Architecture and Local Urban Life*. The discussion of historical shop house setting with the multifunctional spaces has dated back several centuries with families having businesses on the ground floor and living quarters on the first [5]. This form of hybridity is the continuum that allows multi-functional spaces and flexible arrangement of shop house usage. It creates a dynamic architectural relationships between dwelling and the shop [5].

The theory of urban regeneration through cultural quarters was proposed by John Montgomery with a formula of cultural production and consumption into mixed use development and reconfiguration of public realm [6], creating a sense of place with respect to the historical and cultural values in establishing relationships between building and spaces. This theory was applied in the successful rejuvenation of Temple Bar in Dublin, Ireland where active frontages became the primary tool to create an active street life. An introduction of site-specific cultural activities, mixed use programs and flexible spaces were key [10] in establishing new and robust routines, which creates a balanced interaction between the place and the people.

2.2 Choices and responses

A responsive urban environment [11] is essentially democratic and enriches the opportunities for the people by maximizing the degree of choice available to them. As the main medium connecting the values of people-place interaction, claiming their rights to the city. Focusing on the qualities of permeability, variety and robustness [11], this theory is adopted to support the notion to centralize the idea of performativity in the parcel to create a paradigm shift towards a sustainable and robust urban setting through an array of urban stage typologies resulting from the proposed formulation.

2.3 Performing the city

George Town is to be rebranded as a patron to the city's urban theatre incorporating stages and scenography that illuminates the culture, religion and routine of the citizen. The idea of "a city as a theatre", championed by Lewis Mumford, revolves around experiencing the urban environment and selling the idea of an economy based on this experience [8]. This concept highlights the essence of a city lies in the "urban scene" and "urban drama" in the sense of physical spaces, architecture and the design of cities; comprising a multitude of performative qualities such as tension and irony. The "urban drama" is the routine act of the citizens practicing their everyday life through performing their collective memory, imagination and aspiration [8].

His writing also contemplates on the question of identity-formation through this urban performativity [8]. It suggests that the act of formal performances on actual stages with scripted scenes incorporated into the urban fabric may become a point from which the formation of identity ripples throughout the city. Another element that must be taken into consideration is that the people eventually becomes both the spectator and cop performer whereby their interaction with the performances, public spaces and infrastructure is a process of self-identification; of performing the self.

Bernard Tschumi's study of urban performativity through *The Manhattan Transcript* [9] explores confrontation among use, form and social values. It delineates that space, movement



and events are independent but produce new relations when its components are broken down and rebuilt along different axes. The urban fabric is broken down into the infamous tripartite mode of notation introduced by Tschumi, the “events, movements and spaces” to discover the order of experience, moments, intervals and sequences when reading a city [9] - a plot. The study unearths layers of creation of spaces - scenes - through events and movements that occur in a plot, whereby these scenes are mapped out in different axes in order to experience the same plot differently.

2.4 Reconfiguring the parcel

Stemming from this concept, Saki Ichikawa [12] explored the idea of urban public theatre for street culture through contextualism, where London is reconfigured in the context of experience from the perspectives of three protagonists - the visitor, the performer and the observer'. The tourist, as a visitor, has viewpoints of the city; the performer senses the city as a theatre and the stage set designer (an *observer*) investigates the quality of space; street theatre [12]. It is concluded that public spaces assumes diverse qualities and functions as they become street theatres; a space to rest or gather as an auditorium; and at the same time, potentially accommodates a stage and sometimes stage set, thus giving urban performativity its literal function. In the context of a large city, these micro theatrical spaces can be interconnected, thus creating a macro theatre module across the city. Consequently, the macro theatre network may expand into larger applications in cities throughout the state. As complexity increases, this hierarchical growth would presumably be adaptable into extensive environments through a “super lobby/corridor” [13].

These theories gave birth to the idea of re-inventing the parcel through performance spaces - formal and informal - and mapping the spaces in the public realm and the built environment. The performativity and connectivity must tie strongly to the culture, religion and routine of the people in the area.

2.5 Urban scenography

In urban performativity, physical entities such as architecture and infrastructure make up the urban scenography [17] where buildings become the setting against which the performers (i.e. city dwellers) act. The occupation of formal and informal performing spaces encourages spontaneous public gatherings and street theatre events [17] and functions as a platform for natural formation of relationship among the audience, the performer and the space occur.

George Town houses an eclectic variety of buildings with different typologies, architectural styles and at varying scales – for example, Colonial style offices, Chinese-influenced shophouses, Indian-influenced mosques. Inherently, these different types of building frontage embody varying urban scenographies for different typologies of “urban stage”; assuming the role of “backdrop” or environmental setting for confrontations among the key elements of urban performance: Performer, Audience, Space. It is the dynamism and local relevance of these settings that are translated into the different typologies of urban stage in the transcript.

3 URBAN STAGE TRANSCRIPT

The conception of reinventing the parcel driven by “urban drama” must be set off by highlighting potential nodes. These nodes were studied based on The Manhattan Transcripts idea and concluded in a recurring urban model (Fig. 7). The recurring urban model was analysed into several floating typologies of combinations of “stage” and “audience” (Fig. 8).



These typologies would then be applied into the nodes or micro theatres, creating spaces for events and movements as well as events and movements for spaces (Fig. 9). In order for the spaces to contain or spill out the events and movements, multifunctionality must be incorporated.

The events, movements and spaces create a map of the performance spaces and directing the individuals through these spaces experiencing both the role of a performer and the audience. This map is the transcript for the parcel in response to the idea of performativity in the urban setting.

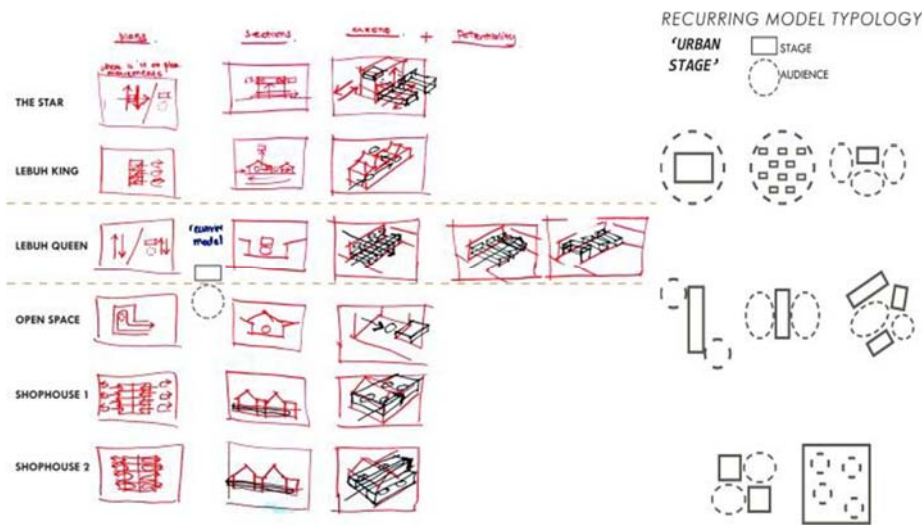


Figure 7: Analysis of nodes and the recurring models of “stage+audience” typology.

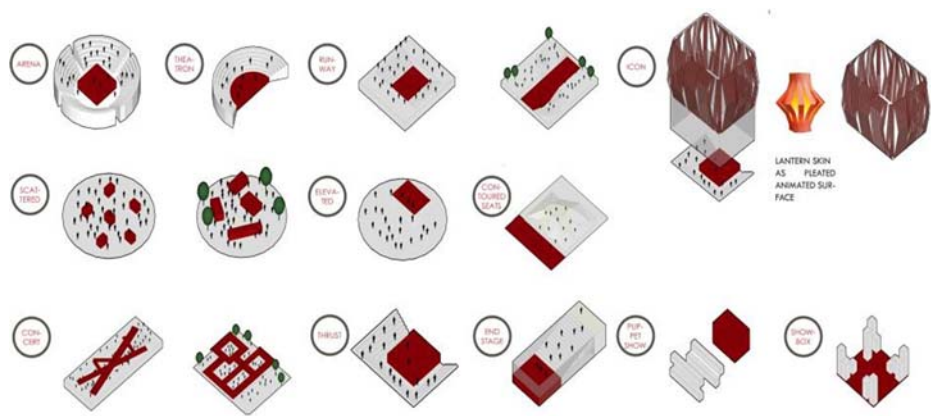


Figure 8: Floating typologies to be incorporated into the parcel from the recurring model.

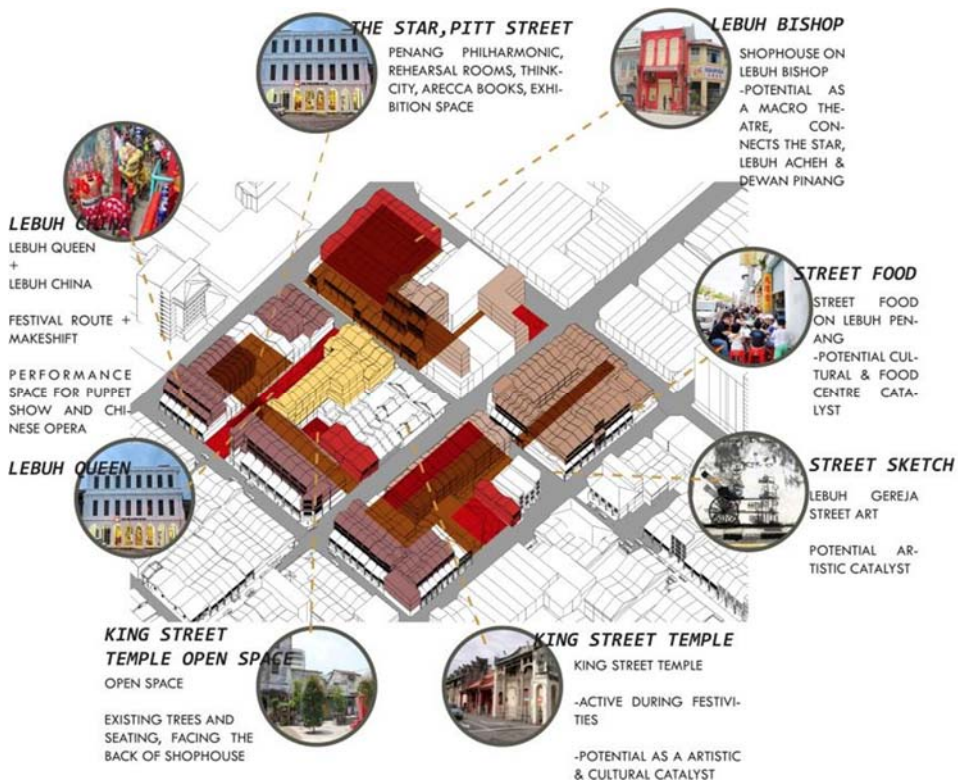


Figure 9: Nodes to be incorporated with the “stage + audience” typologies.

3.1 Mapping the urban performance space

The strategies of the “urban stage” include physical, social and economic instruments. However, in this study, only the physical and social instruments will be elaborated. The physical instrument: hybrid re-organisation of programs in the built environment and public spaces. To promote diversity and resilience, this includes creating active storefronts [4], allocating public realms on ground floor and introducing vertical diversity. Secondary or supporting programs to the urban performances are then introduced to create robustness.

The next set of urban tools work hand in hand; namely the “creative cultural catalyst” and the “new connectivity”. These tools are key framework in the mapping of the performance spaces. The creative cultural catalyst is extracted from the site study, whereby the potential of the site lies in its history of performativity. These elements will be connected by a new form of connectivity that utilizes existing streets, back lanes and ground floor of shophouses. This connectivity will be set off on an axis separate from the norm of the site but finds new relationships that complement the cultural and historical values of the parcel.

The social instrument aims on “engaging creative community” and to “enliven socio-economy”. Such community shall become patrons to the idea of formal and informal urban performance; comprising young professionals and tourists as “tenants” in the parcel.

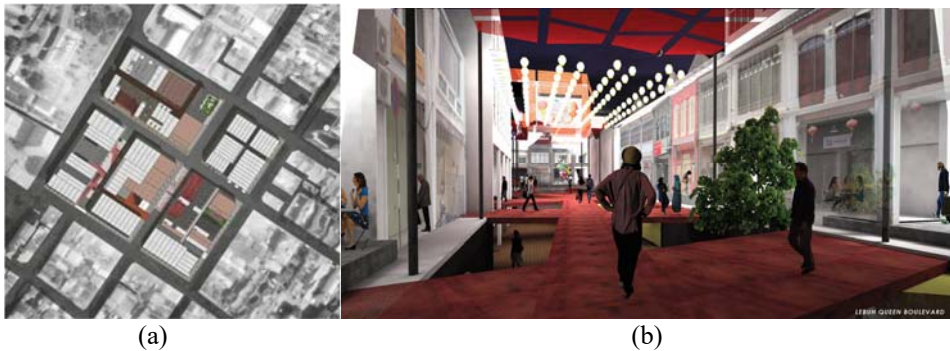


Figure 10: (a) Ground floor site plan incorporating the “Macrotheatre”, “Super-village” and “Super-corridor”; (b) Multi-level ground surfaces on Lebuh Queen.

These strategies culminate into the formation of three main interventions: “Macrotheatre”, “Super-village” and “Super-corridors”. The conception of these ideas are based on the study of theories on urban regeneration and performing the city (Fig. 10(a)). The “Macrotheatre” is a collective of nodes or micro theatres identified on site with potential of becoming multi-functional performance spaces. These nodes are the main element of the map, inter-connected by a series of linkages inclusively known as the “Super-corridors” which also functions as a canvas for street cultures of public art; subsequently a public realm. The idea of “Super-village” will be the collective outcome of the diverse reorganisation of mixed use programs in the built environment and the reinvention of the public realm (Fig. 10(b)).

3.1.1 Typologies

These site-specific typologies (Figs 11–13) are created from the analysed floating typologies incorporated on site with respect to the urban fabric, culture and values. The accumulation of all these typologies ties the parcel together in creating an urban stage transcript that may become a model to shift the paradigm of the whole site to become reinvented as a performative parcel of George Town’s urban fabric.



Figure 11: Super-village model in a block of existing shop house.

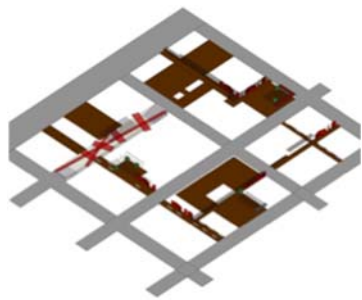


Figure 12: Super-corridor that connects the performance spaces.

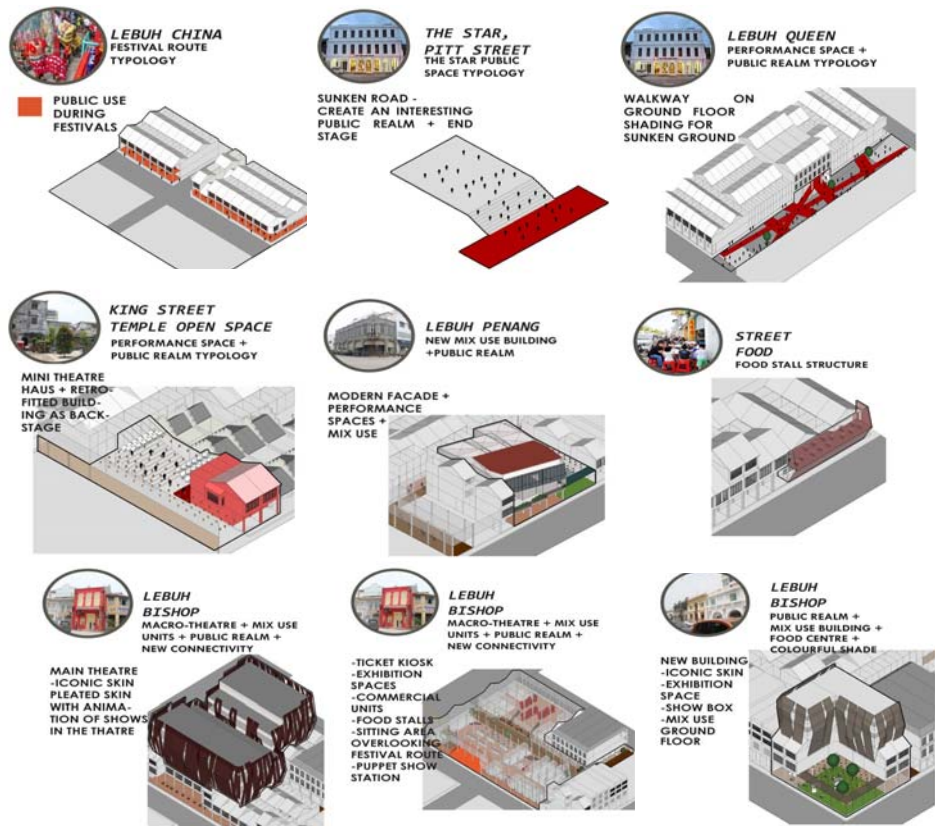


Figure 13: Typologies of urban performance spaces and multi-functional performance space creating the “Macrotheatre”.

CONCLUSION

The Urban Stage Transcript embodies the trail of urban performance at various scales, creating layers of events that occur in hierarchical sequences. The connectivity among

different typologies and locality of the “urban stages” are as important as the programs being injected into these flexible spaces. It is also interesting to see how different building frontages, as urban scenography, provide unique possibilities of manipulation in reaction to movement (routine) being performed in the space (public realm)—establishing dynamic relationships between people and place. Integrating physical, social and economic actors, this model of urban intervention seeks to develop a culture-driven creative economy for George Town.



Figure 14: Overall scheme of the “Urban Stage Transcript” as depicted in an exploded axonometry.

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SECTION 9
THE COMMUNITY
AND THE CITY

CONSIDERING COMPLEXITIES IN UNIQUE AFRICAN PLANNING APPROACHES: ABSTRACTING THE ROLE OF AFRICAN URBAN RESIDENTS

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ABSTRACT

Africa is currently the fastest urbanising region in the world and has subsequently become the centre of continuously growing attention from planning practitioners and academics. Many of these scholars argue for a unique African planning approach in light of the failure of the African urban landscape to emulate Western models of urbanisation. However, whilst practitioners and academics are deliberating concepts like decolonisation and African urbanism, African urban residents have been labouring non-stop to create sustainable living environments and meaningful lives for themselves. This paper aims to showcase how these residents have proven themselves to be active agents in constructing sustainable human settlements rather than simply being passive victims of relentless structural processes beyond their control. It argues the failure of unique African planning approaches and decolonisation attempts to recognise and more importantly, incorporate the solutions provided by the said African residents, because of the inherent Western ideals and ways of thinking guiding global planning approaches. The paper employs theory-based sampling as part of a qualitative inquiry into African urbanism, decolonisation and sustainable human settlement development, before turning to case studies in South Africa and Zambia to consider the complexities within these concepts and support the line of argument. The subsequent discussion begs the question of the role and interference required from planning practitioners and academics within the rapidly changing African urban landscape. It also explores the causative position of African residents in creating sustainable human settlements, highlighting the instances where they have created unique solutions to planning problems and have shaped the urban landscape to suit their own needs and circumstances, challenging Western rationalities underpinning African planning approaches. The paper concludes that abstracting the role of African urban residents in creating a unique African planning approach, may hold potential to create more sustainable and just human settlements in Africa.

Keywords: African urbanism, decolonisation, unplanned settlements, community-based planning, reblocking.

1 INTRODUCTION

Sometime during the year 2007, the world population became predominately urban for the first time in history [1], [2]. Africa, as part of the developing world, has experienced the highest urban growth rate during the past 20 years [3], [4] and has consequently become the centre of continuously growing attention from planning practitioners and academics. Notwithstanding the fact that this dramatic transformation in the world urban environment will be significant to both the global North and global South, the emphasis of this paper will be on that part of the world where these changes will likely have the most profound and visible effect, i.e. the global South and more specifically Africa [5].

Contrary to traditional Western urbanisation trends that were accompanied by inclusive growth within the Western urban landscape [6], Africa's structural transformation failed to keep up with urbanisation trends [4]. This consequently resulted in the proliferation of land invasion, spatial segregation, informal and unplanned settlements, slum-like urban environments, a high rate of urban poverty and rapidly increasing inequality [4].



Further to this, Watson [7], expressed concern that urban planning worldwide is beginning to reveal an alarming and increasing dichotomy between current planning approaches and the mounting challenges elicited by rapid urbanisation, particularly (but not limited to) noticeable in African cities and cities of the global South. Subsequently, Africa became the subject of increasing discourse from planning practitioners and academics [5], [8], seeking solutions to this barrage of planning challenges. Several of these scholars argue for a unique African planning approach [7], [9], [10], to address the said challenges of informality, unplanned settlements and slum conditions, especially in light of the failure of the African urban landscape to emulate Western models of urbanisation and the resulting urban planning solutions.

However, whilst practitioners and academics are deliberating concepts like decolonisation, African new urbanism, collaborative planning, rural-urban migration, the heritage of segregation, land invasion and the creation of sustainable human settlements, residents within unplanned and informal settlements have been labouring non-stop to create sustainable living environments and meaningful lives for themselves [10], [11]. This begs the critical question of the role and interference required from government, planning practitioners and academics within the rapidly changing African urban landscape and the resulting unplanned settlements [7], [12], [13].

This paper therefore aims to refrain from focussing its discussion on the challenges facing the rapidly urbanising and transforming African urban landscape, by rather converging on discussions concerning the unprejudiced reconsideration of the causative role of African residents as active agents in constructing sustainable human settlements instead of simply being passive victims of relentless structural processes beyond their control. The ensuing sections purpose to reflect on the lingering planning prejudice, briefly outline the current discourse on the African urban reality, argument for a metamorphism in abstracting the causative role of African urban residents in creating new planning approaches and a mind shift towards a metamorphism in the IQ of planning.

2 NOT “DONALD TRUMPING” THE INFLUX

“Whether it’s a ban or not, it’s keeping ‘bad people’ out” – Donald Trump, 2017

The current inundating influx of people to cities and seeming unsurmountable planning challenges awaiting the present and next generations of urban planners in Africa and the global South may leave many a planner, whether academic or practitioner, with a feeling of despondency and grappling for easy answers and quick solutions whilst reverting to traditional ways of plan making [14]. The succeeding discussion confirms that the statistics, especially regarding informality and slum-like urban environments, are dooming, the planning environment extremely challenging, and the threat to sustainable urban planning very real especially (but not exclusively) referring to the African urban landscape.

The subsequent sections also enquire into the planning professions’ response to this ostensibly gloomy picture.

2.1 The urbanisation “reality check”

The rate of urbanisation is increasing in both developed and developing countries [1]. Currently, the most urbanised regions in the world comprise North America (82%), Latin America and the Caribbean (80%) and Europe (73%), with Africa and Asia remaining mostly rural exhibiting urban populations of 40% and 48% respectively [1]. This, however, may be a misleading statistic as Africa and Asia are currently urbanising more rapidly than all the



other regions in the world and are projected to become 56% and 64% urban, respectively, by 2050 [1].

Africa, as part of the developing world, has experienced the highest urban growth rate during the past 20 years at a rate of 3.5% per year [2], [3]. This might seem insignificant, but it should be noted with some concern that the rate of urbanisation in Africa, as in the case with Asia, transpired twice as fast as it did in Europe [15]. According to a report in 2014 by the Department of Economic and Social Affairs of the United Nations [1], it took Europe 110 years to transform from 15% urban in 1800, to 40% in 1910. Africa, in contrast, has achieved the same transformation in 60 years, virtually half the time it took Europe.

2.2 Contextualising the African urban landscape

In Africa, as with many other developing countries in the global South, the urbanisation rate trumped those of developed countries during the past couple of decades, but did not correspondingly parallel the economic growth rate that were associated with the Western urbanisation trends [16]. Pending this unprecedented rapid transformation of the African urban landscape, several scholars have expressed their concern during the past decade about the significance of these accelerated changes for the global South and more specifically for Africa. Marx et al. [17] and Watson [9] *inter alia* warns that the said urban changes are transpiring in urban landscapes ravaged by poverty and unemployment, where governments are least equipped to provide urban infrastructure and urban residents are least able to afford it.

Further to this and contrary to traditional Western urbanisation trends that were accompanied by inclusive growth within the Western urban landscape [6], Africa's structural transformation failed to keep up with urbanisation trends [3]. The inexorable consequence has been the rapid growth of unplanned and informal settlements, accelerated land invasion, poor-quality housing, lack of adequate living space, slum-like living environments, a high rate of urban poverty and rapidly increasing inequality in the African urban landscape [4].

Watson [5] further strongly argues that rapid urbanisation is giving rise to never previously confronted complications and challenges in African urban management and planning. The 2013 State of Planning in Africa Report [10] affirms this and further outlines challenges faced by African cities in more disconcerting detail. The stated lack of inclusive growth and structural transformation within the African urban landscape have far-reaching consequences and an immense impact on the African urban planning context [5], [18]. It is evident that the contemporary planning context of the global South and Africa unambiguously differs from that within which European planners addressed urbanisation approximately a century ago.

2.3 African urban residents: "Trumping" the odds?

In the meantime, whilst planning practitioners and academics are increasingly deliberating an irreversibly and rapidly urbanising global South, with particular concern being voiced regarding the African urban landscape, little attention has been given to the actual urbanising residents, being the cause of this whole discourse. Policy formulation and governmental reaction to this influx, have for a long time aimed at fighting the urbanisation dynamic, rather than working with it [19]. Murray and Myers [20], reprimands that in spite of overwhelming adversities these urbanising residents have proven themselves to be active agents in constructing sustainable human settlements rather than simply being passive victims of



relentless structural processes beyond their control. In an address [21] to the 2006 World Planners Congress, UN-Habitat Executive Director Anna Tibaijuka, warned that “anti-poor measures” and the belief that “...in the planned city, the poor should at best be hidden or at worst swept away” will exacerbate social exclusion in cities. She also signalled that the “urbanisation of poverty” will be the most imperative future urban issue.

It is clear that a Trump-like “keeping the bad people out” approach cannot be followed - the influx of people to African cities will be incessant, the growth of unplanned and informal settlements accumulative, and the attitudes of African planning practitioners and theorists towards this transformation, paramount.

3 PLETHORA OF PREJUDICE

“Have no fear of robbers or murderers. They are external dangers, petty dangers. We should fear ourselves. Prejudices are the real robbers; vices the real murderers. The great dangers are within us. Why worry about what threatens our heads or our purses? Let us think instead of what threatens our souls.” – Victor Hugo, Les Misérables

Globally the word “informality” or “slum” would involuntarily conjure thoughts of extreme poverty, inadequately serviced and overcrowded, sub-standard urban housing. As a result of an irreversibly urbanising world, informal and unplanned settlements (also commonly referred to as “slums”) are extemporaneously emerging as a prevailing type of settlement, particularly in the urban landscapes of developing countries [17]. Various recent UN-Habitat reports [14], [22], have signalled that the global slum population is an ever-growing phenomenon. These reports highlighted inter alia that the global slum population increased on average by six million a year since 2000, translating into an escalation of about 16,500 persons daily. In Sub-Saharan Africa, 59% of the current urban population lives in slums.

This situation is not new. The 2003 UN-Habitat report: *The challenge of the slums* [19], explains that the problems of “high urban densities, low standards of housing and squalor” have been around since humankind first began to live in cities. This is echoed in the Global Report on Human Settlements [23] and Marx et al. [17], stating that slums were a characteristic feature of European and US cities during the Industrial Revolution, a trend which continued well into the twentieth century in some cities. It is manifest that the overcrowded, inadequately serviced slum areas, housing the poorest members of urban society, have long been documented as undesirable traits of urban living. For planning practitioners and academics, though, in pursuit of conceivable responses to the construct of informality, it is almost an impossibility to view these informal settlements and slum-like environments stripped from any kind of prejudice or pejorative connotations.

3.1 “What’s in a name?”

This notion of “planning prejudice” might be most easily illustrated in the terminology used all over the world to name or describe these informal settlements and slum areas. In an etymology of slum names, Dahlberg [24], contemplates the inherent implications of these “labels” for both planning practitioners and residents. Most of the slum names listed by Dahlberg [24], indicate an intrinsic adverse perception towards these settlements. This include names like “poor villages” (vijiji) in Kenya, “town of thin people” (Saimingai), “area of bad residences” (Furyô jûtaku chîiki), “illegal occupation” (huho sengkyo), “gang of poor people” (hin min kutsu) in Japan, “misery quarters” (Elendsquartier, Elendsviertel) or “poor quarters”(Armenviertel) in Germany, “lost cities” (ciudades perdidas) in Mexico, “misery societies” (villas miseria) in Argentina, “anarchic settlement” (samnong anatepatai) in



Cambodia, “settlement of rat’s houses” (khu nha o chuot) in Vietnam, “dirty areas” (kolache pradesha) or “dirty settlement” (gallicha wasti) in India and “filth neighbourhood” (mahalle-ye kasif) in Iran.

The Global Report on Human Settlements [23], resonates this, but also cautions that although the word ‘slum’ is an easily comprehensible “catch-all” term, it masquerades the fact that within this, and other terminology used to describe slum areas, rest a host of diverse settlements and communities. Further to this, the report [23], contends that slums may be divided into two broad classes: 1) slums of hope and 2) slums of despair where the former refers to: “progressing settlements, characterised by new, normally selfbuilt structures, usually illegal (e.g. squatters)” and the latter to “declining neighbourhoods where environmental conditions and domestic services are undergoing a process of degeneration.”

3.2 “Spira, spera (breathe, hope)”

The preceding classification in itself underlines an inherent prejudice towards slums and a pejorative connotation that influences the planning philosophy for these areas. In his book “Shadow cities”, Neuwirth [25] contends that the problem of planning for slums and informal settlements involves much more than finances. Developers have no interest in building for the poor and neither do local and national leaders. Residents in informal settlements or slum areas are frequently neglected and disrespected by governments, politicians, the press and even much of the public. They even often neglect and disrespect themselves as well [25]. Neuwirth charges urban planners and developers to do some self-examination and to let go of pejorative connotations regarding these settlements, as this masquerades the hopeful planning physiognomies of these landscapes.

Reflecting on Dahlberg’s etymology of slum names [24], a selection of these names echoes the residents’ hope in being active agents in constructing meaningful lives for themselves rather than simply being passive victims of a plethora of prejudice towards them. Names like “young settlements” (pueblos juvenes) in Peru, “moon village” (daldongnae) or “mountain village” (sandongnae) in South Korea, “village in a city” (chéng zhōngcūn) in China, “rights owned by the people” (Hak milik) in Malaysia, “simulated cities” (bidonvilles) in France and “houses built in moonlight” (tcharacka bet) in Ethiopia, undeniably mirror something about “slums of hope” instead of “slums of despair” and provide a positive platform of departure for planning practitioners and academics.

4 TABULA RASA

“An absence of preconceived ideas or predetermined goals; a clean slate...”

Adding to the plethora of prejudice, the African urban landscape has its own unique challenges as outlined in the preceding discussion. In view of this, a number of scholars are questioning the applicability and relevance of planning theory and paradigms asserting generic or global applicability, yet founded in presuppositions about planning, social and economic conditions that are more specific to a global North or Western context. Many of these scholars argue for a unique African planning approach in light of the failure of the African urban landscape to emulate Western models of urbanisation. It is not the purpose of this paper to track the copious accounts of these debates [5], [9], [26]–[28], but rather to focus on the causative position of African urban residents in creating sustainable human settlements, highlighting the instances where they have created unique solutions to planning problems and have shaped the urban landscape to suit their own needs and circumstances, challenging Western rationalities underpinning the said African planning approaches.



4.1 The formality of informality

The formal-informal dichotomy has been widely debated and captured in literature. Many of these debates centre on the issue of defining or classifying informality as opposed to formality [29]. Watson [5], laments that formality and informality is predominantly defined according to Western perceptions of “normal”. Lombard and Huxley [30], further substantiates this by arguing that the formal-informal dichotomy often encompasses an “implicit positive appraisal” of formality and a “devaluation” of informality with an escorting postulation that informality is a “Third World” problem, hardly ever associated with Western landscapes. Inevitably the informal is therefore typically associated with “slums”, as previously discussed in this paper, and seen as a “problem to be solved” [30], or a “disease to be eradicated.”

In planning theory, the inherent influence from the global North is evident as Modernist epitomes are usually expressed in the formal, whilst the irregularities opposing this, are usually framed as the informal [28]. Further to this, Miraftab [31], strongly argues that stressing only the adverse aspects of informality, augments the formal-informal dichotomy and marginalises informality as a construct completely detached from the formal, planned and modern, whilst in reality the binary are interrelated and directly interdependent. Roy [32], agrees in stating that formal planning provokes the informal by distinguishing between activities as formal or informal, legal or illegal.

An eradication development approach towards informality does not take the role of the informal system into consideration. The informal sector came into existence as a result of the inadequacies and inability of the formal sector to accommodate informal residents into formal socio- economic sectors [33]. Calling for the eradication of informal settlements as a development response, stems from a failure to understand why these settlements exist in the first place and how they function [25], [33]. It is essential to recognise the importance of the community networks that exist within the informal sector and how they form an essential component of people’s day-to-day lives to provide both a safety net and a sense of community engagement. Residents within informal settlements have put many innovative strategies and mechanisms in place in order to survive, whilst facing serious challenges [33].

4.2 “Brexiting” African Planning?

Since urban planning in all parts of the world is undeniably context-driven [5] and culture-defined [34], it should be logical, based on the preceding discussions, that a mere blueprint approach to urban planning in Africa would not be effective. Numerous planning theorists and academics [7], [9], [10], are currently advocating for a unique approach to African urban planning based on the argument that planning theory cannot merely be imported and applied from the global North to the global South, especially in light of the failure of the African urban landscape to emulate Western models of urbanisation and the resulting urban planning responses [35].

However, despite augmented international discourse [36], within the planning academic spheres on this matter, hitherto, governments and planning practitioners in Africa are habitually residing with the known, still endeavouring to apply blueprint copies of the planning principles and theories that were developed in the global North on the metamorphosing urban landscape of Africa [37]. In light of the foregoing discussions, this unchanging approach to African planning, especially within the construct of informality and unplanned settlements, is either very naive or extremely tenacious.



4.3 Clean slate planning for Africa: releasing the preconceived approaches

Healy [26] and Ernstson et al. [27], expressed that varied socio-spatial, economic and environmental constructs demand equally varied planning theories and practical applications. Watson [9] however warns that whilst there is undoubtedly a case for developing an African viewpoint in planning theory, it is also vital to stipulate the limitations on such an endeavour to elude the trap of generating new theoretical binaries.

According to Pieterse [13], the academic literature dealing with urban planning in Africa inclines towards one of three categories:

1. Policy-driven solutions that seek to provide answers within a greater policy determined discourse, based on the assertion that the suggested solutions will be successful should there be enough funding and expertise available;
2. Critical political economy perspectives on current planning approaches within the urban and rural landscape as seen through the prism of capitalism and its consequent state regulation/facilitation; and
3. Ethnographically orientated approaches focussing exhaustively on case studies in order to compensate for and illuminate the lack of social focus displayed by the first two approaches.

Pieterse [13] further cautions that the above-mentioned literature are in many cases functioning in an isolated manner and not providing a holistic perspective on the complex nature and directions of transformation in urban spaces at various scales within the African planning environment. An isolated attempt to understand planning within the African urban landscape in any of the above categories, might have damaging consequences. This paper ultimately argues for a unique qualitative research approach that will release the said preconceived approaches to African planning and take the current literature debate into account, whilst simultaneously capturing the solutions already provided by residents of unplanned settlements in an objective manner, without the subjective influence and criticism of politics and policies.

5 ABSTRACTING THE ROLE OF AFRICAN URBAN RESIDENTS

“If the misery of the poor be caused not by the laws of nature, but by our institutions, great is our sin.” – Charles Darwin (Voyage of the Beagle)

This section of the paper aims to showcase how African urban residents have proven themselves to be active agents in constructing sustainable human settlements rather than merely being passive victims of inexorable structural processes beyond their control. The research employs theory-based sampling as part of a qualitative inquiry into African urbanism and sustainable human settlement development, making use of case studies in South Africa and Zambia to consider the complexities within these concepts and support the line of argument.

5.1 The South African reality

The rapid growth of unplanned and informal settlements, accelerated land invasion, poor-quality housing, a high rate of urban poverty and rapidly increasing inequality in the African urban landscape as mentioned earlier in this paper [4], are all exemplified in the South African landscape [38]. In South Africa these challenges are generally



exacerbated as a result of a sharpened heritage of colonialism, segregation and more recently, a massive influx of rural-urban migrants to South African cities. Although British colonial influence ceased in 1961 when South Africa gained independence, the urban landscape was plagued by an incessantly racially segregated dispensation until the country became a democracy in 1994 [39]. Correspondingly, according to Odendaal [39], during this period (1961–1994), relatively stable economic growth became an impetus for influx across South African borders and a national migration from rural to urban areas.

These dramatic demographic changes in the South African rural and urban landscapes resulted in the establishment of several unplanned and informal settlements [38] that are increasing at an exponential rate. As a result of this, South Africa became the centre of mounting attention from planning practitioners and academics [13], to “solve this problem” or in more extreme terms, to “eradicate the disease”. In the adversity of this unending discourse, excessive bureaucratic rigmarole in the delivery of housing, a failing government and municipal planning system and non-existent service delivery, residents of these unplanned settlements have been labouring non-stop to create sustainable living environments and meaningful lives for themselves. This begs the critical question of the role and interference required from planning practitioners and academics within the rapidly changing South African urban landscape and the resulting unplanned settlements.

5.2 Planning without planners: some practical examples

Observing residents of unplanned and informal settlements within the African urban landscape, over a period of 10 years for research and planning practice purposes, resulted in the identification of some practical examples where African urban residents have proven themselves to be active agents in constructing sustainable human settlements and acceptable living environments for themselves. Table 1 provides a sampling of these practical examples, based on case studies areas within South Africa and Zambia. For the purposes of this study this was illustrated by coding and interfacing these case studies with the key attributes of adequate housing and sustainable human settlements as listed by the Urban Sector Network [40] and the Isandla report [33].

Table 1: Abstracting the role of African urban residents: case study examples.
(Source: Own construction, 2017.)

Sustainable Human Settlement attributes	Theory-based sampling	
	Case study example	Role of African urban residents
Adequate shelter/secure tenure	Makululu shanty compound, Zambia	Baking their own bricks to build their own houses
Access to basic services and infrastructure	Makululu shanty compound, Zambia	Residents manufacture and sell coal to counter lack of electricity
Economic viability/affordability	Makululu shanty compound, Zambia	Residents create economic viability with selling of home grown vegetables and coal
Habitability and health standards	Makululu shanty compound, Zambia	Residents provided for their own clinic and doctor
Accessibility/ transport systems	Marabastad, Kroonstad, RSA	Residents creating walkways and pedestrian friendly environment, accessibility to major transport routes
Social integration and cultural adequacy	Marabastad, Kroonstad, RSA	Residents creating social friendly interacting by means of communal areas e.g. soccer field
Environmental sustainability	Edendale: Dambuza KZN, RSA	Residents started their own recycling project collecting litter within the settlement



The examples provided in Table 1 are not exhaustive, but only aims to illustrate the causative position of African urban residents as active agents within the African urban landscape. The solutions they provide might not meet “Western standards” underpinning the creation of sustainable human settlements, but they have contributed with indigenous knowledge and created unique solutions to planning problems and have shaped the urban landscape to suit their own needs and circumstances challenging Western rationalities underpinning African planning approaches.

6 THE SISTINE CHAPEL OF PLANNING

“The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark.” – Michelangelo

It is common knowledge that when Michelangelo was commissioned to paint the ceiling of the Sistine chapel, he was intimidated by the scale of the assignment and was even apprehensive that such a large-scale project was presented to him by adversaries as a set-up for an inevitable failure [41]. The foregoing discussions in this paper, highlighted the measure of the planning challenges facing the African urban landscape and for many an African planner, practitioner or academic, this might be, or rather should be daunting. The scale of the planning assignment commissioned to African planners is no less intimidating than that of the Sistine chapel painting and it would be foolish to attempt finding a solution in isolation and even worse, in writing only one paper on this topic. This section merely purposes to point to a few nuances in the scope of the African planning landscape that might assist in the quest for workable solutions and ultimately creating better living environments for African urban residents in informal settlements flogged by adversities.

6.1 Bottom-up meeting top-down

Even though section 4 of this paper might suggest otherwise, it is important to emphasise that a proposed “tabula rasa” for African planning does not mean the foundation laid by planning theory originating from the global North, should be entirely ignored. Making special mention of, but not limited to, Davidhoff’s theory on advocacy and pluralism planning [42], his viewpoint that planning should be “pluralistic” and “represent diverse interests”, especially minority interests, underpins the well-established concepts of community planning, participatory planning and bottom-up approaches today. Davidhoff [42], urged urban planners to not endeavour in framing a single plan that denotes the “public interest” but rather “represent and plead the plans of many interest groups.” Reverting back to the urban planner truly acting as “advocate” for the community, might be a part of the answer in addressing the disparity between bottom-up not meeting top-down approaches in the African urban landscape. Participatory and community planning as a means to an end and not the end itself, might be the cause of many urban planners merely “going through the motions” during the planning process and not truly advocating for and representing the diverse needs of the African urban communities in unplanned and informal settlements.

6.2 A new African Planning “philo(love)-sophos(wisdom)”

The most famous section of the Sistine Chapel ceiling is Michelangelo’s Creation of Adam. Many theories exist regarding the identity and meaning of the twelve figures around God in the painting. According to Steinberg [41] the person protected by God’s left arm might be



Sophia, the goddess of wisdom also featuring as one of the primitives in creating the word “philosophy”, meaning the love of wisdom. Davidhoff [42], strongly supported intelligent urban planning and argued that “the practice of plural planning requires educating planners who would be able to engage as professional advocates in the contentious work of forming social policy.” The preceding discussions on African urban planning underline the notion that the African urban landscape is in desperate need of a new African Planning philosophy - one that would encourage urban planning students, practitioners and academics to pursue new and intelligent ways of planning for marginalised communities in unplanned and informal settlements, striving to take the diverse needs and the causative position of the African urban residents into consideration and to act wisely as advocates representing these urban residents.

6.3 “The perfect touch”

Adam’s finger almost touching God’s in Michelangelo’s painting in the Sistine Chapel, most likely rendered the painting its fame. It personifies the almost “perfect touch” and the sensitive balance between life and death [41]. The sensitive positioning of African urban planners in the planning process, and the weight of the responsibility acting as advocates for the African urban community and representing the diverse needs of the urban residents of unplanned and informal settlements, requires wisdom and intelligent decision making.

At the 2006 World Planners Congress, UN-Habitat Executive Director Anna Tibaijuka called on planning practitioners and academics to develop a different approach to planning: one that is pro-poor and inclusive and that centres on the creation of livelihoods [21]. For African urban planners, practitioners and academics this implies a complete African planning metamorphosis. Concluding the arguments in this paper, this sensitive role and balance of the African planner in the planning process would require the following six finer touches/nuances to African urban planning:

1. Accepting, and moreover, welcoming the rapidly changing African urban landscape and the resulting planning environment;
2. Unprejudiced consideration of the informal settlements and slum-like circumstances resulting from this rapidly urbanising landscape.
3. Recognising slums/unplanned/informal settlements as areas with social and economic potential – places of hope and not despair.
4. Releasing the preconceived approaches and starting from a clean slate when planning within an African context.
5. Abstracting the role of African urban residents and recognising their causative position in creating sustainable human settlements.
6. Striving towards becoming a wise and intelligent planner, truly advocating for the diverse needs of communities and fulfilling the sensitive role of balancing the touching point between bottom-up and top-down approaches.

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FEELING OF BEING OUT OF PLACE: A CASE STUDY OF KAMPUNG IN BUMI SERPONG DAMAI, INDONESIA

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ABSTRACT

This paper investigates the spatial experience of indigenous people in light of competing forces in the new urban growth area. It takes the case of urban growth in BSD City, Indonesia, which lies about 27km to the western part of Jakarta. Within this new urban area, the capital forces of giant government-backed developer provide heavy pressure to *kampung* – the indigenous settlement. Several *kampungs* were displaced, while others exist after a series of struggles. However, those *kampungs* are spatially marginalized: access is limited and bounded by fences and walls from its surrounding. This study focuses on how *kampung* dwellers are experiencing their marginalized lived space in the transforming environment. The combined, the separation and the antagonism of dominated and appropriated space are investigated from the lenses of local people using cognitive mapping procedures. In order to reveal dweller experience, 17 out of 128 household head of a small *kampung* were taken as respondent. This study shows that although the indigenous people succeed in shaping urban spaces, qualitatively they were alienated from their new surroundings. This new city does not belong to their life. The feeling of being out of place becomes real as it has been constructed by new city developers.

Keywords: out of place, spatial experience, *kampung*.

1 INTRODUCTION

Henri Lefebvre in his seminal work stated that capitalism and neo-capitalism had produced abstract space, within which the town has disintegrated. One diversified, it opposed, sometimes complemented and sometimes resembled one another. Lefebvre differentiates such space as dominated and appropriated space. The dominated space – space transformed and mediated by technology, by practice and invariably the realization of a master's project – is usually closed, sterilized, emptied out. While the opposite is the concept of appropriated space, a space that resembles a work of art. Both may in principle be combined and, ideally at least, they ought to be combined. However, history – which is to say the history of accumulation – is also the history of their separation and mutual antagonism. The winner of this contest has been domination [1].

Depart from Lefebvre conception; this paper tries to explore the spatial experience of *kampung* dwellers which lies in the vortex of urban growth. *Kampung*, in the Indonesian language, refers to an indigenous settlement where the residents still practiced traditional ways, in their everyday life, as in their village, even though they were in an urban area [2]. *Kampung* represents an appropriated space. It is a natural space modified to serve the needs possibilities of a group that it has been appropriated by that group [1]. The case study was taken in *Kampung Nagrek* - BSD City, located 27km to the western part of Jakarta (Fig. 1.).

Kampung Nagrek was a squatter settlement in the rural area. It consisted of rubber plantations, rice fields, farmland, sand mining and squatter settlement. The construction of BSD City has changed the landscape of its surrounding tremendously. Some neighbouring settlements have disappeared, transformed into luxurious residential clusters along class facilities to support them. The majority of indigenous people have been marginalized to the villages farther away. Those who remain in their houses are now facing a separate fence,



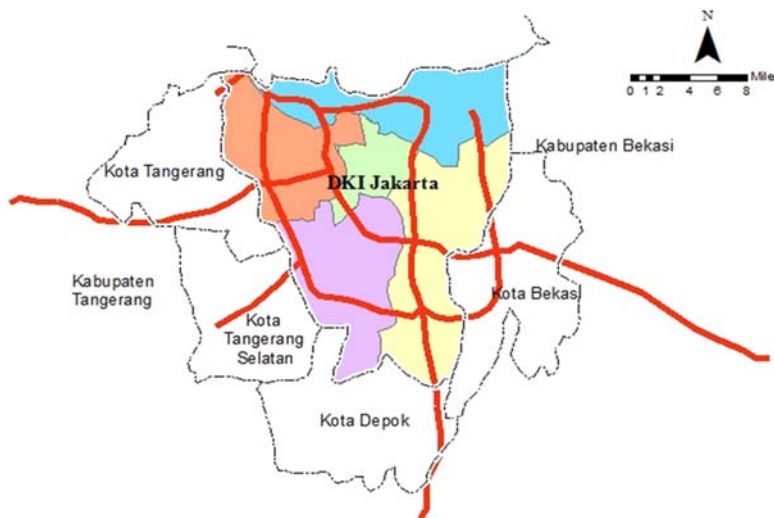


Figure 1: The study area.

wall, new housing, and roads [3]. *Kampung Nagrek* today is no longer a settlement regarding the rural area, rather it is a squatter settlement located in the new urban area.

Within this area, the contestation between dominated space of the new city and the appropriated space of *kampung* come into existence. The case of BSD City and *Kampung Nagrek* shows the combine, the separation and the antagonism of dominated space and appropriated space.

This study attempts to explore how the new changing urban space is experienced by the indigenous *kampung* dwellers within vast spatial and environmental transformation. It is become important to understand their spatial experience since the producing of urban space necessarily entails more than just planning the material space of the city. It involves all aspect of people's life [4]. It also includes a thought concept and feeling – an “experience” [5].

2 SPACE AND SPATIAL EXPERIENCE: A THEORETICAL APPROACH

“The present epoch will be above the epoch of space” [6]. What was predicted by Michel Foucault 50 years ago seems to be relevant today. Space is still a contentious concept. A different understanding of space underlies the separation of epistemology between a philosophical approach and spatial practice. Debates about the space can be traced back to Plato and Aristotle, Bergson and Einstein, Euclid and Carnap, Descartes, Leibniz and Kant, to Lefebvre, Foucault and others [5]. Plato is the first person to explicitly distinguish *chora* (space) and place [7]. According to Plato, space provides a container of everything. It is the womb, the nurse, the receptacle that provides the position of everything that will be. While the place is a comprehensible entity and can be perceived by the perceptual sense, “a sensible entity, it has come into existence, constantly in motion, apprehended by perception being” [8]. Subsequently, Aristotle reduced *Chora* to something immense (*megethos*) and named the place (*topos*) as the immobile content of the *chora*. Aristotelian *topos* concept is one part of the definition of the being of a physical thing [7].

After Plato and Aristotle, Descartes' thought became an important point in the discourse of the concept of space. In Cartesian logic, space has entered the absolute world, in line with the materialism nature of Cartes philosophy. Responding to the views of Descartes, then

Immanuel Kant provides a revision of the concept of space [1]. Kant states that space is not an empirical concept but a subjective condition of the mind. "Space is not something objective and real, nor a substance; Instead, it is subjective and ideal, and originates from the mind's nature in accord with a stable law as a scheme, as it was, for coordinating everything sensed externally" [9]. Kant asserts that space (and time) is not an objective and independent reality. Space is a subjective demand of our sensory ability to make sure everything is in harmony. Space and time serve as an indispensable tool that regulates images of objects imported by sensory organs. The raw data supplied by the eyes and ears will be useless if the mind has no space and time to understand it all [10]. For Kant, space is one of the conditions/conditions of experience. Space is not palpable, but it is a medium in which humans feel the experience of an object [11].

The emergence of phenomenology introduced by Edmund Husserl has shifted the focus from the world out there or what is in reality to how human beings perceive and experience their space [7]. Since human is essentially spatial [12], therefore spatial experience will underline the meaning of peoples' lives as it is [13]. From the lenses of this approach, human beings not only discern geometric patterns in nature and create abstract spaces in mind, but they also try to embody their feelings, images, and thoughts in tangible material [14]. Space is not a series of abstract relations in which the world of life is structured. In contrast, the lived experience is the primary relationship from which all the conceptions of space are built [15]. In other words, people do not perceive space as it exists, but space which is lived [12].

One of the seminal works in investigating lived experience was conducted by Edward Relph's work in 1976. His contribution to the understanding of spatial experience is the concept of insideness and outsideness. To be inside is to belong to it and to identify with it, and the more profoundly inside the person feels, the stronger is this identity with the place [16]. If a person feels inside a place, he or she is here rather than there, safe rather than threatened, enclosed rather than exposed, at ease rather than stressed [17]. On the contrary, outsideness refers to a situation where a person is separated or alienated from their context. Here, people feel some sort of division between themselves and the world [17]. The similar concept of belongingness and identity were brought by Creswell. He introduced the terms 'in place' and 'out of place' to describe the situation when someone belongs to the particular place and not in another [18]. According to Creswell, it is possible for someone to be inside or outside a place. Outsiders are not to be trusted; insiders know the rules and obey them. Since the place has an objective and subjective aspect, then according to Creswell the insider and outsider do not simply refer to a location. Outsider is not just someone who is really from another location but someone who existentially does not know the rules [18].

This study attempts to expand the knowledge of urban lived experience when the dominated and appropriated space combine, separate and antagonize each other, by looking into the lives of the marginal element of the new city. In particular, this study investigates the spatial experience of *kampung* dweller through their perceptual and cognitive conception of their lived space.

3 METHOD

The study reported here is a part of broader research which investigates *kampung* dweller's spatial experience in the enormous urban growth. To understand the people's lived experience, we have to understand how the *kampung* dwellers' live, how do they connect with their world and how do they feel. This paper only focuses on the analysis of *kampung* dweller's perceptual and cognitive conception of their space. The cognitive conception of space understood through the map can help shape our perceptual knowledge, which in turn can characterize everyday spatial encounters as we move through the realm of the real world



[17]. Therefore, this paper employs cognitive maps to reveal how dwellers understand and give the meanings of their daily lived space.

A cognitive map is an individual mindset or individual concept. It identifies representations of objects in the physical environment, the concept of surroundings, living beings, behavior, culture, identity, structure and meaning [2]. We asked the participants to sketch a cognitive map and gave them the opportunity to draw their spatial surroundings through their interpretation of the phrase 'the place where I live.' We intend to know how their space features, and how the spaces of the participants were viewed and used. Through cognitive map, we expect that participants can show what is important, and also reveal what is less important in their daily spaces. The maps produced illustrated not only the physical layout but also psychosocial connections occurred [19].

The participants in this study were *Kampung Nagrek* dwellers. In total, there were 17 people involved consisting 13 males and 4 females, with their age ranging from 20–79 years (Table 1).

Table 1: Participants' characteristics.

Participants (not the real name)		Age	Sex	Occupation		Education
				Before city development	Current job	
1.	Mahfud	44	Male	Farmer	Security	High school
2.	Sofyan	30	Male	Small trader	Small trader	Elementary
3.	Jamal	33	Male	Small trader	Small trader	High school
4.	Munaf	50	Male	Farmer	Motorbike taxi driver	Elementary
5.	Solihin	50	Male	Farmer	Cleaning service	Elementary
6.	Sukarta	33	Male	Small trader	Unemployed	Elementary
7.	Sarifudin	59	Male	Land broker	Trader	
8.	Tasdik	79	Male	Farmer, trader	Trader	--
9.	Ma'sum	52	Male	Private driver	Private driver	Elementary
10.	Yunus	60	Male	Farmer	Unemployed	--
11.	Siman	60	Male	Farmer	Unemployed	--
12.	Anung	20	Male	Student	Small trader	High school
13.	Munar	23	Male	Student	Student	High school
14.	Ermy	40	Female	Housewife	Housewife	Elementary
15.	Sumarni	44	Female	Housewife	Housewife	Elementary
16.	Kokom	35	Female	Housewife	Housewife	Elementary
17.	Iyan	50	Female	Housewife	Housewife	--

4 RESULT

4.1 Participants' living environment

Kampung Nagrek is one of the organic settlements that still survive in the midst of the growth of the new city. The village has undergone enormous environmental changes over a period of 10 years. Formerly this *kampung* was a squatter settlement in the rural area but now turned into a squatter settlement in the urban area. Although *kampung* Nagrek is currently located in a new urban area, the rural characteristics of the village have not changed. Fig. 2 shows the location of *kampung* Nagrek in the formation of a new city space. Differences in landscape and space elements appear to the contrast between the two. The *kampung* is still had rural atmosphere, characterized by lush naturally grown trees, traditional house shapes, the use of conventional building materials, and more organic house arrangements. On the contrary, the landscape of the new city is modern, neat, organized and equipped with premium city-class support facilities. It also characterized by a neat arrangement of trees, modern housing layout and the use of more premium materials. The difference in the materiality of the space makes *Kampung* Nagrek impressed as area out of place, which differs from its surrounding environment.

4.2 Cognitive mapping of *Kampung* dwellers

To obtain a picture of lived space experience of participants, we asked them to sketch “the place where I live” through a cognitive map. The maps were drawn without time limitation to avoid feelings of distress on the participants. We intend to know how their space features, and how the spaces of the participants were viewed and used. Through cognitive map, we expect that participants can show what is important, and also reveal what is less important in their daily spaces. Fig. 3 shows examples of cognitive maps sketched by participants.

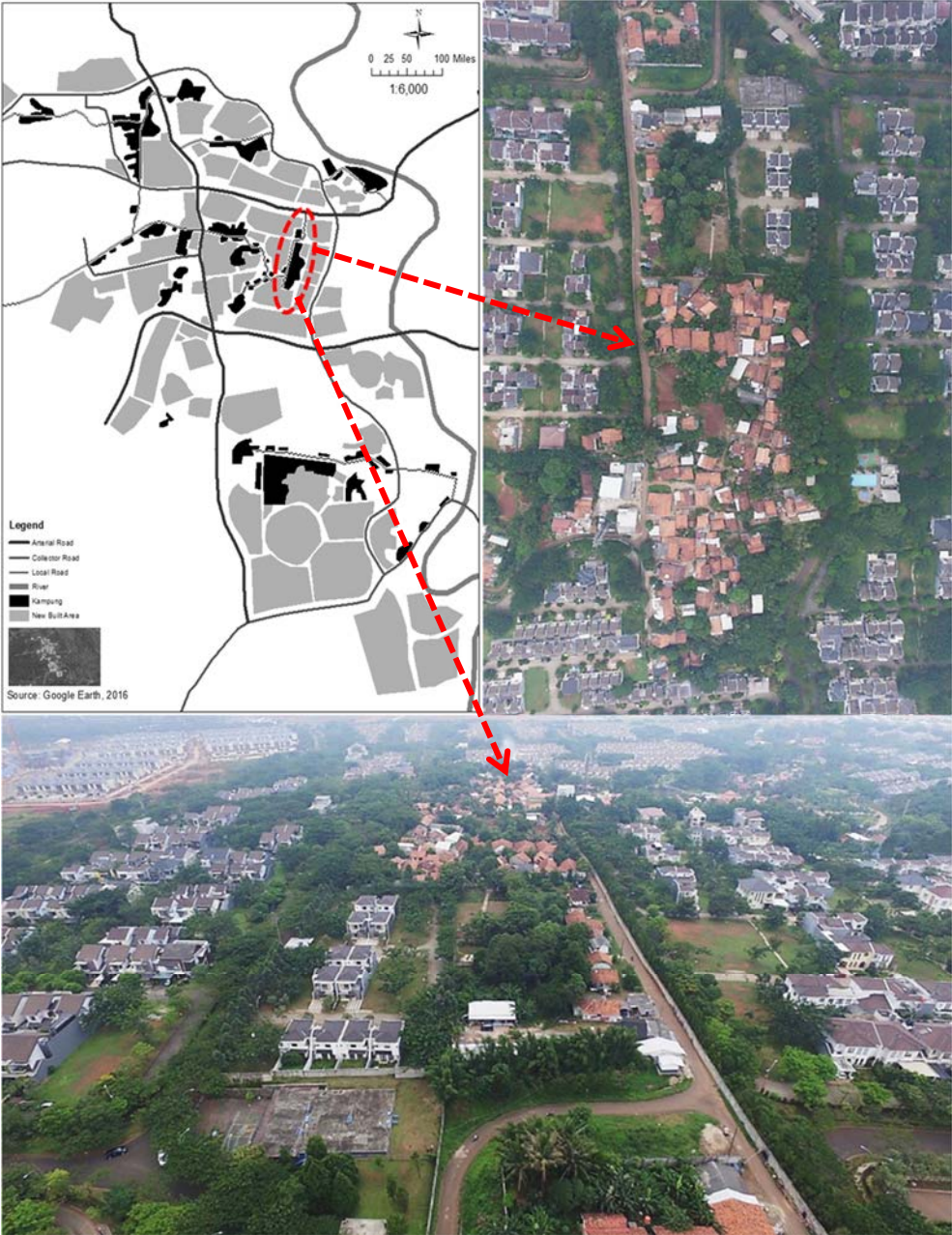
4.3 Seeing the city through the lenses of *kampung*s' dwellers

Based on participants' cognitive maps, some essential elements are identified by looking at its appearance in the map. The presence of these elements are shown in Table 2.

Figure 4 displays the most frequent elements drawn by *kampung* dwellers. They are *kampung*s' lane (17); participants' house (17); Streets (12 out of 17); relatives' house (12 out of 17); Foresta/new residential area of new city (11); Tunnel as entry point to *kampung* (9); Mosque (8); *Kampung* Tegal/the neighbouring *kampung* (7); Informal leader house (4), Traffic Light (4).

Mapping the respondents' identification of “where I live” reveals interesting findings. Based on the responses, dwellers' maps reflect the fragmented nature of the city. There are no participants that demonstrate an “insideness” sense with the new city. From dwellers' maps, it can be seen that the most frequent elements occur is the elements of *kampung*, not the city. It informs us that *kampung* and its elements are the most important elements in their life. Moreover, none of the participants take the setting of a new city to describe their lived space. All of the participants only drew *kampung* Nagrek with its surrounding as their lived space. It means that *kampung* dwellers perceived their *kampung* and the city as different entities. The “outsideness” feeling also can be traced when none of them drew the city facilities, such as hospitals, schools, shopping malls, sport club, etc. Participants only drew some elements of the new city which directly linked to their *kampung*, such as streets as a channel for their movement, tunnel as the entrance to their *kampung*, Foresta as a

residential area close to their *kampung* and traffic light near the entry of the *kampung*. Some participants even describe their lived space in the past area configuration setting, when the new city has not been built (Fig. 5).



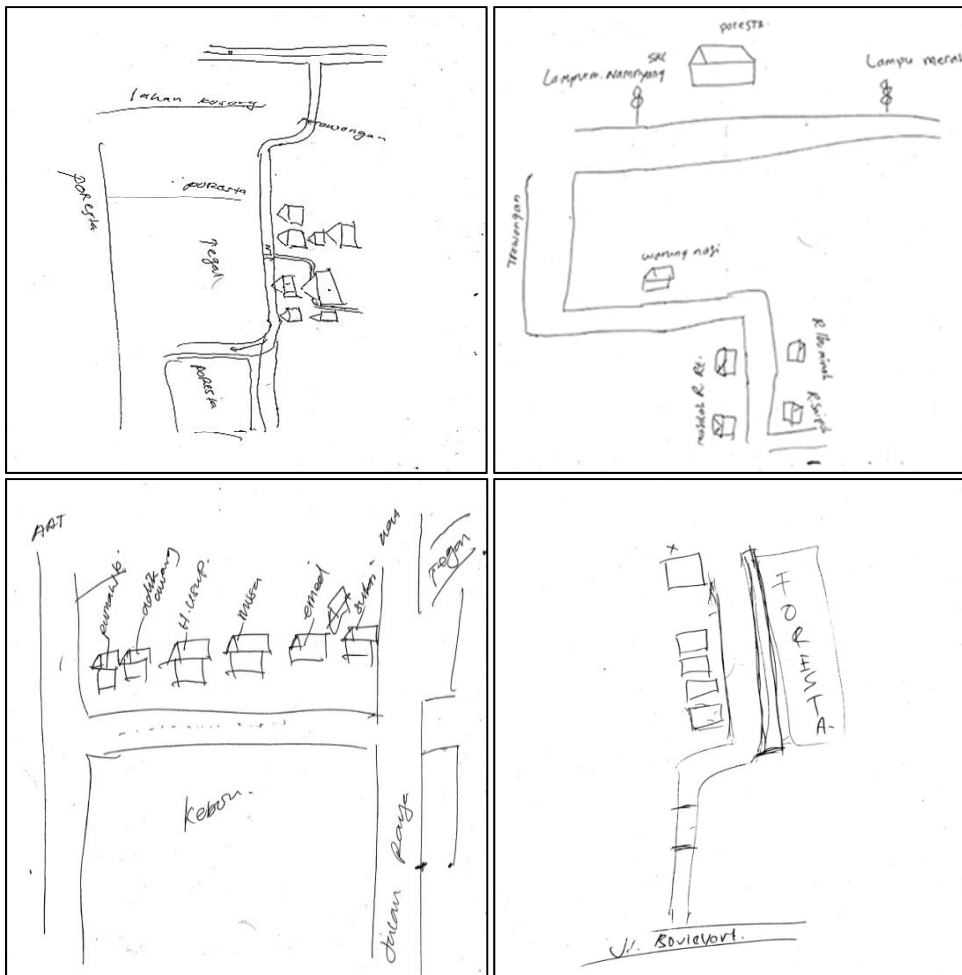


Figure 3: Cognitive maps of *kampung* dwellers.

Table 2: Elements of *kampung* dwellers’ cognitive maps.

The elements of the New City

[illegible]

Table 2: Continued.

The elements of *Kampung*

Participant Element	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<i>Kampungs'</i> lanes																		17
Participants' house																		17
Relatives' house																		12
Tunnel																		9
Mosque																		5
Musholla																		3
Informal leader house																		4
Madrasah																		1
Separating wall																		1
Cemetery																		2
Aas stall																		3
Food stall																		3
Garden																		2
Unused land																		1
Traditional sport field																		2
Trash dump																		1
Paddy fields																		1

The elements of surroundings.

Participant Element	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<i>Kampung</i> Tegal																		7
Sampora Village																		1
Cisauk District																		1
Police Office																		1
Pagedangan District																		1
Legok District																		1
Cicayur Village																		1
Junior High School																		1
Cisadane River																		1
Paddy fields																		1

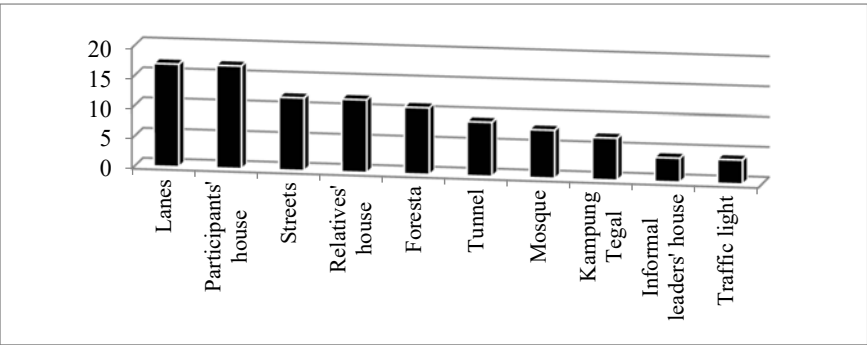


Figure 4: The most frequent elements in Dwellers' maps.



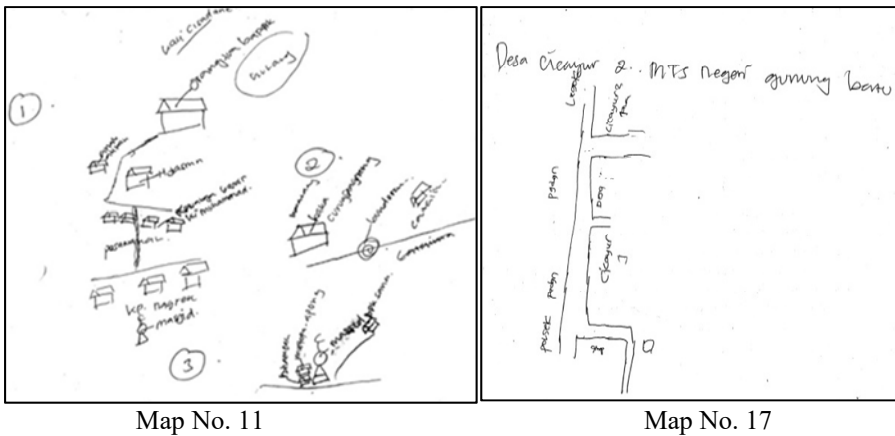


Figure 5: Cognitive maps using past area configuration setting.

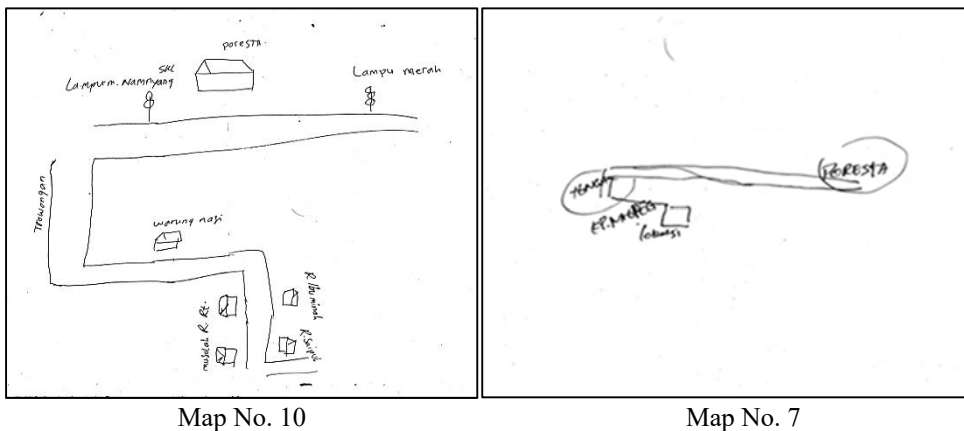


Figure 6: The Perceptual home zone of participants.

The results of mapping the respondents' indications of their home also reveal significant findings. Home is not just a house people happen to live in, it is not something that can be anywhere, that can be exchanged, but an irreplaceable center of significant [16]. In the case of *kampung* Nagrek dwellers, most participants did not realize that their home zone is in the middle of Foresta – one of a residential area in new city – as displayed in Fig. 6. From 17 participants, 11 participants drew Foresta as spatial elements of their daily spaces. While the rest do not consider that their homes are located near to Foresta. However, 8 out of 11 participants define their home in the sense of backwardness. Only 3 persons realize that Foresta surrounds their homes.

5 CONCLUSION

The findings generated from implementing cognitive mapping helped to contribute to understanding the kampung dwellers' spatial experience in the new city. The cognitive maps

produced by kampungs' dwellers reflect the segregated nature of the city. It can be seen from the facts that there are no participants who strongly demonstrate an 'insideness' with the new city. Being inside is knowing where you are [16]. Therefore, if a person feels inside a place, he or she is here rather than there, safe rather than threatened, enclosed rather than exposed, at ease rather than stressed [17]. In this study, we found that participants do not recognize the position of their lived space in urban formation. It indicates that kampung dwellers perceived their kampung and the city as different entities. None of them took the new city in describing their lived space context. Rather, they perceived the lived space in the scope of kampung and its former rural area. They understand the position of their own houses, their relatives' house, and the boundary of their kampung, as they are significant in defining participants' lived space. This study also reveals that although physically participants dwell in urban space, mentally they do not belong in that space. The feeling of being out of place becomes real as new city developers have constructed it.

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BOTTOM UP APPROACH: KANCIL, THE STRIVE OF LOCAL INFORMAL COMMUNITIES

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ABSTRACT

People with low capacity are vulnerable to flood impact. One community that is prone to flood impacts is those who live on the bank of Ciliwung River in Depok City, Indonesia. In facing floods impact, local people developed Komunitas Anak Ciliwung (KANCIL), an informal society. This society aims to increased awareness of the people in order to save the environment, so that the floods impact can be reduced. The purpose of this study was to determine KANCIL achievement in increasing people participation in maintaining their environment. Data collection was completed by in-depth interviews, while analysis was done using triangulation method between interviews results, expert's judgments and previous researches. There are two activities that are often done, cleaning and patrolling the river bank. After two years of running, KANCIL evolves relationships with other communities who care about the river. In the other hand, the number of participants as well as the activities carried by KANCIL has not increased. The study results show that the communities were not ready yet to involved in the activities that planned by KANCIL. There are several factors that influence the success of KANCIL's program. The main factor that is found is the lack of knowledge of the people to the benefits of maintaining the river. Other factors are also influential is the lack of support from formal leaders. This study concluded that the bottom-up activities such as KANCIL, requires knowledge and commitment of participants as means of locomotion. If the local people do not have adequate knowledge, the role of leaders and formal institutions must be strong. Knowledge and support from formal leaders are important to encourage the people in carrying out the program that has been compiled.

Keywords: bottom up approach, participation, informal local society, knowledge, formal leader.

1 INTRODUCTION

Ci Liwung, or commonly written as Ciliwung is one of the most important river in Tatar Pasundan, West Java, especially because this river passes through Jakarta and often causes annual flood in downstream area. The length of its main river stream is nearly 120 kilometers and consists of 387 square kilometers catchment area (watershed). The river is relatively wide. In the past, small boats were able to sail in its downstream to distribute any commodities. Ci Liwung flows through Kabupaten Bogor, Kota Bogor, Kota Depok, and Jakarta [1].

As one of the largest and longest river in West Java and Jakarta, Ciliwung becomes an important part of the town development where it is flowed through. And public concern related to the environment along Ciliwung has triggered the development of about twenty Ciliwung Observer Community. To mention some of those are Komunitas Ciliwung Civil Society, Komunitas Ciliwung Bojong gede, Komunitas Ciliwung Depok, Komunitas Ciliwung Condet, Komunitas Sanggar Ciliwung, Komunitas Tree Grower Community (TGC), Komunitas Teens Go Green, etc. [2].

Community is a small unit of social life. Its members know each other, have their own culture that is different from other community culture, and living in an area which is not clearly defined its borders. The result of preliminary observations in Depok found that there is a community called Komunitas Anak Ciliwung (KANCIL), which is formed in 2014.



This community was established from the initiative of local people who have awareness that there is still some bad behaviours practiced by people living in Ciliwung bank. The kind of these bad behaviours include throwing any trash to the river and the ignorance of young people in Pondok Cina about this phenomenon. So, those trashes keep increasing day by day. The urge is the vision to arouse public awareness in river bank and keep Ciliwung clean to avoid flood. KANCIL is the kind of territorial community (geographical community) which rises from environmental togetherness and tied-place interaction [3].

This study aims to find out KANCIL activities to increase people participation and typology in taking care their environment. A community normally appears in urban areas and has common goals. KANCIL aims to increase public awareness toward Pondok Cina environment in order to reduce flood impact.

Based on the previous research results, entitled “Pengabaian Pemerintah Terhadap Eksistensi Penduduk Pinggir Sungai Ciliwung: Wajah Pengelolaan Sungai di Indonesia” [4], it is concluded that the government has no comprehensive concept in managing river because they focus on physical development. This could be observed as the government excludes people who live along the river and have a direct urgency and dependence on it. This situation underlies my thoughts on how far is the society role toward a disaster, is that community can reduce the impact of a disaster, and how far community can reach their goals.

2 MATERIALS AND METHODS

2.1 The characteristic of research area

Depok is a city which is populated of 2.033.508 people. Depok has tropical climate and the rainfalls difference is quite small. This city is also influenced by seasonal weather [5]. Komunitas Anak Ciliwung (KANCIL) is located in the southern Depok at Jalan Kapuk, Kelurahan Pondok Cina, Kecamatan Beji, Depok, West Java.

Flood and inundation is defined as two different things but actually related to each other. Flood is the overflow water that exceeds river capacity in that flume. It is usually preceded by high rainfall or high flow from upstream area. Puddle or inundation flood is water puddle from heavy rainfall accumulation that inundates an area with poor drainage or high-water absorption retention into the soil. Flood and inundation problem are caused by heavy rainfall, modified or disrupted river morphology conditions, poor drainage systems, and other external factors such as high river sedimentation and landslide. This condition is worsened by reduction water carrying capacity in river due to the construction of river bank and river bluff erosion. Later on, this situation can trigger landslide.

Based on the interview, flood in that area is caused by river flow which is coming from upstream (Bogor) to downstream (Depok) and it passes through Pondok Cina. Flood inundation can be occurred for about 2–3 hours which will cause a dirty environment because it is dominated by trashes. Those trashes are the waste products people throw to the river.

2.2 Types of public participation

Sherry Arnstein (Bizjak [6]), divides participation in eight stair steps which are grouped into three typologies consist of citizen power, tokenism, and non-participation. It can be seen in the following picture and table for further information.

Citizen control and full participation are in the same level, which society can participate inside and control the entire process of decision-making. Tokenism level only provides limited opportunities to the society to be involved in the planning process. This participation



is the same as public participation or pseudo participation; people are not really empowered to be involved in decision-making process. At the level of non-participation, holder of power justifies a proposal as if involve the community [7].

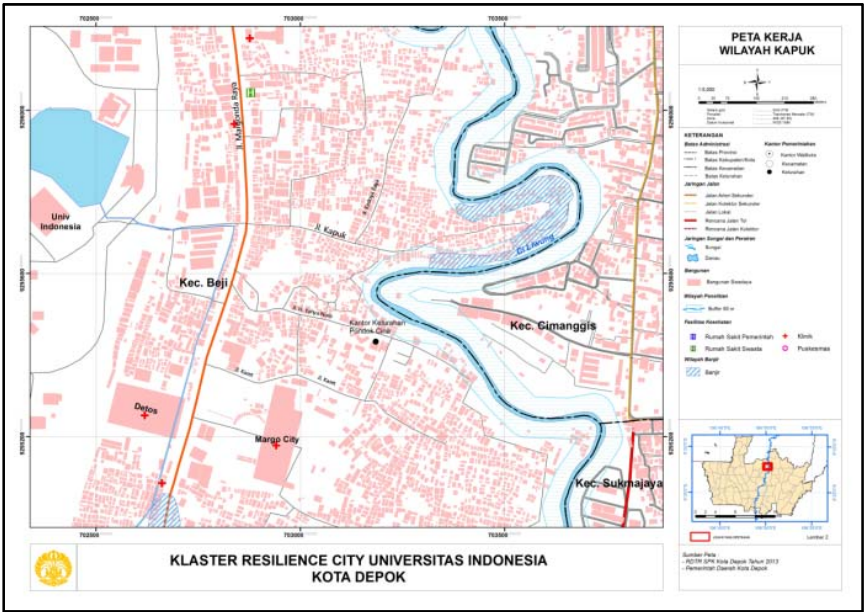


Figure 1: The map of area which is affected by flood in Pondok Cina. (Source: Resilience City Cluster Research Report.)

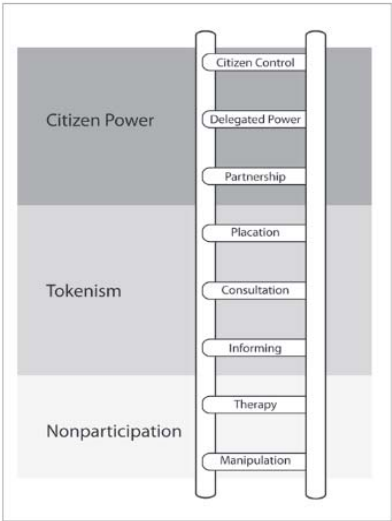


Figure 2: Participation Level According to Sherry Arnstein (Bizjak [6]). (Source: Bizjak, I (2012).)

Table 1: Levels of Participation According to Sherry Arnstein (Bizjak [6]). (Source: Darminto, 2003 and Aspac Mitra Consultindo, 2005 in Safrida, 2007.)

Tipologi Masyarakat	Tingkat Partisipasi	Uraian
Degrees of Citizen Power	Citizen Control	Societies have power over public policy, both in the formulation, implementation, evaluation, and control.
	Delegated Power	The government distributes most of its authority to take care of some needs.
	Partnership	Societies and governments become equal partner.
Degree of Tokenism	Placation	There have been dialogues and negotiations, but the power to decide in government level.
	Consultation	There is bidirectional communication such as public hearing.
	Informing	There is improvement but still one-way communication.
Non-participation	Therapy	Communication is limited and directives.
	Manipulation	There is no communications and dialogues.

2.3 Methodology

According to William Wiersma (Bachri [8]), “Triangulation is qualitative cross-validation. It assesses the sufficiency of the data according to the convergence of multiple data source or multiple data collection procedures”. There are three types of triangulation. It consists of Source, Time, Theory, Researcher, and Methodology of Triangulation. The triangulation type that we use is Source Triangulation. It means we compared/rechecked how reliable the information that has been obtained through different sources. For example, compared observation results with interviews; compared between what was said in public and in private, compared interview results with the real documents. The analysis was done based on observation results, comprehensive interviews, assessment from experts, data documentations, and other supporting data such as maps and historical formation of KANCIL.

3 RESULT AND DISCUSSION

Community can be used as an identity reference when faced with other communities. Members of the community have a high degree of solidarity [9]. KANCIL is a community formed by people mutual awareness about the importance of protecting the environment such as flood that happened in river bank. Participation was appeared on the initiative young people who have willingness to reduce the impact of flood and clean up the environment together. But the lack of society participation in river bank is shown by still many people throw garbage to the river.

The community members consist of natives who live around Gang Kapuk, Pondok Cina (Gg.Kapuk, Pondok Cina is dominated by newcomers now (boarding house/rent house)

compared to natives). The membership is voluntary, and no special requirements needed to be the member. The active members are 15 persons now. Before KANCIL community was formed, there were some communities that has been formed such as FKH (Forum Komunitas Hijau) dan KCD (Komunitas Ciliwung Depok). Here is the structure chart, membership, and types of KANCIL activities.

The administrator of this community consists of a Chairman, Vice Chairman, Secretary, Treasurer and several sections include Public Relations Division and Section Skills. Total members are 30 people, while 15 people are the active members, the rest are temporary (if there are certain activities only). KANCIL programs include cleaning and maintaining activities along the Ciliwung by boat (every week), socializing to people (door to door), planting trees on the Ciliwung riverbanks, participating in special events related to Ciliwung and Environment (for example: Annual Event of Ciliwung Day, Exhibitions, etc.). The following are visualization of KANCIL programs (see Fig. 4).

Based on interviews and observations, the area along the river bank in Pondok Cina is vulnerable toward flood. This area is part of Depok which is a connector zone due to its location at the center between Bogor (upstream) and Jakarta (downstream). So many trashes remain in this area. Either comes from upstream or from anyone who lives along the Ciliwung riverbanks. The spirit of togetherness in KANCIL triggers cleaning activities in riverbanks once a week, which is conducted by 15 people. In addition, they also have high solidarity, mutual trust, respect, and support each other. The next focus activity in this paper is maintaining act. This activity utilizes boats to discover and control along the Ciliwung river.

Based on the results of interviews of the members of KANCIL, we know that KANCIL activities cannot be separated from the support of some communities around them such as FKH (Forum Komunitas Hijau) and KCD (Komunitas Ciliwung Depok) that have some same vision for protecting the environment along the river banks to keep it clean. This condition can raise the awareness of society along the Ciliwung riverbank. This picture below shows the location of several Communities that giving attention to the environment along the Ciliwung riverbank.

Fig. 5 shows the three communities that are Community Children Ciliwung (KANCIL), Forum Komunitas Hijau (KFH) and Komunitas Ciliwung Depok (KCD). The distribution of community location shows the division of area along the Ciliwung river, the location of KANCIL is in the northern part of Depok, this community is located in Kelurahan Pondok Cina, on Kampung Kapuk. Meanwhile, the location of the KFH secretariat is in the downtown, in Dinas Badan Lingkungan Hidup (BLH) Depok, while KCD's location is in Grand Depok City, southern part of Depok.

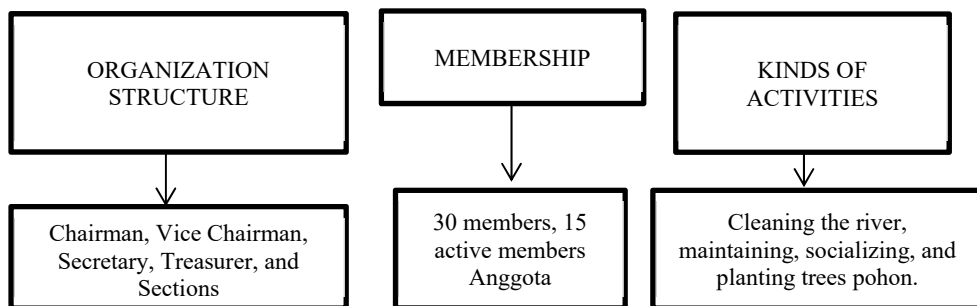


Figure 3: Structure Chart, Membership and Type of KANCIL activities. (Source: Interview Results.)



Figure 4: KANCIL activities in the river bank. (Source: KANCIL Documentation.)

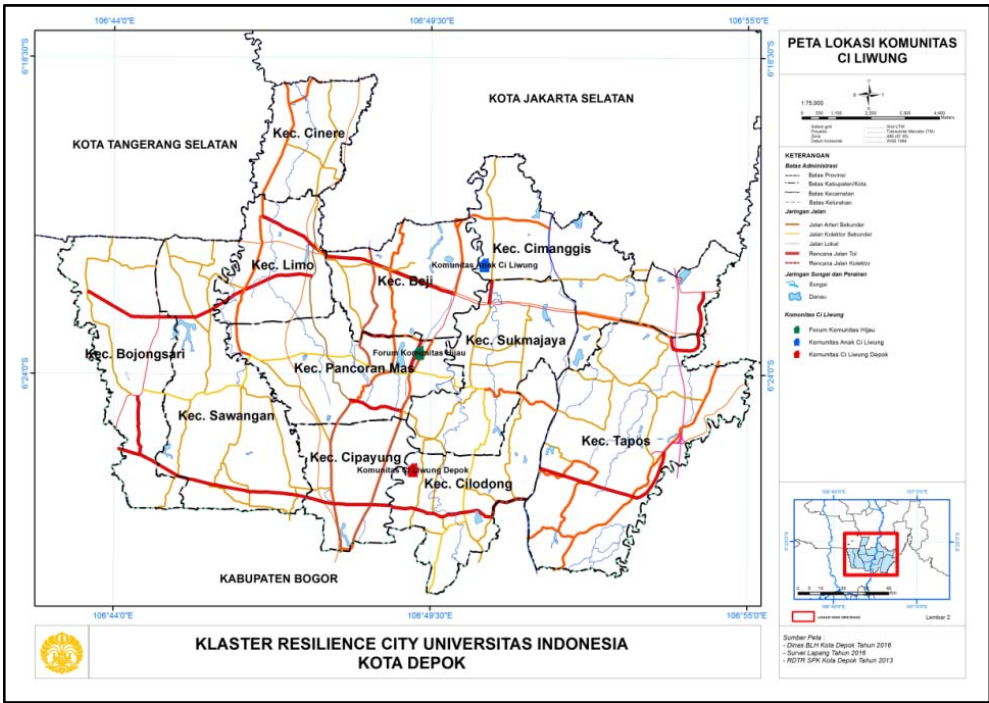


Figure 5: Map Location of KANCIL, FKH, and KCD. (Source: Resilience City Cluster Research Report.)





Figure 6: KANCIL basecamp. (Source: Personal Documentation.)

As once said by Mr. Yopie Septiady in his lecture of *masyarakat dan kebudayaan perkotaan*, a community can be used as a reference for identity. And KANCIL showed their identity as a community which were born and formed by the idea of some youth who are initiatively to maintain 'their area'. It can reduce the impact of flood. KANCIL opens their secretariat or basecamp along the Ciliwung river banks in the form of stilts.

KANCIL has jargon “Salam Ciliwung” and “Salam Lestari”. These phrases are ones of spirit identities of KANCIL community in realizing and achieving their visions and missions. But behind the community spirit and high solidarity, there are absolutely obstacles faced by KANCIL such as few people who are involved in this community and many people are not environmentally conscious. Means that from the initial formation of KANCIL, until this time there has not been a significant change.

There is still big amount of trash, less members of KANCIL, and lack of knowledge about river as their adequacy and limitation currently.

These lacks are also marked by the weak of control and government support so that the society should require an active role, but they must face the limitations such as the lack of knowledge on human resources who can make proposals that aim to invoke the fund activities to city government. Currently, KANCIL still utilizes the fund of a joint between the members. They are a little out of scope from Depok City Government reach. That can be seen when I interviewed one of the staff of civil servant in Depok City Government. When I asked, “is there any community to assist the government in flood problems through the river banks?”, they just mentioned FKH (Forum Komunitas Hijau) as their partner, where the existence of KANCIL is not known for real. Therefore, KANCIL referred as the community which was informally formed. As a matter of fact, I assume the characteristic of informal community is seen from the limitation resources, having voluntary and having less than 30 members slightly.

That is absolutely the obstacles of government in establishing communication between the community and the government as well as on the contrary. Arnstein (Bizjak [6]) suggested typology of the society and the type of society participation are emphasized in the typology of citizen power as follows:

The table below shows that KANCIL is in typology of Citizen Power, but they are weak in several levels, such as in the Citizen Control of Society. KANCIL has not had the power over public policy, both in the formulation, implementation, evaluation and control, Delegated Power emphasized the government which has not distributed a portion of its

Table 2: KANCIL typology and type participation.

Tipologi Masyarakat KANCIL	Tingkat Partisipasi	Uraian
<i>Degrees of Citizen Power</i>	<i>Citizen Control</i>	The society has not had power over public policy, both in the formulation, implementation, evaluation and control.
	<i>Delegated Power</i>	The government has not distributed a portion of its authority to take in charge some needs.
	<i>Partnership</i>	The societies and governments have not become equal partners yet.

authority to handle some needs, and Partnership that is the society and the government has not been equal partner.

Thus, the role of government should be very important when KANCIL and the society along the river could be encouraged as the pioneers of environmental awareness through the provision of training and knowledge against the importance of protecting the environment and the river sanitation in order to reduce the impact of floods.

4 CONCLUSION

KANCIL (Komunitas Anak Ciliwung) plays an active part of protecting the environment of the Ciliwung river bank. Yet, the lack of concern from Pondok Cina's people toward Ciliwung river banks, the relationship between the community, and the support of local government as well as RT / RW and communities along the river of Ciliwung have not supported KANCIL activities. This community also has not had adequate resources yet, so they have not been able to work closely with the government of Depok.

Therefore, the main factor discovered is the lack of knowledge against the benefits on keeping the river in the informal community or society. Another factor is the lack of support from formal leader. This study concluded that the bottom-up activities, such as KANCIL, required knowledge and commitment of participants as the pioneers. If the local people do not have adequate knowledge, the role of leader and formal institutions must be strong. Knowledge and support of formal leaders are very important to encourage the people in carrying out the program that has been compiled, so that all levels of society could be involved.

ACKNOWLEDGEMENTS

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HEALTH FAIR: COMMUNITY INVOLVEMENT AND OWNERSHIP IN EVENT PLANNING

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ABSTRACT

Over the years, Bangladesh Center for Communication Programs (BCCP) has been working on Behaviour Change Communication (BCC) and Community Mobilization for Bangladesh communities; BCCP is partnering with NGO Health Service Delivery Project (NHSDP), that delivers essential healthcare services across the country through a network of 25 NGOs covering 15% of the total population through Surjer Hashi (SH) clinics. BCCP is working with NHSDP on community mobilization for reaching out to different stakeholders, creating partnerships in order to identify community resources, health needs and promoting health seeking behaviour at household level. To accelerate community ownership and demonstrate role of the stakeholders in mobilizing resources for promoting model community action - a series of activities had been carried out under a community congregation named "Health Fair"; which was planned, organized and facilitated by community groups. This was an interactive event showcasing health messages and listening to community voices. A total of 25 Health Fairs had been held. With community involvement, the NGOs leveraged social capital, volunteerism, government ownership and private stakeholders' involvement. The perception analysis of attending audiences showed this as a highly successful event where 79.5% respondents commented this as useful for them, 95.7% were willing to share information with others and 99% thought that this kind of fair should be arranged in future. The participation of the communities is key to the success. Creating community ownership can work for discovering and unfolding of the community resources for the sustainability of health promotion.

Keywords: community, stakeholders, mobilization, action, resource, ownership, sustainability, health, involvement, promotion.

1 INTRODUCTION

Bangladesh has made significant strides in the health sector, and is on track to reach Millennium Development Goals 1, 4 and 5, including a steady rise in life expectancy at birth. Attention is now turning to the Sustainable Development Goals, particularly Goal # 3 which aims at ensuring healthy lives and promoting well-being for all at all ages [1]. The Alma Ata Declaration in 1978 framed community involvement as central to primary healthcare [2]. It has also been enshrined as an important standard within rights based approaches to health that has a basic value in and of itself [3]. Since these landmark agreements reinforce community involvement, considerable experience has been built regarding it, with plenty of argue and reflection about its definition, rationale and outcomes [4]–[12]. Community involvement can be instrumental as working with communities can help make interventions more relevant to local needs, informed by local knowledge and priorities, and therefore more effective. More necessarily, depending on the social processes involved, it can also be transformative, helping to empower and emancipate marginalized communities. At the same time, community involvement without attention to power relations can distort participation from its developmental aims, exacerbate existing patterns of exclusion and further entrench inequities. While there is growing consensus on the value of community involvement in health systems, there is variation in how communities are defined and understood. While communities are often defined as being geographic, such as in villages or neighbourhoods, they are not necessarily territorial, as they can also include social groups united by activities



or interests, and in a range of spaces. The Latin word ‘communitas’ combines the terms ‘with/together’ with ‘gift’, as a broad term for fellowship or organized society. In this sense, Campbell and Jovchelovitch defined as communities are constituted by those with a shared social identity; that is of members with the same set of social representations, which are the meanings, symbols and aspirations through which people make sense of their world [13]. These are not purely markers of affinity, but also governed by power relations (Navarro [14]). In this sense, communities are also heterogeneous and constitute sites of social exclusion [15], [16]. These social conditions are not permanent. Communities are also sites of empowerment, where unequal relations can be challenged [17], [18]. Though a defining element in assessing community involvement is the level of control or power that communities command in an initiative (Joffe [18]), the terminology that categorizes the processes and conditions by which communities are involved also at times blurred, ranging from mobilization to empowerment. Some view community mobilization as mainly externally driven (Rifkin [20]), while others define it as how communities plan, carry out, and evaluate activities on a participatory and sustained basis to improve their health and other needs, either on their own initiative or stimulated by others (O’Rourke et al. [21]). Beyond community mobilization lies community empowerment, the expansion of capability to participate in; negotiate with; influence, control, and hold accountable institutions that affect the wellbeing of the community. It is through empowerment that communities gain mastery over their lives and change their social and political environment to improve their health and quality of life (Wallerstein [22]). Since multiple reviews have argued the value of community participation [4]–[12], evaluations have largely focused on health outcomes. None assess the extent to which community participation figures in research on health systems interventions. It is not the intention of the review to provide a comprehensive catalogue of the literature on community participation, as this has already been done by others [4], [5], [10], [20], [23], [24]. Hence, the purpose of this research is to experience how people’s congregation accelerates community ownership and demonstrates role of the stakeholders in mobilizing resources for promoting model community health practice through Health Fairs, also to see the level and scope of community involvement in event planning for health awareness intervention.

Over the years Bangladesh Center for Communication Programs (BCCP) has been working on Behaviour Change Communication (BCC) and Community Mobilization (CM) for Bangladesh communities in continuation of which they are partnering with NGO Health Service Delivery Project (NHSDP), that delivers essential healthcare services across the country through 399 static and 10186 satellite Surjer Hashi (SH) clinics through a network of 25 NGOs covering 15% [25], of the total population in Bangladesh. The project is funded by USAID and DFID. Around 5000 NGO staff and 7350 community volunteers are engaged in delivering these services, creating awareness ensuring high quality and a strong commitment to contribute in improvement of health and population sector. BCCP is working with NHSDP on BCC and CM to design for reaching out to different stakeholders and creating partnerships in order to identify their community resources, health needs, promoting health seeking behaviour at household level and capacity building of NGOs on BCC and CM.

1.1 Purpose

The purpose of this research is to experience how people’s congregation accelerates community ownership and demonstrates role of stakeholders in mobilizing resources for promoting model community health practice through Health Fairs, also to see the level and scope of community involvement in event planning for health awareness intervention.



2 METHOD

A series of activities were carried out under a community congregation named “Health Fair” which were planned, organized and facilitated with active involvement of the community leaders, social elites, community groups, and local government officials. These were educational and interactive event that showcased different health messages and encouraged listening to community voice. The Health Fair has two parts; the first part with formal inauguration while the second part has daylong enter-educative event. The daylong event included health dialogues, storytelling by the champions, traditional cultural shows, drama shows, quiz competition, outdoor games for children, demonstrating benefit of positive health behaviour, and displaying stalls of health services offered by SH clinics. However, in some clinics continued the fair for two to three days. Each Health Fair was participated by around 3500 number of community people. Out of these, 680 Health Fair attendees were interviewed from 25 health fairs and they were selected on random basis.

2.1 Key approaches of Health Fair

The Health Fairs were held in a festive mood engaging the communities in each of the clinic catchment population. The following were the main key approached/features:

- a) Forming Health Fair organizing committee
- b) Massive promotions on Health Fair event
- c) Involve local educational institutions
- d) Maintain collaboration and coordination with GoB, Local Government and NGOs
- e) Mobilize sponsorship/CSR
- f) Recognition of satellite clinics space donors, Community Service Providers (CSP), Surjer Hashi Community Support Groups (SHCSG) and newly married couples
- g) Active engagement of community volunteers as a vehicle to generate demand for health services

2.2 Steps of Health Fair

As mentioned, there were 25 Health Fairs held in 25 SH clinics’ locations of 23 partner NGOs for SH network across the country. The 25 SH clinics’ locations were selected from 388 SH clinics based on certain criteria as follows, which located throughout the country:

- Clinics where performance of certain key service indicators were low despite the density of catchment population were significant in numbers
- Clinics located in a strategic location where a nearby open field was available for the fair to accommodate 1000 -2000 audience at a time
- Availability of other health project(s) implementing in the same or adjacent areas with scope to mobilize their participation in the fair
- Scope to mobilize the GOB counterparts to support inorganizing the fair

Preference was given to those clinics where community support group for SH clinics (SHCSG) were active and clinic staff received BCC and CM training.

The SH clinic ensured active involvement of community stakeholders, team leaders and active members of SHCSG, local cultural groups in planning and organizing the Health Fair, managing resources and sharing their voices and experiences. A Health Fair committee was formed for each event comprised of that locality as members from community stakeholders, local elected leaders, government officers, students and local level cultural personnel.



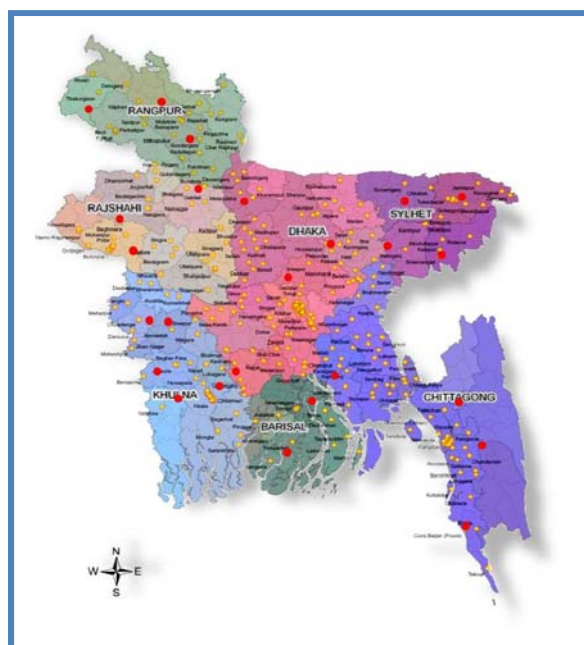


Figure 1: Red dots are locations of Health Fairs.

The Fair also involved other NGOs who were working on health, nutrition and family planning for displaying their services. The organizing committee also formed volunteer groups with school and college students, and scouts who worked as guide for the visitors, maintained the discipline within fair, and were engaged to promote health messages. To attract more visitors, selection of venue for the Health Fair was important. The Health Fair was held in an open place such as playground or any open field near to a busy crossroads, which was easy to access and close to densely populated neighbourhood so that a good number of nearby residents could visit the fair and take the services. The fairs also managed space to accommodate the stalls and venues were community sponsored. The committee listed down and invited all relevant key stakeholders from community, government, NGOs, local media (print and electronic) and community support groups members of SH clinics for their presence and endorsement in promoting community health practice.

These fairs were decorated with banner, festoon and colourful cut-outs to make the event attractive and bring a festive mode. Enter-educative audio-visual shows on health awareness were displayed; BCC materials and service charge discount forms were distributed creating a buzz in this event. The respective SH clinic and organizing committee took special initiatives to mobilize local resource and manage sponsorship that contributed in managing the fair. Sponsorship were made in many forms: providing free venue, awarding the champion, paying the cultural team; giving prize to the quiz contest winners; providing free transportation; arranging games, providing logistics to decorate the venue, providing refreshment for the volunteers etc. Promotional activities for the Health Fair were usually initiated 2-3 days before the actual event through mike announcements, distributing leaflets, house to house visits and during outreach activities of the clinics. The invitation was done mostly by the members of the organizing committee and the SH clinic staffs.



Figure 2: Some momentum of festive mood in the Health Fair.

The Health Fair committee commonly invited the government officials like Deputy Commissioner, Civil Surgeon, Deputy Director Family Planning, Police Commissioners etc, peoples' representatives like Member of Parliament, City Mayor, Upazila Chairman and the local elites to inaugurate the fair. Their participation in the fair was critically valued by the local people. In the Health Fair SH clinics and other NGOs used to offer essential health care services at a discount price for those who visited the fair. In the fair there was provision for quiz competitions on health information and awarding the winners. This has attracted more visitors to the fair and in turn provided them opportunity to expose with health messages. During the fair health related street drama and cultural shows were performed which helped to attract more people to visit the Health Fair. The drama was performed by the local cultural team and clinic staff. The committee members were involved in selecting local talents to perform in the shows. The health messages delivered through this event were tailored into local language to make them more lively and familiar for the audience. There were story telling sessions where the satisfied clients of SH clinics, best performing community health volunteers, proactive SHCSG leaders were invited to narrate their stories to the audience as a "success stories".

Clinic arranged Audio-Visual (AV) van show with the support of department of Mass Communication, Ministry of Information. They displayed promotional videos of SH services through AV Van at the distant community that has drawn attention of huge number of people to visit the Health Fair. In some locations, the local cable TV network gave scroll message with the news of Health Fair and also showed videos on the SH services in a discount price that promoted the Health Fair greatly. Each of the fairs was supervised by the organizing committee; besides the BCC experts of NHSDP also provided technical support and monitored these events using a standard checklist. The SH clinics documented the process of Health Fairs with lessons learned in a standard format. They also documented what strategy they applied to involve the community stakeholders; how they mobilized resources and what were their recommendations. Besides they also conducted exit-interview with randomly selected audiences of the Health Fair with a standard set of questions to assess the successes and document the lessons learned from these fairs.

3 RESULTS

A total of 25 Health Fairs were held at different SH clinic locations across the country. The Health Fair event revealed that NGOs can really leverage social capital and community volunteerism, government sponsorship and ownership and private stakeholders' involvement

in public health programs. They can work for discovering and unfolding of the resources that exists in the community throughout SH network in 399 locations of Bangladesh.

It is evident that the key stakeholders of the community were involved actively in organizing the Health Fair. The fair committee played significant role in planning and organizing the event. They also positively influenced participation of high level government officials as well as public representatives that resonated their ownership of the program. It is visible that considerable community resources could be mobilized for organizing BCC interventions for community health awareness. It was documented that the community sponsored venue, volunteer services, free promotion, cultural talents and awards; all of which added considerable value to the program. It is envisioned that the people are now become more empowered with the health information they receive from various events of Health Fair. Many clinics reported that the number of customers have increased after the Health Fair. The fair also opened a window of opportunity to have CSR from local organizations. In a nutshell Health Fair reflected a sense of ‘ownership’ among the local stakeholders.

3.1 Response of attending audience and on-spot feedback

Each Health Fair was successfully organized by the Surjer Hashi NGOs in their clinics across the country. These one-day, and in some cases multi-day events that attracted thousands of people along with GOB and other stakeholders and gained widespread media attention. In each Health Fair the average attendance was 600 as discussant while thousands of visitors gathered in the events. The events were strongly represented by Members of Parliament, City Corporation and Municipal Mayors, Upazilla and UP Chairmen, school and college students and a variety of community people. District and divisional level GOB officials from health, family planning and administration were also active supporters and participants. These Health Fairs were held in an open field with festive mode close to respective SH clinics.

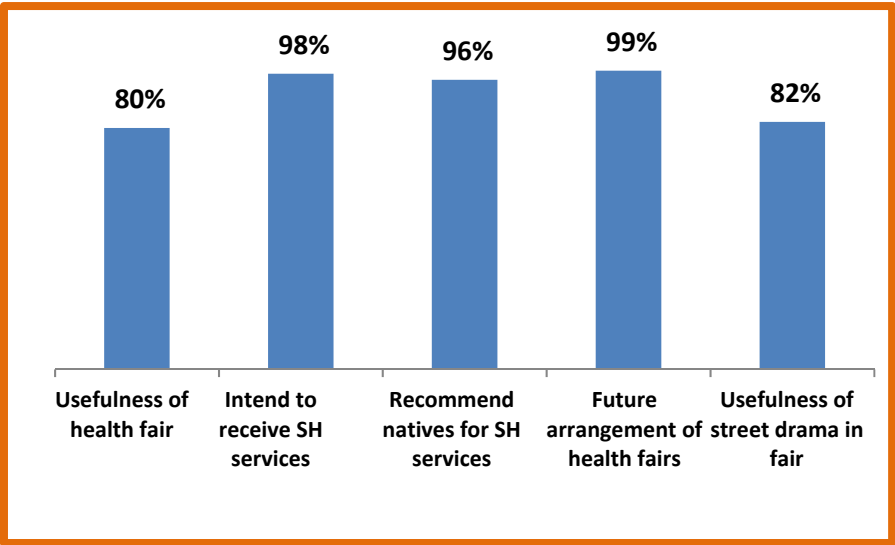


Figure 3: Response of attending audience.



At the end of each Health Fair a quick people attendance survey took place among 680 attendees using a tool on their observations, feelings and usefulness of the event. The graph shows a very positive feedback on the Health Fair attendees who are keen to advocate for Surjer Hashi clinics and eager to receive health services from the network. Among 680 respondents, 98% intends to receive services from SH clinic; 96% people said that they will refer their relatives to receive services from SH clinic. The survey also revealed that street drama is the most effective mode of communication (82%) to disseminate health messages. NHSDP has provided technical support in organizing different events and ensuring participation of different stakeholders, so that, the clinics would be able to generate support for better health services.

4 DISCUSSION

The participation of the communities is key to success of the program. Creating community ownership can work for discovering and unfolding of the resources that exist in the community for the sustainability of Social and Behaviour Change Communication (SBCC) activities. This Health Fair event is a unique example for mobilizing resource mobilization by involving the community which results in the participation of different types of community stakeholders, getting Health Fair venue free of cost, getting several local level sponsorship, voluntarism of local folk and drama team for dissemination of health messages through their performance which was disseminated by local cable TV network free of cost etc. All these activities required advance planning with multidimensional activities in a good team spirit with full commitment and dedication. By nature, Bengali literature and cultural activities are very reach and people are keen to engage in a simple and with open mind to relax and enjoy them. All these Health Fairs capitalise these resources and able to make huge buzz to make significant contribution in delivering health services to people who mostly deserve this at their doorsteps.

5 CONCLUSION

Health Fair has never been implemented before at the Surjer Hashi network in Bangladesh. However, the experience of NHSDP, suggests that Health Fairs can successfully contribute to improve autonomy, accountability, focus, and engagement, thus contributing to improve NGO performance. Performance improvement is a complex endeavour that requires motivations of individuals, groups, and organizations, as well as changing the behaviour of individuals, groups, and organizations. Because of this complexity, NHSDP recognizes first, that Health Fair may drive change, but are not directly or solely responsible for this change. Second, to understand how and why change occurs, implementers must apply flexible learning approaches that allow them to learn about and respond to drivers of performance and behaviour change in real-time. This event made the local community confident and capacitated on sustainable development community planning, resource mobilization and participating in practicing and influencing others for model health behaviour. With this tremendous success, all the 25 NGOs planned to conduct around 65 similar Health Fair events in the next year across the country to improve the quality of lives of mass people.

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SECTION 10
ENVIRONMENTAL
MANAGEMENT

THE USE OF THE DSPIR FRAMEWORK TO ESTIMATE IMPACTS OF URBANIZATION ON MANGROVES: A CASE STUDY FROM LA PAZ, BAJA CALIFORNIA SUR, MEXICO

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ABSTRACT

The mangrove ecosystem is integrated mainly by halophytes plants that grow on coastal zones of tropical and subtropical regions. This ecosystem provides direct and indirect services for human well-being such as food, wood, climate regulation, natural hazard protection, recreation and aesthetic values. However, academic research indicates that more than 35% of world's mangrove coverage has been lost in the past three decades. The primary drivers of change of cover lost are aquaculture activities and development of urban infrastructure. The objective of this work was to conduct an exploratory assessment of the impacts of urbanization on mangrove communities located in the city of La Paz, Mexico using the Driver-Pressure-State-Impact-Response framework (DPSIR). The assessment was complemented by a Delphi survey to incorporate information obtained from experts and stakeholders. The results indicated that the most important pressing factors on mangrove communities were: tourism, urban growth and waste. However, the data on mangrove cover and conservation status show that the overall situation of mangroves in La Paz is "barely adequate," with communities showing positive and adverse conditions. It is estimated that mangrove communities classified as "Vulnerable" and "Endangered" probably do not generate the same ecosystem services as mangroves classified under the "Near Threatened" and "Least Concern" categories. Protection actions as protected areas, environmental laws, and ecological restoration have helped in the conservation of mangroves in the study area. This work concludes that DPSIR framework is a handy tool to analyze in the first instance the conditions of the mangroves and may be replicable in other regions that have this ecosystem, even in places with little scientific research.

Keywords: coastal development, conservation status, DPSIR framework, drivers of change, ecosystem services, sustainability, wetlands.

1 INTRODUCTION

1.1 Definition and importance of mangroves

Mangroves can be defined as: "an ecological assemblage of trees and shrubs adapted to grow in intertidal environments along tropical coasts" [1]. According to data for the year 2000, mangroves are present in 118 countries (Figure 1), and this ecosystem had an extension of 137,760 km² [2], [3]. However, according to Global Forest Watch (GFW), from 2001 to 2012 there was a loss of 192,000 hectares. Asia and North America were the regions with the highest losses [4].

This ecosystem, like other coastal wetlands, contributes significantly to human well-being. This through of the numerous ecosystem services such as provisioning (e.g. food and water), regulation and maintenance (e.g. carbon capture and storage, maintaining of nursery



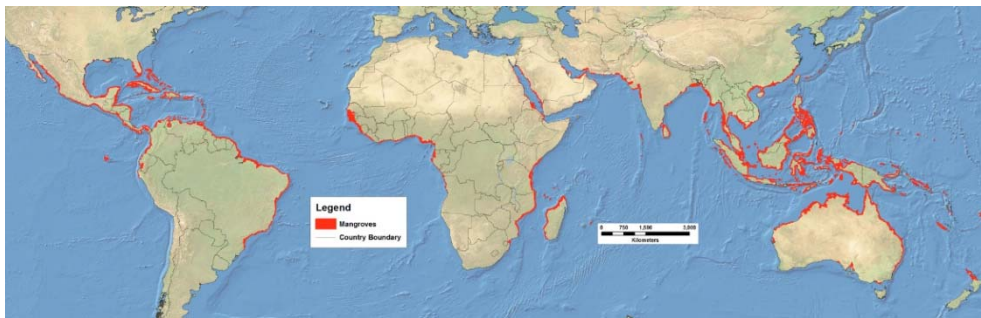


Figure 1: Distribution of mangroves in the world. (Source: UNEP-DEWA, 2013) [3].

populations and storm protection) and cultural (e.g. physical and spiritual interactions) among many others. The most recent valuation indicates that the value of mangrove services is of 193,843 USD/ha/year [5].

However, the mangroves face various threats and drivers of change. The most important are: conversion to agriculture or aquaculture, pollution, hydrological changes-indirect disturbance, exploitation, climate change and extreme weather events and coastal development [6]. This last driver originates the loss of mangrove cover for the development of diverse activities like the development of port-urban infrastructure and tourism. This situation is readily observable in regions close to coastal cities around the world.

The abundance of natural resources in the marine areas has caused that many settlements and towns to settle in the coastal zone to use them, which leads to conflicts with the surrounding ecosystems. And the city-mangrove case it is not an exception to the rule. This scenario is particularly noticeable in countries with fast population growth in coastal areas such as Mexico [7]. Perhaps, a good example of a city-environment conflict related to mangroves is the “Tajamar” case in the city of Cancun, Quintana Roo State, Mexico; where 22 hectares were destroyed due to the construction of tourist complex. This action generates numerous protests that led to the suspension of the project [8]. Also, Ezcurra mentions that due to the loss of mangroves in Quintana Roo in recent years, the Mexican government had to rebuild beaches that had been degraded by different extreme weather events [9].

1.2 Background of DPSIR framework

The study of issues focused on sustainability requires an integral-holistic approach; this because the same concept of sustainability considers as its core components the social, ecological and economic aspects which in themselves are already difficult subjects. Therefore, researchers and decision makers have looked for different models that consider an integrated approach and one of the most used the Driver-Pressure-State-Impact-Response framework (DPSIR).

Its origin comes from the Stress-Response framework developed by Statistics Canada in 1979. Then, Pressure-State-Response framework was originated, and afterward, the DPSIR framework was developed [10]. The use of DPSIR framework (Fig. 2) began in 2003, is designed and utilized by the European Environment Agency (EEA). Subsequently, its use was extended and is now employed by various agencies and global institutions among them the Global Environmental Outlook (GEO) reports from UNEP [11].

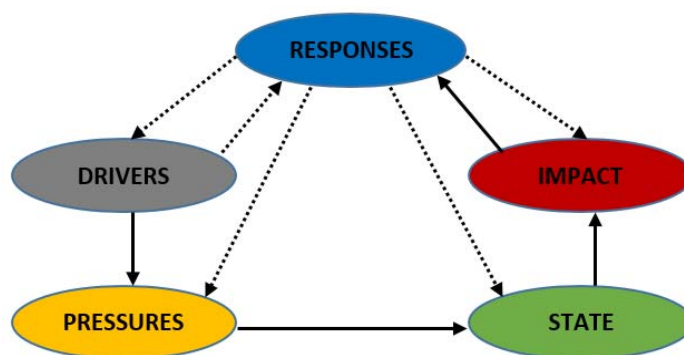


Figure 2: The DPSIR model. (*Adapted from Albert et al., 2015*) [17].

The DPSIR framework has confirmed a great instrument to understand the relationships between the environment and society and have been used in diverse ways. For instance, this structure has helped to bridge the gap between science and policy, especially in the case of coastal zone management [12]. Also, this tool has been used to examine the role of the major coastal cities in the environmental degradation of their nearby ecosystems as well as their repercussions to climate change [13].

In the case of wetlands, the framework was used to analyze changes in coastal wetlands in Xiamen, China [14]. Another study used this approach to estimate anthropic impacts on the coastal ecosystems of Berau, East Kalimantan, Indonesia and identified as a pressure indicator to mangrove conversion and overexploitation [15]. In this regard, the framework was used in the assessment of the mangrove community “Enfermería” located in the Bay of La Paz, Gulf of California, Mexico [16].

2 Methodology

2.1 Study area

The study area is comprised of 16 mangrove communities which are within of the limits of La Paz city according to its urban development plan. This settlement is situated to the southeast of the Baja California Peninsula (placed in the northwest of Mexico) and is the capital of Baja California Sur State (Fig. 3). The city is located in the DMS latitude-longitude coordinates 24°08'32"N 110°18'39"W; belongs to the Municipality of the same name, and borders to the north with the Municipality of Comondú and the southern limits with the Municipality of Los Cabos. On the east by La Paz Bay, Gulf of California and on the west by the Pacific Ocean [18].

The climate of this city, according to the classification of Köppen, modified by E. García is BW (h') w. It is classified as very warm and arid: with an average annual temperature greater than 22°C and average over 18°C for the coldest month, with rainfall predominant in summer and between 5 and 10.2% of the total rains occur during the winter period.

Originally its economic activities were mainly based on fishing and trade, although in recent years the tourism and services activity has increased considerably, due to the beauty of its natural landscapes, particularly coastal areas [19]. Also, La Paz is an important seaport of northwest Mexico. Its particular geographic and climatic conditions have allowed to the

area to have a significant number of natural resources, especially services provided by coastal ecosystems as coastal plains, coastal dunes, sandy beaches, sandbars and mangroves [20].

2.2 Research procedures

The DPSIR framework was used to identify the drivers of change affecting mangroves, to estimate their effects on the ecosystem services offered by these wetlands and to determine the measures used for their conservation in the city of La Paz.

Within this framework, the drivers are factors that exert pressures on the environment, and such forces can cause changes in their state. Consistent impacts on ecosystem services trigger a societal response to developing or changing environmental policies and developing programs to prevent, minimize or mitigate the pressures and driving forces. To feed this outline, we reviewed and compiled literature related to the mangrove communities of the City of La Paz (focusing on the period 1970–2015). In particular, an analysis of the literature was made in publications such as scientific articles, technical reports, scientific conference reports, theses, etc.

2.3 Delphi method

Preferably, the groups of experts and stakeholders should be together to identify the DPSIR variables and to lay their pathways. However, due to limitations of time and technical constraints in the research, the opinions were gathered from one-off questionnaires and personal interviews. Information from a desktop study was used to develop the surveys.

The survey was prepared in two types, for stakeholders and experts. In some cases that were needed prioritization, the questionnaire followed a Likert scale, where the statements that have to be scored, this measure comprised between 1 (bad) to 10 (good), by the respondents.

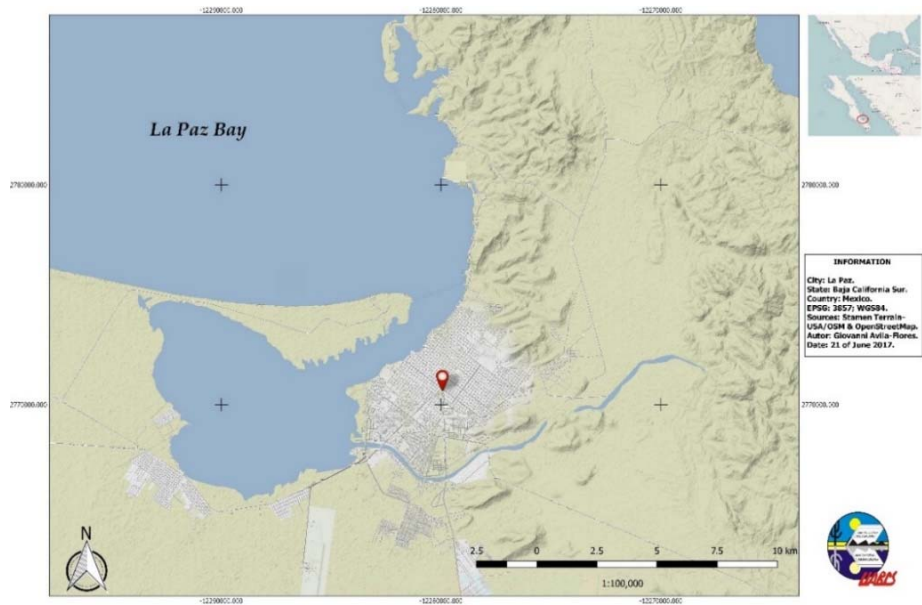


Figure 3: Map of La Paz city: area of study.

Table 1: DPSIR indicators for estimation of the state of mangroves in La Paz.
(Adapted from Xu et al., 2015) [23].

<i>Modules</i>	<i>Indicator</i>	<i>Description</i>	<i>Assessment</i>
<i>Driver</i>	Human development index	Measure of HDI	QL
	Population	Demographic evolution	QL
<i>Pressure</i>	Climate change	Estimation of future effects	QL
	Tourism	Number of tourist arrivals	QL
	Urban growth	Effects of infrastructure development	QL
	Waste	Effects of waste disposal	QL
	Meteorological phenomena	Affectation of destructive cyclones	QL
<i>State</i>	Sea level rise	Total vulnerability to sea rise	QL
	Mangrove cover	Changes in mangrove cover	QT
	Conservation status	Establishment of categories of risk	QT
<i>Impact Responses</i>	Loss of ecosystem services	Estimation of loss of ecosystem services	QL
	Protected Areas	Surface and types of protected areas	QL
	Environmental Legislation	Number of laws related to mangroves	QL
	Ecological restoration	Number of restoration projects	QL

Note: HDI, Human Development Index; QL, qualitative assessment; QT, quantitative assessment.

3 RESEARCH PROCESS AND RESULTS

Through the application of DPSIR framework, three indicators were identified in the Drivers Module, five in the Pressure Module, two in the State Module, one in the Impact Module and three in the Responses Module (Table 1). The framework has been generated mainly on three aspects: 1) the availability of data, 2) the approaches of various experts on DPSIR with studies on coastal wetlands, and 3) assessments of local stakeholders [21]–[23]. Each of these modules, as well as their indicators, are explained in more detail above.

3.1 Drivers

Human Development Index: In 2010, La Paz is the municipality with the highest human development index (HDI) in Baja California Sur (BCS), with a value of 0.816 [24].

Population: The city of La Paz, population for the year 2015 was approximately 244, 219 inhabitants. In 1990, the number of residents was 137, 641, in 2000 it was 162, 954 and in 2010 it was 215,178. This increase is due to this city has been an important magnet for internal immigration in recent years; although the intensity of these flows has been reduced [25].

Climate change: The Mexican Report on Climate Change report that mangrove communities in Mexico are highly vulnerable to any shift in elevation sea as well as by hurricanes [26]. It includes to mangroves located in La Paz city too. This situation would cause a significant loss of ecosystem services, but this would vary according to the projected scenario.

3.2 Pressure

Tourism: Tourism is one of the main components of the local development and generates a substantial economic revenue. Tourism showed a decrease in the number of visitors in 2010 (1,622,179) compared to 2008 (2,150, 095) and 2014 (1,740, 469) but a recovery was observed in recent years. On the other hand, in the past, the development of tourism sector



affected some mangroves areas, and the development of new projects could put to these wetlands at risk [27].

Urban growth: The development of urban infrastructure along the coast of the city of La Paz has caused disturbances in mangroves during the last 30 years. The construction of the road to the port of Pichilingue in the 1960s caused impacts to several mangrove communities such as “Pichilingue-Brujas,” “Enfermería” and “Eréndira.” Similarly, housing developments have affected the “El Conchalito” mangrove, as well “Palmira” [28].

Waste: Riosmena-Rodríguez report that the residues found in mangroves of La Paz vary from rotten food, plastic-glass bottles, tires, diapers, aluminum cans, and. Even, in these communities, there have been spills of sewage, fuel, and oil-asphalt [29].

Meteorological phenomena: Although La Paz presents a high incidence of cyclones year after year, the scientific evidence is scarce to conclude that there have been changes in the cyclonic activity caused by climate change. However, in September 2014, Hurricane Odile impacted the coasts of this state, resulting in severe consequences that led to social unrest and significant economic losses. Moreover, the effects on mangroves are ignored [30].

Sea level rise: The Climate Action Plan for the state of BCS, report that in reason to its index of total vulnerability, La Paz obtained a value of 2.0. This result makes it the second most vulnerable site in BCS to sea level rise, only below of Los Cabos that obtained a value of 2.4 [31].

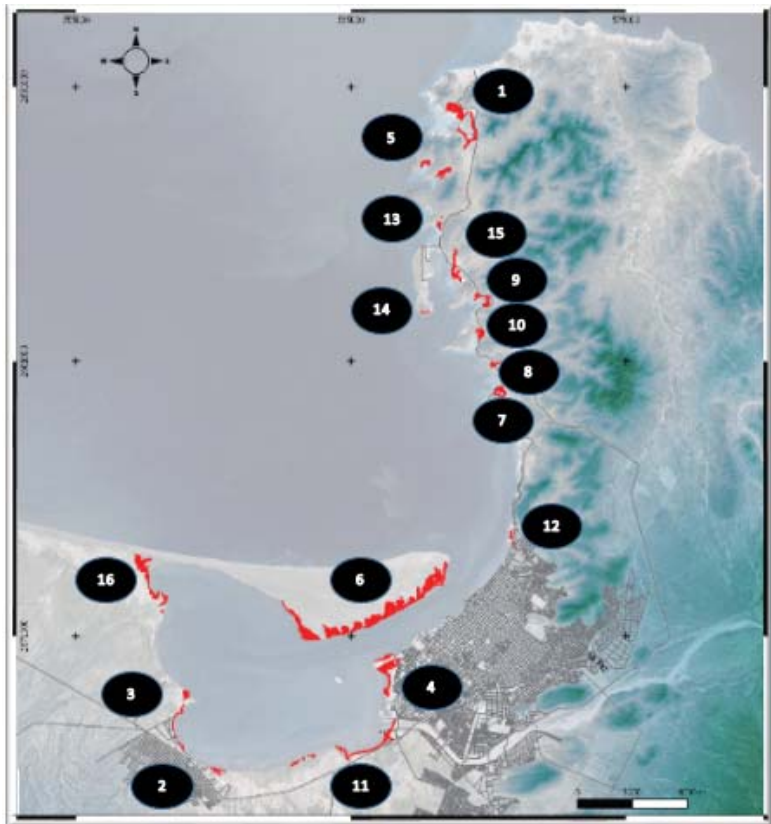


Figure 4: Location of mangrove communities situated in the city of La Paz.

3.3 State

Mangrove Cover: Avila-Flores [32] reports the mangrove cover of the town of La Paz for the year 2014 is estimated at approximately 25.91 hectares (Fig. 4). Moreover, in 1973 there was a mangrove cover of 22.70 hectares. This result represented an increase in mangrove cover of 3.21 hectares over a period of 30 years (an increase of 14 %). It should be noted that in 10 of the 16 communities there were losses of cover, five presented increases and one without changes.

Conservation Status: Seven mangrove communities were classified under the “Least Concern” category, other seven under the “Near Threatened” category, one under the “Vulnerable” category and another in the type “Endangered” (Table 2). These results were obtained considering aspects of mangrove cover and expert analysis. And using the classification “Red List for Ecosystems” of the International Union for Conservation of Nature and Natural Resources (IUCN) [32].

3.4 Impact

Loss of ecosystem services: So far, no scientific research has evaluated the loss of ecosystem services in the study area, although there are several methods for estimating mangrove services [33]. However, is considered that disturbed mangroves in the area, such as “Enfermería” and “Pichilingue-Brujas” not have the same value as other mangroves such as “Balandra” and “El Merito” which have a better conservation status.

Table 2: Conservation status of mangroves from La Paz.

#	<i>Mangrove communities</i>	<i>Categories of risk IUCN</i>
1	Balandra	<i>Least Concern</i>
2	Centenario-Chametla	<i>Least Concern</i>
3	Comitán	<i>Least Concern</i>
4	El Conchalito	<i>Near Threatened</i>
5	El Merito	<i>Least Concern</i>
6	El Mogote	<i>Near Threatened</i>
7	Enfermería	<i>Vulnerable</i>
8	Eréndira	<i>Near Threatened</i>
9	Estero Bahía Falsa	<i>Least Concern</i>
10	Estero El Gato	<i>Least Concern</i>
11	La Paz-Aeropuerto	<i>Near Threatened</i>
12	Palmira	<i>Near Threatened</i>
13	Playa Pichilingue-Brujas	<i>Endangered</i>
14	Salinas de Pichilingue	<i>Near Threatened</i>
15	Unidad Pichilingue UABCS	<i>Near Threatened</i>
16	Zacatecas	<i>Least Concern</i>

3.5 Responses

Protected areas: In this respect, all mangroves located within the coverage of the city of La Paz are under this scheme. One of them is the Ramsar Site No. 1.816 “Wetlands Mogote-Ensenada de La Paz” which has an area of 9,184.07 hectares (ha) and was designated as a coastal wetland of international importance on February 2, 2008. The other protected area is “Balandra” which is an extent under the Federal category. The publication of its decree was on November 30, 2012. This zone holds an area of 2,512 ha, and this is designated as a Ramsar Site too.

Environmental legislation: There is a significant number of laws and regulations that protect mangroves both directly and indirectly. At least there are 14 legal instruments to give protection to mangroves in the area [34]. The most important norm is the NOM-022-SEMARNAT-2003. This standard establishes that “productive activities such as agriculture, intensive or semi-intensive aquaculture, urban infrastructure, must leave a minimum distance of 100 m concerning the limit of vegetation (mangrove), in which productive activities will not be allowed” [35].

Ecological restoration: Efforts have been made by the civil society to remove solid waste from the city's beaches and nearby mangroves. However, only two cases could be considered as ecological rehabilitation of mangroves. One was developed in 2004 because of adverse impacts of a hurricane on the mangrove community “El Mogote.” [36]. The other restoration project was carried out in 2013 in the mangrove community “Enfermería” by the Department of Ecology and Environment of the State Government of Baja California Sur, along with other academic institutions such as CIBNOR and local volunteers. This last project was carried out due to a requirement indicated by the Secretariat of Environment and Natural Resources of Mexico (SEMARNAT) of the contiguous project “Center of Conventions of the city of La Paz.”

4 FINAL REMARKS

Although the scope of the DPSIR framework may be limited, it offers a critical initial approach and is a basis for further studies as well as the development of indicators for continuous monitoring. In this regard, it is considered that this tool has potential to be applied in coastal management because it can be implemented in different geographic areas and helps the analysis of complex zones systems [37]. Drivers such as economic development and population growth have been key factors in affecting mangroves, but climate change is expected to play a greater role in the area. In the past, urban growth was the most impacting factor in these communities and to a lesser extent were tourism and waste generation. However, it is surprising that there was no loss of mangrove cover, but instead, there was a slight increase. Moreover, this fact is possibly due to strict public policies on mangrove conservation. And an example is that all the mangroves of this zone are under the legal cover of a protected area. Finally, it is necessary to improve or maintain the conservation status of the mangroves in this region and the development of projects that consider the sustainable use of these ecosystems will undoubtedly be of vital importance to achieve a fair and sustainable local development.

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TEMPORAL ANALYSIS OF THE EFFECT OF URBANIZATION ON SURFACE RUNOFF IN FOUR NEIGHBOURHOODS IN THE CITY OF UMUARAMA IN PARANÁ, BRAZIL

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ABSTRACT

This paper presents a temporal analysis of the relation between urbanized area growth and changes in the hydrological balance on the studied area, observing alterations in runoff and losses by infiltration in four neighbourhoods located in the city of Umuarama-PR, namely Jardim Bela Vista, Jardim Colibri, Jardim Yonezu and Parque San Remo I and II. This temporal analysis was made from three scenarios, representing the past (2004), the present (2013) and the future (projection), the area was divided into 26 blocks (sub-catchments) and was used the hydrological model SWMM 5:00:22 (Storm Water Management Model) to generate results such as the flow reaching at the receiver rainwater drainage channel, losses of the volume precipitated by infiltration into the soil - using a project precipitation with return period (Rp) of 3 years. The study area was analyzed as a whole and also individually, block by block. This paper draws attention to the issue of urban planning in the growth of cities and their social function, taking into account the identity of the place of study as well as environmental quality.

Keywords: SWMM, urbanization, runoff.

1 INTRODUCTION

One of current models of urban development found in Brazilian's cities, has resulted in an increase in the impermeabilized area and consequent increase of the water loads dumped in the drainage systems, because of the increase of the urbanized area it is natural the impacts occurrence, for example the grow in the runoff, the grow in the sediments production, and the water's quality deterioration.

Otherwise, the surface impermeabilization and the drainage systems construction could result in the frequency and magnitude increase [1], these also could change the rivers characteristics which are inserted in urban areas and even the region's microclimate [2].

In this way, the spring flow of the Pinhalzinho II River located in the city of Umuarama, Paraná – Brazil were constatated with some of these urban's water resources problems, this is one of another afluentes of Goioere River. The Pinhalzinho II River is on almost all urbanized area since the 1970s.

This research was developed to understand the correlation between the surface use and occupation in the neighborhoods located in the Pinhalzinho II river's drainage area and the effects in this river. This study has used three different scenarios, each one with different rates of impermeable areas, to observe the effects of runoff in the water body, taking into account the characteristics and peculiarities over the years, following the intensification of urbanization processes.

All of these three scenarios were simulated through the SWMM (Storm Water Management Model), used throughout the world for planning, analysis, design, management and another uses in the urban areas drainage systems [3].



2 MATERIAL AND METHODS

2.1 Studied area

The study was realized on the neighbourhoods Bela Vista, Colibri, Yonezu, and San Remo I and II, included in the River Pinhalzinho drainage area in the city of Umuarama, Paraná, Brazil (Fig. 1). The studied area is located at coordinates 23°46'36" S; 53°19'11" W, where also are located the urban drainage's receiving channel. The studied area comprises approximately 371.747,21m², in a perimeter of 2.454,73m (Fig. 2). This area was subdivided in 26 sub-catchments that each one corresponds to one block as represented by the Fig. 3.

According to the master plan for the Umuarama city (2006) this area is classified as medium density residential area, which allows the following types of dwellings: single family, single family in series, trade and vicinal services, community uses (teaching and health) as well as permissible institutional housing, condominiums and industrial use.

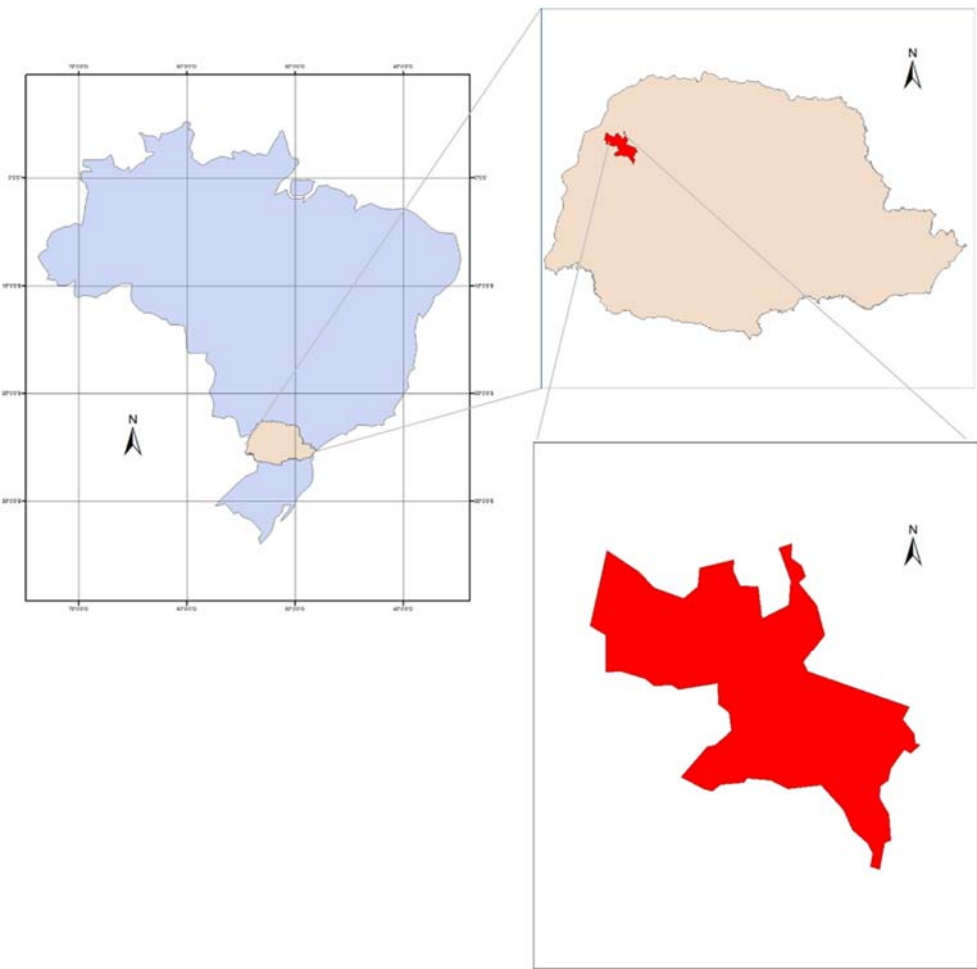


Figure 1: Location of Umuarama City in Brazil.

The soils are basically composed of latosols, argisols and nitosols. The latosols are divided into Red Latosols with sandy texture (very porous and permeable) and Red Latosols with clayey texture (very porous, friable, markedly drained and very deep). While the argisols, more frequent in medium slopes where the relief is wavy and gently undulating. The nitosols are composed of non-hydromorphic mineral soils, commonly found in medium slopes and gently undulating reliefs [4].

The climate is classified as humid subtropical climate, whose characteristics are humid summer due to the presence of unstable tropical masses, the region is comprised by semideciduous submontane seasonal forest characterized by the occurrence in mountainous regions with average elevations above 400 meters of altitude.

2.2 Survey of project information

For this study was analyzed satellite images given by the software Google Earth Pro, the images were for the years 2013 and 2004, there are used to verify the percentage of impermeable area, to permit the simulation of drainage system for these scenarios.

Each block was measured in its entirety using the ruler tool of Google Earth Pro and then the impermeable areas of each of them were measured using the same tool, generating the comparison for year 2004 and, for the year 2013, whose percentage averages were 69% in 2004 and 89% in 2013.

In addition to these scenarios, a scenario was also established with a projection where all the blocks present a percentage of impermeable area of 99%, assuming that it maintains a population growth in the region and this growth maintains the current tendency to cover up the land surface with waterproof materials, as concrete for example, the great part of the terrain.

The project rain was defined through the IDF curve proposed by Fendrich [5], represented by the eqn (1).

$$i = \frac{1752,27 R_p^{0,148}}{(t+17)^{0,840}} \quad (1)$$

- i is the intensity of the rainfall;
- R_p is the return period of this precipitation (it means the estimated time interval between events of a similar size or intensity); and
- t is the duration time's rainfall.

The return period (R_p) was the recommended on the guidelines for hydraulic and drainage projects in the São Paulo city, which presents the return times according to the type of work, in this case, 3 years. The rainfall durations were 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55 and 60 minutes, named "Rain 1" and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 e 15 minutes, named "Rain 2". The graphic representation of the precipitation (hyetogram) "Rain 1" and "Rain 2" are showed by the Figs 4 and 5.

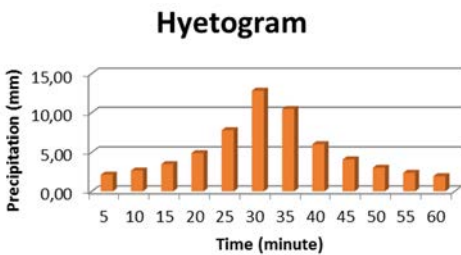


Figure 4: Hyetogram for rainfall “Rain 1”.

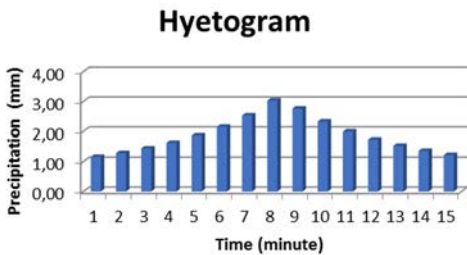


Figure 5: Hyetogram for rainfall “Rain 2”.

2.3 SWMM

For simulation in the model SWMM, the model of infiltration used was Green-Ampt and the flow routing was the dynamic wave, the variables employed in this research are displayed at the Table 1.

The runoff was distributed in 2 different outfalls, named “Node 1” and “Node 2” as can possible verify in the Fig. 7. The shape of the receiving channel was considered as trapezoidal, the width was measured by a field tape measure which showed 2.5m between the nodes 1 and 2, and 290m of length, and 4m for width and 195m for length between the node 2 and Exut1. The slope in the channel was 0.5m for each riverside and the deep was 1m.

3 RESULTS AND DISCUSSIONS

This chapter shows the results of the simulation performed by SWMM model. The place studied presents high level impermeability patterns, as could be observed in the thematic maps in the Fig. 8.

Some places have maintained the same pattern of occupancy, so it is possible to observe that the percentages in some blocks have remained.

On the other hand, the blocks which had an intense increase in the percentage of impermeable area probably are due to the occupations that in 2004 did not arrive until these places, but with the course of the years and of the population growth, they began to be parcelled and occupied.

The data presented by the regime “Rain 1” had a greater representatively than those presented by the “Rain 2” regime, due to the more pronounced values.

Table 1: Variables utilized in the simulation.

Variable	Impermeable areas	Permeable areas
N (Manning coefficient)	0.013	0.15
Depression storage (mm)	1.7	3.5
Suction head (mm)	60.96	-
Conductivity (mm/h)	29.972	-
Initial deficit	0.390	-





Figure 6: Representation of the simulation project in the SWMM model.

Therefore, only the data generated from the rainfall event “Rain 1” will be used, due to the greater ease to observe the comparisons and results to be discussed. In some moments, graphs and results related to the 30 minutes of this event will be used, since in general, it was the one that presented the highest values.

3.1 2004 scenario

This scenario is characterized by being the smallest percentage of impermeable area. The volume of water drained is approximately 68% of the total volume precipitated, according to Tucci [1], a soil in natural environments, usually drains approximately 10% of the total precipitate, that is, even the scenario with the lowest impermeabilized area, still presents a high percentage of surface runoff.

3.2 2013 scenario

This scenario represents a situation closer to the current one, due to the temporal proximity. There was an increase of about 20% in the average of impervious areas, which represents an area of 74,349.44m².

In this case, a very important point to be raised is that the rate of surface runoff increased proportionally to the increase of impermeable areas in relation to scenario one, because in this case, the runoff was 86% of the total precipitated volume, 18% more than 2004 scenario.

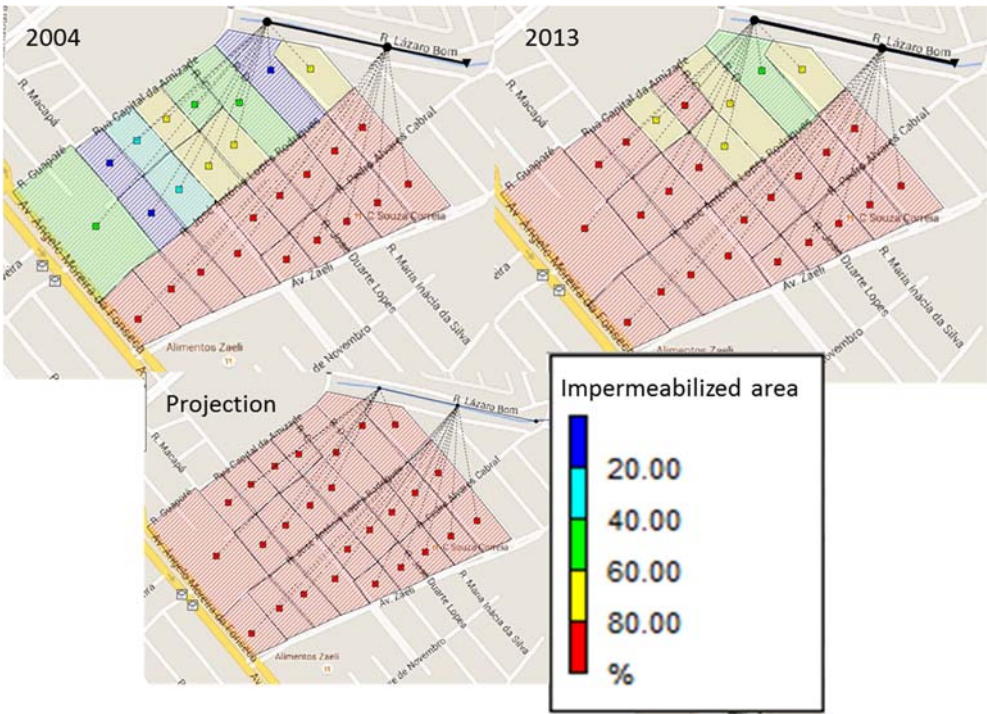


Figure 7: Representation of the impermeabilized area in the three scenarios.

3.3 Projection scenario

The hypothetical scenario with a mean of impermeable2,1 area is 99%, it means, the sites that can be infiltrated will total only 3,717.47m² of the total study area. This projection took into account the possible increase of the occupations of the lots.

The total losses by infiltration and plant interception, quite low, about 20 liters, for a precipitation with a total volume of approximately 2,190L, indicates that the receiving channel will have a fairly high flow.

3.4 Comparison between the scenarios

The comparison between the water balance in these three scenarios is presented in the Table 2.

Table 2: Comparison between the three scenarios water balance.

Water Balance	Volume (m ³)		
	2004	2013	Projection
Total precipitation	2.19	2.19	2.19
Losses for infiltration	0.67	0.26	0.02
Runoff	1.49	1.89	2.13
Final Storage	0.03	0.04	0.04

The runoff and losses are graphically represented by Figs 8 and 9.

In the urban area, there is a drastic difference in the water balance, when compared to the water balance that occurs in the natural environment, mainly because of the strong increase in surface flow. Even if a natural environment is not compared, in this research it was possible to observe this alteration of the water balance related to the urban area growth.

This disparity between the runoff rates in the three scenarios analyzed is mainly due to the large change in percentages of waterproofed area at the study site. This increase in surface runoff can anticipate peak flows, as well as, according to Tucci [1], to increase the average maximum flow rate by six to seven times.

The reduction of water infiltration in the soil can lead to damages such as the decrease in the level of the groundwater by the lack (or decrease) of the feed, while the reduction of losses by plant interception is detrimental because it considerably reduces evapotranspiration rates since the surface of the urban area does not retain water in the same way as the vegetation cover [1].

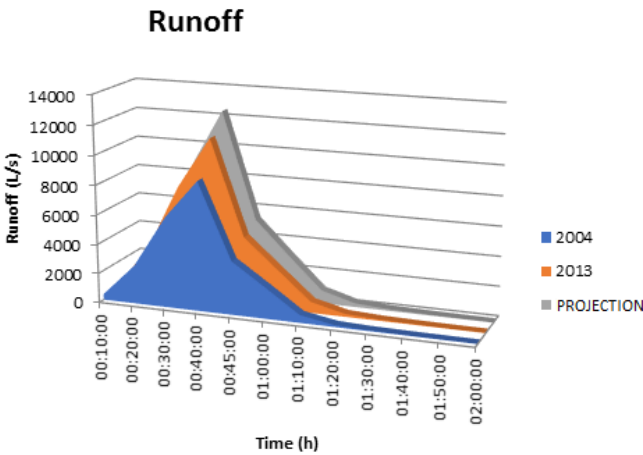


Figure 8: Runoff observed after the simulation.

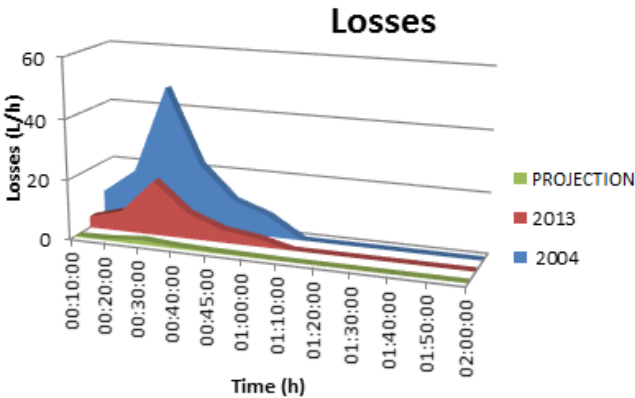


Figure 9: Losses by infiltration and interception observed in the simulations.



4 CONCLUSIONS

The scenarios presented many changes and the consequences of urbanization in a disorderly way or with little effective legislation, can be quite drastic. Even in the situation which had a less modified environment, the results obtained for surface runoff were still high. More effective studies are needed in relation to the consequences that this imbalance in the water balance can cause to the receiving channel, however, it can be assumed that the main ones are sedimentation and erosion, increase of the amount of sediment, increase of the pollution. There is a need for more restrictive legislation and more effectiveness environmental management actions, which stipulates a reasonable value of permeable area in the constructions, that allows a greater infiltration. Thus, the consequences of the increase of the urban area are softened and the city can fulfil its role of quality of life for the population, without very serious damage to the environment where it is inserted.

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IMPACT PERFORMANCE OF LOW CEMENT ULTRA-HIGH-PERFORMANCE CONCRETE

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ABSTRACT

Technology advancement in concrete industry and expanding interest for high quality construction materials have prompted the development of Ultra-High-Performance Concrete (UHPC). Despite of many advantages gained using UHPC, however, conventional design of UHPC poses many concerns especially on sustainability issues. Producing UHPC, requires relatively high amount of cement content and in most cases, the compositions are not optimized causing an increase in materials and energy cost. Low cement UHPC was proposed to minimize the economic and environmental disadvantages of current UHPC by incorporating high volume of Fly Ash (FA) and Silica Fume (SF) as cement replacement materials and locally available coarse aggregates. An experimental program was carried out to evaluate the effect of combined FA and SF on mechanical and impact performance of low cement UHPC. Both hooked and straight steel fibers with aspect ratio of 83 and 100 were used respectively as the reinforcing material. An enhancement of 111% was observed in impact resistance of the fibrous concretes with an incorporation of both FA and SF replacing 50% of cement, as compared to specimen without any replacement.

Keywords: ultra-high-performance concrete, cement replacement materials, compressive strength, impact resistance.

1 INTRODUCTION

Recent advancement in UHPC has showed very exciting results in both strength and durability, and UHPC has been found in numerous numbers of infrastructure projects [1]. Despite many advantages gained using UHPC, however, conventional design of UHPC poses many concerns especially on sustainability issues due to extremely high usage of cement content, high production cost, and sensitive in-situ construction that restricts its wider application.

UHPC also known as Reactive Powder Concrete is a type of special concrete with ultra-high strength, durability and workability, which are achieved by the elimination of coarse aggregate and the introduction of ultra-fine constituents. Removal of coarse aggregates increased the cement usage in the mix. The cement in UHPC becomes comparable to the coarse aggregates used in conventional concrete making it very costly and unsustainable [2]. It is reported that the production of cement alone contributes about 7% of CO₂ emissions, which impacts on global warming [3]–[5]. In line of making the world greener, the recent direction in concrete industry is to produce sustainable concrete with lower CO₂ emissions while providing same reliability with an improved durability.

Effective method in producing sustainable UHPC mix is by reducing the cement amount without affecting its mechanical properties. Cement content in UHPC can reach as high as 800–1000 kg/m³ compared to 300–500 kg/m³ for conventional concrete [2], [5]. Using certain amount of cement replacement material in UHPC would lower the amount of cement used in the mix that leads to a lower cost of UHPC. According to past researches, due to the low water to binder ratio used in UHPC, the degree of hydration has been estimated in the range of 30–60%. The unhydrated cement particles UHPC mix works as micro-aggregates making it to be the most expensive fillers. UHPC with supplementary cementitious materials,



such as slag and fly ash has been reported as an excellent solution from durability point of view. However, the strength gained will normally be slower than that in Ordinary Portland Cement (OPC) concrete [6], [7].

In this research, high amount Fly Ash (FA) and undensified Silica Fume (SF) were used as cement replacement materials. While, in normal practice, the FA dosage limit is around 15-20% by mass of total cementitious material. These values are usually being applied for economical purposes focusing more on workability without any enhancement in durability. Larger amount of FA that is in the range of 25–60% are needed to improve its durability. Earlier study made by Malhotra [8], demonstrated that half or more substitution of FA is possible to produce sustainable and high-performance concrete with good workability and improved ultimate strength, durability and shrinkage. John and Ashok [9], on their previous studies reported high strength concrete both at early and later age together with good workability were achieved by incorporating high volume of FA and superplasticizer. Halit [10], made an earlier study on self-compacting concrete with FA in the range of 30% to 60% together with a combination of 10% SF. The addition of 10% SF was reported to improve both fresh and hardened properties of high performance high volume FA concrete. From previous results, it can be summarized that fly ash have negative effects on concrete strength which can be contradicting in preparing UHPC. However, when properly designed; high volume FA concrete can have adequate early-age strength and high later-age strength.

Introduction of discrete and discontinuous fiber in UHPC mix was done to ensure ductility and to improve concrete properties particularly tensile strength, abrasion resistance and energy absorbing capacity [11], [12]. The presence of fiber helped to refrain crack growth and propagation and to transfer load to the unaffected area [13].

The properties of fiber reinforced concrete would be affected by the type, volume fraction and aspect ratio of fiber [14]. Based on previous study by Naaman [15], the suggested volume fraction of steel fiber used in the concrete mix was around 2% to achieve effectiveness in concrete composites.

Previous studies made by earlier researchers showed direct relationship between impact resistance of fiber reinforced concrete with concrete strength [16]–[19]. Lin and Suen [18], studied the effect of fibers and silica fume on abrasion and impact performance of concrete. Fibers such as steel, carbon and glass were used in his study as reinforcement material for the concrete composite and silica fume was selected to replace cement by 10 to 20%. The test results showed that the combination of 10% SF with 2% steel fiber gave highest value of both abrasion resistance and impact energy absorbed as compared to others. The SF added in the mix helped fiber dispersion and improved fiber bonding strength between the matrix.

In this paper, UHPC incorporating high volume of FA and SF with locally available aggregate was developed to provide an outstanding yet economical solution for the growing demand of high strength and high durability concrete in the industry. Drop weight test was used to investigate the impact performance of combined effect of FA, SF and steel fiber.

2 EXPERIMENTAL WORK

2.1 Work program

The experimental program was done to study the effects of cement replacement content on compressive strength and impact performance of UHPC. Concrete specimens were prepared with 30%, 40% and 50% FA replacing cement. The optimum FA amount used in producing UHPC should be established by testing to determine the effectiveness of supplementary material as excessive or inadequate quantity could negatively affect the concrete properties.



In this work, a total of seven (7) UHPC mixes with various replacements amount of FA and SF were prepared and its effect on compressive strength and impact performance were studied.

2.2 Material properties

FA and SF used as cement replacement materials were locally produced. The chemical composition for ordinary Portland cement (OPC), FA and SF were analyzed by X-ray fluorescence technique (XRF), the results are given in Table 1. River sand with a fineness modulus of 2.8 and Polycarboxylic Ether based superplasticizer were used in all mixes. Both straight fiber and hooked-end fiber in the amount of 1.0% by volume respectively were employed in this study and their properties are shown in Table 2.

Table 1: Chemical composition of OPC, FA and SF by XRF analysis.

Oxide	Percentage (%)		
	OPC	FA	SF
Na ₂ O	0.20		
MgO	2.42		
Al ₂ O ₃	4.45	29.1	0.71
SiO ₂	21.45	51.7	90.3
P ₂ O ₅	0.11	1.7	6
K ₂ O	0.83	1.6	
CaO	63.81	8.84	0.45
TiO ₂	0.22	0.7	
Fe ₂ O ₃	3.07	4.76	1.31
SO ₃	2.46	1.5	0.41
MnO	0.20		

Table 2: Characteristic of steel fibers.



Fiber properties		
	Straight	Hooked-End
Length, mm	20	25
Diameter, mm	0.2	0.3
Aspect ratio (l/d)	100	83.33
Tensile strength, MPa	> 2300	> 2300

Table 3: Mix proportions in kg/m³.

Mix ID	OPC	CRM		Sand	Coarse Aggregates	W/B
		SF	FA			
M0	900	-	-	620	930	0.16
M1	630	-	270	620	930	0.16
M2	540	-	360	620	930	0.16
M3	450	-	450	620	930	0.16
M4	540	90	270	620	930	0.16
M5	450	90	360	620	930	0.16
M6	360	90	450	620	930	0.16

2.3 Concrete mix proportions

A total of seven (7) UHPC mix proportions were carried out to determine the optimum FA replacement. Details of the mix proportions are given in Table 3.

2.4 Experimental program

The experimental program consisted of casting and testing 42 cubes of size 100mm and 9 circular plates with diameter of 150mm and height of 64mm. The cubes were used for the compressive strength done in accordance to BS EN 12390-3:2009. The reported results are the average of three (3) samples.

Impact performance assessment was performed using the circular plate following the recommendations of ACI 544. A 63.5mm diameter steel ball with 4.54kg weight dropped from a height of 914 mm and recorded the number of drops until the first visible crack and ultimate failure was found. The ultimate failure was defined once the opening of the cracks touches three of the four positioning lugs on the base plate.

3 RESULTS AND DISCUSSIONS

3.1 Compressive strength

Effect of FA dosage of up to 50% together with or without the combination of SF on compressive strength was investigated and the results are shown in Table 4.

The results of compressive strength in Table 4 show that the maximum content of FA and SF used in UHPC were 50% and 10%, respectively. These contents are considered as maximum values to study the effect of FA and SF on the development of compressive strength of UHPC. It was found that the addition of 10% of SF had a positive effect on all UHPC mixes improving the compressive strength of UHPC at both 28 and 90 days. No strength reduction can be seen for M5 (40% FA and 10% SF) mix on all ages. The compressive strength at the age of 28 and 90 days for mix M5 showed higher value than the reference mix by 8% and 15% respectively.

Incorporation of 30% FA in UHPC increased the compressive strength at 28 days however, when more than 30% of FA was added, the 28 days compressive strength reduced by about 15%. Slower strength development can be seen after 28 days for all FA mixes. Combination of SF in the mix can counteract the reduced strength due to the increase of FA

Table 4: Compressive strength results.

Mix	Bulk Specific Gravity G_s	Compressive Strength (MPa)	
		28 days	90 days
M0	2.4	120	140
M1	2.43	127	148
M2	2.4	120	146
M3	2.45	98	140
M4	2.38	128	150
M5	2.37	130	160
M6	2.35	117	143



volume. Addition of 10% SF improved compressive strength of the high-volume FA UHPC at both 28 and 90 days except for mix M6. The compressive strength was up to 10% higher compared to mixes with FA alone together with 15% improvement on reference. Incorporation of FA reduced the heat of hydration thus slower down the setting time that caused reduction in the early age strength, which explained the slower strength development for all mix with FA. It is clear that using a combination of FA and 10% SF provided higher early strength. FA acts as reactive pozzolan and effective void filler to improve cement paste cohesion and aggregate particle adhesion. This can be explained by better dispersion of cement grains, which leads to an improved gel phase's development [20].

Higher compressive strength of more than 140MPa can be seen at 90 days for all mixes with FA with an improvement of up to 13% compared to reference. Larger FA replacement of up to 40% showed better strength performance at later age for UHPC mix with W/B of 0.16. The strength enhancement due to the increase of FA volume is acceptable when compared to results obtained by Lam et al. [21]. They demonstrated an increase of 28-day compressive strength for high strength concrete mix with large volume of FA replacement of up to 45% if W/B was reduced from 0.5 to 0.3. The high volume of FA with low W/B underwent a lower degree of hydration due to limited water available for the reaction and less space for the reaction products to form. It is reported that about 40% of the cement and 80% of the FA remained unreacted at the age of 90 days [21]. These unreacted cement and FA particles served as micro-aggregates, which also contributed to the strength of the cementitious material.

3.2 Impact performance

The results of drop weight test are summarized in Table 5, which indicates brittle failure for the specimen without fibers.

Addition of 2% fibers in the mix increased the ultimate resistance tremendously by about 95% with energy absorbed capacity of 19 times than the non-fibrous specimen. Concrete without fiber are brittle and more prone to damage through the impact of heavy items and loads, particularly at the exposed edges and surfaces. Impact damage is one of the major causes for structure life span reduction leading to early structural replacement due to premature failure [22]. The key to increase the performance of cement-based composites under impact is to increase its cracking resistance. Steel fibers in the composites can restrain the extension of the crack, change the direction of crack growth and act as a bridge to delay the crack growth rate [23]. Besides fiber amount, the fiber types also played important role as the short straight fibers will act as a bridge to reduce the formation of micro-cracks and when the crack grows bigger, the longer hooked-end fibers will take charge and arrest propagation of macro-cracks thus increases the concrete toughness.

Table 5: Impact test results.

Mix	First Crack (blows) N_1	Ultimate Crack (blows) N_2	Impact Resistance (%)	Impact Energy (kJ-m)
NF	329	335	2	7
M0	1588	6450	306	130
M5	1639	7074	332	144



The number of blows for first crack and at failure for mix M5 (40% FA and 10% SF) was higher compared to the control sample by 112% at 573 number of blows. The synergic effect between FA and SF was found to improve both the strength and impact resistance. The FA and SF help reduced concrete porosity through micro pores structure modifications done by filling up the empty spaces in concrete pore structures through pozzolanic reactions. Incorporation of both FA and SF in the mix M5 produces tougher and denser surface with higher surface durability compared to control sample (M0), thus resulting in a higher impact resistance. Besides that, addition of both FA and SF also improved fiber dispersion in concrete mix thus increases the bond between fiber and concrete matrix. FA helps fiber dispersion during mixing by having spherical shape. The ball bearing effects in FA help to reduce internal friction in fresh concrete thus increasing its flowability and compaction of the concrete [24]. Micro and macro pores presents in the concrete are filled up by finer particles of SF and FA, which lead to an increase of fiber matrix adhesion [25]. Mix M5 specimen with 40% FA, 10% SF and 2% fiber presents excellent impact resistance by having energy absorbed capacity 18 times than the specimen without fiber (NF) and 1.3 times than mix M0. This showed that M5 specimen has a great ability to absorb impact energy due to the combined effect of both FA and SF with steel fiber.

4 CONCLUSIONS

Based on the results of this experiment the following conclusions can be made:

1. Up to 50% of cement can be optimally replaced with both FA and SF at W/B of 0.16. The compressive strength of low cement UHPC made by 40% FA and 10% SF can reach 130MPa and 160MPa at 28 and 90 days respectively, under normal curing conditions.
2. The negative effect of high FA replacement in UHPC on concrete strength appeared to be insignificant with strength, as the reduction value was less than 3%. The combinations of high volume of FA with low W/B in UHPC retard the hydration activity for cement and FA particles. The unhydrated particles then work as micro-aggregates to increase the concrete strength. Combination of 10% SF showed positive effect on compressive strength at both 28 and 90 days with improvement of 2% to 15% respectively. SF acted as reactive pozzolan and effective void filler to improve cement paste cohesion and aggregate particle adhesion to form better dispersion of cement grains and development of gel phases.
3. Incorporation of FA and SF with steel fibers as in mix M5 improved the specimens' impact resistance by considerably more than inclusion of fiber alone (mix M0). At 40% FA, 10% SF and 2% steel fiber addition, the impact energy improved by 110%. Combination of FA and SF benefits fiber dispersion and improves the bond between fiber and matrix thus increases the kinetic energy absorption.

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SECTION 11
PLANNING, DEVELOPMENT
AND MANAGEMENT

LAND-USE PLANNING FOR ZERO-ENERGY-BUILDINGS: COMPARISON OF FOUR HIGH-DENSITY CITIES

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ABSTRACT

A net approach to Zero-Energy-Building (Net ZEB) requires all energy demand to be met by on-site generation of renewable energy. An off-site ZEB with compensating measure (off-site ZEB_CM) allows off-site land to be used if the energy demand cannot be met due to the urban arrangement of buildings. A method is developed for evaluating the potential and risk of Net ZEB and off-site ZEB_CM in densified urban situations by examining their land-use requirement on- or off-site. Four cities with different climates are modelled: Singapore, Cairo, Beijing and Hamburg. The preliminary results indicate that (1) the rate of change in CM per unit of area of use is not a constant number and varies with numbers of storeys, urban density and climate zone; (2) to save land for the compensating measure, a small number of storeys should be used; (3) to save land in general, high plot ratio should be used. Within a high-density situation, a small number of storeys should be used. This research contributes to the discussion about urban sprawl and compact city by investigating the relationship between urban fabric and energy harvesting. It may encourage the land-use policy makers to include land-use requirement of renewable energy harvesting.

Keywords: zero energy building, compensating areas, urban density, energy demand, land-use planning, low-carbon society

1 INTRODUCTION

The main interest of this paper is to examine the relationship between urban fabric and land-use requirements for achieving enough renewable energy to cover urban energy demand. Even though it is known that there is the discrepancy between demand and supply by the renewables, this problem is often overlooked. The importance of this problem has been further emphasized by recent studies reporting that energy sprawl, which is defined by the development of new land area required for energy production, is now one of the largest driver of land use change for the foreseeable future with increasing proportion of renewable energy harvesting. For example, Trainor et al. [1], quantify projected energy sprawl in the United States through 2040. Their results show that when land-use requirements of compensating measures (CM) are included, more than 800,000 km² of the additional land area will be affected by energy development. Not only is this number higher than projections for future land use change from residential development or agriculture, but also that the pace of development is more than double the historic rate of urban and residential development. "The possibility of widespread energy sprawl further increases the need for energy conservation, appropriate siting, sustainable production practices, and compensatory mitigation offsets" [2]. The need for reducing energy sprawl, therefore, further enhances the importance of research that investigate the density, the geometrical and morphological characteristics of buildings that minimize the energy consumption.

In order to bring primary energy consumption and CO₂ emission to zero, one significant contribution is the optimization of buildings to a new standard of Net Zero-Energy-Building (Net ZEB). The most common definition of a ZEB is the Net ZEB that calculates primary energy consumption, including thermal energy for heating, cooling and hot water as well as



power for mechanical ventilation and artificial light. It contains all sorts of energy in buildings that can be directly influenced by building design.

It should be mentioned that power for appliances and energy for traffic are not included in this paper. For some locations with low heating or cooling demand, power for appliances may be dominant. To create a real carbon-free city, power for appliances and energy for traffic have to be covered by renewables. Nevertheless, this paper concentrates on energy consumption that is influenced by building design and arrangement. The power for appliances and energy for traffic are not included in this paper and the standard definition of a ZEB is used here.

A ZEB balances the energy of demand and supply sides. Energy demand can be minimized by architectural techniques, but it is not possible to bring it to zero. For example, the use of buildings during the dark hours leads to the demand for artificial light. To reach zero, the remaining energy demand has to be covered by building services using renewable energies.

The Net ZEB definition framework developed by Satori et al. [3], describes and analyses different aspects of Net ZEB in a series of five criteria and sub-criteria. One of the criteria, the physical boundary of the building system, is used in this paper to identify the so-called “on-site” and “off-site” generation systems. Defining the building system boundary is necessary for identifying whether energy flows cross the boundary. The physical boundary of the building system may encompass a single building or a group of buildings. If all energy flows are within the boundary it is considered on-site, otherwise, it is off-site. Detailed definitions of Net ZEB and off-site ZEB_CM used in this paper are in the following.

1.1 On-site Net Zero-Energy-Building (Net ZEB)

The Net definition of a ZEB requires that this energy is to be gained on-site from the building envelope or the ground under or near the building [4]. This requirement leads to the competition between the area of use to be served, which creates energy demand, and size of building envelope and size of the estate to cover this demand with renewable energies. This requirement also limits number of possible storeys and minimal building distance. In this paper, this type of ZEB is called an on-site ZEB.

1.2 Off-site Zero-Energy-Building with Compensating Measures (off-site ZEB_CM)

A wider definition of ZEB allows producing a part of energy off-site on compensating areas outside of town. A compensating area could be covered with wind turbines, PV modules, sustainable agriculture, and etc. In this paper, this type of ZEB is called an off-site Zero-Energy-Building with compensating measures (off-site ZEB_CM). From an ecological point of view, both versions of ZEBs have the same zero contribution to CO₂ emission and they are adequate options.

The first challenge faced by land-use planners is that, in a city with very high urban density, a Net ZEB is often not possible because it is usually limited by height and volume due to the requirement to produce energy on-site. Or, vice versa, the attempt to derive a city with a Net ZEB would lead to a limited urban density. The limited urban density would not be optimal for public transport systems, which minimized transportation energy [5], and a liveable urban situation.



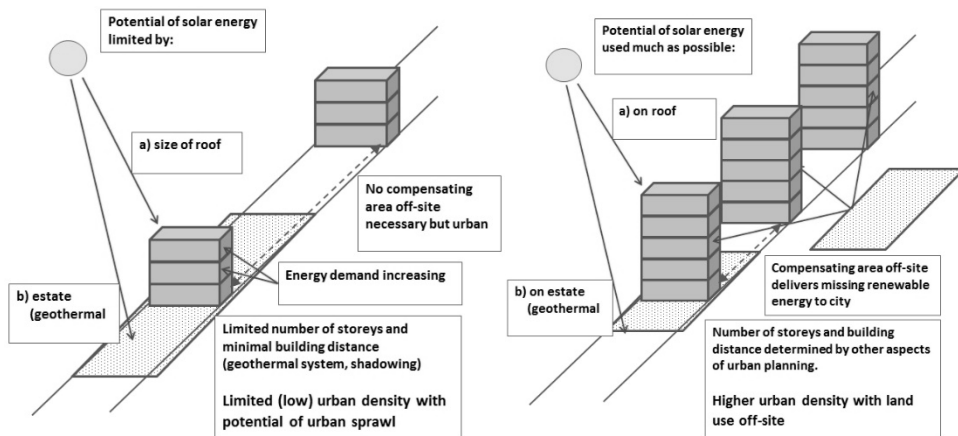


Figure 1: Main characteristics of Net ZEB (left) and off-site ZEB_CM (right).

Although an off-site ZEB_CM represents an alternative solution, land-use planners still face the challenge that an off-site ZEB_CM requires compensating areas outside of town and this requirement creates competition among the land uses, such as forestry protection or agricultural activities. “To create a sustainable energy future for their own people, countries (or cities) with both dense and high-consumption, should expect renewable facilities to occupy a significant fraction of their land, if they ever want to live on their own renewables” [6].

1.3 Aim of this paper

The aim of this paper is to develop a preliminary method to derive general tendencies of renewable energy development in different climates by examining the land-use requirement of Net ZEB and off-site ZEB_CM and by offering a simplified model with general and identical assumptions for all locations to obtain comparable results. The intention is to address these questions and draw broader attention to further explore the relationship between the variables. It may also encourage land-use policy makers to include land-use requirement of renewable energy harvesting into consideration.

The existing tools, such as CitySim or Umi (MIT), are not used in the current research because they are more tailored for detailed simulations for one specific location. The objective of this paper is to derive general tendencies and rules for different climates without regarding detailed situations of a special location.

The following questions are investigated:

- For the land-use for energy demand: How can energy consumption and energy sprawl be reduced without affecting urban density?
- For the land-use for renewable energy supply: How does compensating area per unit of area of use change with numbers of storey, urban density and energy harvesting technologies?

2 METHODS

The method used in this paper has been developed for a master course. Here the students explore the potential of Net ZEB and off-site ZEB_CM for big cities in all main climate zones around the world. The target is to derive design rules for Net ZEB and off-site ZEB_CM, to carry out the design of building types and type facades, to develop rules for building distance and urban density and to investigate the required space for the compensating area for all these locations.

The analysis focuses on office buildings instead of a real urban land use, which includes residences, offices, retail, industries etc. The reasons for this simplification is that, firstly, it is not possible to find a distribution of land uses which is really representative for all climates, locations, or cultures. The target of this paper is to derive general tendencies and comparable results for different climate zones. Therefore, a general and identical assumption for all chosen cases is necessary. Secondly, although residential buildings have the highest percentage in area of use in all locations, the energy demand of office buildings is higher than that of residential buildings. Thus, if the derived design proposal can cover the demand for office buildings, it can also cover the demand for residential buildings.

Before the investigation starts, there are several preconditions with regard to the definition of building types, comfort models for summer and winter, and regenerative building services.

2.1 Definition of standard office room, building type and building mode

A standard office room with 168 m² of area of usage (12 m width and 14 m depth) for 12 users was predetermined to gain comparable results. It was assumed that this room could be one of a series of rooms, situated in the middle of an office building so that the building can be thought as continued horizontally and vertically.

The development of the optimized room, which is adapted to local climate and conditions, is based on several tools and sources: 1) Climate analysis was carried out by Climate Consultant [7] and its rules; 2) Best practice examples, vernacular or traditional architecture; 3) Experiences of students coming from these locations. Finally, the construction, window size, shading system of the office room are also carefully selected to adapt to the local climate and condition.

The remaining energy demand has to be covered by renewable building services on-site for Net ZEB and on- and off-site for off-site ZEB_CM. Three types of corresponding building mode can be distinguished: adaptive, air-conditioned and hybrid.

An adaptive building is understood as a building with natural ventilation where the users can adapt their surrounding according to their preferences: no dress code, operable windows, personal switches for artificial light, thermostats, and etc. Besides heating with standard systems, cooling is also possible with thermally activated ceilings. In adaptive buildings, the expected comfort temperature is assumed in accordance with adaptive comfort models [8], [9], where above 20°C indoor comfort temperature varies slightly with the mean value of outdoor temperature. This assumption delivers comfort and also saves energy for cooling.

At locations with outdoor temperatures far from comfort range, mechanical ventilation (with heat recovery) is used to control air change and thus thermal losses. This may happen for cold periods for heating as well as for hot periods for air-conditioning, which controls the temperature to be mostly at 26°C. Singapore is a typical example of a hot and humid climate, where air-conditioning is used 12 months a year.



A hybrid building is the one which can be adaptive for some months when outdoor temperature is not too far from comfort range and also be run with mechanical ventilation and heating or air-conditioning for other months.

Four cities representing different types of weather will be investigated in detail: Hamburg (cold winter with mechanical ventilation), Beijing (cold winter and hot summer with adaptive months in between), Singapore (hot winter and hot summer) and Cairo (adaptive period in winter and hot summer).

The energy demand of this optimized room is determined by Energy Plus (U.S. Department of Energy, n.d.) based transient simulation software, PRIMERO-COMFORT [10]. The effect of buildings shadowing each other and its influence on power demand for artificial light are included.

2.2 Building services and renewable energy harvesting on-site (Net ZEB)

The renewable energy concept is based on a combination of two systems for thermal and electrical energy. A geothermal system uses thermal energy from the ground (heat exchangers up to 100 m depth are assumed) which is transferred to the right temperature for heating and cooling with a power-driven heat pump (Coefficient of power (COP) heating 3.5; Energy Efficiency Ratio (EER) cooling 2.5). The power harvesting is delivered from PV modules with an efficiency of 14% including system losses mounted on the building's roof. The Net ZEB produces all energy on site. The numbers of storey and building distances are not free of choice but determined by the target to reach a ZEB. Thus, the peak of heating or cooling energy demand determines the necessary size of the geothermal system. Because the ground between two buildings can be used only once for geothermal systems, this demand also determines the minimal size of the estate and thus the building distance. For power, it is assumed that the grid can serve as storage. Effects of time shift between production and consumption are neglected here. The necessary size of PV modules is thus determined by the yearly power demand of the building. Because it is assumed that only the roof as the possible area for PV, this determines the maximal numbers of storey producing this power demand.

2.3 Building services and renewable energy harvesting on-site and off-site (off-site ZEB_CM)

For an off-site ZEB_CM, the numbers of storey and building distances are set by other criteria of urban planning. From this predefined building distance, the maximal power of the geothermal system can be calculated backward. If the geothermal system is too small to cover the demand, it is necessary to add standard air-to-air heat pumps (split device, EER 1.5) for further cooling.

The maximal yearly power generation from the building's roof can also be calculated. If the real thermal and electrical energy is not covered by the systems on-site, the remaining part has to be covered by renewable compensating measures off-site to reach an off-site ZEB_CM. For the investigations presented here, PV-modules horizontal for power are chosen. For thermal energy, the problem of transporting from compensating land to the city was already mentioned. Thus, the thermal energy has to be transported as raw material in form of any energy plant. To be comparable the same wood pellets are chosen for all locations regardless of whether they are available there.

For the selected cities, the energy demand, the coverage potential on-site and the need of compensating land off-site are investigated for a set of different urban arrangements

Table 1: Different investigated variants for urban density (plot ration pr) and number of storeys.

Storeys	4 8 12 24 36	4 8 12 24 36	4 8 12 24 36	4 8 12 24 36	4 8 12 24 36	4 8 12 24 36
pr	1.5	2	3.5	3	3.5	4

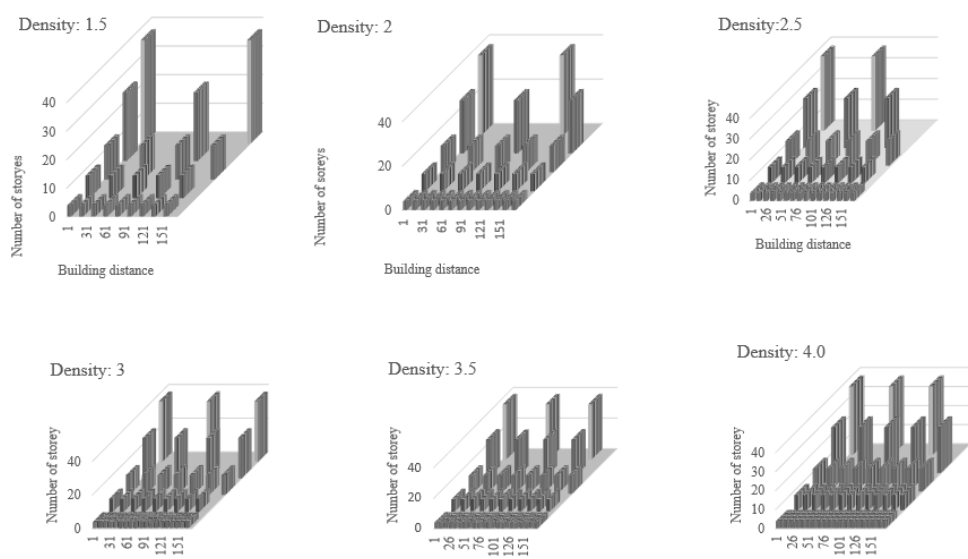


Figure 2: Relationship between urban density, the number of storeys and building distance.

covering different densities (plot ratio) which are realized by different numbers of storey and building distances (Table 1 and Fig. 2). The plot ratio of medium-high to high densities, which are also the plot ratios prescribed in Singapore’s development plan (Singapore Urban Redevelopment Authority, 2014), are chosen the investigation. The numbers of storey ranges from low to multi-storey buildings in order to cover all styles.

3 RESULTS FOR LAND-USE EFFICIENCY OF OFF-SITE ZEB_CM

The land-use efficiency of different urban densities and numbers of storey can be described by the following indicators that take both of estate and compensating area into consideration.

3.1 Indicators for evaluating the land-use efficiency of energy harvesting

The land-use efficiency of energy harvesting is measured by ratio of compensating area to area of use (CM ratio (1)). It represents the need of compensating area for each unit of area of use. This standardized compensating area makes it easier to carry out the comparison of

land-use efficiency among different types of buildings. The smaller the CM ratio (1), the less CM is required and the higher the land-use efficiency it is. Therefore, a smaller CM ratio (1) is preferred.

$$\text{CM ratio (1)} = \text{compensating area} / \text{area of use.} \quad (1)$$

Furthermore, it would also be interesting to examine the ratio of total area, i.e. the sum of estate area and compensating area, and area of use.

$$\begin{aligned} \text{CM ratio (2)} &= (\text{estate area} + \text{compensating area}) / \text{area of use} \\ &= \text{total area} / \text{area of use.} \end{aligned} \quad (2)$$

3.2 Indicators for effect of compensating area on urban density

A measure for original urban density is plot ratio, which is:

$$\text{Original urban density} = \text{plot ratio} = (\text{area of use}) / (\text{estate area}). \quad (3)$$

Due to the requirement of the compensating area to supply renewable energy, urban density is changed after including compensating area in the calculation. The modified urban density is defined as the following:

$$\text{Extended urban density} = \text{area of use} / [(\text{estate area}) + (\text{compensating area})]. \quad (4)$$

3.3 Results for CM ratio (1)

The analysis of results focuses the relationship between climate zones, land-use efficiency and urban fabric. The results in Fig. 3 present the relationship between CM ratio (1) and urban fabric. The first pattern to be observed is the relationship between CM ratio (1) and numbers of storey. Because the CM ratio (1) is a standardized indicator, if the number of storey does not affect the CM requirement, CM ratio should be the same among different number of storeys. However, the results show that CM ratio (1) increases with numbers of storey. This means that the larger the numbers of storey, the more compensating area is required for each unit of area of use. In other words, for each unit of area of use, a higher building needs more compensation area than a low-rise building. Land-use efficiency decreases with numbers of storey and there is a negative relationship between numbers of storey and land-use efficiency.

Another result that can be observed in Fig. 3 is the relationship between urban density and CM ratio (1). The results show that the larger the urban density, the more compensating area is required for each unit of area of use. In other words, for each unit of area of use, a larger urban density needs more compensation area than a small one. Land-use efficiency decreases with urban density and there is a negative relationship between urban density and land-use efficiency.

3.4 Results for CM ratio (2)

The results in Fig. 4 compare the relationship between CM ratio (2) and urban fabric at city level within each climate zone. The first pattern to be observed is the relationship between CM ratio (2) and numbers of storey. Fig. 4 shows that, the larger the numbers of storey, the more estate and compensating area is required for each unit of area of use. In other words, for each unit of area of use, a higher building needs more estate and compensating area than

a low-rise building. Land-use efficiency decreases with numbers of storey and there is a negative relationship between numbers of storey and land-use efficiency.

Another result that can be observed in Fig. 4 is the relationship between urban density and CM ratio (2). The results show that the larger the urban density, the more estate and compensating area is required for each unit of area of use. In other words, for each unit of area of use, a larger urban density needs more estate and compensating area than a small one. Land-use efficiency decreases with urban density and there is a negative relationship between urban density and land-use efficiency.

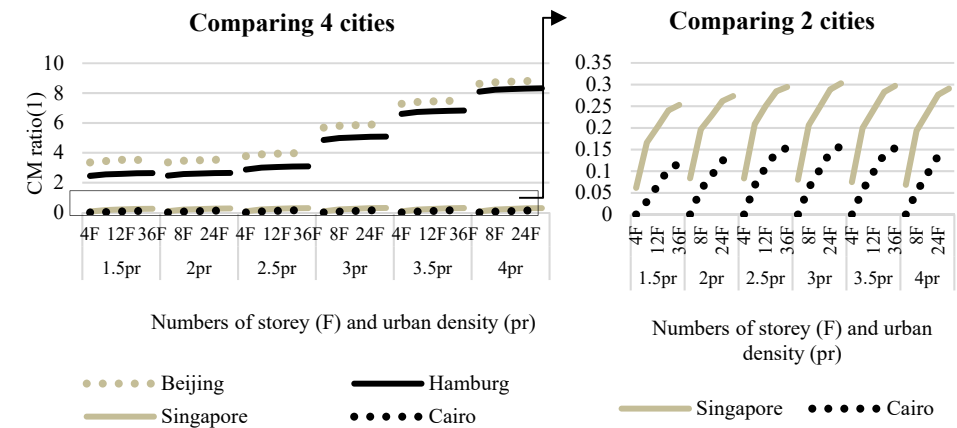


Figure 3: CM ratio (1) by the numbers of storey and urban density in Beijing, Hamburg, Singapore and Cairo.

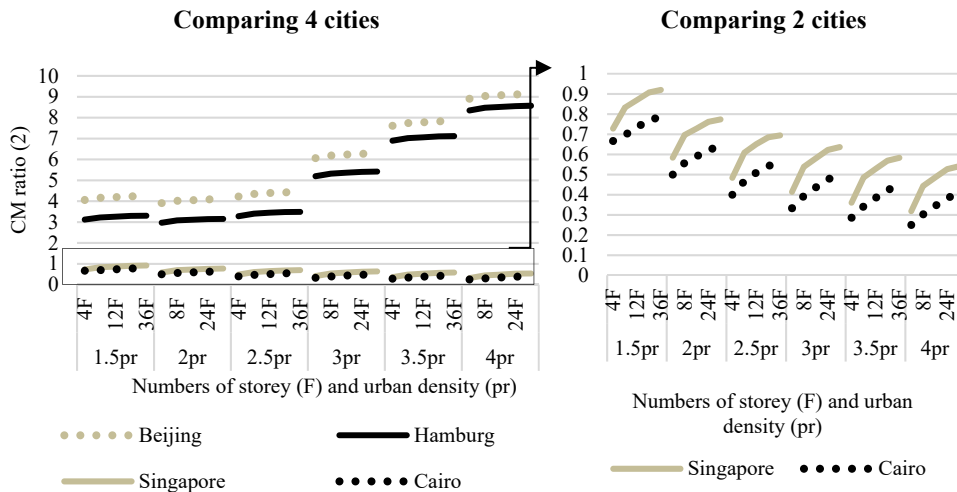


Figure 4: CM ratio (2) by the numbers of storey and urban density in Beijing, Hamburg, Singapore and Cairo.

3.5 Results for effect of compensating area on extended urban density

The results in Fig. 5 presents the relationship between numbers of storey and extended urban density. The results show that the higher the building, the smaller the extended urban density and the larger the difference between original density and extended urban density. And the difference is even greater for higher buildings. The important implication here is that, on the one hand, higher buildings increase the area of use and, therefore, increases the extended urban density. On the other hand, it also increases the requirement for CM and reduces the extended urban density. There is a diluting effect of CM on the extended urban density.

Another result that can be observed in Fig. 5 is the relationship between original and extended urban density. The results show that the larger the original urban density, the smaller the extended urban density and the larger the difference between original and extended urban density. This also means that, on the one hand, extended urban density can be increased by reducing the building distance and, on the other hand, it also increases the requirement for CM and reduces the extended urban density.

4 DISCUSSION

This paper is motivated by anticipation that the development of new land area required for energy production is becoming the main driving force of land use change. The immediate challenge faced by urban planners is to reduce the energy consumption and energy sprawl without affecting urban density. In the high-density area, the CM becomes an important factor to land use change. There is the pressing need to understand how compensating area changes with the numbers of storey, urban density and energy harvesting technologies. More specifically, the core of the question is to explore the relationship between urban fabric and the CM.

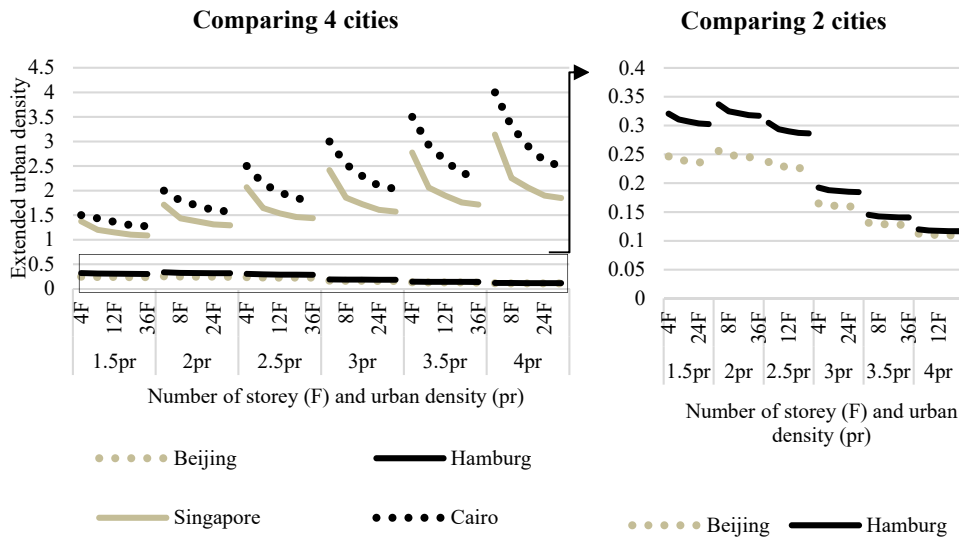


Figure 5: Extended urban density by the numbers of storey and urban density in Beijing, Hamburg, Singapore and Cairo.

To answer these questions, this paper develops an experimental method with regard to how to find the best solution for land use planning of ZEB and which parameters may be taken into consideration. As the planning targets vary among different cities, planners can now apply this tool to explore the effect of CM on their own proposal.

4.1 Physical aspects

The detailed noted figures, such as plot ratio, EER or COP, are specific for each location and will be different from each other. But they represent the typical behaviour for corresponding climates. The results depend strongly on the efficiency (EER and COP for machines, energy density for harvesting of solar radiation) of renewable energy harvesting for thermal energy, including heating and cooling, and power on-site and off-site. Changes in the kind of energy harvesting technology may completely inverse tendencies.

In Singapore, there is only demand for cooling and the need for heating does not exist. In Cairo, cooling demand is much higher than heating demand and becomes the dominant source of energy demand. The cooling demand can be easily covered by the geothermal system and heat pump. Thus, compensating measure means power harvesting by PV off-site. In order to determine the necessary compensating area, the PV modules of off-site ZEB_CM and those on the building roof inside the city are assumed with the same efficiency, same arrangement, and same harvest per m². The energy density of PV modules is relatively high (see Fig. 2) and the high cooling demand would lead to a moderate compensating area.

While Beijing has both cooling and heating demand, Hamburg has only heating demand. That leads to both power and heating demand to serve all systems. Thus, compensating measure means power harvesting by PV and wood pellets off-site. The energy density of wood pellets is very weak (see Fig. 2). Therefore, a high heating demand would lead to a huge requirement of compensating area dominated by PV. This pattern can be observed in all of the graphs, which show that the difference between Beijing and Hamburg as well as the difference between Singapore and Cairo becomes smaller as the numbers of storey and urban density increase.

For all locations, there is a different threshold where the capacity of the geothermal system is fully used and less efficient technologies for cooling (split device) has to be used or compensating measures for heating have to be used respectively.

4.2 General recommendations

The main target of this paper is to develop a tool for planners to include CM in the planning process, therefore, the values of the results in this paper are not intended to be not representative. Instead, the results serve as an example to demonstrate how to use the method. Based on the results, general suggestions are derived with regard to the planning of land-use requirement of energy harvesting:

- If the priority of land-use planning is to save land inside the town, use high plot ratio.
- If the priority of land-use planning is to save land for CM, use small numbers of storey.
- If the priority of land-use planning is to save land in general, use high plot ratio with small numbers of storey and low-rise building.



- Try to use other possibilities for renewable heat production inside the city, such as district heating based renewables. Try to avoid using the compensating area for energy plants that competes with food production. For wood pellet production, sustainable forestation should be given the priority.
- The smallest plot ratio has the lowest need in compensating area for heating. Under these constellations with low plot ratio, low-rise building with small numbers of storey are the optimal option because compensating area is minimised, and the priority is given to daylight access.
- Up to urban density 2.5, there is a remarkable influence of shadowing and the resulting power demand for artificial light. Buildings with higher numbers of storey and bigger distances have the lowest power demand with the best daylight access. For buildings with the urban density greater than 3.5, the shadowing is so strong that artificial light has to be used at all time, regardless of the numbers of storey.

5 CONCLUSIONS

In this paper, supplementary measures were created to explore the relationship between building density and energy harvesting. This research fills the gap between researches about energy density and building design by revealing the relationships between different types of energy harvesting technologies and land-use requirement of different urban densities. The results show that the optimisation of zero-energy buildings with on-site energy generation will reduce urban densities in several different climatic zones and that low-rise buildings with high density may be an optimal option. It is suggested that the land-use planning for renewable energy must measure energy density and also consider the amount of land required by different building designs. This research highlights the importance of land-use policy and the need for urban policy to create a more holistic view by including a land-use requirement for energy harvesting.

The target of the current paper is to generalize tendencies and dependencies between area of use, estate area and compensating land for different climates. Future studies focussing on the detailed investigations for one special location would benefit from the more detailed description of urban fabric and mix-use of land between studied cities. Also, more precise assumptions about time displacement of production versus consumption and whether the grid absorbs differences between onsite production or consumption should be included in the subsequent studies. Detailed solutions, which optimizes the supply side in terms of land requirements, for special cities in different climate zones requires more precise tools. However, such results would be specific and only valid for the chosen city, instead of the general tendencies provided in this paper. These issues deserve to be further discussed in future studies.

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SECTION 12
PLANNING FOR RISK AND
NATURAL HAZARDS

MITIGATING PROJECTED IMPACTS OF CLIMATE CHANGE AND BUILDING RESILIENCY THROUGH PERMACULTURE: A COMMUNITY 'BEE INSPIRED GARDENS' MOVEMENT IN THE DESERT SOUTHWEST, USA

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ABSTRACT

Permaculture, an integrative design process creating resilient and productive landscapes and communities, can serve as a useful mitigation tool for projected climate change impacts. In the United States, the desert southwest town of Moab, Utah, has employed permaculture design in a community initiative called 'Bee Inspired Gardens.' This initiative has harnessed social capital to create resilient landscapes demonstrating pollinator health, water conservation, and perennial food and forage systems. Bee Inspired Gardens have been designed at a University, middle school, charter school, Bureau of Land Management property, hotel, public park, environmental education non-profit, and more. Community members are now harvesting fruit and seeds from existing garden sites, attending educational workshops at the gardens, and volunteering to help with the design and implementation processes. In the desert southwest, climate change projections are for hotter, drier, weather. In preparing for, and working to mitigate, projected impacts, initiatives like 'Bee Inspired Gardens' can serve as models for other communities looking to take positive action in climate mitigation and adaptation.

Keywords: permaculture, climate change, water harvesting, conservation, resiliency, regenerative, pollinator health, perennial food, social structures, desert.

1 INTRODUCTION

Average temperatures in the United States (US) have risen between 1.3 and 1.9 degrees Fahrenheit since 1895, with the highest rate of increase occurring since 1970 [1]. Substantial scientific research predicts temperatures in most areas of the US will increase another 2 to 4 degrees Fahrenheit over the next few decades [1]. As with many areas globally, the Southwest region of the US is predicted to experience hotter, drier weather due to climate change, yet this region also relies more heavily on irrigation than any other region in the country. Water supplies, primarily driven by winter snow levels in the Sierra Nevada Mountains and the Rocky Mountains, are critical to meeting irrigation needs in the Southwest. In this region, the US Department of Agriculture Southwest Climate Hub [2] has correlated climate change with:

- A prolonged, extreme drought persisting over several years;
- Large, destructive and catastrophic wildfires that have taken both lives and property;
- Expansive areas of forest tree mortality as a result of insect outbreaks;
- A severe decline in reservoir water supplies across the region to previously unseen levels;
- Documented rising temperatures that increase the frequency of heat waves and reduce the frequency of cold snaps.



Recent regional catastrophes and water shortages have been directly linked to changing climatic conditions in the US Southwest. For example, California experienced its hottest and driest 12-month stretch in 120 years of official record keeping in 2014. Nearly 60 percent of the state endured months of exceptional drought conditions, with the rest in at least moderate drought levels. A lack of water and extreme dryness led to heavy agricultural damage and other direct economic impacts. In 2014 alone, Western drought resulted in \$4 billion in economic losses, and \$1.5 billion in insured losses [3]. Water is a scarce and vital resource to farmers, ranchers, and the general public in the region. Unfortunately, drought and increased competition for water will be a more frequent reality in coming years [2].

In the face of changing climatic conditions, permaculture can serve as a mitigation and adaptation tool. Permaculture is an integrative framework for designing and creating landscapes and communities that are more resilient and productive (improved recovery time from damage to infrastructure, increased self-reliance, etc.). Resilient and productive landscapes will both mitigate the projected impacts of climate change, and also be more adaptive as climate change impacts temperature and precipitation patterns, alters growing seasons, increases plant moisture stress, and potentially triggers further extreme events. This article shares how permaculture design can serve as a climate change mitigation and adaptation tool, drawing on a specific example of a community movement in the US desert southwest, called “Bee Inspired Gardens.”

2 PERMACULTURE DESIGN AS A SOLUTION

Permaculture, a merging of the terms “permanent” and “agriculture,” was first coined in Tasmania by Bill Mollison and David Holmgren in the mid-1970’s. In observing the environmental destruction and social stresses associated with providing basic human needs in an industrial era, Mollison and Holmgren sought a regenerative alternative. This alternative was envisioned as “an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to man” [4]. Holmgren has since expanded the definition to “consciously designed landscapes which mimic the patterns and relationships found in nature, while yielding an abundance of food, fibre and energy for provision of local needs” [5].

Permaculture design is guided by ethics and principles, using a systems lens with feedback loops for adaptation. This holistic framework teaches mimicking the diversity, functionality and resilience of natural ecosystems – a framework that applies beyond landscaping to one’s work life, social life, and community. The result is the establishment of land use and settlement systems that are productive, adaptive and resource-efficient in providing abundant and/or diverse yields for meeting human needs, including the need for existing within a healthy and functioning ecosystem. The principles and practices used are drawn from traditional ecological knowledge of indigenous cultures, combined with modern scientific understanding, technological advances, and place-based field experience across many disciplines.

Three ethics guide all permaculture work: “care for the earth”, “care for people”, and “return and/or share the surplus”. These ethics help us reflect on our choices as we work toward the shared goals of individual, societal, and ecosystem well-being. The concept of self-regulation teaches us that our behaviors and choices do matter. Humanity is viewed as an ethical species with a shared responsibility to limit our consumption and to seek forms of production and technology that satisfy our basic needs while providing the highest positive impacts on broader ecological and social systems. The ethics of care for the earth, care for people, and to return and/or share the surplus are operationalized through guiding principles ranging from “long and slow observation” to “creatively using and responding to change.”



2.1 The permaculture design process

The permaculture design process – the process applied in the Bee Inspired Gardens initiative, works from patterns to details, cultivating an understanding of the place-based climatic, site, community and socio-economic conditions influencing a project and a vision for what is possible. The design process starts with this assessment and visioning. Assessments include pattern recognition and obtaining baseline information about the climate, regulatory and bio-physical conditions influencing a particular site. Visioning provides the opportunity to actively articulate the desired or ideal future conditions and goals of a project.

Assessment helps us understand where we are, and visioning helps us clarify where we want to go. The creative tension arising from the gap between our current and desired conditions serves as the driver for designing and developing strategies and solutions to move us towards our vision.

A key part of the permaculture design process is assessment and analysis of the conditions one is working with, which begins with observation and research. Climatic information that is important to consider includes the plant hardiness zone, precipitation patterns, length of growing season, depth to frost line, prevailing winds, and other factors. Regulatory information that may be needed includes building codes, setbacks, drainage, water rights, zoning and other ordinances that may influence a particular site or desired function. Biophysical site conditions include topography, aspect, elevation, infrastructure, buildings, access, vegetation, soils, hydrology, wildlife, animals and other site characteristics. The broader climatic, regulatory, and biophysical conditions will help shape the design by providing realistic parameters, allowing you to design effectively from patterns to details, and to fit solutions to place.

As climatic impacts increase, valuing diversity and experimenting with different species and varieties of plants and animals in our landscapes and agriculture will increase in importance. Seeking opportunities to create, enhance and work with microclimates on a given site is important for creating productive systems that are diverse and resilient.

2.2 Let the design guide the techniques

A common misunderstanding about permaculture is the belief that specific techniques (such as an organic garden, swale or herb spiral) represent permaculture anywhere that the technique is inserted. While many techniques can be very valuable when included in a permaculture-based design, the technique itself does not represent permaculture until it is placed in the context of the larger site design and development. For example, an herb spiral designed and located to perform multiple functions and form strategic relationships with other elements, techniques and uses of a site within the context of the larger site design is an example of permaculture design. An herb spiral that is undersized, out of place or disconnected from other site uses and features is not. Refraining from the tendency to skip site assessment and immediately apply specific techniques will keep the options open and allow details to be worked out as concepts come together more fully based on observation and interaction.

One way to maximize multi-functional placement of elements is through a zone and sector analysis. This is a technique used to inform the layout and selection of site features and strategies. Zones refer to the spatial layout of different areas of use and management on a site, based upon a site's topography, proximity to living/activity areas, access paths and the timing and energy requirements to manage and harvest. Zones help us use our time and resources wisely, and increase the chances that the systems of a site receive the attention



needed for proper operations. Sectors are energies moving through or within a particular site. Examples of sectors include sunshine at different times of day and year, wind, run-on or run-off, a favorable or unfavorable view, noise, smells, light pollution, wildlife and wild fire. There may be additional sectors to consider for any given site. Once Sectors are identified, one can explore the strategies to work with the energy from a particular sector. In broad terms, the options available to work with sectors include: blocking, directing, or harvesting.

Taking the sun sector as an example, through multiple elements in passive solar home design, the function of effectively working with the sun sector is performed. A combination of glazing (windows), overhangs, thermal mass, insulation, and ventilation, ensures a passive solar home that harvests sunshine in cool months to warm the building, and blocks sunshine in the hot months to keep the interior space cool. This minimizes the need for additional HVAC systems. The relative location and functional connections of the elements directs sunshine to thermal mass, which absorbs and holds heat to release slowly overtime to maintain a relatively consistent indoor temperature.

Zone and sector analyses inform integrated design for maximized energy efficiency, comfort, and productivity with a resultant decrease in external resources required to meet site needs. A shift from consumption to local production has multiple positive benefits and builds resiliency from supply disruptions and disasters, particularly as many small individual actions achieve scale at the community and watershed level.

3 BEE INSPIRED GARDENS: A COMMUNITY PERMACULTURE MOVEMENT

The desert southwest town of Moab, Utah, has been growing a movement that re-envisioned how water and resources are used to build resiliency in the wake of climate change. Through prolonged observation and interaction, a collaborative initiative has emerged, resulting in over a dozen permaculture landscapes installed in under two years. One of those sites, Utah State University (USU) Moab, has been a pioneering catalyst of the Bee Inspired Gardens movement and will serve as an example of permaculture principles in action.

3.1 Background

In 2013, the USU Moab campus was undergoing a major parking lot upgrade, in which approximately half of the landscaped area would be removed and replanted. The original plan included replacing existing landscaping (planted primarily in juniper shrubs *juniperus spp.*) with raised flower beds fed by an irrigation drip system. This design did not adequately account for site specific conditions and micro-climate, available on-site resources, nor the opportunity to address or resolve additional site-specific challenges in the process.

After an inquiry to instead redesign the campus landscaping to serve as a teaching tool and an opportunity to foster inspiration both within and outside of the classroom, permission was granted to apply permaculture to the project as a model of climate resiliency. The approval for permaculture design from USU Moab's Dean served as a catalyst for development of a community initiative, called Bee Inspired Gardens.

In light of the new direction intended for campus landscaping, a community visioning meeting was held with USU Extension Sustainability's coordinator and a permaculture intern, a city council representative, owner of a local nursery, director of a local nonprofit building affordable straw bale housing for low-income families, a local community-supported agriculture provider, US Department of Agriculture Natural Resources Conservation Service's local representative, Moab's Bureau of Land Management representative, director of a nonprofit youth organic gardening organization, permaculture



designers, and the county bee inspector. During this meeting, representatives discussed community concerns, namely water resources, pollinator population decline, and a lack of community self-sufficiency. In identifying these common concerns, a team was formed that would work to establish educational and interactive spaces throughout the community, under the mission “to inspire efforts toward pollinator health, water conservation, and food and forage systems using gardens, workshops and resources in a way that benefits our community and ecosystems.”

3.2 Human diversity

The USU Moab garden design process began with slow and thoughtful observation. The USU Extension Sustainability team organized a series of community workshops to teach locals about permaculture while engaging the community actively in the USU Moab garden design process.

The workshop series began with a design charrette and followed by a hands-on work day. Participant observations during the initial workshop were incorporated into the final design of the garden, including an assessment of the need for more parking lot shade (which led to the establishment of shade trees planted in water harvesting tree islands with curb cuts – see Fig. 1) and the need to remediate the recurring issue of freeze and thaw cycles caused by roof downspouts out letting into the parking lot (solved by redirecting water flow into garden green spaces). Within the year, the USU Moab permaculture gardens were installed, showcasing innovative examples of green infrastructure with water harvesting technologies and a perennial food forest with diverse pollinator plantings (Fig. 2).

One of the most important outcomes of the garden was the process that empowered participants to develop their own projects and the model that continues to inspire and engage the community. Highlighted below are several aspects of the project which emphasize the value and impact of permaculture design on the site and community scale.

3.3 Building a network

Site analysis and assessment identified existing, underused resources available. Most immediate at USU Moab was the abundance of water runoff available for harvest in the dense urban environment of the site. Impermeable surfaces abounded – as roofs, concrete sidewalks and asphalt parking lots. This included runoff from both on-site surfaces and neighboring buildings. This runoff resource could be harvested by two means: (a) direct conveyance to depressional features in the landscape – called basins or swales; and (b) capture and storage in tanks, or cisterns, to hold the water for use during the dry season and drought periods. The most substantial water harvesting source was the roof of a neighboring hardware store building, which provided an opportunity to form a relationship with the store’s management. Excited about the project, the local business offered to finance and install a gutter and downspout system on their building to support water harvesting at the University.

A second community relationship was then developed with a local tree trimming company, who donated woody mulch, a byproduct of their tree trimming work, as a surface layer to increase water retention, contribute to building healthy garden soils, and suppress the growth of undesirable plants. This relationship later led to a partnership in building a pergola for an outdoor social space. Then, a third relationship was formed with a local mule and horse ranch who donated a large quantity of composted animal manures to help amend the soils in the garden. In this case, the ranch’s overabundance of resources had become a burden to their operation. Its use in the garden proved a benefit to all parties.



This process has had a direct benefit in building resilience given climate projections for the Southwest. Permaculture designer Jason Gerhardt calculates over 125,000 gallons of water are now harvested annually at USU Moab either directly into the garden soil or into a series of rain tanks for later use – all in a climate that only gets 9 inches of rain a year. Ultimately, what we observe are localized solutions working in conjunction with available on-site and neighborhood resources, in the form of natural elements and social relationships, that cumulatively demonstrate how to apply these techniques on a larger scale within the city.

3.4 Techniques used to slow, spread and sink water

Basins

- Basins are depressional features with capacity for a given amount of water to be retained (temporarily pool) and infiltrated into the surrounding soil. The garden landscape is a sinuous basin and swale system designed to maximize the retention and infiltration potentials of the site. During a precipitation event, water running off the surrounding roofs is directed into the rock lined channel, where it temporarily pools up and soaks into the adjacent soils.

Swales

- Swales can be either on-contour (level) or off-contour (sloped). On-contour swales are used to distribute water evenly across an area. Off-contour swales are used to convey water slowly between points, allowing for infiltration to occur along the way. USU Moab's swales were designed off-contour, with an approximate 1% to 2% slope to direct water into basins and intentional overflow areas.

Curb cuts

- Curb cuts are strategically located openings in a curb and gutter system or sidewalk that allows the flow of storm water to enter a depressional landscaped area. Curb cuts are often located in series along a parking lot or roadway, providing redundancy and increased capacity as one curb cut fed basin fills the water flows down to the next. Curb cuts were included in two parking lot vegetation islands at USU Moab, shown in Fig. 1. A simple shift from having these vegetation islands be raised, as is currently the norm, to being depressional allows for hundreds of gallons of water to be retained and absorbed during rain events, providing abundant, deep infiltration of water to support the plantings. Shade trees planted in these basins are growing large and fast, providing valuable shade to lower the heat islands of this parking area, making for a more inviting and healthy space, even in the middle of a sea of asphalt.

Cisterns or tanks

- Storage containers of various sizes can be used to hold water during precipitation events for use at later times. The volume of water stored can be matched to the available roof area and precipitation patterns, and should always include an overflow to an appropriate location.





Figure 1: Parking lot shade islands with curb cuts and basins, USU Moab. (*Photo credit: Roslynn Brain.*)



Figure 2: USU Moab Garden Progression over two years. (*Photo credit: Roslynn Brain.*)



Supplemental drip

- Most plants in an arid climate like Moab require some level of supplemental irrigation during their establishment period and occasionally during periods of extreme or prolonged drought. Plant establishment typically requires 1 or 2 growing seasons for plant roots to become robust and able to more effectively survive on available soil moisture from local precipitation and water harvesting strategies. Supplemental irrigation can be provided by hand watering, drip irrigation or a combination. Providing infrequent, deep watering is more effective at promoting deep root growth and plant establishment than frequent, shallow watering. USU Moab's permaculture gardens were established primarily via hand watering (through an integrated design of the rainwater cisterns and garden basins in which a series of pipes direct stored rainwater to flood into the rock-lined garden swales). Only beds surrounding the buildings use drip irrigation, as the irrigation systems were already installed and building overhangs limit direct precipitation.

3.5 Carbon sequestration

Carbon sequestration comes in the form of planting with diverse, perennial trees, shrubs, and plants, and using organic mulches, as well as building soil structure. According to Colorado State University Extension [6], wood or bark chip mulch is ideal around trees, shrubs, perennials, and small fruits. A wood/bark chip mulch creates a favorable environment for earthworms and soil microorganisms, which helps to reduce soil compaction in time. In perennial and shrub beds, wood/bark chips can reduce the need for irrigation by as much as 50% [6]. Also, when used on the soil surface as mulch, wood/bark chips do not tie-up soil nitrogen. USU Moab's permaculture gardens used approximately six inches of wood mulch during installation with a fresh layer added annually or as needed to maintain cover. Listed benefits of wood mulch by Colorado State University Extension [6] include:

- Reduces evaporation from soil surface, cutting water use by 25–50%;
- Organic mulches promote soil microorganism activity, which in turn, improves soil tilth and helps lessen soil compaction;
- Stabilizes soil moisture;
- Controls weeds, which rob soil moisture;
- Moderates soil temperature extremes;
- Controls erosion;
- Gives a finished look, improving aesthetic quality.

Where does carbon sequestration tie in with wood mulch? Although a complicated relationship, research published in *Nature* [7], by scientists from the University of Texas at Austin, the Smithsonian Tropical Research Institute, and Boston University assessed the carbon and nitrogen cycles under different mycorrhizal (fungus and root relationships) regimens including those in wood mulch and found that plants linked with fruiting, or mushroom-type, fungi stored 70% more carbon per unit of nitrogen in soil. The fungi uptake of organic nitrogen on behalf of the plant was found to out-compete soil microorganisms that decompose organic matter and release carbon [7].

In addition to the carbon sequestration occurring through maturing perennial plants and wood mulch, carbon emissions have also been reduced through the maintenance required by



the design. As opposed to mono-planted lawns or landscapes, the USU Moab gardens do not require any fossil-fuel equipment to maintain.

3.6 Plant selection and placement

An important component of the garden design at USU Moab was an effort to take into account local and regional natural and human history. Permaculture stresses the value of ancestral and indigenous values in contemporary design and how these aspects contribute to the transmission of cultural wisdom. In developing a plant palette for the USU Moab permaculture gardens, the history of land use and settlement in the Moab Valley was taken into consideration. The plant palettes drew from distinctive epochs in regional history, including: native plants harvested and used by early indigenous inhabitants of the valley (e.g. Indian Rice Grass, *Achnatherum hymenoides*, and Sumac, *Rhus integrifolia*), perennial crops (stone fruit trees) grown by later Mormon settlers and a plethora of herbal, medicinal and edible plants propagated for use in contemporary times.

The planting pattern was designed around the permaculture concept of guilds, which – in gardens, are groups of plants chosen for their mutually beneficial and interacting functions, planted in proximity to one another. The layout mimics the Seven-Layer Forest Garden design described in Toby Hemenway's book *Gaia's Garden* [8], wherein the layering of a natural forest ecosystem includes a root layer, groundcover and grasses, herbaceous perennials, a shrub understory, low and high-tree canopies and vines. Each plant at USU was chosen to fill a particular niche or function in this system of layers, and each was placed so to interact with the species planted in proximity to it.

One example of a plant guild in the USU Moab permaculture garden is the Santa Rosa Plum (*Prunus salicina*) guild, which includes: Nanking Cherry (*Prunus tomentosa*), Common Yarrow (*Achillea millefolium*), Beardtongue Penstemon (*Penstemon Palmeri*) and Thyme (*Thymus vulgaris*). In this guild, each plant serves as a unique pollinator attractant. In addition, the thyme grows low and sprawling as a groundcover, the yarrow draws deep roots to break up compacted soils and contributes surface mulch through seasonal leaf-drop, the penstemon provides an early season bloom for pollinators and non-competitive drought tolerant characteristics, the Nanking cherry offers bird and beneficial insect habitat as well as shade from summer sun, and a break from seasonal winds, and the plum tree provides additional shade (creating a microclimate for other species) as well as food production for people. The thyme has culinary uses, the yarrow is dried for medicinal uses, and the Nanking cherry provides an early season berry for birds and people. These are just a few of the interacting and overlapping functions which formed the basis for the plant palette, and it is just one of several plant guilds designed for the permaculture garden, harboring native and adapted species such as Banana Yucca (*Yucca baccata*), Grapevines (*Vitis labrusca*), Jujube Tree (*Ziziphus jujuba*), Apache Plume (*Fallugia paradoxa*) and Golden Currant (*Ribes aureum*).

Throughout the design process, emphasis was put on designing for place. This entailed designing for regional climate (present and future), local context (neighborhood and site specific), and culture (demographics and site management) in an integrative way that seeks to unite what are typically viewed as disparate elements.

3.7 Other Bee Inspired Garden sites

Although aspects of the design vary between garden sites throughout the town of Moab Utah, the key elements of pollinator health, water conservation, and perennial food and forage systems remain the same. Sites range from a remote desert site on a reclaimed cattle range to



a rainwater-fed pollinator garden at a K-6th grade charter school. Consistent elements in all garden designs, implementation, and maintenance include involving community members, creating educational workshops, including interpretive signage, providing feedback when input is sought, and sharing the abundance provided.

4 ADOPTING THESE PRACTICES IN YOUR COMMUNITY

Designing landscapes, buildings and communities through the ethics and principles of permaculture is a way to build resiliency in the wake of the challenges of global climate change. Permaculture design can also support the shift from our current economic growth model dependent on machines and extractive industries with high greenhouse gas emissions to one focused on resilience and the integrated health of human communities and broader ecological systems. In addition to the main ethics and principles of permaculture, the following is recommended if you are interested in adopting these practices in your community:

- Educate yourself about permaculture. Take a permaculture design certification course through a credible organization, ideally based in your geographic region.
- Spend time observing and interacting with your community (key stakeholders, change agents, social networks). Inventory your own skills and resources and those within the community. Vision the ideal future conditions for your site and community. Use this information to decide where to best direct your energy and resources.
- Establish a collaborative team and start to implement small projects; use this as a trial ground to test ideas and garner feedback on how to improve. Use these demonstrations as leverage points to help city government, schools and others see how the design process works.
- As a resource starting point, read Toby Hemenway's *Gaia's Garden* and *The Permaculture City*, Gary Nabhan's *Growing Food in a Hotter Drier Land*, and Brad Lancaster's *Rainwater Harvesting for Drylands* and *Beyond Volumes 1 and 2*. As well, it is recommended to seek out the indigenous knowledge of native plant communities from your area – through research and direct conversation.

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A COMPARATIVE ANALYSIS OF THE LEVEL OF URBAN RESILIENCE IN THE CITY COMPREHENSIVE PLAN

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ABSTRACT

In recent years, due to rapid changes in society, and climate change, cities have experienced difficulties in predicting various types of upcoming hazards and stresses. Uncertainties about the nature and extent of risks are increased especially when it comes to cities where interactions exist among various elements including human, society, economy, and culture. Considering limited prediction on inherent crises and difficulties in reaction plans, resilience strategy should be implemented prior to prevention strategy. The purpose of this study is to compare urban resilience levels of comprehensive plans for metropolitan areas with a population of over 1 million. Resilience measurements of capacity of resistance, adaptation, and recovery from external shocks and stresses will be applied to evaluate the level of urban resilience of cities in Korea. For the method of the study, it defined concepts of urban resilience through literature review, and derived indexes for urban resilience using preceding researches and case studies. Then, it developed detailed assessment indexes for evaluation of urban resilience level, and, finally, it evaluated and compared urban resilience level of comprehensive plans, using derived assessment indexes. As a result of the study, it suggested 56 assessment indexes and checklists in 8 sectors including land use plan, urban and residential environment, infrastructure, and more. The result of this study can be used as a base data for the future comprehensive plans when developing resilient cities.

Keywords: urban resilience, indicator, city comprehensive plan, checklist analysis.

1 INTRODUCTION

It is impossible to predict various risks such as disasters and economic crises in cities due to globalization and climate change, and the complexity increased due to the interactions of various factors such as humanities, society, and economy. Thus, the unpredictability and uncertainty of risk are maximized. For this reason, it is argued that the urban resilience force should be increased beyond the prevention of individual incidents or local accidents that occur in the city, as the awareness of the limitation on the prevention of urban planning is increasing.

Urban resilience is necessary because city problems cannot be overcome by simply eliminating or preventing a single risk factor from a preventive point of view, but rather mitigating damage, improving vulnerability and adaptability to change. Therefore, it is necessary to have a city-planning strategy to comprehensively consider all factors. Resilience strategy can also be more effective than prevention strategy if the city's potential risk or crisis prediction is limited, and it is difficult to find a countermeasure [1].

The purpose of this study is to analyse the urban resilience level of urban comprehensive plan in order to build resilient cities in a metropolitan. Applying the concept of urban resilience that can cope with external shocks and stresses to domestic cities, diagnose and analyse the resilience of each city, and contribute to sustainable urban development by presenting resilience factors to be reflected in urban planning, it is possible to search for directions.

The purpose of this study is as follows: first, analysing the concrete contents of the city's comprehensive plan, which is a top-level plan established at the city level, and examine the relationship between city comprehensive plan and urban resilience by examining theories, researches, and applications related to urban resilience. Secondly, to establish a resilient



urban plan that reflects local characteristics, we will build an index of urban resilience indicators for each sector and compare the resilience levels of existing city comprehensive plans. Through this, this study will propose a direction and policy and institutional improvement plan which should be aimed at creating a resilient city when establishing the city comprehensive plan in the future.

The spatial and temporal scope of this study covers 4 out of the 5 cities except Seoul, where the 2030 city comprehensive plan was established among more than 1 million large cities in Korea. The contextual scope is limited to assessing the level of resilience through a context analysis and the divisional elements of the city comprehensive plan are reviewed with a focus on urban resilience [2].

The research method is as follows: First, the concept of city comprehensive plan and city resilience is defined through literature review, and diagnosis index related to resilience is derived through precedent research and case study. Second is based on the derived diagnosis index, it analyses the degree of the city's recovery ability in the current city comprehensive plan establishment guidelines and builds detailed evaluation index by each component. Third is a checklist, it was prepared based on the detailed evaluation index to evaluate the urban resilience level of the city comprehensive plan.

2 LITERATURE REVIEW

2.1 City comprehensive plan

The city comprehensive plan is a national plan established in accordance with Article 19 (3) of the National Land Planning and Utilization Act and Article 16 is the Enforcement Decree of the same Act, which has the status of a top-level plan established at the city level. The status and significance of the city comprehensive plan are shown in Table 1 and Fig. 1, respectively. It suggests a policy direction that can improve the quality of life of residents by efficiently utilizing the limited resources of the country efficiently and rationally, and to develop the liveable and sustainable. At the same time, it has the character of a comprehensive plan that suggests a structural framework to develop the city spatially over the long term.

Table 1: The significance of city comprehensive plan. (Source: ministry of land and transport affairs, 2015.)

Category		Range
An integrated approach	Sustainable	Ensure sustainability of national land management for utilization and development and conservation of the country.
	Environmental	Rapid growth of cities and prevention of spread of global climate change. Active response to global warming and reduction of carbon emissions.
	Economical	Job Creation in the Region. Urban regeneration and activation of local economy. Seek economic efficiency of resource utilization. Achieve cost-effective urban development and achieve low carbon green growth.
	Social	Considering social equity (collecting opinions of various interests of community, reflecting). Contributing to the promotion of social capital (social conflict minimization, integration promotion). Establishing a plan that takes into account social disadvantages (low-income, elderly, disabled, etc.). Enhancing community cultural diversity.



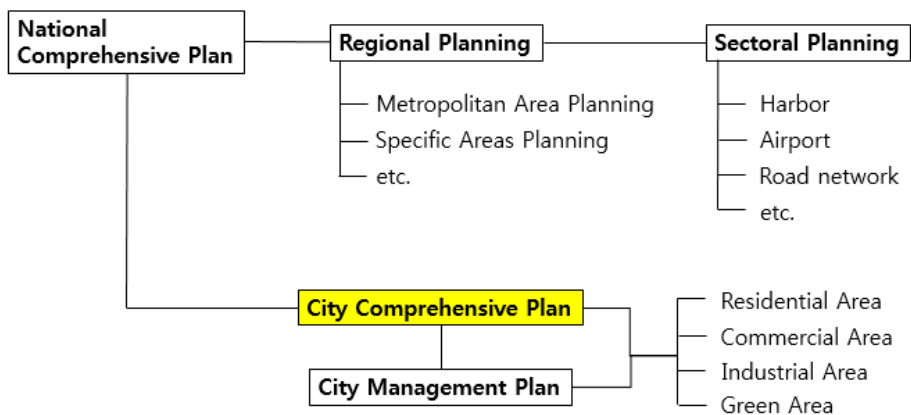


Figure 1: The status of city comprehensive plan. (Source: Ministry of Land and Transport Affairs, 2015.)

Most studies dealing with linkages between urban comprehensive planning and resilience are addressed in the areas of carbon reduction and disaster prevention. “Evaluation of Urban Comprehensive Plan with Disaster Cities Indicators” by Lee Seung-hee (2013), “Assessment and Analysis of Disaster Prevention and Safety Plan Planning by City Comprehensive Plan” by Park, Joon Sung (2014) and “A Comparative Analysis of Carbon Abatement Strategies in the City Comprehensive Plan” by Henan Suo (2014).

2.2 Urban resilience

Resilience comes from the Latin word “Resilio”, which means “To jump back,” and has been applied and spread in various fields such as ecology, engineering, economics, and psychology [3]. Resilience is largely classified into three concepts.

Resilience can be applied at the urban and community level. As urbanization accelerates due to industrialization and technological development, the proportion of the population living in the city has increased, and the quality of life has increased, so that infrastructure, public service and welfare demand are also increasing. On the other hand, as cities become increasingly overcrowded and complicated, they are more likely to be exposed to external risks or shocks as well as more difficult to forecast and the extent of damage is also

Table 2: Three concepts of resilience [4].

Concepts	Characteristic	Focus	Context
Engineering	Recovery period Efficiency	Recovery Robust	Stable Balance state
Ecological	Buffer capacity Shock mitigation Maintain function	Sustainability Durability	Multiple balance
Social-ecological	Maintaining and developing interactions of disability and re-organization	Adaptive Capacity Multi-variate Learning and Innovation	Integrated and active interaction



Table 3: Definition of urban resilience.

Author	Definition
Godschalk [5]	Ability to resist shock without immediate chaos or permanent deformation or breakage.
Sophie and Cassidy [6]	Ability to resist or absorb dangerous effects through resistance and adaptation that can maintain and restore or recover basic and essential functions and structures in a crisis situation.

increasing. Therefore, it is important to discuss resilience from the perspective of the city and the community.

Resilience in Korea research is expressed in various words such as disinfection ability, and resilience in the area of disaster prevention and the regional policy development. First, the research on the resilience of disaster prevention is based on the “Development of Indicators and Checklist for Urban Disaster Risk Assessment” [2], “Resilience Analysis of Climate Disasters in Local Governments” and Disaster Resilience Measurement (UNDP) (2014), which provides methods for measuring resilience recovery, And the “City Resilience Index” of Arup [1], which summarizes resilience indicators through case studies.

In this study, urban resilience is defined as capacity to improve quality of life and function in urban areas. In order to create a resilient city, it was defined that the qualities of reflective, resourceful, robust, redundant, flexible, inclusive, and integrated were needed.

3 RESEARCH PLAN

3.1 Index set up

Among the literature review and previous research, City Resilience Framework [1], was presented in 100 Resilient cities, which are building urban resilience networks centred on various examples of recent global cities, (reflective, resourceful, robust, redundant, flexible, inclusive, integrated). It was reconstructed to suit the situation in Korea.

In order to derive the index for the detailed evaluation, the criteria of the evaluation items and the keywords of the urban resilience index presented in the literature review were used. It reviews and analyses the contents of each divisional plan of the Urban Comprehensive Plan Establishment Related to Urban Resilience, and presents criteria for a selection of detailed indicators (land-use, infrastructure, urban and residential environment, environmental, conservation and management, green spaces, disaster prevention, safety and crime prevention, development and promotion of economy, industry, society, culture).

However, for the convenience of evaluation, “disaster prevention and safety and crime prevention” among the seven sectoral plans were limited to the disaster prevention sector, and “development and promotion of the economy, industry, society and culture” was limited to the economy and industry. In the case of “infrastructure” and “environmental preservation and management” it was subdivided into transportation facilities, supply processing facilities (water and sewage, energy, waste), environment preservation and management (air quality, water quality and other natural resources). As a result, we have established 56 detailed indicators based on 8 sectors.



Table 4: Selection criteria for evaluation index.

Component	Criteria
Reflective	Analyse the situation and set goals in consideration of the experience from the risk and the local characteristics.
Resourceful	Set up index for resource management.
Robust	Establish a proactive plan
Redundant	Alternative facilities to accommodate the crisis, diversity of systems
Flexible	Step by step planning, monitoring
Inclusive	Accepting various interests and communication
Integrated	Relation between upper-level and related plans and sector-specific plans

Table 5: Category and range of urban resilience index in city comprehensive plan.

	Category	Range
Reflective	land-use	Analysis of inefficient land use area and urban function distortion area
	urban and residential environment	Declining areas in the city (declining trend of business, depreciation of buildings etc.)
	transportation facilities	Regional allocation by transportation
	supply processing facilities	Supply processing facilities (water and wastewater, waste, energy)
	environment preservation and management	Air quality, water quality, other natural resources
	green spaces	Park green space related
	disaster prevention	Analysis of disaster risk factors/disaster prevention systems by disaster type
	economy and industry	Establishment of planning goals through analyzing current economic situation
Resourceful	land-use	Setting of available land supply considering local characteristics
	urban and residential environment	Establish planned supply plan for housing
	transportation facilities	Establishment of traffic related indicators
	supply processing facilities	Providing indicators related to supply processing facilities
	environment preservation and management	Establishing indicators related to atmosphere/water environment
	green spaces	Establishment of indicators related to parks and green spaces
	disaster prevention	Establishment of indicators related to disaster prevention facilities
	economy and industry	Establishment of economic scale, industrial structure, income, consumption structure, and financial indicators



Table 5: Continued.

	Category	Range
Robust	land-use	Efficient use of land resources (standard)
	urban and residential environment	Balanced regional development strategy (urban/rural, new and old)
	transportation facilities	Utilization of city's internal and external traffic networks and improvement of accessibility
	supply processing facilities	Stable supply plan of supply processing facility
	environment preservation and management	Establish management and reduction plan for environmental pollution (atmospheric environment, water quality environment) by media
	green spaces	Comprehensive green space system plan and plan
	disaster prevention	Disaster prevention plan and disaster prevention plan prepared for damage
Redundant	economy and industry	Establishment of industry-specific (1st, 2nd, 3rd) development plan
	land-use	Securing adequate amount of conservation land
	urban and residential environment	Planning of various types of residential and residential complexes considering regional characteristics and landscape
	transportation facilities	Plan for alternative transportation facilities and spare capacity (transit transportation facility planning)
	supply processing facilities	Planning for alternative supply processing facilities and spare capacity
	environment preservation and management	Environment-friendly development promotion plan
	green spaces	Disaster prevention function and pollutant reduction plan in waterside space and park green space facility
	disaster prevention	Plan for spare capacity for alternative disaster prevention facilities and disasters
Flexible	economy and industry	Specialized industrial plan for strengthening regional competitiveness
	land-use	Step-by-step development plan of developmental land (monitoring)
	urban and residential environment	Urban Renewal Plan
	transportation facilities	Green / New traffic planning
	supply processing facilities	Planning and implementation of resource circulation system (monitoring)
	environment preservation and management	Low carbon green growth plan
	green spaces	Green space planning to respond flexibly to changes in conditions
	disaster prevention	Plan for the construction and operation of comprehensive disaster prevention system (monitoring)



Table 5: Continued.

	Category	Range
Inclusive	economy and industry	Old age industrial park recycling plan
	land-use	Establishment of land use plan considering various stakeholders
	urban and residential environment	Establish measures to improve the living standards of vulnerable groups (low-income families, multicultural families, etc.)
	transportation facilities	Establishment of transportation plan considering social vulnerable classes
	Supply processing facilities	Supply planning of supply facilities in backward region
	environment preservation and management	Environmental preservation and management plan considering various stakeholders
	green spaces	Park green space planning considering regional, intergenerational, and inter-tier equality
	disaster prevention	Preparing measures to reduce disaster damage to poor people (poor)
	economy and industry	Planning for the vulnerable
Integrated		Top and related plans (related planning, divisional planning) and linkages

This study evaluated the urban resilience of the sectoral plans and assessed the urban resilience level of the domestic cities, and the evaluation method of Brody [11], which was used for the evaluation. The evaluation criteria are evaluated as 0–2 according to the degree of the concrete establishment of the plan. If the contents of the plan are not reflected yet, or if the contents of the plan are reflected in the plan in general, or if the plan is reflected in the plan comprehensively, 2 points will be awarded if the plan is reflected specifically in 1 point, the sum of the index values composed of the two-point scale thus calculated is converted into 100 points by the following eqn (1).

$$UR_j = \frac{100}{2m_j} \sum_{i=1}^{m_j} I_i \quad (1)$$

- UR_j : Indicator score of urban resilience type (j)
- m_j : Number of detailed indices of indices of urban resilience type (j)
- I_i : I-th detail indicator score

The scores of each indicator were then averaged by city resilience type to assess city resilience level by city. Eqn (2) is evaluation.

$$L = \frac{1}{n} \sum_{j=1}^n UR_j \quad (2)$$

- L : Level of plan by urban resilience type
- n : Number of indicators by type of urban resilience



4 RESULT OF ANALYSIS

4.1 Urban resilience level assessment

The resilience level of the city was 66.7 in Incheon city, 49.4 in Suwon city, 47.3 in Ulsan city, and 45.5 in Daejeon city, and the average was 52.5. Considering the difference in planning and timing of cities, the score is gradually increasing, which suggests that urban resilience level is improving and developing in urban comprehensive plans [7]–[10].

4.2 Urban resilience level by indicator

The results of the evaluation of urban resilience level for each component are shown in the table above. It can be seen that inclusive and integration are relatively.

The resilience level of the sectoral plans are as follows. The urban resilience level of each sectoral plan shows an almost equal evaluation.

Table 6: Urban resilience level table (components).

Component	Daejeon (2013)	Suwon (2014)	Incheon (2015)	Ulsan (2016)	Average
Reflective	66.7	70.8	72.9	66.7	69.275
Resourceful	56.3	54.2	79.2	47.9	59.4
Robust	52.1	54.2	72.9	58.3	59.375
Redundant	37.5	39.6	66.7	50.0	48.45
Flexible	52.1	56.3	72.9	45.8	56.775
Inclusive	29.2	31.3	47.9	35.4	35.95
Integrated	25.0	39.6	54.2	27.1	36.475

Table 7: Urban resilience level table (sectoral plans).

Sectoral Plan	Daejeon (2013)	Suwon (2014)	Incheon (2015)	Ulsan (2016)	Average
Land-use	57.1	57.1	66.7	45.2	56.525
Urban and residential environment	42.9	57.1	69.0	42.9	52.975
Transportation facilities	59.5	66.7	71.4	61.9	64.875
Supply processing facilities	33.3	38.1	64.3	47.6	45.825
Environment preservation and management	42.9	45.2	64.3	52.4	51.2
Green spaces	40.5	57.1	61.9	50.0	52.375
Disaster prevention	47.6	38.1	54.8	33.3	43.45
Economy and industry	40.5	35.7	81.0	45.2	50.6



5 CONCLUSION

The purpose of this study is to analyse the current state of resilience of urban resilience in the current city and county comprehensive planning guidelines through national, internal and external resilience indicators. Based on this, it was applied to the city comprehensive plan in 2030 and established in the metropolitan areas (Daejeon city, Suwon city, Incheon city, Ulsan city) with more than 1 million population in Korea, and the urban resilience level of each city was evaluated.

As a result, the city with the lowest resilience of the city is 45.5, Daejeon metropolitan city which was planned in 2013, and the city with the highest resilience of cities is Incheon Metropolitan City, planned in 2015, with average level of 52.2 points.

In this study, the urban resilience level according to the seven qualities of reflectivity, resource mobilization, durability, substitution, flexibility, inclusion and integration defined as the constituent elements of the resilient city showed the highest reflectivity of 69.3 points, and inclusion and integration were relatively low at 35.9 points and 36.5 points, respectively.

In terms of the level of resilience of cities according to each division, the traffic facilities among the infrastructures were 64.9 points, reflecting the most resilience of cities, and the plans for the disaster prevention and supply treatment facilities were less reflective of urban resilience than other plans do.

The results of this study are as follows:

First, the urban comprehensive plan of the city in 2030 shows that the contents of the urban resilience are gradually reflected and embodied over time, though there is a difference in the degree of concrete content due to the conditions and characteristics of each region.

Secondly, the planning of the divisional plan of most cities is based on the analysis of the current plan, the establishment of the comprehensive direction, and the establishment of the relevant indicators such as the planning of the future (reflectivity, resource mobilization) On the other hand, it is analysed that the link between the plan and the plan considering various stakeholders (especially the socially weak) is rather low. Therefore, it will be necessary to revise the city and county comprehensive planning guidelines so that a plan reflecting the inclusion and integration, a component of urban resilience, can be established in order to establish a resilient city plan.

Based on the checklist presented in this study, we suggest the possibility of reflecting the plan to improve the city resilience in the city comprehensive plan of 2030, which will be established in future, this can be suggested as a basis for establishing measures to promote urban resilience by sector in establishing future urban comprehensive planning policies.

Also. It should be considered to create a resilient city when establishing plans related to cities of various sizes and characteristics, such as urban management plans and district unit plans, as well as urban comprehensive plans by introducing national and internal resilience indicators through literature review and prior research This is because it is easy to analyse the urban recovery force index.

As the limitation of this study, the scope of the study is applied to the entire plan of the sector, and related index is derived to evaluate the level of resilience of the city. There is a need to subdivide the indicators and checklists of the Urban Resilience Test.

In assessing the level of urban resilience, it is necessary to analyse whether the implementation of each plan is enriched in the implementation process of the plan, not to determine whether it is reflected in the plan. Further research is required to analyse the results.

In order to improve the resilience of cities in urban planning, it is necessary to identify the urban recovery indicators that each city should reflect, what plan contents should be specifically set in each divisional plan, I hope that comprehensive research will be carried out to link the subsequent research and city planning with urban resilience in general.



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SECTION 13
WASTE MANAGEMENT

A CASE STUDY OF INNOVATIVE BUSINESSES INVOLVED WITH EFFICIENT MUNICIPAL SOLID WASTE MANAGEMENT IN ISLAMABAD, PAKISTAN

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ABSTRACT

This paper deliberates on an innovation in the field of municipal solid waste management being practiced in a housing scheme developed and maintained by private sector in the capital city of Islamabad, Pakistan. The purpose of this case study is to know about the initiation of the unusual social business in the area of municipal solid waste management, challenges faced in establishing the business, and how it emerged as a successful model. This study also assesses the efficiency and effectiveness of this model of municipal waste management. A household survey has been conducted in the project area to know about the satisfaction of the users and their views about the location of waste compost facility established in the area. Moreover, in-depth interviews have been conducted with the management society of the area working under the private sector that developed the housing scheme, to ascertain the effectiveness and efficiency of the current solid waste management system. The innovative social enterprise has been found successful. A proactive role of local as well as of international NGOs is highly appreciable in providing seed funding and extending technical assistance in making the initiative a success story. The social enterprise has brought about improvement in waste collection, transportation, and recovery of recyclables and waste reduction measures through waste composting. The success story of the unusual social enterprise has convinced the regulatory authorities of capital city to replicate the same model in other residential and commercial areas of the city.

Keywords: business unusual, efficient municipal waste management, social enterprise, waste recycling, NGOs, waste reduction strategy, integrated resource recovery centre (IRRC), zone 2, Islamabad.

1 INTRODUCTION

The world has experienced unprecedented urban growth in recent decades. It is estimated that 60 percent of the world population will be urban by 2025 according to a report by BBC World [1], with most of the urban growth occurring in less developed countries. As cited in the Planning Commission of Pakistan [2], by the year 2030, the urban population of Pakistan would be about 50% with 17 cities having urban population exceeding one million. This critical condition engenders various challenges for availability of public amenities as fast increasing urban population component seriously impacts availability of infrastructure, housing, urban services such as solid waste management closely associated with daily life and having direct impacts on environment as well as economy of the cities (Haider and Badami [3]). According to Agenda 21 [4], by the end of this century, 2 billion people will be without an access to basic sanitation and half of the estimated population will be without access to the solid waste management services. Presence of solid wastes in the communities is the root cause of 40 human diseases. Inappropriate and conventional management of ever increasing municipal waste quantities especially in developing countries has become an uncontrolled and overburdened issue for the concerned departments, Annual Report AHKMT [5]. Annual population growth rate in Islamabad is 5.2%, which is higher than rest of the country, Population census [6]. Responsibility of services delivery such as water supply, sewerage, drainage and management of municipal solid waste in municipal area remained



with Capital Development Authority (CDA), while in rest of the Islamabad, this responsibility rested with Local Government of Islamabad Capital Territory Administration (ICT) until recently, the function of services delivery, stands transferred to Metropolitan Corporation Islamabad (MCI) in the whole of Islamabad.

2 MUNICIPAL SOLID WASTE MANAGEMENT IN ISLAMABAD

Master plan of Islamabad [7], the capital of Pakistan, was prepared in 1960, which divides the capital city into five zones. Zones 1, 2, and 5 are meant for housing, zone 3 comprises of old villages, Margalla hills and Margalla National Park Area, whereas zone 4 usually known as Islamabad National Park, provides for housing, farm housing and large institutions. Concentration of population in Islamabad is mainly in zone 1, 2, 4 and 5, attributed to CDA developed sectors in zone 1, housing developments in private sector in zone 2 and informal settlements in zone 4 and 5 (ICT Zoning Regulation [8]).

As a matter of fact, management of municipal solid waste is undertaken by CDA only in zone 1, whereas services provision in residential developments in zone 2, 4 and 5 is the responsibility of respective developers and builders, as in [8]. Other than that, residential developments were carried out in private sector in zones 2, 4 and 5, however, there is no formal arrangement of municipal waste collection, transportation and disposal, but dumped on open areas along major roads, hidden open spaces and banks of water streams, Director General Civic Management, CDA [9]. Alike other developing countries, selection and development of waste disposal site based on sound planning, engineering and environmental safety principles in terms of availability of land and other expenses, is yet an outstanding issue, as in [5].

Segregation of recyclables is all in informal arrangement at various stages, ranging from source segregation by housemaids, scavenging at communal collection points and waste

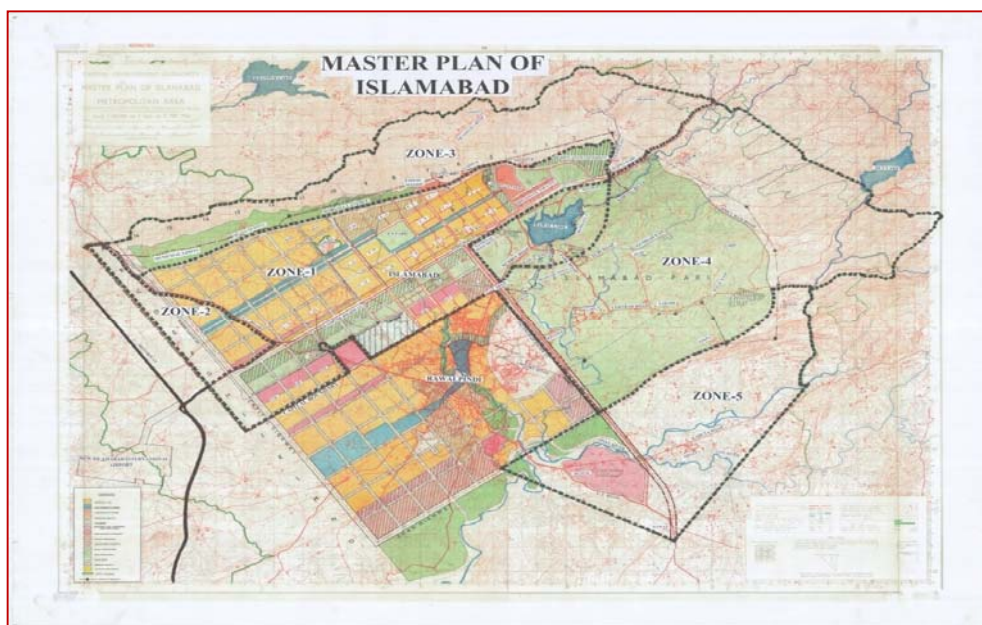


Figure 1: Master plan of Islamabad. (Source: Capital Development Authority, Islamabad.)

disposal site, Chief Sanitary Superintendent, CDA [10]. Moreover, there is no formal institutional arrangement for segregation of recyclables, recoverable, reusable and waste treatment. As reported by 10 interviewees of CDA Area Sanitary Inspectors [11], usually the role of NGOs, CBOs and other stakeholders is restricted to the extent of occasional awareness campaigns supported by donors.

In localities outside the municipal area, the responsibility of infrastructure provision in the residential and commercial developments in zones 2 and 5 lies with the respective developers [8]. However, the provision of municipal services including management of municipal solid waste is hardly found adequate or appropriate, as in [5]. The identified gap provided a space for intervention by a third sector for provision of effective solid waste management services. This study attempts to explore and highlight the case of intervention by a third sector in the form of an integrated resource recovery centre (IRRC).

3 RESEARCH OBJECTIVES

The key objective of the study is to explore the ins and outs of the unusual business in the area of municipal solid waste management. The specific objectives of the study include:

1. To find out the motives behind the conception of the initiative.
2. To investigate the barriers in launching of unusual business and the factors responsible for the promotion and success of the initiative.
3. To highlight the steps taken by the service provider to ensure provision of adequate and appropriate municipal waste management service.
4. To look into the social, economic and environmental benefits of the initiative.
5. To identify the steps taken to ensure sustainability of the system.
6. To ascertain the efficacy of the IRRC unusual business initiative for its replication in other residential/commercial sectors developed by the private sector.

4 RESEARCH METHODOLOGY

The research methodology employed for the case study comprises ocular observation, in-depth interviews, and a questionnaire survey. Interviews were conducted with the Program officer of AHKMT, the service provider along with other employees engaged in door-to-door waste collection, segregation of recyclable materials and operation of Integrated Resource Recovery Centre (IRRC) to have in-depth information about the initiation of the project, factors for success of the model, response of the residents and the society management towards the execution of the system, weaknesses to be rectified and suggestions for improvements to warrant its sustainability and its potential for replication.

Interviews were also conducted with the society management in order to ascertain their satisfaction with the solid waste management services provided by the third sector. Moreover, questionnaire survey was conducted with the residents of the community to know about their satisfaction with the service provider.

5 THEORETICAL BACKGROUND

The concept of social enterprise can be traced in a number of countries around the globe. For example, in Italy, it can be traced since 1980s, where a new journal named “Impresa Sociali-Social enterprise” was launched concerned with social cooperatives working mainly for welfare services (Defourny and Nyssens [12]). The concept of social enterprises has deep roots in Finland and Sweden, where a large number of labour cooperatives have been established to assist the unemployed and nursery cooperatives for childcare respectively, as in [12]. Development of new social enterprise and reshaping the



established third sector organizations in changed context and market dynamics in public services provision are the major dimensions and the themes underlying the new social enterprises, as in [12]. The role of third sector or social enterprise is being recognized globally for cost effectiveness and for sustainable provision of municipal services in various cities, as in [12].

European Commission [13], defines social enterprise as “an organization that combines a social purpose with entrepreneurial activity”. Similarly, Social Enterprise UK [14], defines it as “A business driven by social and/or environmental purpose. Their assets are often looked for community purposes”, while according to Social Enterprise Alliance [15], “Social enterprises are businesses where the power of marketplace is used to progress the social, environmental and human justice agenda”.

A comprehensive definition has been given by the British Council [16], which is quoted below:

Social enterprises are businesses, which trade in order to address social and environmental problems. They generate income like other businesses, but reinvest all or most of their profits into their social mission. They create jobs, reduce inequalities and are accountable for their actions, bringing together the entrepreneurial skills of the private sector and the values of public service.

The potential of social enterprise can be harnessed once it is acknowledged that social and economic outcomes are to be achieved by the governments, with the help of third sector and the government would be supportive for larger role of social enterprise in service delivery, Defourny and Nyssens [17]. There can be found strong legislation regarding social enterprise in developed countries such as UK, Italy, Spain, Finland, Greece, France etc. since 1991, as in [17], which is summarized in Table 1.

Similarly, existence of social enterprise is traced in Japan, South America and South Korea after legislation in 2007, as in [17].

In Pakistan, Social entrepreneurship is comparatively a new approach, however, given the burgeoning social, economic and environmental problems, it has great potential to overcome the problems, Khan [18].

Table 1: Legislation for social enterprise.

Country	Type of Structure	Date formed	Number
Italy	Social co-operative	1991	7,000+
Portugal	Social solidarity co-operative	1996/98	500+
Spain	Social initiative co-operative	1999	
Spain	Work integration enterprise	2007	
Greece	Limited liability social co-operative	1999	
France	Collective interest co-operative society	2000	94
Latvia	Social enterprises law	2004	
Lithuania	Social enterprise	2004	
Poland	Social co-operative	2006	
Belgium	Social finality enterprise	1996	400
Finland	Social enterprise	2004	69
UK	Community interest company	2005	2,000+
Italy	Social enterprise	2005/06	

Source: Defourny, J & Nyssens, 2008.



On the issues of municipal waste management in Islamabad, program officer of an NGO titled Akhtar Hameed Khan Memorial Trust (AHKMT), informed in a meeting of community based resource recovery municipal waste management initiative, in a residential settlement developed in private sector, where there is no formal municipal waste management service. This aroused interest of the authors to explore the initiative in detail.

6 DESCRIPTION OF CASE STUDY AREA

The project area is located in zone 2 of Islamabad, where housing schemes are to be planned and managed in a private setup. The project area is known as Khayaban-e-Kashmir, sector G-15, developed by Jammu and Kashmir cooperative society. In this settlement, there are 4500 residential planned plots in addition to commercial plots and community facilities. Provision of municipal services like municipal waste management and other infrastructure is the responsibility of the respective cooperative society, as in [8].

Presently, 2000 houses are constructed out of planned 4500 residential units and there is an increase of approximately 300 units annually as the settlement is in the phase of development, Program manager AKHMT [19].

6.1 Municipal solid waste management in case study area

An interview with the society management revealed that initially, there was no formal arrangement for collection and disposal of garbage other than 2/3 sweepers for occasional sweeping Chairman Jammu and Kashmir Cooperative Housing Society [20]. The increased built housing units in due course of time, necessitated the provision of adequate municipal services and as a consequence of public pressure, the society management arranged garbage collection at the expenses of the households.

This service was limited to irregular door-to-door waste collection, with no arrangement for regular cleaning of common areas and haphazard open-air waste disposal in the nearby open spaces, as in [20]. This poor state of affairs of inadequate and inappropriate mandatory service created awareness in residents to pay appropriately for appropriate service and the society management for making necessary arrangement, which led to the engagement of a

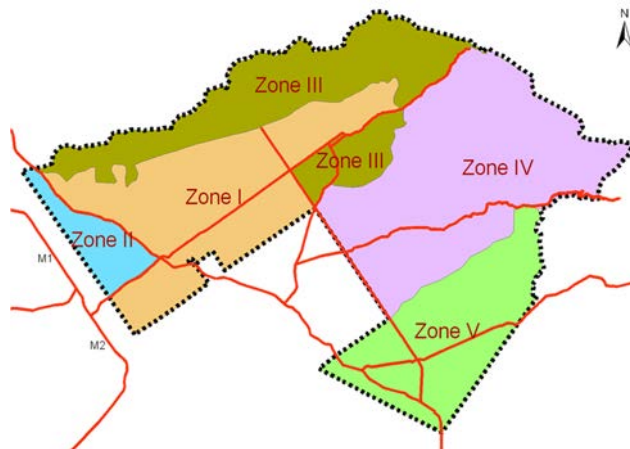


Figure 2: Zones of Islamabad. (Source: ICT Zoning Regulation, 2010 for Zone 4, Islamabad.)

service provider. In order to fill this gap, the society management approached the Akhtar Hameed Khan Memorial Trust (AHKMT), an NGO working with communities in various fields including municipal waste management. The society management signed an agreement with the NGO for door-to-door waste collection, safe transportation and disposal of the garbage at an affordable price in the year 2012 (General Secretary [21]). At the initial stage, there was agreement between the society management, the client and E-Guard, a subsidiary of AHKMT, the service provider for a period of three years, which has been extended for another term of six (6) years till 2021. The services provided include door-to-door municipal waste collection, segregation, waste transportation and its disposal at CDA designated waste disposal site and it does not include street sweeping and cleaning of open areas in the case project area. Charges for these services are Rs.250 per household, as in [20].

In the initial period of the project, only 25% (1.25 tons) of the total collected waste (5 tons) used to be segregated and rest 75% (3.75 tons) used to be disposed off at CDA waste disposal area, which increased operation cost on the one hand and made the waste handling complicated and cumbersome on the other hand, as in [5].

Learning from the field experience of working with communities for handling the household waste, negotiations were initiated with the society management by AHKMT to take appropriate measures for reduction of operation cost, reduce the waste quantities to be transported and disposed of and to make the waste management operation sustainable. Thus, the establishment of Integrated Resource Recovery Centre (IRRC) at sector G-15 on 3R's strategy was agreed, for which land-measuring 800 square meters was provided by the society management, as in [5].

7 INTEGRATED RESOURCE RECOVERY CENTRE (IRRC)

Integrated resource recovery centre (IRRC) is an integrated and sustainable municipal solid waste management initiative, normally termed as pro-poor waste management approach (AHKMT, 2016). This initiative has been undertaken in a privately developed and managed residential settlement, as in [5].

7.1 Establishment of IRRC

The Integrated Resource Recovery Centre (IRRC) is a joint initiative of AHKMT, an NGO working in solid waste management in the areas where, there is no formal institutional municipal solid waste management, UN-HABITAT and UN-ESCAPE. The initiative is first of its nature in Pakistan and targets the reduction of severe impacts of inadequate municipal waste management on environment and achieving the UN Sustainable Development Goals for future clean and healthy environment, as in [5].

7.2 Hurdles in the establishment of IRRC

Establishment of IRRC at sector G-15 is first such an initiative of its kind in Pakistan and therefore, there were fears and doubts about its operation and sustainability, revolving around the issues like availability of land, fears of odor from the compost setup, approvals of the government such as EIA and financial viability issues on account of lower quantities of municipal waste attributed to less number of constructed housing units in the sector G-15 as in [5].



7.3 Municipal solid waste processing mechanism at IRRC

7.3.1 Municipal waste collection

Municipal solid waste is collected by a small sanitary staff- known as e-guards and fleet of three lorries. The households in the project area are provided with two color bins, one for organic waste and one for other waste. The e-guards collect, segregate and process the municipal waste, as in [5].

The segregation of collected waste is undertaken at IRRC facility primarily into three categories such as organic/bio waste/green waste, recyclables and other waste. Organic waste is major component of collected waste that is about 60%, as in [5], which is processed at IRRC facility.

7.3.2 Processing of organic waste

After segregation, organic waste is collected in perforated boxes specifically designed for waste composting thus allowing easy access of oxygen and drainage of excess water. It also requires lesser space as compared to other composting techniques.

There are 12 perforated composting boxes at IRRC Islamabad where the waste remains for 45–50 days prior to its transfer to maturing boxes. The waste is kept for another 15 days in mature boxes within controlled temperature, observed and noted carefully by the specialist staff as in [5]. After this entire process, the dry compost is debased through a manual strainer drum and fine compost is packed for sale in the market after its quality testing by Arid Agriculture University Rawalpindi, as in [5].

7.3.3 Leachate management system

A considerable amount of wastewater is produced during the composting process and cleaning of the premises. This wastewater is stored in an underground tank instead of discharging into open drains. This wastewater is later on reused to maintain the moisture level in new piles and enrich the decomposition process by mixing it with fresh water, thus saving the ground water resources, as in [5].

7.3.4 Economic benefits

Recovery of recyclables and conversion of organic component of municipal waste into compost results in diversion of large quantity of solid waste from landfill. Presently, out of total municipal waste collection of 5 tons in the project area, 60% organic component (3 tons) is converted into compost, 25% municipal waste in terms of recyclables (1.25 tons) are recovered and only 15% (0.75 tons) is transported to the waste disposal site. This situation results in long life of existing landfills, reduces the need of new landfill, saves the waste handling cost of this major portion and therefore, saves money in the long term, as in [5].

7.3.5 Social benefits

Establishment of IRRC from the stage of waste collection to sale of recyclables and fine compost creates employment opportunities as well. Currently, 12 people have been employed as manager, supervisor, coordinator, mali, security guard, sanitary worker, 2 e-guard workers, 3 drivers with three vehicles and one supervisor, with a safe working environment and a safe and secure livelihood, as in [5].



7.3.6 Environmental benefits

Environmental benefits of establishment of IRRC include reduction of greenhouse gas emission by treatment of organic fraction of waste; which can evade spread of bad odor, as well as formation of leachate water and spread of diseases in open dumps.

According to IRRC management, IRRC is a tested model in various countries like Cambodia, Sri Lanka and Viet Nam. IRRC model is tested as pilot project in Islamabad and its replication is expected in other cities of Pakistan, as in [5].

8 SUSTAINABILITY OF THE IRRC INITIATIVE

The financial sustainability of the initiative has been ensured through minimal waste collection charges of Pak Rupee 250/= per household in G-15 sector, the area served by IRRC. Moreover, revenue is collected through sale of material recovered from recycling. The high quality natural manure that is produced from composting is sold to horticulturists and farmers. It also make ups one of the good revenue sources. Income generated from the above mentioned sources is sufficient enough to meet all the expenses to run the social business and make it financially sustainable, as in [5].

9 SATISFACTION OF THE RESIDENTS ABOUT THE SERVICES PROVIDED BY IRRC

For the purpose of having satisfaction of the residents on the performance of AHKMT and establishment of IRRC in the case study area, random household survey (350 households) has been carried out. Also, society management has been interviewed for their viewpoint on performance of Social enterprise for provision of cost effective municipal waste management service. 90% of the surveyed households showed satisfaction on door-to-door waste collection at such a lower price and they have no problem on establishment of IRRC near the settlement, instead it facilitates the availability of sanitary workers in odd timings. However, they had reservation on quality and quantity of street sweeping and cleaning of open spaces. Additionally, the waste management operation could be more environments friendly if better designed waste collection vehicles were used. Further, the interviewees have opined that on account of effective recycling mechanism, movement of free-lancer scavengers in the streets could be controlled.

The society management is satisfied with the improvement of municipal waste management in the scheme at a lower price and the reduced number of complaints from the residents regarding the door-to-door waste collection but worried about increasing number of complaints for inappropriate street sweeping. And the society management is working to broaden the scope of the project, adopting a total solution approach to address complete range of municipal waste management issues. According to the program manager of Arif Hameed Khan Memorial Trust (AHKMT), NGO custodian of IRRC operation, the initiative is a success story to the extent of its defined domain in terms of door-to-door waste collection, recovery of recyclables (25%), composting of organic waste (60%) and reduction of waste quantities transported to the waste disposal site in addition to economic, social and environmental benefits of Integrated Resource Recovery Centre (IRRC).

10 CONCLUSION AND RECOMMENDATIONS

High percentage of organic waste in Islamabad and availability of compost as a replacement of expensive chemical fertilizer makes the waste composting a cost effective and environment friendly option for sustainable solid waste management.



Establishment of Integrated Resource Recovery Centre (IRRC) in a settlement where there is no public-sector arrangement for management of municipal solid waste is a successful example of effective, efficient and sustainable municipal waste management by a social enterprise- third sector in terms of provision of service and establishment of eco-business. This joint venture of social enterprise, private sector and community has come up with a model to share responsibility, provision of urban services, share and lessen the burden on resources of the authorities concerned in public sector, creation of jobs and reasonable earning in the setup. This model may be replicated with modified local arrangements with holistic approach to address the subject of municipal waste management, especially in the areas where there is no arrangement for provision of urban services in public sector. These areas are developments situated in the suburbs of Islamabad and planned, developed and to be maintained by private sector. Provision of urban services, including municipal waste management in these settlements is usually inadequate and inappropriate, so the residents are more vulnerable on account of non-existence of formal arrangement for provision of urban infrastructure and poor monitoring of the concerned authorities. This state of affairs creates space for social enterprise or third sector to perform at competitive costs ensuring provision of sustainable urban services and experiment resource generating models.

In order to fill this gap, IRRC model experimented in a settlement in private setup in the hand resource generating provision of urban services in the settlements around the city where there is no formal and regular provision of urban services or supplement the existing substandard urban services. However, the model needs to be modified taking into consideration the local situation in terms of institutional arrangement for provision of municipal services, availability of funds, institutional monitoring, existing arrangements and will for innovations. Necessary legislation should be made immediately, if is warranted to ensure cost effective and sustainable municipal waste management in the settlements at larger scale where there is no regular public service.

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THERMAL PERFORMANCE, USAGE BEHAVIOUR AND FOOD WASTE OF DOMESTIC REFRIGERATORS IN A UNIVERSITY STUDENT COMMUNITY: FINDINGS TOWARDS CITIES SUSTAINABILITY

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ABSTRACT

Food safety and quality as well as storage conditions leading to food waste are related to the reduced thermal performance of domestic refrigerators, the mismanagement of food stored in it or the misuse of the equipment. This paper analyses the operative conditions of refrigerators in the student community of the University of Beira Interior (Covilhã, Portugal). A test sample of 51 appliances in the student households was instrumented with temperature dataloggers. Simultaneously, surveys on the use of refrigerator and food waste were applied to the students, ultimate users of the appliances. The students, with an average of 23 years old, mostly female (65.9%), live alone (6%), with their parents (24%), or with other students (71%). The test sample of appliances had, on average, a nominal electrical power of 126 W and an inner volume of 205 liters. It was found that the average storage temperature was 5.5°C. The storage temperature in the appliances increased with the number of people who used it. This figure was largely due to improper use behaviour, in particular the number of times that the refrigerator door was open unnecessarily. The joint analysis of these data allows relating the use behaviour of with food waste. The comparison with similar studies conducted in the past shows that the average storage temperature in the current study is lower, mainly due to the technological evolution of appliances as well as the global awareness concerning food safety and food waste. The results of this work, apart from offering results about the performance of the operative conditions of refrigerators in a community not studied so far, highlights the need for further awareness of good practices to reduce food waste and simultaneously ensure food safety of the perishable food products stored in domestic refrigerators. These results could be extrapolated to the remaining people in order to develop strategies to improve cities sustainability.

Keywords: refrigerator, operative conditions, performance, student households, survey, food waste, usage behaviour.

1 INTRODUCTION

The need for a proper preservation of food in terms of time, safety and quality is closely related to the increasing trend of the worldwide food demand. The trend increased significantly over the last century, as well as, consequently, the number of domestic refrigerators. The technological evolution of these appliances was dictated by the need to answer the contemporary society needs. These needs are related with food safety and quality concerns, de availability of the latest technologies and to the compliance with the increasingly strict food legislation. Thus, the refrigerators technological evolution involves the improvement of the thermal performance but also of it energy efficiency. Over the past two decades, innovation, research and development studies helped increasing the energy efficiency of refrigerators [1]. Some technological improvements in refrigerators that increased the energy efficiency helped the usage behaviour, such as, the user alert when the refrigerator door is left open for too long (door opening alarms), the automatic control of the storage temperature depending on the usage type, among others [1].



Given the use of household refrigerators to preserve food and the witnessed technological evolution, one would expect that the food waste was marginal. However, the annual per capita food waste in Europe and USA is 95 to 115 kg [2], mainly originated from domestic consumption, being estimated that 60% of it can be avoided [3]. The European Parliament proposed some measures to promote the reduction of the food waste, such as labelling with double validity period (i.e., a target date of sale and a further deadline for consumption), discount on product sales that are near the expiration date, packaging size modification or the sale of unit products, among others. In fact, well-defined regulations, policies and strategies are more effective than fiscal measures in mitigating household food waste generation [4]. Beyond all these measures, it is imperative to promote the general awareness to the need to reduce the food waste. This paper aims to contribute in this sense. It describes a case study of the analysis of the performance of operative conditions of domestic refrigerators in the households of the student community of the University of Beira Interior (Covilhã, Portugal). The study involved the measurement of storage temperature and collection of the nominal electrical power and inner volume of the appliances. The storage temperature was measured by a datalogger placed in the appliance middle-shelf. Simultaneously, surveys were conducted to students to evaluate how the usage behaviour influence the thermal performance of the appliances and their information and awareness about food waste in today societies.

2 STATE OF THE ART

Some experimental studies have been conducted to evaluate the operative conditions of domestic refrigerators as well as to determine the concerns of users with food safety issues. The average global temperature measurements in 112 domestic refrigerators and freezers in the UK was 4.4°C [5]. The refrigerators operated above 5.0°C during 58% of the test, nevertheless representing a reduction of 2.0°C compared to a similar study done two decades earlier. In fact, there are benefits in terms of storage life extend and consequently in food waste reduction reducing storage temperature of the refrigerator to 4°C and promoting home freezing [6]–[8]. In an experimental study making use of temperature loggers placed at three shelf levels of 119 domestic refrigerators it was found that most users open the door around 20 times per day [9]. The global average storage temperature was 6.6°C and 80% of refrigerators had temperature above 5.0°C. It became clear through the results analysis of a collection of studies published over the last 30 years related to the performance and utilization of domestic refrigerators, that the majority of the refrigeration equipment in the world operates at a higher storage temperature than recommended (70% of equipment operates at a temperature higher than 5.0°C) [10]. This set of studies shows the thermal behaviour of domestic refrigeration equipment in various countries over the years, concluding that there is a significant share of refrigerators in the world operating at temperature higher than the recommended, regardless of the technological evolution and informative campaigns about food safety. To determine the sensitivity of the energy consumption of refrigerators to various operational factors that reflect actual operating conditions, four different refrigerators were tested using the experimental design method Box-Behnken with three variables (room temperature, thermostat setting position and additional thermal load for hot food storage) [11]. Results show that the energy consumption of refrigerators is highly sensitive to real-life situations (variations up to 2 kWh). The analysis of variance (ANOVA) revealed that the room temperature is the most influential factor in the energy consumption of a refrigerator. The heat transfer inside domestic refrigerators was studied by several authors and several models were proposed to quantify heat exchange by convection, conduction and radiation in a typical refrigerator [12]–[17]. A new dynamic model for a domestic refrigerator with heat storage capacitor with SSPCM (shape-stabilized phase change materials) shows that the



coefficient of performance, COP, increased about 19% due to latent heat stored in SSPCM [18]. The application of vacuum insulation panels (VIPs) in the refrigeration chain, incorporating them in the polyurethane (PU) foam existing on the walls of the refrigerator and freezer compartments allows potential energy savings with an investment average return of 9.7 years and 4.5 years for refrigerators and freezers respectively [19]. A review of the studies that have been published since 2008 concerning the temperature performance of refrigerators show that despite improvements in energy use, the temperature performance and use of refrigerators have not changed significantly in the last 40 years [20]. Many householders still remain unaware of the recommended refrigeration temperature range, how to ensure that the correct refrigeration temperature range is achieved, the importance of monitoring that it is being maintained, and the potential hazards of temperature abuse. While the experimental and numerical studies described above are related to the performance of refrigerators, information concerning usage procedures, attitudes and behaviours as well as the general knowledge concerning food safety was not discussed. The studies described below provide an insight on these topics. A cross-sectional study in 1178 higher education students was conducted in Kuala Lumpur (Malaysia) [21]. An online questionnaire was applied to analyze the knowledge, attitudes and behaviours related to food hygiene. The study results justify the need for a more effective educational program in creating a greater awareness of food hygiene among youth. The level of food safety knowledge in 1172 Lebanese university students was assessed through a survey [22]. The questionnaire concerning food-handling practices consists of 16 questions related to food safety knowledge and 14 questions related to preparation practices, contamination, storage and hygiene. The results confirm the need for educational initiatives to improve the relatively low awareness on food safety between the Lebanese young adults group. For last, since the joint analysis also covers the food waste from household refrigerators, it is important to recall the research work developed on this topic. In order to suggest sustainable solutions for reducing food waste 12 tonnes of residual household waste collected from 1474 households were analysed [23]. The results showed that food waste mass increases with the number of occupants per household (household size) and the housing type. Additionally, it was determined that avoidable food waste occurred in 97% of the households, suggesting that most Danish households could avoid or at least reduce how much waste they generate. Food wasting behaviours are dependent on social, cultural, economic, and institutional factors that extent from household shopping practices, food preparation habits, use of waste management systems to food related attitudes, beliefs, and lifestyles [24]. There is not a single strategy or intervention that can meaningfully address the diverse constraints and challenges that prevent household food waste reduction. In relation to the drivers of food waste generation and behaviours and attitudes leading to food wastage, education campaigns are required focusing on the issue of food waste, quantities generated, and why it is an environmental, economic, and social concern [25], [26]. Nevertheless, these measures must be country-tailored to increase its real impact on the reduction of food waste [27]. As food systems are complex and are driven by economic, cultural and environmental factors, the potential contradictions between food policy measures can arise [28]: (1) concerns on food safety vs. food waste; (2) a higher storage temperature can be seen suited for energy saving purposes but will accelerate the degradation of the quality of products; (3) lower temperature setting would increase the energy cost, while improving food safety. Thus, there is no simple answer to improve the sustainability of food chains linking food waste prevention, energy consumption and food safety. The bibliographic review presented above allows verifying the current state of the art involving operative conditions of domestic refrigerators, food safety and food waste. However, it was shown that the information and awareness of the population is also required

to improve refrigerators usage and reduce food waste. This study aims to contribute on this matter, providing valuable information about operative conditions and food waste knowledge and avoidance procedures obtained through in-situ households tests and surveys respectively on a community not studied so far.

3 MATERIAL AND METHODS

3.1 Sample

The student community of UBI, for the school year of 2014-2015, was composed by 6014 students (UBI's Quality Office, 2014). A value of 201 students for test sample for the existing population is obtained assuming a confidence level of 85% and a confidence interval (margin of error) of 5% determined by Equation 1. Considering the data collected throughout this study, it is concluded that in each household inhabit on average 4 students (std. dev. = 2). The refrigerators users were students with an average age of 22 (std. dev. = 2), mostly female (62%). Assuming that four students occupy each household, the optimal sample of equipment to be analyzed is 51 appliances. This sample value ensures the representability of the results and provides a reliable study

$$n = \frac{N \cdot Z^2 \cdot p \cdot (1-p)}{Z^2 \cdot p \cdot (1-p) + e^2 \cdot (N-1)}, \quad (1)$$

where, n is the ideal sample calculated, N the population in which the study is carried out, that is the number of elements in the research universe; Z the standard normal variable associated to the confidence level ($Z = 1.44$); p the true probability of the event occur (probability of 50%, $p = 50\%$); and e the margin of error.

3.2 Dataloggers

Dataloggers of Lascar Electronics, model EL-USB-2-LCD+ were used for measurements. The dataloggers include temperature, relative humidity and dew point temperature sensors. The datalogger is a measuring device consisting of a battery, a sensor and a USB port to download the data stored in memory. The device operation is configured by software, such as the required time of measurements, values of temperature alarms (high and low), among others. The datalogger allows a wide range of configurations with regard to the desired time for measurements. The software also provides graphical visualization of the collected data, allowing overriding irrelevant data curves. After setup, the datalogger is set to start acquiring data. Once activated, the device is placed in the environment where it will acquire the data. After the measuring time, the device may be removed to transfer the data to a computer for later analysis.

3.3 Survey details

For the study of the operative conditions was necessary to analyze the behaviour of refrigerator users. So, two surveys were applied with different focus. The 1st survey addressed the use of the appliance, if he/she lives alone, lives with his/her parents or shares the accommodation with other students. The 2nd survey focuses on the food waste detected during the test period. These surveys allow getting relevant information such as the number of people who uses the appliance, how these people are organized in the main meals of the

day, and the reasons that led to the existing waste. These surveys were conducted with easy answer-type questions. They were mostly answers assessment on a scale of 0 (null) to 10 (high), or affirmation/denial (yes/no). For both surveys, the written responses were scarce.

3.4 Collection and processing of data

Data collection was conducted during 6 months (November to April). The procedure for data acquisition consisted on placing the datalogger in the middle height shelf of the refrigerator. In addition to the air temperature and relative humidity measurements, all the information and technical specifications of the appliances were collected in order to perform a reasonable comparison of results. The dataloggers acquired data for a minimum period of 8 days, with one-minute data acquisition rate. Thereafter, the collected data was processed (average, maximum, minimum and standard deviation values) for each appliance.

4 ANALYSIS AND DISCUSSION OF RESULTS

This study aims to evaluate the operative conditions performance of refrigerators used in a specific community, particularly the student community of the University of Beira Interior. A large part of the students of this university is not from the region, so they need to rent a household. To reduce costs, it is usual students to gather in-group to rent a household. Usually, the households are rent with furniture and appliances. Often, the owners put in the households to rent old appliances or purchase low-end appliances. The study takes into account variables that affect the thermal behaviour of the appliance, such as the number of people that uses it and the awareness of energy efficiency and food waste issues. This study aims to evaluate the relationship between food waste and operative conditions performance of refrigerators depending on the usage type. So, the study is completely aligned with cities sustainability concerns and the results could be extrapolated to other communities.

4.1 Operative conditions performance

The nominal electrical power, P [W], and the capacity (volume), V [m³], of a refrigerator are two of the most important features. These features were extracted from appliances specifications. Fig. 1 shows a linear correlation between these two variables. The test sample appliances have an average nominal electrical power of 126 W (std. dev. = 59 W). The average cold storage volume is 205 liters (std. dev. = 79 liters).

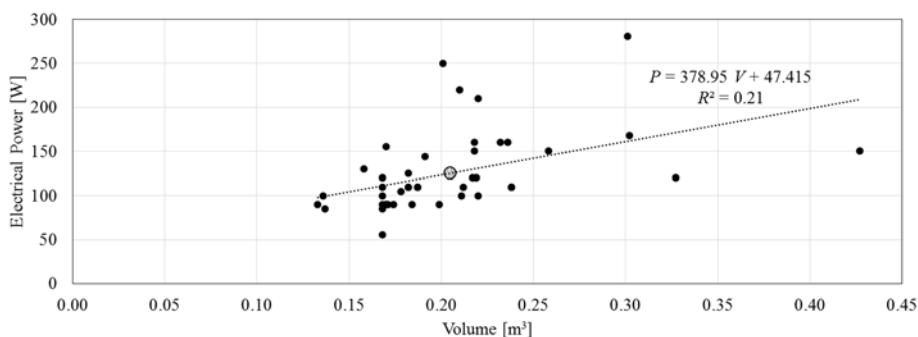


Figure 1: Correlation between volume and nominal electrical power of the test sample.

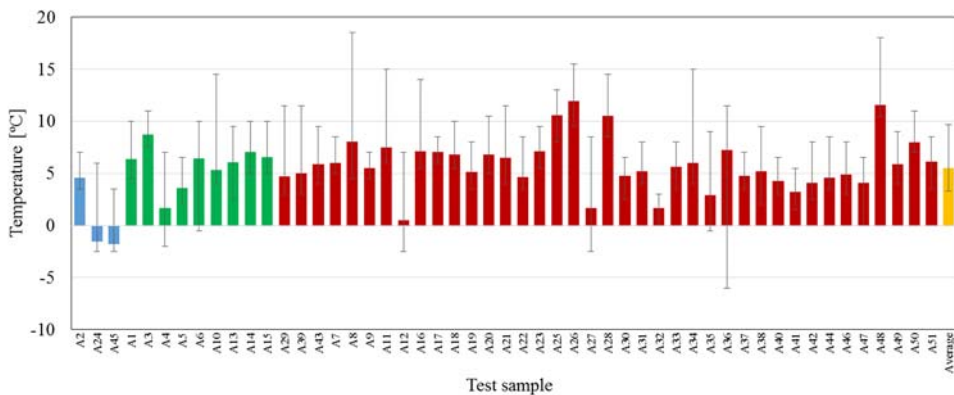


Figure 2: Avg., min. and max. values of storage temperature of the test sample.

However, the inner volumes of test sample ranged from 133 liters to 427 liters. The low value of the determination coefficient ($R^2 = 0.21$), despite the correlation type, indicates that there is not a strong relationship between cold storage volume and the electrical power. Thus, to enable a fair comparison between the test sample devices, the specific electrical power, p [W/m^3] was determined. This parameter extracted from the appliance specification has an average value of 616 [W/m^3] with a standard deviation of 241 [W/m^3]. Fig. 2 shows the average, minimum and maximum values of the storage temperature of each test sample appliance.

This figure also shows the overall average value and its minimum and maximum values. The different types of household sharing of students are differentiated by colors. The “blue” cases are results of students who live alone, “green” cases are results of students who live with their family, i.e., native students from Covilhã and “red” cases are results of students that share accommodation with other students. The average value is shown in “orange”. The overall average value of the storage temperature is 5.5°C. This value is 0.5°C above the operating limit range temperature for household refrigerators. The average operating temperature is over the higher temperature limit in 66.6% of the cases.

4.2 Surveys

The analysis of results obtained from answers range from how students are organized making the meals to the way as purchases of perishable products requiring refrigeration are performed. All these topics are relevant for the analysis of operative conditions performance and food waste assessment.

4.2.1 Profile of students' accommodation sharing

An analysis and discussion of results taking into account the profile of the accommodation sharing was developed. The results of the test students sample are divided in 3 different profiles: (1) living alone (6%), (2) living with family (23%), or (3) sharing accommodation with other students (71%). Fig. 3 shows the overall average, maximum and minimum values of storage temperature for each profile of accommodation sharing. The appliances of students living alone present the lowest average storage temperature (0.4°C). The factors that could lead to this situation can be related to the smaller number of times of opening the

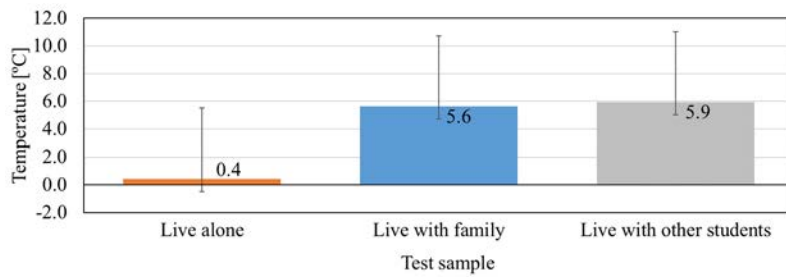


Figure 3: Avg., min. max storage temperature for each profile of accommodation sharing.

refrigerator's door, since it is only one user. The appliances located in households where students live with their parents have a higher average storage temperature than the previous situation (5.6°C). For the test sample, four individuals typically compose the family. Finally, the appliances located in households shared by several students have the highest average storage temperature (5.9°C). This condition arises from the household be shared by four students (or more) which implies a greater number of refrigerator's door opening. The door openings are related to the organization of the principal meals making and the distribution of each student's food products inside the appliance.

4.2.2 College attending

The students belong to different faculties: (1) Engineering, (2) Social Sciences (3) Health Sciences (4) Arts and Letters and (5) Science. Concerning the global average storage temperature, only the appliances used by students of the Faculties of Sciences and Arts and Letters are below the food safety threshold, 4.1°C and 4.2°C, respectively. The overall average value of the maximum storage temperature reaches 6.5°C. Conversely, the overall average values of minimum storage temperature registered was 0.0°C. The case studies with poorer thermal operative conditions belong to students attending Faculty courses where topics of food safety, thermal performance and energy efficiency are certainly discussed. The highest average value of the storage temperature is measured in appliances of students attending the Faculty of Health Sciences. Food safety and quality topics are addressed with certainty in the courses offered at this Faculty. A similar situation occurs in the appliances of students attending the Faculty of Engineering. Topics of thermal performance and energy efficiency are taught in several course units. The appliances of students attending courses offered by the Faculties of Sciences and Arts and Letters are those with a better operative conditions performance. These results are exactly the opposite of what would be expected given the knowledge and sensitivity to these issues by the students of these colleges.

4.2.3 Survey 1 - Survey on the use of refrigeration equipment

The objective of this first survey is to gather information regarding the use of refrigerators by the students. The survey is composed by 10 questions, which relates to how the students use the refrigerator, the number of people who uses the equipment daily, the number of times the refrigerator door is opened, among others. Following is an analysis of the major findings from the survey.

Question 1: How do you use your refrigerator? Overall, students consider using properly the refrigerator as shown in Fig. 4. Only 6% of the student feels that uses the refrigerator in a negative way. 60% of respondents think to make very good use of the appliance.

Question 2: How do your refrigerator preserves food? The respondents assume that none of the appliances preserves food poorly, as shown in Fig. 4. 94% of respondents consider that their refrigerator preserves food in a positive way. Thus, there is general perception that the appliances preserve food in good conditions, that is, with low storage temperature. If Fig. 2 values are taken into account, some of the respondents have a wrong idea of the operative conditions performance provided by their refrigerator.

Question 3: How do you rate the food waste in your household? By the analysis of Fig. 4, it can be concluded that food waste is reduced. Only 20% of students consider wasting too much food. So, it can be concluded that most of students try to avoid food waste.

Question 4: How your appliance affects the household energy consumption? As shown in Fig. 4, there is no consistent opinion of students. Overall, they consider that the refrigerator has a medium effect on the household energy consumption.

Question 5: How are organized the main meals (lunch and dinner) in the household? As shown in Fig. 5, the students organize themselves in one of the three following ways: (1) alone, (2) into several groups or (3) all together. The way the students are organized in main meals influences the operative conditions performance of the refrigerator due to the amount of times the door(s) of the refrigerator is(are) open prior to meals for it preparation. 63% of respondents do not organize their meals alone. This answer is related to the average time that the refrigerators doors remain open.

Question 6: If you answered several groups indicate how many. This question is related to the previous aiming to determine the number of groups set up to prepare the main meals. From the analysis of Fig. 5, the majority of students organized themselves into two groups. It is noticeable that the organization of main meals into three groups of students will incur in more time that the refrigerator door will be open and consequently a worse operative condition performance will be reached.

Question 7: Is your refrigerator's door opened often? This question intends to investigate if students are aware of the implications on the operative condition performance due to time that the refrigerator's door remain open. As shown in Fig. 6, it is concluded that 67% of students considers that open the refrigerator's door more times than necessary throughout the day.

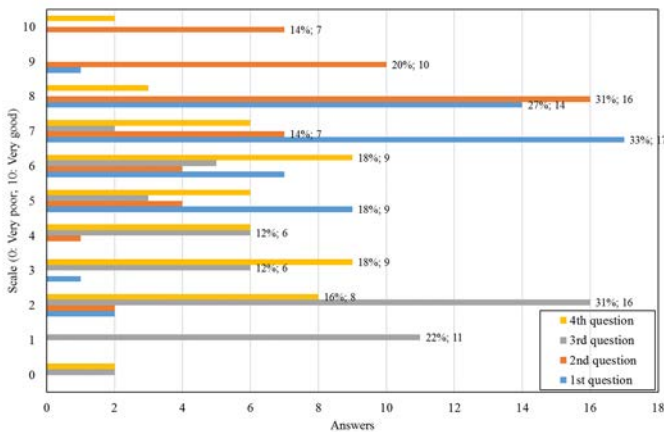


Figure 4: Survey 1 – Answers to questions 1, 2, 3 and 4.

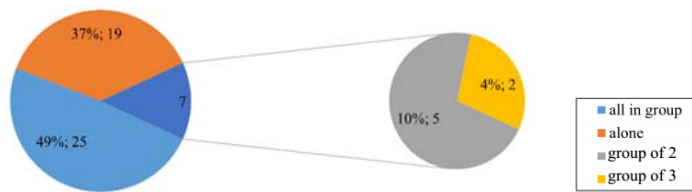


Figure 5: Survey 1 – Answers to questions 5 and 6.

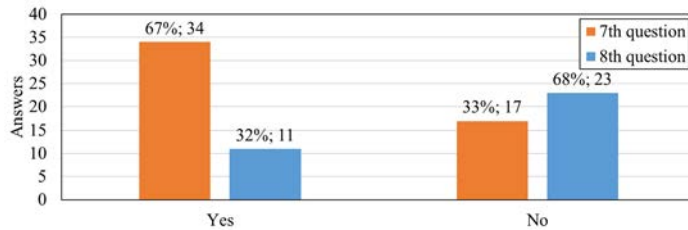


Figure 6: Survey 1 – Answers to questions 7 and 8.

Question 8: Do you think that the all refrigerator's door opening was necessary? However, as shown in Fig. 6, only 32% of respondents consider that the all times that the refrigerator's door was open for necessity. The remaining 68% are aware the refrigerator's door was open too much. These two issues allow concluding that there is a negative perceived behaviour by most students. This behaviour can be easily changed, by raising the awareness of students concerning the negative effects of opening the refrigerator's door more than necessary.

Question 9: How many times had you changed the thermostat setting throughout the year? About half of respondents change the thermostat setpoint once in a year and 4% of students regulate the refrigerator thermostat setpoint many times over the year.

Question 10: How many people on a daily basis uses the refrigerator? As shown in Fig. 7, 65% of the answers indicate that 3 to 5 persons use the refrigerator. However, 28% of answers indicate only 1 or 2 refrigerator users.

The data collected in this survey allows characterizing the appliances usage by students and relating the results with the experimental data of the operative conditions performance. The second survey aimed to analyze the food wasted by the students at the end of test period. It is constituted by four questions related to the amount and possible reasons for the food waste, the average number of times of the opening the refrigerator's door and a conscientious analysis of the refrigerator use during the test period. The major findings are:

Question 1: How do you evaluate the food waste during the test period? The purpose of this question is to evaluate the food waste in the households of the students when they are aware of the consequences of this situation. There was not a large food waste during the test period. Therefore, the information and awareness to the food waste issue when placing the dataloggers help students to manage the food in their refrigerator in order to reduce it.

Question 2: How did you use the refrigerator during the test period? The goal of this question is to assess the behaviour of students using the refrigerator during the test period when they are informed and aware of best practices. 91% of respondents indicate having used the refrigerator correctly. So, this question aims to evaluate whether the awareness provided

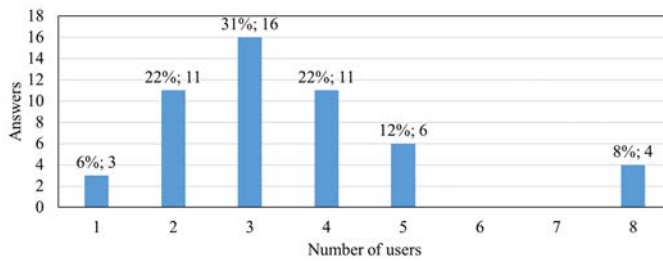


Figure 7: Survey 1 – Answers to question 10.

by this experimental study allowed the change of habits and the application of good practices leading to a better operative conditions performance and less food waste.

Question 3: What was the main reason for the food waste? The main reasons for food waste are: (1st) Mismanagement of food or during meals preparation that led to food waste (27%); (2nd) Expiration date of foods passed (25%); (3rd) Food forgotten in the refrigerator (10%); (4th) Other reasons.

Question 4: How often have you opened the refrigerator's door per day? Comparing the with results prior to the information and awareness gain of food waste issue, it can be concluded that most students gain good habits when it comes to opening the refrigerator's door (68% between 6 and 8 openings).

From the global analysis of the answers provided by respondents to the second survey, it is clear that informing and highlighting the food waste issues to the population will promote awareness and a concern culture. This condition may be accomplished by a broader communication plan, making use of print media, the internet and other media, with specific measures concerning household food waste-prevention [31], [32]. An effective communication and a deep involvement of government parties (national and regional) should be proposed in order to raise awareness within society and promote the reduction of waste food. In this context, the development of a communication and dissemination plan conveniently structured and coordinated among all stakeholders is a fundamental key point. The communication plan should include information materials: flyers, brochures and leaflets to distribute to the population; outreach and awareness actions through media services as journal, radio and television, and by information sessions.

5 CONCLUSIONS

The high levels of food waste are a global concern. Its largest share is found in households, where more than 50% could be avoided. The most of food waste at household level occur in domestic refrigerators. The factors leading to this waste result from the thermal performance of the appliance, the mismanagement of food stored-in and misuse of the appliance. This study describes the evaluation of the operative conditions of refrigerators used by the student community at the University of Beira Interior (Covilhã, Portugal). The experimental study monitored the cold storage temperature on a sample of 51 appliances. The sample devices have an average electric power of 126 W and average inner volume of 205 liters (0.205 m³). The overall average value of the cold storage temperature is 5.5°C. It can be concluded that the overall operative thermal conditions surpass the upper temperature limit by a small margin (0.5°C). This temperature higher than the reference level for ensuring adequate food safety may incur risks to the public health. This figure is largely related with improper behaviour of students, in particular, by the large number of times that the refrigerator is

opened unnecessarily, thereby causing an increase in the thermal load by ambient air infiltration. The practice to reduce this condition consists in information and awareness of users about the negative usage procedures of the appliance and describing how these procedures can be corrected, and consequently improving the thermal performance, ensuring temperature values within a range for a proper food quality and safety. The comparison of the experimental results with the results of similar studies developed in several countries allows concluding that the values are very similar, although it is perceptible the influence of the technological evolution of the appliance in the overall improvement of the thermal operation.

Two surveys were conducted to evaluate how students use the refrigerator and to assess the food waste after the information and awareness provided when the dataloggers were placed inside the refrigerator to evaluate the operative conditions performance. The results show how students use the refrigerator and manage foods and meals. It also shows the knowledge gain concerning food waste and energy efficiency by the information and awareness provided. This study, additionally, provides experimental results on the thermal performance of refrigerators in a community not studied so far, intending to contribute as a reminder of the good practices for reducing food waste, while ensuring food safety of perishable food products. These results could be extrapolated to the remaining community in order to develop strategies to improve cities sustainability.

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MATERIAL MANAGEMENT PRACTICES FOR CONSTRUCTION WASTE REDUCTION

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ABSTRACT

The construction sector plays a key role in shaping and developing the built environment creating wealth and development for the countries. At the same time the sector is producing negative impacts due to the vast quantities of natural resources required and the high amounts of waste produced. Costa Rica is a country in Central America that has a construction sector contributing in 2016 a 4.4% of its GDP. In the country, several studies have been done in order to determine waste quantities but not the composition of the construction residues. Additionally, causes of waste generation have been reported and grouped in the following categories: design, execution, material management, residuals and other activities. This paper presents the results of a research that has been done with the objective to determine the types of hazardous and non-hazardous waste that are produced during the procurement of an edifice as well as the best general practices used by innovative construction companies to reduce the amount of waste produced.

Keywords: construction waste materials, hazardous waste, best practices, construction waste reduction.

1 INTRODUCTION

The construction industry plays an important role in economic growth and socio-economic development. Any piece of infrastructure or real estate erected around us is undertaken by segments under this industry. Within this industry, the performance of the projects are mostly based on labour costs which not consider sustainability aspects and the negative impact on the environment [1]. This industry is perceived as a major contributor to environmental degradation. It consumes large quantities of natural resources, while producing large volumes of waste [2]. It is reported in literature amounts of residues of this activity by weight in final disposal sites as high as 57% in Japan [3], or an average for the world between 13% and 29% [4].

Construction waste is becoming a serious environmental problem in many large cities in the developing world arising concerns in the population at the local context and challenging the industry to become more environmentally friendly and promote sustainability [5], [6].

Costa Rica is a developing country in Central America in which the sector provided approximately 4.4% to the GDP during 2016 [7]. This sector was responsible for the construction of 10 388 384 m², being housing and commercial construction the highest percentage, 65% [8]. Different studies have reported construction waste generation with values such as 300–700 kg/m² [9], 11–25 kg/m² [10], 115 kg/m² [11] and 24, 1 kg/m² [12]. It has also been studied the reasons for it which have been classified in the following categories: design, execution, material management, residuals and other activities [13].

It has been mentioned by different researchers that developing countries are characterized by poor information system, inadequate and inaccurate data, especially those related to the construction activity [14]. Additionally, searching in literature for construction waste materials and the best practices for construction material management as an element for waste reduction, it was proven that most of the information are related to developed countries.



In an effort to bridge some of these gaps, the objective of this article is to inform the findings on a study performed in Costa Rica with the support of the Costa Rican Construction Chamber. The objective is to present the hazardous and non-hazardous waste produced as well as a view of the general best practices employed by construction companies to reduce the generation of waste.

2 RESEARCH METHODOLOGY

2.1 Literature review

The literature review provided the items tapping the theoretical constructs for the research. Several authors have reported causes of construction waste generation [15]–[17], as well as good practices to reduce them [18]–[20], among others.

2.2 Data collection

It utilized a mixed method approach, in which a survey instrument was applied to small, medium and big construction companies, structured interviews were held, on-site visits and a panel experts' discussion validated the collected information.

2.3 Survey instrument

Two survey instruments were constructed based on the information gathered during the literature study. Survey one contained questions related to general information about the company and the types of waste produced which were divided in two groups: non-hazardous and hazardous waste. The data was collected vis-à-vis in 30 small, 15 medium and 7 big construction companies. Descriptive statistics was used to analyse the variables including central tendency and frequencies. Survey two had the Architects and Designers as a target group. It was placed on the website of the Architects Federation. It included questions associated to causes of waste generation during the design phase and good practices that can be applied to prevent its generation.

Prior to data collection, the survey instruments were pre-tested for ease of understanding and content validity. Based on the feedback received, the instruments were modified to enhance clarity and appropriateness of the measures purporting to tap the constructs.

For survey two, efforts were made to ensure high quality responses from respondents. These included: a personalized cover letter; a confidentiality statement to assure strict confidence on the information provided and telephone follow-ups of all non-respondents after two weeks of the survey being on-line.

2.4 Interview data

Structured interviews were carried out to key persons from 5 innovative big construction firms. They were intended for enriching the data of the surveys and for the discussion of good practices utilized in those companies for construction waste reduction.

2.5 On-site visits

Construction projects were visited to determine the type of waste being produced, the possible causes for its generation and the good practices applied for waste reduction.



2.6 Panel experts' discussion

A panel of experts' discussion took place with the objective to explore the meanings of the survey results, to analyse the participants' views on the presented topics and to collect a wider insight into different opinions [21].

The group was composed of 20 professionals from the construction industry, including companies that participated in the survey, representatives of Federation of Engineers and Architects, academic sector, Costa Rican Construction Chamber and Non-Governmental Organisations working in sustainable construction. It was conducted over approximately two hours, beginning with a 30-minute presentation of the research's results followed by an analysis of the good practices which were divided in six groups. Each of the group members was free to express his/her minds openly.

3 RESULTS AND DISCUSSION

3.1 Responding firms

A total of 52 construction companies answered the questionnaire. The sample was composed of 30 micro and small enterprises with less than 10 workers, 15 medium with more than 10 and less than 100 workers and 7 big with more than 100 workers.

3.2 Types of waste produced at the construction site

The study revealed that the companies produced in general non-hazardous and hazardous waste. They are the following materials:

NON-HAZARDOUS	HAZARDOUS
<ul style="list-style-type: none"> • Metal piping pieces • Aluminium pieces • Cement paper-plastic bags • Electric wire • Ceramic pieces • Cooper from piping • Concrete • Masonry (concrete with metal) • Styrofoam • Malfunctioning equipment • Iron pieces • Broken bricks • Corrugated roof sheet pieces • Brass • Bronze (locks) • Wood • Insulation material • Soil materials • Packaging paper materials • Plastics • Melamine 	<ul style="list-style-type: none"> • Acids • Solvents and detergents • Concrete additives • Concrete release • Oil containers • Lubricants • Metal paint containers • Plastic paint containers • Chemical treated wood • Paint • Asbestos • Lubricants • Fibre glass • Welding materials • Chemical treated wood • Silicon and other sealing materials • Contaminated soil • Textiles with solvents • Paint brushes • Lighting systems



- Light walls materials
- Stones
- Marble
- Granite
- Polyvinyl chloride (PVC)
- Gypsum
- Handle mortar
- Plaster
- Sets
- Clothing
- Glass

3.3 Best practices for construction waste reduction

The best practices are separated by design, material management, procurement management, execution stages, residuals and others.

3.3.1 Design

Good practices in the design stage are related to:

- Using modular coordination with modular products and construction systems
- Producing a 3D model, detailed and simple workshop drawings
- Using prefabricated structures, units and products
- Coordinating among the different professionals, technicians and clients involved in the project
- Designers being aware of available material, products and dimensions in the market as well as waste reduction processes
- Designers considering reuse, recycling and deconstruction while designing
- Planning the quantity and quality of materials, the generation of waste and its possible treatment, the construction techniques, the human resources and machinery needed
- Following up during the construction on the instructions of designer, structural, electric and topographer engineers
- Clients being aware about environmental friendly materials, resistant and nontoxic elements, the impact of waste generation and the benefits to reduce them and the money savings

3.3.2 Material management

Good practices in the material management stage are correlated to:

- Controlling and examining materials at their arrival and in the storage room, including expiration date
- Packaging and care of materials during transportation, in the on-site storage and while construction goes on
- Training to employees on the use and management of materials
- Encouraging reuse and collection for recycling of building materials
- Developing environmental culture of the company



- Establishing clear communication mechanisms between the workers and the foreman on materials management
- Creating incentive policies to promote environmental culture for the employees
- Sub-contractors following good practices for material management otherwise fines applied

3.3.3 Procurement management

Good practices in the procurement management stage are connected to:

- Making a good procurement planning for materials
- Suppliers providing flexibility to order small quantities
- Storing remaining materials for future projects
- Ordering materials with quality certification
- Ensuring that the materials to be ordered have the purchase approvals
- Buying locally sourced materials (aggregates, ceramic elements and others)

3.3.4 Execution

Good practices for this stage are associated to:

- Good planning and material management strategies during the planning and design stages
- Establishing control procedures for: budget, material specifications and their quality, material and waste management, collection for recycling, purchase, change of orders and acceptance of materials
- Choosing the right technology, equipment and tools for the processes, their maintenance before, during and after finishing the tasks
- Labour training plans for the use of materials, tools and equipment, material and waste management
- Training employees on process technologies, safety and hygiene and the importance of the environment
- Acknowledging the use of good practices by economic incentives, encouraging the employees in providing ideas and suggestion for an improved execution
- Considering the site lay-out that bear in mind temporarily spaces and structures that facilitate material and waste management

3.3.5 Residuals

Good practices considered in residuals are related to:

- Protecting and using removed soil for gardening and green areas
- Controlling and registering the amount of waste generated and its disposal
- Sorting and separating the waste when generated to prevent mixing
- Reusing surplus materials (e.g. formwork, bricks, ceramics) in the same or in other projects
- Keeping clean working areas
- Applying incentives to contractors that reduce or collect waste for recycling as well as penalties for incorrect waste management practices
- Agreeing with supplier's strategies for preventing materials deterioration



3.3.6 Others

Good practices for other activities are correlated to:

- Developing strategies for storage and materials protection
- Developing a waste management plan that includes resources needed and materials that can be reused or recycled
- Keeping records of waste generation and causes
- Informing the staff about their responsibilities regarding waste handling
- Creating mechanisms to control waste being disposed, frequency and final disposal
- Identifying potential buyers/sellers of used or recycled materials, recycling facilities available near the project and discuss with them the possibilities and requirements for their services
- Providing training programs to help customers and stakeholders to appreciate the benefits waste reduction

4 CONCLUSIONS

1. The study demonstrated that most of the construction sites produce hazardous and non-hazardous waste. The reduction of those materials can lead to important savings in purchasing, treatment and disposal costs.
2. Many factors influence waste generation however it was proved that reduction can be achieved by establishing good practices.
3. The research demonstrated that construction waste can be generated during any phase of the life cycle of project. The application of best practices can reduce it.
4. The general best practices for material management for waste reduction presented in this paper can be applied before and during the construction processes. It is meant for contractors that either develop new projects as well as for repair or refurbishing ones.
5. The use of the best practices presented promote reduction of construction waste sent to disposal sites, thus demonstrating a contribution to sustainable development and reducing project costs.
6. The best practices can be applied without big changes in the construction processes.
7. Project stakeholders must work together and understand the benefits of implementing and follow good practices on waste management to assure waste reduction.

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TRANSSHIPMENT STATION FOR URBAN SOLID WASTE: AN ANALYSIS CONSIDERING CITY LOGISTICS CONCEPTS

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ABSTRACT

In this paper we analyze the impact of a transshipment station on the urban solid waste management, considering the trade-off among (i) transportation and operational costs of the transshipment; (ii) operational costs of the trips considering the transshipment station; and (iii) costs for the collection trips from the districts directly to the landfill. The study was carried out in the city of Belo Horizonte (Brazil), which produces 1,730 tons of urban solid waste per day. We have evaluated three scenarios: (i) baseline scenario, in which part of the solid waste is consolidated on a transshipment station and the other part is destined directly to the landfill; (ii) transport direct to the landfill; and (iii) consolidation of all solid waste on the transshipment station. We have evaluated these scenarios considering the cost of collecting and transporting the solid waste. We then analyzed the correlation between cost and distances: distance and total transportation cost have a positive correlation, and distance has a negative correlation with the unitary transportation cost (R\$/km), i.e., when the distance increases, the cost of transportation per kilometer decreases. Our results indicate that the transshipment station has economic advantages for consolidating and transporting solid waste to a landfill. However, direct transport to a landfill is more profitable if the transportation cost (R\$/km) increases up to 9.28%. If the transportation cost increases more than 15%, the operation cost of a transshipment station can increase up to 62%. However, an efficient operation in the transshipment station is critical to ensure this level of profit. Finally, the location of the transshipment station is imperative, and baseline scenario presents a better network for the urban solid waste logistics management.

Keywords: urban waste management, transshipment station, urban freight transport.

1 INTRODUCTION

Urban freight transport is a fundamental activity for the maintenance of the urban lifestyle. However, urban waste is a cargo category not always welcome in urban areas [1], produced by domestic activities in urban dwellings (household waste) and as a result of sweeping, cleaning of public places and roads, and other urban cleaning services (municipal waste cleaning) [2]. Also, the collection and transportation of municipal solid waste (MSW) has economic and environmental impacts on the urban environment [3], besides being an important activity in the MSW management [4]. Still, economic competitiveness is fundamental in defining the location of facilities for MSW management [5].

The management of urban solid waste logistics is necessary with the increase of MSW and the need for the reuse of non-renewable resources [6]. In general, MSW logistics involves the collection of solid waste by compactor trucks with the capacity up to 15m³; transportation to the transshipment stations consolidation of waste; and transportation using vehicles of higher capacity to the landfill. When there is no MSW consolidation at the transshipment stations, there is a direct transport to the landfill, as shown in Fig. 1.

According to [7], collection and transportation costs are high, and the service level is low (low collection frequency in the population viewpoint), and it is important to provide a regular service to improve the service level.



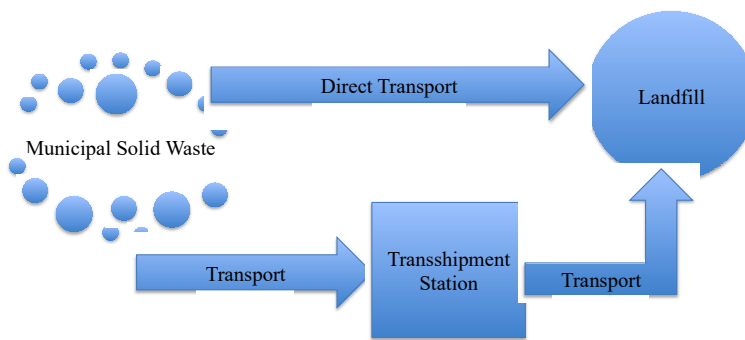


Figure 1: Typical logistics operation of municipal solid waste.

Considering the options for the shift of MSW to the landfill, the disposal of waste in areas closer to the place where it is generated eliminates the need for transshipment stations. Considering the transshipment process, it is important to analyze if the gathered costs considering (i) collection and transportation costs to the transshipment station, (ii) operational costs and (iii) the transportation cost to the landfill are less than the collection and transport costs directly to the landfill. According to [8], in general, the definition of the location of a transshipment station considers the minimization of transportation costs. For [7], the location choice of the transshipment station must meet: (i) exclusion criteria (swamps and flood plains, areas of protection of flora and fauna, areas of historical, cultural and archaeological protection, agricultural and coastal areas); (ii) community criteria (impact on air quality, local infrastructure, use of adjacent land, proximity to schools, churches, residential and leisure areas); and (iii) technical criteria (central and accessible location, adequate area and topography, and possibility of area expansion). Also, [7] indicates that the cost of collection and transportation can vary significantly depending on the location of the transshipment station.

In this context, the object of this study is the assessment of the transshipment station, one of the solid waste management stages regarding the Brazilian National Solid Waste Policy [2] and part of the MSW management system [8]. MSW transshipment stations are defined by [9] as a logistical facility that interconnects the solid waste collected to the landfill, where the MSW is consolidated from multiple vehicles to vehicles of greater capacity, in order to obtain transportation savings for final disposal in a landfill. In [10], a similar concept is adopted.

According to [3], to reduce transport costs, the managers seek different strategies for collecting and transporting MSW. The transshipment stations allow reducing transportation costs through freight consolidation, with consequent reduction of fuel consumption, maintenance costs, urban traffic, and pollution [9], [10].

Thus, this paper assesses the benefits of a transshipment station to the MSW consolidation considering a case study in Belo Horizonte. For that, we have considered the trade-off between (i) the distance from the collection districts to the transshipment station; and (ii) the costs of collecting, transporting and operating the transshipment station. This evaluation is necessary since the literature shows different cases about urban waste logistics, detailed below.

In Abadan (Iran), the solid waste is transported directly to the landfill [11]. In Calcutta (India), a transshipment station to consolidate MSW in vehicles of greater capacity is used

[11]. In Israel, there are 30 transshipment stations and the largest one is in the Tel Aviv Metropolitan Region, with an operational capacity of 3,000 tons of MSW per day [10]. In Urmia (Iran), the transshipment station is located 8 km south of the city, and the landfill is located 17 km to the north [12]. In São Paulo, there are five transshipment stations in different areas of the city with an estimated volume of 1,200 tons per day [13]. In [14], the existence of 3,500 transshipment stations in the USA in 1999 is reported.

Among the studies that address the transshipment station, we highlight [9], who proposed a manual for guidance on the deployment and operation of transfer stations. [12], analyzed the effects of MSW management to reduce costs in Urmia (Iran). The results indicate that the use of a transshipment station, despite the proximity, is not economical due to the location (the station is located in the south of the city and the landfill in the north). [4], presented a survey that addresses urban waste logistics considering the reverse logistics approach. The authors identified a gap in the literature about reverse logistics on the urban environment and the importance of MSW management in logistics systems.

[10], analyzed the economic cost of externalities related to MSW transshipment stations in Israel. The main question is whether the proximity of MSW transshipment stations, considering environmental issues, impacts the sale price of the residences. The results indicated that transshipment stations generate discomfort for the population and suggest incorporating the impacts of the installation on the cost of land in locational studies of these logistical facilities.

[8], analyzed the location of a transshipment station from the environmental viewpoint to assess its feasibility as a logistics facility for the MSW management system. The authors identified a 16.8% reduction in the environmental impact when the transshipment station is an integral part of the MSW system. Also, the environmental impact is proportional to the distance and volume of MSW transported. If the transshipment station is implemented, the energy consumption contributes 45% to the environmental impact, which is compensated by the fuel economy. With these results, authors concluded that the use of the transshipment station is viable from the environmental point of view in eight cities of the Province of Castellón (Spain).

[10], estimated the economic value of externalities related to MSW transshipment stations in Israel. The authors found problems when the transshipment station is implemented within a radius of up to 2.8 km regarding residential areas. Also, the cost of the property increases by US\$ 5,000 for each additional kilometer from the residential area to the transshipment station. Thus, a 1% increase in the average distance of a residence from the transshipment station is associated with a 0.06% increase in the price of the property. The results point out the need for compensation policies to determine the location of transshipment stations.

[15], identified 13 studies that incorporate the location of the transshipment stations as a strategic issue of the MSW management, considering Operations Research as a methodological approach. The literature review shows focus on travel generation, travel time and cost reduction, mostly due to the large monetary sum involved in the management of urban solid waste.

[3], proposed a model to find the minimum route between the collection point and the landfill, considering collection, transference, and transport of the MSW. Using data from the metropolitan region of Calcutta (India), the authors obtained a reduction of 30% in the traveled distance in collection routes, which implies considerable transport savings.

This brief literature review shows the importance of the transshipment station for the MSW management and emphasizes that the distance and costs of collection, transportation, and operation of the transshipment station can have a direct impact on the total cost. Thus,



the next section reports the MSW system in Belo Horizonte and draws comparisons with literature indicators.

2 MUNICIPALITY SOLID WASTE MANAGEMENT
IN BELO HORIZONTE (BRAZIL)

Belo Horizonte, the capital of the Minas Gerais State, has a population of 2.5 million inhabitants that produced, in 2015, 631,279 tons of MSW, resulting in a rate of 252.51 kilos per year per capita or 0.67 kg/inhabitant/day.

In 2010, per capita expenditure regarding the MSW was R\$114.73/inhabitant in Belo Horizonte, considering the collection of 0.78 kg/inhabitant/day and collection and transport costs of R\$108.72/ton (US\$1 ≈ R\$3.09, in February/2016). The total cost of collecting and transporting the MSW represented 5.89% of the city's expenses [16], (MSW is managed by the municipality in Belo Horizonte). Collection costs in low and middle-income countries represent, respectively, 80-90% and 50-80% of the total cost of MSW management for companies [3]. In Urmia (Iran), 60% of the expenses with MSW management are related to the collection and transportation, with an average cost of US\$ 114–120 [14].

In Fig. 2 we present indicators of the amount of MSW collected per capita and collection and transportation costs in the period from 2002 to 2015 in Belo Horizonte. It is possible to observe little variability in the per capita generation of MSW (average of 0.73 kg/inhabitant/day and standard deviation of 0.06 kg/inhabitant/day). In 2015, collection and transportation costs were R\$ 110.31/ton, collecting 0.69kg/inhabitants/day. From 2010 to 2015, the collection and transportation costs increased 1.46%.

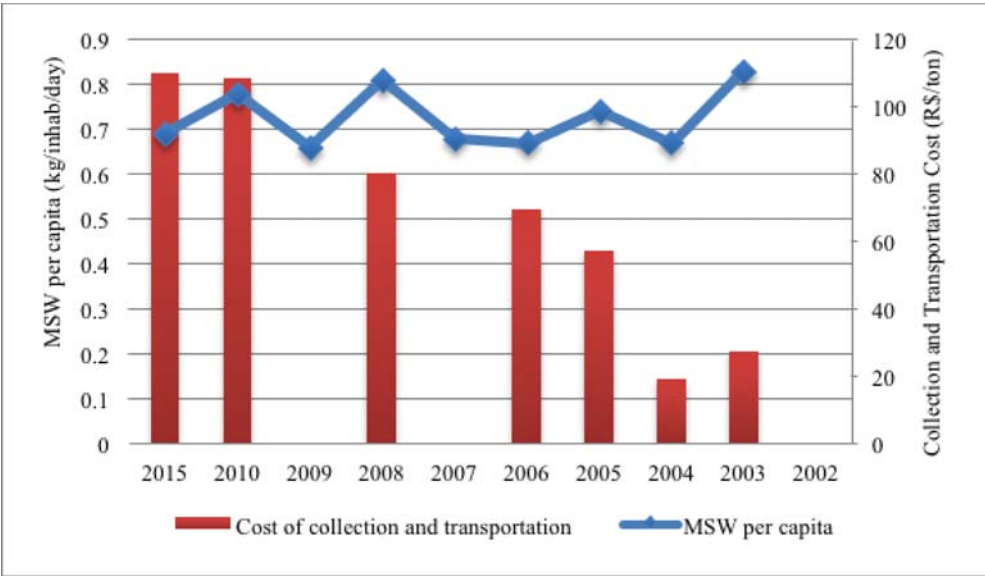


Figure 2: Indicators of MSW in Belo Horizonte.

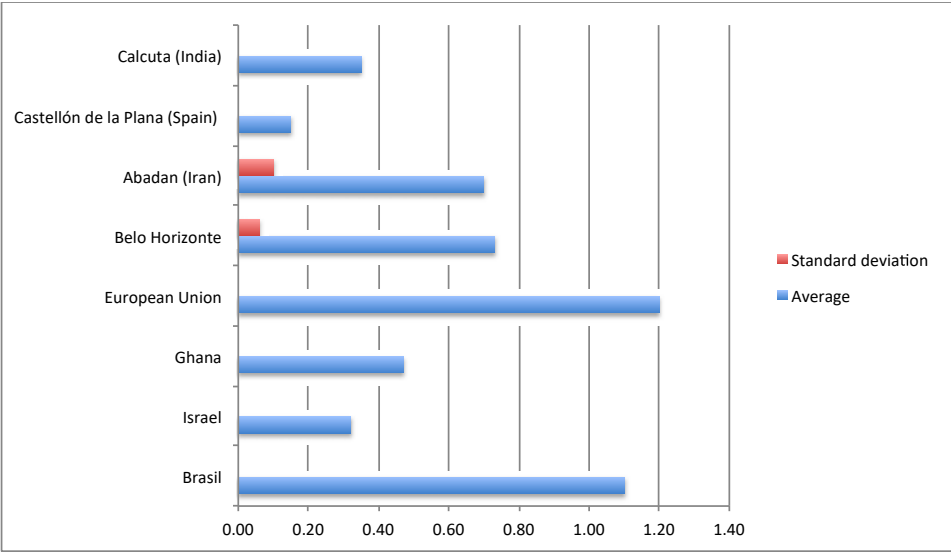


Figure 3: MSW per capita [3], [9], [11], [13], [16], [17].

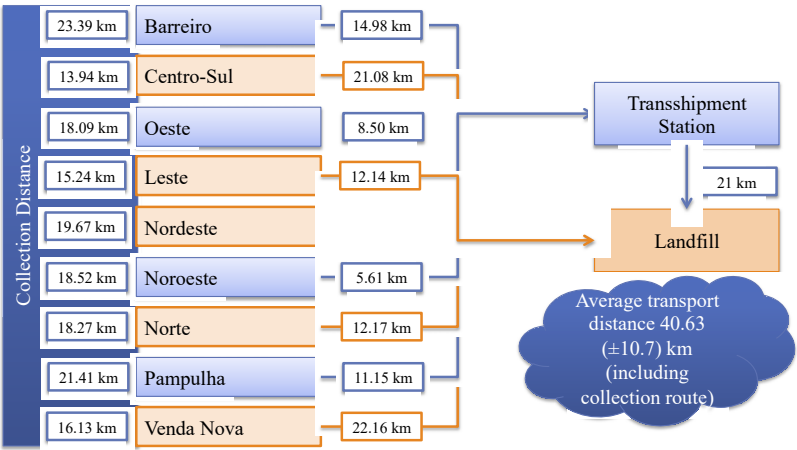


Figure 4: Logistics operation of the MSW in Belo Horizonte.

The per capita generation of MSW in Belo Horizonte is similar to Abadan (Iran), 209% higher than Calcutta (India) and represents 63% of the residue per capita of Castellón de la Plana (Spain) (Fig. 3).

The logistics of MSW in Belo Horizonte is illustrated in Fig. 4. Belo Horizonte is divided into nine administrative regions, and the MSW of each administrative region has a specific destination: (i) for Barreiro, Oeste, Noroeste and Pampulha, the MSW is transported to the transshipment station; and (ii) for Centro-Sul, Oeste, Noroeste, Norte and Venda Nova, the MSW is transported directly to the landfill using compactor trucks. The average transport distance is 40.63 km (± 10.7 of a standard deviation - SD), including the collection process.

The transshipment station in Belo Horizonte is located at BR-040, km 531 and the warehouse occupies an area of 4,435 m² to transfer the MSW from 15m² compactor trucks to 50m³ trucks and then transport the waste to the landfill. The Macaúbas landfill is located at MG-5, km 8.1, in Sabará, a municipality near to Belo Horizonte.

In 2015, 631,279 tons of MSW were transferred to the landfill, an average of 52,606 ($\pm 2,977$) tons per month. In Fig. 5 we show the monthly movement of MSW in 2015, for Belo Horizonte. Each regional produces, on a monthly basis, an average of 70,142 ($\pm 17,045$) tons of MSW. The ‘Centro-Sul’ Regional is responsible for 18% of the total MSW generated in Belo Horizonte, which has a daily collection to meet the MSW demand. On average, the region produces 5.59 (± 1.79) tons of waste per square kilometer and 0.73 (± 0.14) kilograms of waste per inhabitant per day. These data are detailed in Table 1.

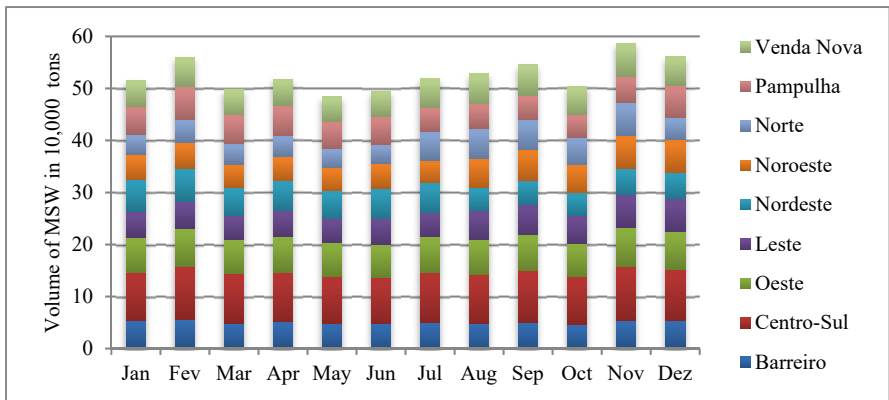


Figure 5: The amount of MSW in Belo Horizonte, in 2015.

Table 1: Details of MSW generation in Belo Horizonte.

Regional	Percentage of MSW generation	Volume (ton/day)	Density (ton/km ² /day)	Generation per capita (kg/inhab./day)
Barreiro	10%	6.99	3.14	0.59
Centro-Sul	18%	10.12	9.88	1.11
Oeste	13%	7.51	6.27	0.73
Leste	10%	7.21	6.20	0.73
Nordeste	10%	6.51	4.47	0.60
Noroeste	10%	6.50	5.62	0.63
Norte	9%	7.35	4.74	0.73
Pampulha	10%	6.01	3.41	0.77
Venda Nova	10%	5.89	6.06	0.67
Total	100%	64.09	-	-
Average	11%	7.12	5.54	0.73
SD	$\pm 3\%$	± 1.13	± 1.79	± 0.14

The MSW produced by Barreiro, Oeste, Noroeste and Pampulha (43%) is destined to the transshipment station and represents an annual volume of 268,764 tons. In this study, we analyze the impact of transporting this volume directly to the landfill.

3 METHODOLOGICAL APPROACH

In this study we have used the premises proposed by [9] to define the methodological approach, which is composed of the three steps:

- Step 1: (i) determine the cost of the transshipment station operation (R\$/ton) and (ii) determine the cost of collection and transportation to the transshipment station (R\$/ton);
- Step 2: (i) calculate the total cost (R\$/ton.km) and (ii) determine distances in different scenarios evaluated;
- Step 3: (i) analyze the scenarios.

The objective of the study is to assess the trade-off between the operation using the transshipment station and the trips directly to the landfill. For that, the break-even point (considering distance and cost) of the usage of the transshipment station was determined. Therefore, in step 1, the operation costs of the transshipment station, the costs of collection and transportation to the landfill, and to the transshipment station were obtained. In step 2, we calculated the total transport costs (R\$/ton.km) that supported the scenario analysis. In step 3, we analyzed the scenarios and determined the break-even point of the transshipment station operation, considering distance and total cost.

It is important to notice that the transshipment station is a suggested solution to reduce the impacts of collection and transportation of municipality solid waste in urban areas. The consolidation of the MSW in the transshipment station generates less vehicle traffic and, consequently, less noise and environmental pollution. A major challenge for public managers is to assess the distance from the collection districts to the transshipment station to get economically advantages in the consolidation process.

4 RESULTS

The following data were obtained from the Municipality of Belo Horizonte:

- distance from each collection district to the transshipment station and the landfill;
- volume of MSW from January to December of 2015, by region;
- cost of the collection, transportation and the operational cost of the transshipment station.

In Table 3 we present the costs' values considered in this study. The collection and transportation consider collecting MSW in each districts and transporting it to the final destination, according to Fig. 4 (landfill or transshipment station). The operational cost of the transshipment station (TS) includes (i) operational cost (41%); and (ii) transport cost (59%) from the transshipment station to the landfill. The total cost is the sum of collection and transportation costs, plus the operational cost of TS (if applicable). The unitary transportation cost considers the average distance traveled in *Status Quo* Scenario, presented in Fig. 4.

We have then analyzed three scenarios:

- *status quo* Scenario represented in Fig. 4;
- scenario one, in which all MSW is transported to the landfill;



- scenario two, in which all MSW is transported to the transshipment station. This is a hypothetical scenario, but it is important to validate the *status quo* scenario.

In Table 3 we detail the distances in the scenarios analyzed. The results indicate the importance of the transshipment station to reduce the average distance traveled. In scenario two, we can notice the much higher distance (+34%), indicating that operate all MSW in the transshipment station is not viable and has a negative impact on transportation costs (more distance traveled implies in an increase in the transportation cost). This result indicates that the *status quo* scenario is more viable than scenario two. Due to that, the following analysis presents a comparison the *status quo* scenario and the scenario one.

The results indicated that: (i) the total distance and the total cost have a positive correlation ($\rho = 0.7$), i.e., if the distance increases, total cost also increases; (ii) the total MSW volume and the total cost have no dependence ($\rho = -0.28$); (iii) collection and transportation costs

Table 2: The costs' values considered in this study.

Regional	Cost of collection and transportation (R\$/ton)	Operational cost of TS (R\$/ton)	Total Cost (R\$/ton)	Unitary Transportation Cost (R\$/ton.km)
Barreiro	98.18	22.00	120.18	3.17
Centro-Sul	98.18	0.00	98.18	2.80
Oeste	98.18	22.00	120.18	4.31
Leste	93.81	0.00	93.81	3.39
Nordeste	93.81	0.00	93.81	3.28
Noroeste	93.81	22.00	115.81	4.50
Norte	112.11	0.00	112.11	3.68
Pampulha	112.11	22.00	134.11	4.06
Venda Nova	112.11	0.00	112.11	2.93

Table 3: Distances considered in different scenarios.

Regional	<i>Status Quo</i> Scenario	Scenario one (landfill)	Distance Increase (%) <i>status quo</i> and scenario one	Scenario two (transshipment station)	Distance Increase (%) <i>Status Quo</i> and Scenario two
Barreiro	59.37 km	60.04 km	1%	59.37 km	0%
Centro-Sul	35.02 km	35.02 km	0%	51.06 km	46%
Oeste	47.59 km	46.33 km	-3%	47.59 km	0%
Leste	27.68 km	27.68 km	0%	54.43 km	97%
Nordeste	28.62 km	28.62 km	0%	61.15 km	114%
Noroeste	45.13 km	41.88 km	-7%	45.13 km	0%
Norte	30.44 km	30.44 km	0%	61.44 km	102%
Pampulha	53.56 km	41.68 km	-22%	53.56 km	0%
Venda Nova	38.29 km	38.29 km	0%	57.16 km	49%
Average	40.63 km	38.89 km	-4%	54.54 km	34%
SD	10.75 km	9.65 km	-	5.49 km	-

We have used descriptive statistics to assess the data. Considering the Pearson correlation coefficient, the degree of correlation among the variables used in the study was evaluated. and distance do not have dependence; and (iv) the total distance has a negative correlation regarding the unitary transport cost (R\$/ton.km) ($\rho = -0.94$), i.e., if the distance increases, the unitary transport cost decreases. This statistical analysis indicates consistency in the data used.

In each scenario, we did three analyses:

- analysis one: economic impact on transporting all MSW from the collection districts to the landfill: what is the maximum distance between the collection districts and the landfill that results in an economically advantageous transport?
- analysis two: what is the operation cost of the transshipment station to make this station feasible?
- analysis three: sensitivity analysis of the total transportation cost: what is the maximum cost of collection and transportation (R\$/ton) that makes the transport to the landfill advantageous?

The results of all those analyses, considering the *status quo* scenario and the scenario one, are presented below.

4.1 Analysis one

In this analysis, we have considered the average distances traveled for each scenario and the respective unitary transportation cost to determine the economic impact of transporting all MSW directly to the landfill. The volume processed in the transshipment station represents 43% of the total volume collected in Belo Horizonte. The cost of collection and transportation represents 39% of the total cost. The operation of the transshipment station represents 8% of the total cost, from which 5% refers to the transport from the transshipment station to the landfill and 3% are generated by the operational activities in the transshipment station.

4.2 Analysis two

In scenario two, we did a sensitivity analysis regarding the total transportation cost to identify values that made the collection and transportation to the landfill advantageous. In Table 5 we show the results of this analysis. Simulating an increase of up to 9.28% in the collection and transportation costs in the *status quo* scenario, the transport of all MSW to the landfill is more advantageous than operating the transshipment station at the cost of R\$ 22/ton. With this increase, the costs of collecting, transporting and operating the transshipment station (*status quo* scenario) are same as the transportation costs to the landfill (scenario 1).

The results indicate that the growth of the operational costs of the transshipment station is closely related to the cost of collection and transportation. Also, the higher the increase in the collection and transportation costs, the greater the margin of growth regarding the transshipment station operational cost.

5 CONCLUSION

Transshipment stations are critical logistics facilities, which contribute to the logistical sustainability, through the reduction of the number of vehicles in the urban area (less congestion), lower emission of pollutants and improved operation of municipality solid waste management. However, it is necessary to observe the organizational structure, the operational



Table 4: Sensitivity analysis of the transportation cost.

Growth in the cost of Collection and Transportation (%)	Increase of the Annual Transportation Cost (%)	Increase of the operational cost of the TS (%)
< 9.28%	0%	0%
10%	1%	8%
11%	2%	19%
13%	3%	40%
15%	5%	62%

efficiency considering scale and vehicles used, the financial viability, the environmental and traffic impacts regarding the transshipment station operation.

This study indicates that transshipment stations can be advantageous considering their location and may allow the consolidation of MSW and the reduction of the number of freight vehicles utilized to transport MSW to the landfill. However, the financial viability is related to the collection and transportation cost.

The scenario one (transport to the landfill) is feasible if the increase in the cost of collection and transportation does not exceed 9.28% and the operational cost of the transshipment station is up R\$ 22 per ton. Rises higher than 15% of the collection and transportation costs allow growths up to 62% in the operational cost of the transshipment station. Thus, for increases of more than 10% in the collection and transportation cost, a careful evaluation of the TS operational costs must be carried out to validate this cost (R\$ 22 per ton), making the operation of the transshipment station possible.

Finally, the transshipment station contributes to the improvement of the urban environment quality, since it reduces the pollutants emission. Thus, it is necessary to think about the city that we want and, consequently, to plan the municipality urban waste management. This planning should be aligned with this “desired” city, referring to operations that are not only financially viable, but also sustainable.

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SECTION 14

WATER RESOURCES

CLIMATE CHANGES AND DRINKING WATER IN SUSTAINABLE CITIES: IMPACTS AND ADAPTATION

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ABSTRACT

Planning and management of sustainable cities must consider the impacts of climate changes on urban water resources. There is a growing concern about how climate changes affect the quality of drinking water from the catchment to the citizen's tap. Changes in precipitation and temperature patterns can have effects on quality of water sources and on the capacity of water treatment and distribution infrastructure to respond with such changes. We present herein a research program that investigates the potential impacts of climate change scenarios on source and drinking water quality. The research methodology is based on a modelling framework that exploit datasets from Canadian cities concerning land use, source and tap water quality, water infrastructure and operations, and estimations on future changes on water temperature and local rainfall. The paper concludes with the initiatives that municipalities must conduct in order to implement sustainable strategies for adapting to climate changes regarding drinking water resources.

Keywords: drinking water, cities, climate change, impacts, adaptation.

1 INTRODUCTION

Drinking water is one of the most important services provided by cities to population. Sustainable cities must ensure the distribution of safe drinking water at any time, despite the fact that source waters are more and more vulnerable to land use pressures and climate changes. The quality of source waters is particularly sensitive to anthropogenic pressures resulting from land use such as agriculture, urban sprawl, deforestation, area waterproofing, etc. Climatic variables such as temperature and precipitations could lead to a decrease in the quality of drinking water sources when contaminants are transported by overland and subsurface flow and discharged into surface waters following rainfall events [1]. As an example, increases in organic contaminants such as road salts and organic matter may occur [2], [3]. According to the literature, heavy rainfall is the climatic factor with the greatest and most reported impacts on drinking water quality and safety, such as for example waterborne disease outbreaks [4], [5]. Changes in raw water quality consecutive to rainfall events can also have negative impacts for water treatment plants that use surface waters, such as membrane fouling and blocking, increase in chemical product dosing (increased coagulant and disinfectant doses, pH adjustments, etc.) and decrease in filter run-time [3]. All of these modifications (i.e., increases in organic matter and chloride/bromide, decrease in treatment performance, etc.) have the potential to modify the chemical water quality of drinking water, in particular the presence of disinfection by-products (DBPs).

Temperature and precipitation are expected to vary in the future in Canada and elsewhere due to increases in greenhouse gas emissions [6], [7]. Shifts in climate patterns (i.e., rainfall increase) could then have consequences on source water quality due to the intensification of surface and groundwater runoff contamination events, leading to a decline in drinking water treatment efficiency and ultimately in drinking water quality.



Considering these potential impacts of land use and climate changes on the quality of raw and drinking waters, we designed a research program that aim to improve the understanding of the variation of water quality under climatic and land use pressures, and to model the potential consequences of modifications in the patterns of these pressures in the future. The results of this research program will help municipal decision-makers to identify strategies to reduce the impacts of land use and climate changes on drinking water quality distributed to the population.

Our research program is made up of three different projects (in total five sub-projects). These projects are dedicated to study the influence of land use, climate (rainfalls) and climate change on water quality, from the source to the tap. These projects were all conducted in the Province of Quebec, Canada.

2 EFFECTS OF CLIMATE AND LAND USE ON SOURCE WATER QUALITY

In this project, the relative influence of a set of watershed characteristics (climate, land use, morphology and pedology) and climatic variables on two key water quality parameters: turbidity and fecal coliforms (FC) was examined [8]. Fecal coliforms are a commonly used indicator of pathogens in water and is also used to assess microbial [9], [10]. Turbidity is an indicator of the presence of suspended solids, organic matter and microorganisms, and is also used to assess water treatment efficiency and potential chlorination by-product formation [11]. Twenty-four catchments located in the southern part of the Province of Quebec were studied at various spatial scales (1 km, 5 km, 10 km and the entire catchment).

With the use of Spearman's correlation rank tests, we revealed that the entire catchment was a better predictor of water quality for both water quality parameters. Based on this information, linear mixed effect models for predicting turbidity and FC levels were developed. A set of land use and climate scenarios was considered and applied within the water quality models. Four land use scenarios (Scenario 1: no change; Scenario 2: constant rate of land use variation; Scenario 3: optimistic (decrease in agricultural land, reforestation, no urban sprawling); and Scenario 4: pessimistic (increase in agricultural land, deforestation, and urban sprawling) and three climate change scenarios (based on emissions scenarios B1, A1B and A2) were tested. The variations for the near future (2025) were calculated and compared to the reference period (2000).

Climate change impacts on water quality remained low annually for 2025 time horizon (turbidity: +1.5%, FC: +1.6%, for the high emissions scenario A2). On the other hand, the influence of land use changes appeared to predominate. Significant benefits for both parameters could be expected following the optimistic scenario (turbidity: -16.4%, FC: -6.3%; $p < 0.05$) (Fig. 1(a)). However, pessimistic land use scenario led to significant increases on an annual basis (turbidity: +11.6%, FC: +15.2%; $p < 0.05$). Additional simulations conducted for the late 21st century (2090) revealed that climate change impacts could become equivalent to those modeled for land use for this horizon (Fig. 1(b)).

Anticipation and quantification of surface source water contamination are vital in maintaining a high degree of safety for drinking water purposes. Best land use management practices such as the maintenance of riparian vegetation and wetlands, construction of retention ponds, application of fecal waste management plans and restriction of livestock in immediate catchment perimeters are particularly important to mitigate the risk of intensification of water quality degradation episodes associated with climate change [12]. Future modifications in agricultural practices itself due to advances in technologies or climate change (type of crops, fertilizers and pesticide uses, apparition of new cultivars, longer growing seasons) could also have important impacts on downstream surface waters.



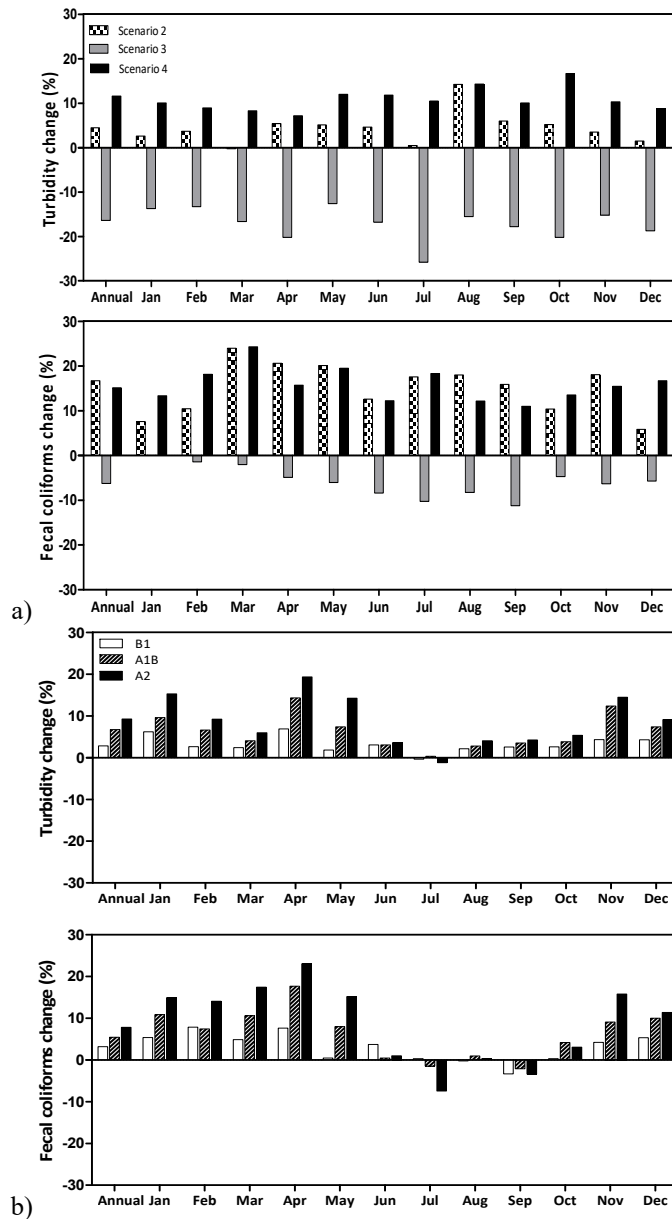


Figure 1: (a) Annual and monthly variations in turbidity and fecal coliform median concentrations between the three different land use scenarios (scenarios 2, 3 and 4) and reference (scenario 1) land use scenario in 2025 (under A1B scenario). (b) Annual and monthly variations in turbidity and fecal coliform median concentrations between climate change scenarios for late 21st century (2090) and reference scenario (2000).

3 CONTAMINATION OF DRINKING WATER AND CLIMATE CHANGE SCENARIOS

3.1 Impacts of climate changes in water quality of small municipalities

This study aims to assess the impacts of climate change (CC) scenarios on disinfection by-product (DBP) formation in small water systems. To this end, a suite of models linking climate to DBPs was used [13]. This study applies three emissions scenarios (B1, A1B and A2) for three 30-year horizons (2020, 2050 and 2080) in order to produce inputs to test several DBP models (trihalomethanes (THMs), haloacetic acids (HAAs) and haloacetonitriles (HAN)). This assessment was achieved for 13 small water systems located in Quebec, Canada and supplied by surface water. 17 DBPs models (10 for THMs, 6 for HAAs, and 1 for HAN) were selected and tested.

An annual increase is estimated for all DBPs for each CC scenario and horizon. The highest seasonal increases were estimated for winter for all DBP groups or species. In the worst-case scenario (A2-2080), THMs could be affected more particularly during winter (+34.0%), followed by spring (+16.1%) and fall (+4.4%), whereas summer concentrations would remain stable (-0.3 to +0.4%). Other DBPs groups (HAAs and HANs) shows smaller rises. Potentially, small water utilities applying only a disinfection step could be more affected by rising THM concentrations associated with CC than those having implemented a complete water treatment process (coagulation–flocculation, filtration and disinfection) with +13.6% and +8.2% increases respectively (A2-2080) (Fig. 2).

Further studies could include the modelling of other factors related to DBP formation (UV254, chlorine dose, pH or residence time) under climate modifications, especially bromide ion, a key DBP precursor whose levels could be modified by increasing rainfall. Developing predictive models for emerging DBPs such as nitrogenous DBPs (N-DBPs), halonitromethanes, haloacetamides and halonitromethanes is needed as these DBPs have been proven to be far more cytotoxic and genotoxic than THMs and HAAs [14]. In climate change studies, the results are dependent of the climate model chosen. Consequently, further studies should consider the inputs of various climate change models to better include and assess uncertainty in projections. Finally, more complete research could be achieved by combining our approach with the development of decision support systems to help drinking water managers anticipate the potential consequences of CCs on their drinking waters.

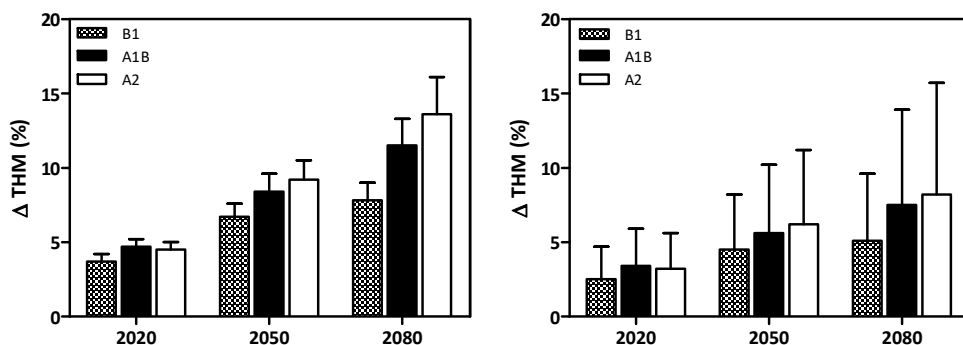


Figure 2: Comparison between mean annual THMs variations obtained with models using raw water data (left, 4 models tested) and those using treated waters data (right, 6 models tested).

3.2 Impacts of climate changes in chemical contamination peaks

This project is strongly related with the precedent. The objective is to explore and estimate the impact of future possible variations in temperature and precipitation – associated with climate change scenarios – on the probability of THM4 (total trihalomethanes) concentrations exceeding a specific threshold (80 µg/L (based on the mean annual regulatory threshold from the Quebec, Canada, drinking water regulation) [15].

A total of 112 drinking water utilities (DWUs) supplied by surface water and located in the Province of Quebec (Canada) were selected for this study. Possible variations in temperature and precipitation from the current period (2006-2009) to three predicted periods (2020: 2010-2039, 2050: 2040-2069, and 2080: 2070-2099) were estimated using two climate models: one global (CGCM3T47) and one regional (CRCM) and four emission scenarios (G.B1, G.A1B and G.A2 for the global climate model and R.A2 for the regional climate model). The probability of THM concentrations exceeding the threshold was calculated using a multilevel logistic regression model based on three variables (treatment type, temperature, and precipitation) and three hierarchical levels (THM samples, DWUs and the ecosystem at the source).

Results showed a relatively low, but statistically significant, increase in the probability of THM concentrations exceeding the threshold over time (between 1.9% and 4.7%, depending on the emission scenario). Statistically significant differences in probability were found for the 2080 predicted period only, between the least extreme emission scenario (G. B1) and the most extremes emission scenarios (G.A2 and R.A2) and between the average emission scenario (G.A1B) and the most extreme emission scenario from the regional climate model (R.A2). Statistically significant differences in probability were found between the current period and both the 2050 and the 2080 predicted periods, for all emission scenarios. Finally, large statistically significant differences in probability were found between seasons (up to approximately 30%) and between treatment types (between 25% and 40%) with higher probabilities during summer, followed by fall, spring and winter, and for DWUs using chlorination alone as treatment (Table 1).

Extreme precipitation and drought may influence peaks in water quality by its impact on source water [16], [17]. In future work, it would be relevant to analyze the impact of extreme weather events on THMs (and other DBPs, including the emerging ones) concentrations or on their probability of exceeding regulatory or health-based thresholds.

4 WATER CONTAMINATION FOLLOWING RAINFALL EVENTS

4.1 Full-scale study

This project aims to investigate the effects of various spring rainfall events on the quality of treated waters at a large water treatment plant through the implementation of intensive water quality monitoring of raw, filtered and treated waters during different heavy rainfall events (>10mm in 24h) [18]. The study was carried out in the region of Québec City, Canada, in a large water treatment plant (WTP) that provides water to 306 000 inhabitants of the city. The Saint Charles river watershed is used as water source. Although the area is mainly covered by forest and urban land [19], the watershed is known to be polluted by road salt application leading to continuously increasing levels of chloride and conductivity [20].

Four spring rainfall events were monitored with the help of 24-bottles autosamplers (ISCO 6712FR) that were installed in the WTP at the raw water intake and after the filtration step, just before final chlorination. DBPs (four trihalomethanes and six haloacetic acids) and their



Table 1: Comparison of the predicted probability (%) of THM concentrations exceeding the threshold between the DWU treatment types according to time periods and seasons.

Time periods	Treatment type	Winter	Spring	Summer	Fall	Overall	Intra-annual variation*
Current	CI2	28.8	35.4	69.8	59.4	48.6	41.0
	Advanced	4.0	6.3	30.2	20.2	15.1	26.2
2020	CI2	29.6	35.9	70.6	60.1	49.3	41.0
	Advanced	4.2	6.5	31.2	20.8	15.6	27.0
2050	CI2	31.8	37.6	72.6	61.8	51.2	40.8
	Advanced	4.8	7.3	33.4	22.4	16.9	28.6
2080	CI2	33.9	39.2	74.4	63.8	53.1	40.5
	Advanced	5.5	8.2	35.7	24.4	18.3	30.2
Total variation**	CI2	5.1	3.8	4.6	4.4	4.5	
	Advanced	1.5	1.9	5.5	4.2	3.2	

*Intra-annual variation presented in Table 1 correspond to the variation in probability between seasons having the lowest (i.e., winter) and the highest (i.e., summer) probabilities.

** Total variations correspond to the variation in probability between the current period and the 2080 predicted period. The overall total variation is significant for both treatment types (p-value < 0.01).

explanatory variables (pH, turbidity, water temperature, specific ultraviolet absorbance, total and dissolved organic carbon, bromide and chlorine dose) were measured on samples collected.

The results showed that water quality degrades during and following rainfall, leading to small increases in THM4 and HAA6 in treated waters. While THM4 and HAA6 levels remained low during the prerairfall period (<9 mg/L) for the four sampling campaigns, small increases in THM4 and HAA6 during and after rainfall events were observed. During the rainfall and post-rainfall periods, concentration peaks corresponding to 3-fold and 2-fold increases (respectively 27.5 mg/L for THM4 and 12.6 mg/L for HAA6) compared to pre-rainfall levels were also measured (Fig. 3). A slight decrease in harmful brominated THM and HAA proportion was also observed following rainfall events.

Despite relatively low increases in the DBPs monitored, complementary studies should include measurements within the distribution system to assess the behaviour of regulated (and emerging) DBPs following rainfall. Emerging DBPs (e.g., halonitromethanes and haloacetonitriles) were also detected in this distribution system [21]. However, little is known about the behaviour of these DBPs and their precursors following rainfalls.

4.2 Experimental study

This study compares the influence of land use and climate on DBP precursors in two catchments supplying the region around the City of Québec, Canada, and assesses the variability of DBPs concentration and speciation following various experimental DBP formation tests [22].



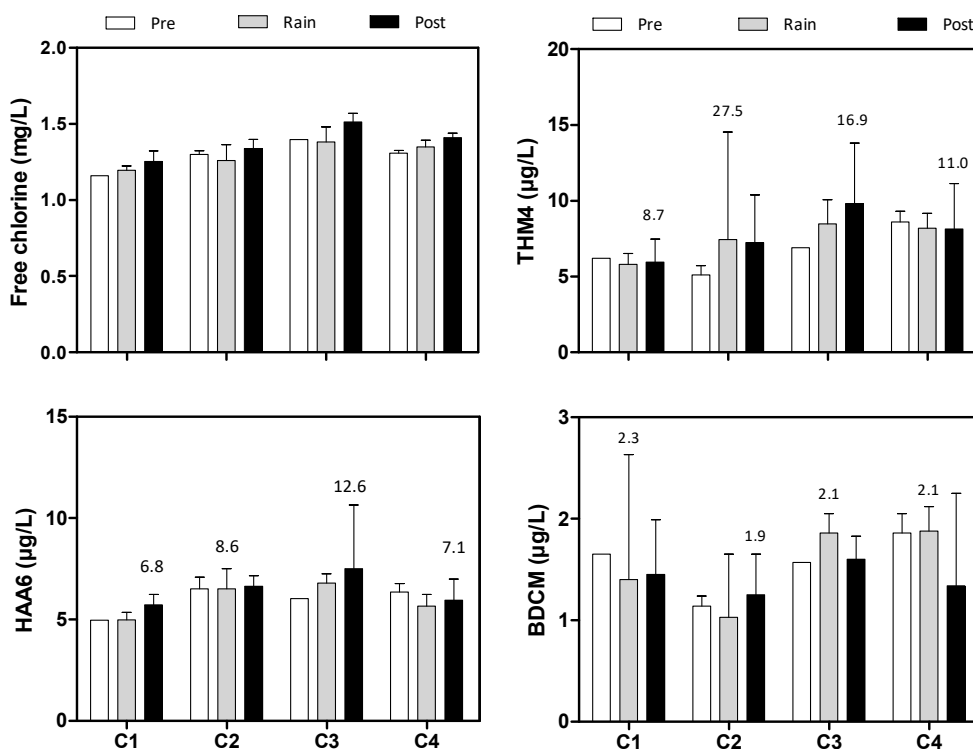


Figure 3: Free chlorine and DBP levels by hydroclimatic periods in treated waters. Means and standard deviation are indicated (4 sampling campaigns). Maximum DBP values by campaign are indicated.

The study was conducted in the Saint Charles and Chaudière rivers. Samples were collected using the same sampling protocol as in project 2.4. DBPs (THMs and HAAs) and their precursors in raw waters (pH, turbidity, specific ultraviolet absorbance (SUVA), total and dissolved organic carbon, bromide and chlorine dose) were monitored. Various experimental chlorination tests: DBP formation potential (DBPFP) and Simulated Distribution Systems (SDS), were also performed.

Differences in pre-rainfall (baseflow) water quality were noted according to the different watershed land uses. Raw water quality patterns showed modifications between baseflow and rainfall periods, with a degradation of raw water quality according to turbidity and SUVA in both water sources. Rainfall events were also shown to alter organic matter reactivity with an increase in THM formation potential for both sites. A less noticeable impact on HAA formation potential was observed. However, no clear differences in DBPFP tests were observed between the sites (data not shown). SDS tests showed that rainfall events lead to considerable rises in organic carbon reactivity of filtered waters, even after primary treatment, with a 2-fold increase in THM and HAA concentrations following rainfall (Fig. 4) for waters representing the end of one main distribution system (20 h contact time). These increases are linked mainly to a rise in non-brominated DBPs such as chloroform, trichloroacetic acid and dichloroacetic acid.

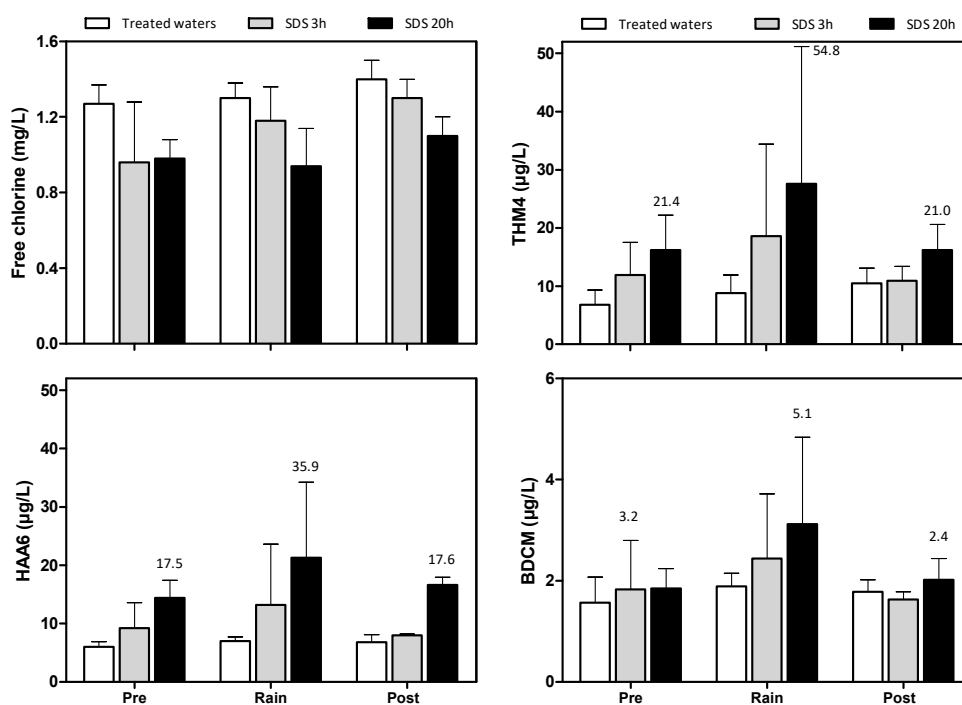


Figure 4: SDS tests (THM4 and HAA6) at 10°C for treated waters (contact time = 0h), and for 3h and 20h contact time. Means, standard deviation and maximum values for each hydroclimatic period are indicated (4 sampling campaigns).

This study confirms the importance of strictly controlling organic matter levels during drinking water treatment to ensure safe drinking water quality throughout the distribution system. The rechlorination of distributed waters is known to have a significant impact on THM and HAA concentrations [23]. It could be interesting to assess the effects of rechlorination on DBPs levels following rainfall events in distribution systems, since OM quality and quantity changes are observed even after a complete treatment and that these changes could affect DBPs formation experimentally.

5 CONCLUSIONS

Results of our research program suggest that sustainable cities need to generate reliable data on water quality from source to tap in order to assess the impact of climate changes on the presence of contaminants in raw and drinking waters. In addition, precise data on changes in land use must be developed, given the impact of anthropogenic pressures on source water quality. The use of different scenarios for precipitation and temperature changes associated with climate change on a regional level must be favoured for this type of study. The quality of data is the key factor in obtaining accurate estimates of the possible impacts of climate changes on drinking water quality. With solid data and reliable models, it will also be possible to identify adaptive measures aimed at reducing the impacts of climate change on water resources. City planners should consider such impacts in their decision-making in the design and the update of strategies for water source protection and urban water infrastructure

management. This will allow them to better adapt to climate changes in the future. The adaptations aimed at reducing the impacts of climate change on drinking water must include: better policies for sustainable land-use management (urban, industrial, agricultural, etc.); source water protection plans that take into consideration future land use and climate parameter changes; the development of early warning systems to predict contamination peaks in raw water from treatment plants; improved treatment technologies to reduce the impacts of contamination peaks and emerging contaminants in source waters; renewal of distribution system pipes which account for potential changes in water demand and quality; and monitoring strategies for water quality and quantity from the watershed to the citizen's tap.

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MEMBRANE SELECTION FOR ORGANIC CONTAMINANTS REMOVAL FROM HARTBEESPOORT DAM WATER IN SOUTH AFRICA

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ABSTRACT

Membrane filtration of raw water obtained from Hartbeespoort dam in South Africa and spiked with four different organochlorides pesticides and three polyaromatic hydrocarbons was done using three different commercially available membranes (AFC 40, AFC80 and AFC99). The purpose was to determine important membrane characteristics for removal of organic contaminants and enhance water recovery. AFC40, a nanofiltration membrane, showed a modular structure, has 2.9% porosity and average roughness 0.76. AFC80, a reverse osmosis membrane, showed little modular structure, has 2.9% porosity and average roughness 0.79. AFC99, another reverse osmosis membrane was tight and showed no nodular structure, percentage porosity was 0.2 while average roughness was 0.67. All the membranes are hydrophilic and gave more than 99% rejection of organic solutes however water recovery was higher with AFC40 which is more hydrophilic (Contact angle 30° – 40°) and lowest with AFC99 which is less hydrophilic (Contact angle 40° – 63°). EDX results showed that AFC99 has the lowest sodium and sulphur contents. This may have contributed to the absence of modular structure, lower hydrophilicity, and its tightness. The FTIR analysis of the membranes indicated a significant presence of amides group (peak at 1650cm^{-1}) and acyl and phenyl C-O groups in all the membranes (peak at 1150cm^{-1}). The presence of ortho disubstituted aromatic group (peak at 74cm^{-1}) was observed in both AFC40 and AFC80 but not in AFC99. This is suspected to have contributed to the tight structure of AFC99. AFC40 had little effect on the conductivity of the feed water. Membranes with higher nodular structure have a higher porosity. The presence of nodular structure increases water recovery but also allows the passage of some dissolved solids, and is therefore important in the selection of membranes for organic contaminants removal from hartbeespoort dam water.

Keywords: Hartbeespoort dam, organic solutes, membranes, reverse osmosis, nanofiltration.

1 INTRODUCTION

Chemical pollution of natural waters has already become a major public concern in almost all parts of the world since it has largely unknown long-term effects on aquatic life and on human health [1]. Most of these chemical pollutants can be removed by the conventional treatment method of coagulation and sedimentation. However, the occurrence of micro-pollutants in both surface and underground water is a major concern to water practitioners all over the world [2], [3]. There are two major reasons for this, the first one is the fact that the adverse effect of these micro-pollutants is significant and the extent of damage to human is not well documented if taken through drinking water [4]. The other reason is that the conventional treatment methods may not be adequate for the removal of these micro-pollutants [2], [5]. The technology options available for the removal of these micro-pollutants are advanced treatment methods such as Advance Oxidation Processes (AOP), Granular Activated Carbon (GAC) or Membrane Technology [5]. The addition of more advanced final treatment steps (usually involving oxidation by H_2O_2 or O_3 , and granular activated carbon – GAC–filtration) is generally considered to be effective, although significant problems still arise, mainly related to saturation of activated carbon, and to toxic chemical by-products,



which may develop in the GAC filters under some conditions [3]. When a high water quality is desired, membrane processes such as reverse osmosis (RO) and nanofiltration (NF) might be used as tertiary treatment [6].

Hartbeespoort dam located in South Africa is a major source of drinking water. There is a water purification plant located near the dam which uses the conventional treatment method. However recent analysis of the dam water indicated the presence of micro-pollutants [7]. Membrane technology is being considered as an option in order to remove these micro-pollutants. The purpose of this work is to investigate three membranes for filtration of water obtained from Hartbeespoort dam in order to determine important membrane characteristics for removal of organic contaminants and enhance water recovery.

2 MATERIAL AND METHOD

2.1 Material

2.1.1 Membrane

Three membranes obtained from Xylem UK were used for the experiments. They are all made from 1,2-benzisothiazol-3(2H)-one, sodium salt. They are tubular membranes of about 32cm in length and 1.4cm in diameter. The trade names are AFC40, AFC80 and AFC99. AFC40 is a nanofiltration membrane while AFC99 and AFC80 are Reverse Osmosis membranes

2.1.2 Source and characterization of dam water

The raw water sample was obtained from Hartbeespoort dam located 25°45'09.97"S, 27°53'04.39"E, about 37km west of Pretoria and on the Crocodile River in North West Province, South Africa. Turbidity measurement was done using portable microprocessor turbidity meter HI93703) from HANNA. pH of process water was measured using Jenway 3510 pH meter obtained from Lansec. The conductivity of water was determined with conductivity meter HI8033 obtained from HANNA while Total Dissolved Solid (TDS) was calculated from conductivity values with chemiasoft [8]. The raw water was pretreated using sand filtration and ultrafiltration.

2.1.3 Preparation of organic solutes

Amdany et al. [7], found PAHs at concentrations ranged from 30.0 ng/L to 51.5 ng/L, and OCPs at 0.3 to 0.8 ng/L in the raw water obtained from the dam, organic solutes had to be prepared in order to increase the concentration of the solutes in the raw dam water. Four organochloride pesticides (OCPs) (4,4-DDT 10.4 µg/L; Heptachlor 10.4 µg/L; Aldrin 26.05 µg/L; Endosulfan sulfate 10.4 µg/L); and three polyaromatic hydrocarbons (PAHs) (Pyrene 5.2 µg/L; Naphthalene 4.15 µg/L; Acenaphthene 10.4 µg/L) solution were prepared. The preparation was done by dissolving a certain mass of the organics in either ethanol or methanol. This is because the organics were insoluble in water so each of them was dissolved in an organic solvent that is highly soluble in water. The organics were added to the raw water obtained from the dam after pretreatment.

2.1.4 Process equipment

A laboratory scale reverse osmosis pilot plant manufactured by Elettronica Veneta, Italy was used for the process experiment.



2.2 Method

2.2.1 Membrane characterization

Fourier Transform Infrared Spectroscopy (FTIR)

Fourier transform infrared spectroscopy was performed on the membrane samples using a PerkinElmer Spectrum 100 spectrometer (PerkinElmer, USA) between 500 cm^{-1} and 4000 cm^{-1} wave number.

Scan Electron Microscopy- Energy Dispersive X-Rays (SEM-EDX)

The surfaces of the membranes were scanned using Joel Field Emission Electron Microscope JESM-7600F. The virgin membranes were mounted on a double-sided carbon tape and the surfaces were coated with iridium (about 5 nm thickness) in order to make it conductive before SEM analysis. The sample was exposed to the electron beam at an accelerating voltage of 15 KV. EDX data was obtained during SEM measurement. The SEM images were analyzed with the aid of WSxM 5.0 Develop 8 [9] and ImageJ [10], for surface roughness, percentage porosity, and pore identification.

Contact angle

Contact-angle measurements for the membrane were done using Sessile drop water measurement. The equipment used was Dataphysics Contact Angle Instrument (SCA 20, OCA 15EC). This was done by depositing sessile drops of deionized water on the dry surfaces of the membranes at room temperature. Images were captured five seconds after depositing the water drop onto the sample just before measurement of the contact angles. Three measurements were taken at different locations of the membrane sample. The average was calculated to obtain the membrane's contact angle.

2.2.2 Membrane preparation

The AFC99 membrane was cleaned with a solution of 3 ml/l (70% Nitric Acid) at temperature (55°C) and was recirculated for 30 minutes. As for AFC40 and AFC80 membrane, they were cleaned with a solution of 2 ml/l (70% Nitric Acid) at temperature (55°C) and was also recirculated for 30 minutes.

2.2.3 Process experiment

The pretreated raw water was spiked with the organic solutes at the concentration (4,4-DDT $10.4\text{ }\mu\text{g/L}$; Heptachlor $10.4\text{ }\mu\text{g/L}$; Aldrin $26.05\text{ }\mu\text{g/L}$; Pyrene $5.2\text{ }\mu\text{g/L}$; Naphthalene $4.15\text{ }\mu\text{g/L}$; Acenaphthene $10.4\text{ }\mu\text{g/L}$). The water was then treated in a cross-flow laboratory pilot plant at pressures of ranges from 5 to 45bars. The flow rate was 1018 L/h. The flow diagram is shown in Fig 1. The permeate flow rate was taken against the applied pressures.

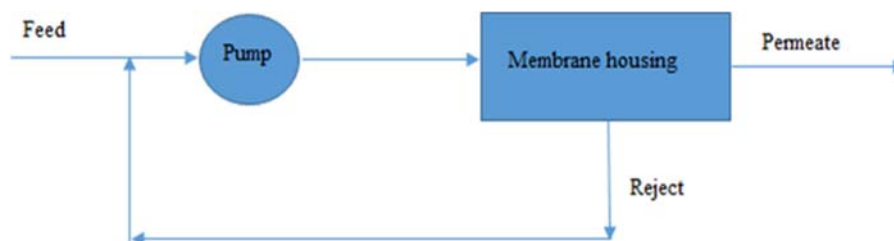


Figure 1: Flow diagram of the filtration process.

2.2.4 Organic contaminants rejection

Two 500 ml sample of permeate were taken for every filtration run conducted at 20bars. The organic solutes present in the permeate were extracted using liquid-liquid extraction. The solvent used for the extraction was 100ml of dichloromethane (99+% purity). The extraction was done three times and the process done in duplicate. Excess water was removed from the extracted solvent using anhydrous sodium sulphate (99% purity). The sodium sulphate was activated in a furnace before use. This was done by heating the anhydrous sodium sulphate in the furnace at 600°C for 72 hours. The solvent was concentrated using a vacuum evaporator to about 2ml. This was further concentrated to 0.5μL using Nitrogen gas. before being analyzed using Gas Chromatography Mass Spectrometry (GCMS). The clean extracts were analyzed for selected PAHs and OCPs by Shimadzu model 2010 plus gas chromatograph coupled with a model QP 2010 ultra, mass spectrometer (Shimadzu, Japan) using electron ionization and injected by a Shimadzu A0C-20i auto sampler. Equation 1 was used to calculate the rejection coefficient

$$R = \left(1 - \frac{C_p}{C_f}\right) \times 100\%, \quad (1)$$

where R is Rejection coefficient; C_p is the solute concentration in permeate; C_f is the solute concentration in the feed.

3 RESULTS AND DISCUSSION

3.1 Membranes characteristics

Fourier Transform Infrared (FTIR) Spectroscopy was used to analyze the chemical compositions of the three membranes by identifying the type of functional group in the active layer of the membrane. The FTIR results for each of the membrane reveal similar patterns as shown in Fig. 2. There is strong presence of saturated amides group and weak amines group in each of the membranes with equal intensity as indicated by peak at 1650 cm^{-1} . The peak results from infrared radiation absorption by C-C stretch aromatic and N-H blends in the active polyamide layer. This is expected because the membranes are made from 1,2-benzisothiazol-3(2H)-one, sodium salt, a polyamide. There is a strong presence of acyl and phenyl C-O groups in all the membranes (peak at 1150 cm^{-1}). There is also the presence of amines group with equal intensity for AFC99 and AFC40 but higher than the intensity of AFC80 (peak at 3310 cm^{-1}). There is the presence of ortho disubstituted aromatic group in each of the membranes (peak at 740 cm^{-1}) but was not observed in AFC99. This might have increased the tightness of AFC99 because Lee et al., [11], stated that the presence of substituted groups affects the membrane properties.

The qualitative EDX analysis of the membranes showed that AFC40 contain Carbon (75.31wt %), Oxygen (14.66wt%), Sodium (0.46 wt %) and Sulphur (9.57 wt %). AFC80 contains Carbon (61.19 wt %), Oxygen (11.88 wt %), Sodium (0.32 wt %), Sulphur (25.14 wt %). AFC99 contains Carbon (74.02 wt %), Oxygen (19.04 wt %), Sodium (0.26 wt%), Sulphur (6.06 wt %). It is of note that although the sodium contents of all the membranes are low, there is a progressive decrease in sodium contents from AFC40 (highest) to AFC99 (lowest). AFC99 has the lowest sodium and sulphur contents. This may have contributed to the absence of modular structure, lower hydrophilicity, and its tightness.

The contact angle is a measure of hydrophilicity of the membranes, the lower the values of contact angles, the more hydrophilic the membrane is. Materials that are hydrophilic



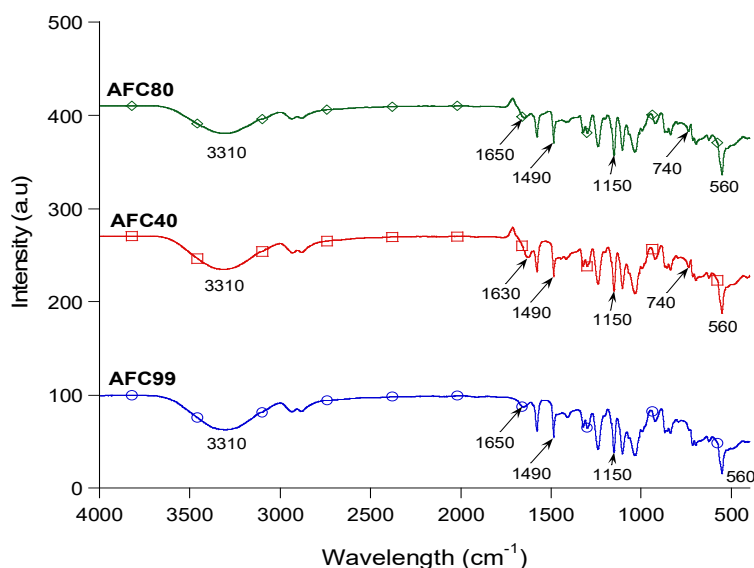


Figure 2: FTIR results for the membranes.

generally have contact angles less than 90° while hydrophobic materials have contact angles greater than 90° . All the membranes investigated are hydrophilic, however, AFC40 exhibits more hydrophilicity (30° – 40°) than AFC80 (32° – 50°) and AFC99 (40° – 63°).

SEM images are as shown in Fig. 3. Both AFC40 and AFC80 showed a nodular structure but nodules of AFC40 are bigger than that of AFC80. AFC99 showed no nodular structure. A progressive disappearance of the nodular structure is observed from AFC40 to AFC99. AFC40 a Nanofiltration membrane has the highest nodules while AFC99 a Reverse Osmosis membrane has none. However, although AFC80 is a Reverse Osmosis membrane, it has some nodular structures but not as big and as pronounced as that of AFC40. This is likely to have an effect on the rejection of solute and water flux obtained from each of the membranes. Nodular structure increases the surface roughness of the membrane [12]. The nodular structure is more pronounced when the film is formed over polysulfone blend supports [13]. The nodular structure also depends on the reaction time during interfacial polymerization [14]. For shorter reaction time, the degree of cross-linking is lower, and the “thin and loose” polyamide skin layer will allow the higher permeation of both water and salt. As the reaction time extends, the thickness and cross-linking degree of the polyamide skin layer will increase, which results in reduced water flux and increased salt rejection. None of the images showed visible pores. All the images showed a dense finely dispersed structure with AFC99 showing higher density and fineness than AFC80 and AFC40.

The SEM images were processed using ImageJ. The threshold images which separates the background from the objects are as shown in Fig. 4. The Figure showed that AFC40 is more porous than AFC80 and AFC99, while AFC99 showed a totally dense membrane. The porosity and roughness analysis of each of the membranes as determined using WSxM 5.0 Develop 8 software are shown in Table 1. AFC40 is more porous but less rough than AFC80. AFC99 has the lowest porosity and roughness, however, the porosity and roughness of each of the membranes are low.

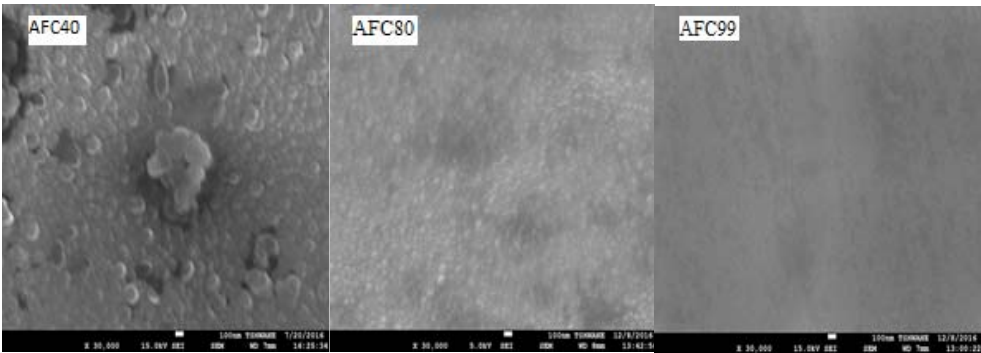


Figure 3: SEM images of the membranes at 30000x

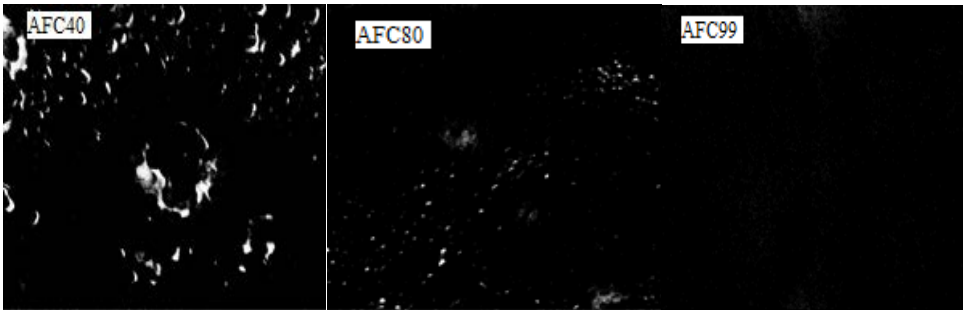


Figure 4: ImageJ threshold images of membranes.

Table 1: Comparison of porosity and roughness.

	Percentage porosity	Roughness average
AFC40	2.90%	0.76
AFC80	0.90%	0.79
AFC99	0.20%	0.67

3.2 Process water

The raw water used for the experiment was characterized for Conductivity, TDS, pH and Turbidity. The results are shown in Table 2. The Conductivity of the raw water was low and hence the low value of the total dissolved solid (TDS). This means the water is of low ionic strength [15]. The sand filtration process increased the TDS and turbidity. The ultrafiltration process reduced the turbidity significantly as expected but has no effect on the Total Dissolved Solids. The final water fed into the membranes system is slightly alkaline, it is less turbid and also has low TDS.

Table 2: Process water characterization [16].

Parameter	Raw water	Sand filtration	Ultrafiltration
Conductivity ($\mu\text{S}/\text{cm}$)	590	610	580
TDS (mg/L)	306	317	301
pH	8.23	7.97	8.22
Turbidity (NTU)	4.16	4.95	1.13

Table 3: Comparison of Conductivity, TDS, pH and Turbidity measurements.

	Conductivity ($\mu\text{S}/\text{cm}$)	TDS (mg/L)	pH	TURBIDITY (NTU)
Ultrafiltration permeate	580	301	8.22	1.13
AFC40 permeate	550	285	7.56	0.92
AFC80 permeate	500	259	7.62	0.46
AFC 99 permeate	260	133	7.42	0.38

Table 3 shows the comparison of the effect of each membrane on the Conductivity, TDS, pH, and Turbidity of the feed water. Both AFC 99 and AFC80 significantly reduced the turbidity of the process water. It is observed that only AFC99 has a significant effect on the TDS and this is due to the tightness of the membrane.

3.3 Solute rejection

The water obtained after the ultrafiltration stage was spiked with the organics before treatment on a reverse osmosis laboratory pilot plant. Results of rejection at a pressure of 20bars are as shown in Tables 4. Units are expressed in ng/L for easy comparison. All the membranes exhibit greater than 99% rejection of the organic solutes. This may be due to low porosity of the membranes and high molecular weight of the organic solutes.

3.4 Water recovery

Water recovery increases with pressure as indicated by a progressive increase in permeate flow with pressure (Fig. 5). This is expected but at higher pressure, the rate of increase in permeate flow for each of membranes dropped. This is because the ionic strength of the

Table 4: Comparison of rejection.

Membrane	Raw dam water spiked with PAH and OCP (ng/L)						
	Heptachlor 10,400	Aldrin 26,050	4,4- DDT 10,400	Endosulfan sulfate 10,400	Pyrene 5,200	Naphthalene 4,150	Acenaphthene 10,400
	Solute Concentration in Permeate (ng/L)						
AFC40	0.06	2.44	0.09	0.7	0.49	0.13	0.72
AFC80	0.13	3.91	0.17	1.69	0.77	0.44	1.65
AFC99	0.05	1.05	0.07	0.54	0.28	0.16	0.62



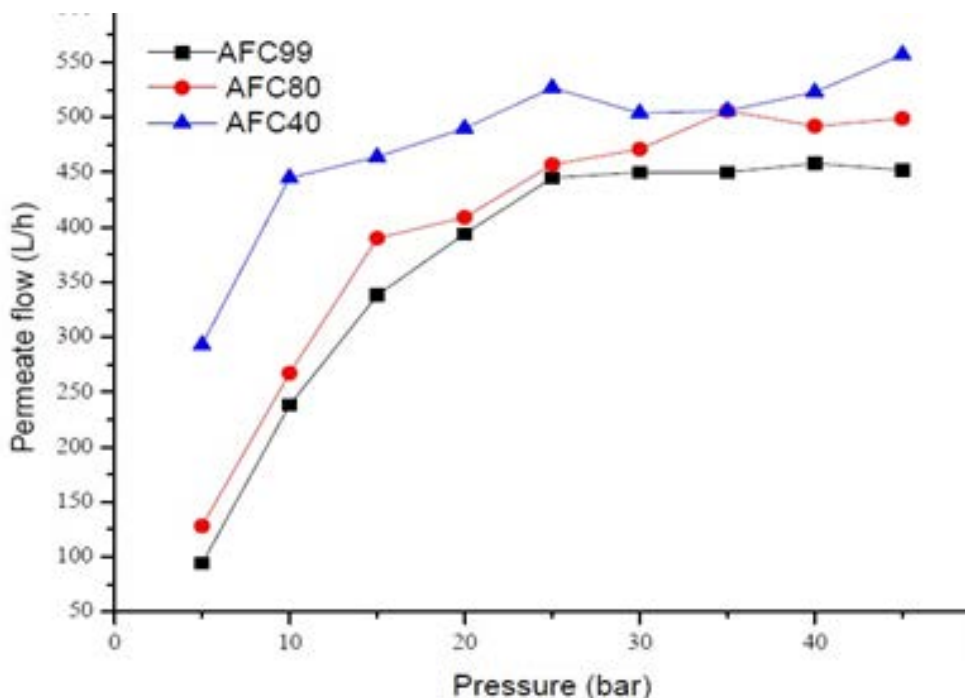


Figure 5: Comparison of permeate flow rates.

process water is low and consequently, the osmotic pressure is also low. This means high pressure is not needed for the filtration process. Fig. 5 actually showed that a pressure greater than 20bars is not needed. Generally, AFC40 showed higher water recovery than AFC80 and AFC99. This may be due to higher porosity which is attributed to the nodular structure of the membrane. The fact that the membrane has high hydrophilicity may also contribute to increase in permeate water flux.

4 CONCLUSION

All the membranes showed a significant presence of amides group because the membranes are made from polyamides. EDX results showed that AFC99 has the lowest sodium and sulphur contents. This may have contributed to the absence of modular structure, lower hydrophilicity, and its tightness. The presence of ortho disubstituted aromatic group (peak at 740 cm⁻¹) was observed in both AFC40 and AFC80 but not in AFC99. This is suspected to have contributed to the tight structure of AFC99. All the membranes are of low porosity and roughness. However, AFC40, a nanofiltration membrane, has a high nodular structure which causes an increase in porosity. AFC40 has higher porosity than AFC80 and AFC99 and gave highest permeate water flow. All the membranes gave adequate rejection of the organic solute although AFC40 has little effect on the conductivity of the process water. The nodular structure in AFC40 and its high hydrophilicity may have increased permeate flow, but the nodular structure allows the passage of some dissolved solids. The presence of nodular structure is important in the selection of membranes for organic contaminants removal from hartbeespoort dam water.

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Sustainable Development and Planning IX

*Edited by: C.A. BREBBIA, Wessex Institute, UK; J. LONGHURST, University of the West of England, UK;
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Containing papers presented at the 9th International Conference on Sustainable Development and Planning this volume brings together the work of academics, policy makers, practitioners and other international stakeholders and discusses new academic findings and their application in planning and development strategies, assessment tools and decision making processes.

Problems related to development and planning are present in all areas and regions of the world. Accelerated urbanisation has resulted in both the deterioration of the environment and quality of life. Taking into consideration the interaction between different regions and developing new methodologies for monitoring, planning and implementation, new strategies can offer solutions mitigating environmental pollution and non-sustainable use of available resources.

Energy saving and eco-friendly buildings have become an important part of modern day progress with emphasis on resource optimisation. Planning is a key part in ensuring that these solutions along with new materials and processes are efficiently incorporated. Planners, environmentalists, architects, engineers and economists have to work collectively to ensure that present and future needs are met.

The papers in the book cover a number of topics, including: City planning; Urban architecture; Regional planning; Sustainability and the built environment; Environmental management; Cultural heritage; Quality of life; Sustainable solutions in emerging countries; Sustainable tourism; Transportation; Community planning; Timber structures; Governance; Socio-economic issues; Mobility in the city; Energy efficiency; Education for sustainable development; Case studies; Sustainable development indicators.

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