SUSTAINABLE HABITAT: LITERATURE REVIEW AND INSIGHTS

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ABSTRACT
This study focuses on different forms of housing in Tunisia and their various types of construction. It seeks to better understand the phenomenon of traditional and modern housing for the purpose of potentially reshaping the way we build in a particular context. This study provides a realistic solution for accommodation, and it explains how to think about housing differently in order to live together more effectively and to reflect an ideal evolutionary and ecological approach to architecture for future living spaces. This research shows that housing can reflect new social and community lifestyles and can also develop and adapt to economic, environmental, and social needs. Furthermore, the basic premise of the city of the future is to involve humans with the design process and to develop social exchange by promoting social connectivity around concepts for new design intentions such as smart buildings that are connected, modular, eco-responsible and respectful of the environment.
Keywords: living collectively, grouped housing, evolutionary approach, adaptability, ecological.

1 INTRODUCTION

Shelter is a basic human need that is crucial for survival. It provides security, personal safety and protection. Adequate housing provides people with the opportunity to lead normal lives and to establish their place in a community. We all carry the need "to be and do with space" [1]. Since the dawn of time, inhabiting a space has been one of the major human concerns that has generated, throughout the history of humanity, several possibilities for housing and shelter while integrating it into nature. In fact, humans deployed their intelligence in order to build their living space by adapting it to the environment and the climate [2]. From the caves of the nomads to the buildings of the 20th century, habitat has never ceased to reinvent itself to respond to human needs under different conditions. Between the traditional and modern structures, they both represent pioneering fronts in ways of living and valuable responses to different contexts.

However, what does inhabiting mean? What are the various forms of housing in Tunisia? How can we improve the current situation of this heritage, and what is the ideal image of housing for the future? How can we design a scalable and adapted housing model? How can we rethink the status of the individual house? How can we live collectively?

2 TUNISIAN CONTEXT

As is seen by its architecture and the way of occupying the space in different geographical areas, urban housing in Tunisia is a response to a specific context by adapting it to the environment as well as to the climate. The climate has a considerable influence both on the type of the materials available in each region and on the type of building itself in order to guarantee adequate housing for the site and the way of living of its inhabitants. Nowadays, the development of technologies has generated new materials and new forms of implementation. They do facilitate daily life, but unfortunately, they are neither environmentally friendly nor suitable for society's needs.

2.1 Habitat adapted to the environment

Through analyses of the Tunisian context, housing has taken several forms. They used to be simple shapes (either squares or rectangles) such as houses with patios in the medinas, the vernacular Djerbian houses and the troglodyte constructions in Matmata, etc. The forms of habitat have always been diversified and their characteristics have always been very particular and unique, but very well adapted to various climates (arid, Mediterranean, etc.) and different geographical contexts (mountains, desert, seacoast, etc.). In the case of Matmata in Tunisia, its troglodyte people took advantage of the area's topography to build shelter underground by digging into the rock on the mountainside or by digging vertically into the earth and creating large wells.

In these regions, temperatures climb to unreasonable heights, so their inhabitants utilized construction methods to create shade and increase coolness [2] through (1) earthen and stone structures well known for heating up slowly during the day and cooling down slowly at night; (2) structures with thick walls with only a few small openings in order to maintain a relatively stable interior temperature; (3) the white facades and domes that reflect ultraviolet rays; (4) narrow streets and closely placed houses that are organized to reduce the surface area of the walls exposed to the sun in order to decrease the temperature inside the house and provide shade outside; and (5) patios (the houses built around inner courtyards which existed in Mesopotamia, 6,000 years ago, and which we find in Egypt, China, Greece, the Roman Empire and in South America), allow a microclimate inside the house and four walls protect it from the sun. This space maintains fresh air throughout the day that has accumulated during the night and filters the direct sunlight to the interior using the Mashrabiyas. The freshness of the patios is reinforced by the presence of water fountains and plants. As for roofs, similar to patios, they are dedicated to exchange between family members and neighbors where they meet, eat and even sleep when the nights are too hot. The roofs are also considered a livable exterior space. Overall, the traditional Tunisian habitat is an interesting example of an ecological and bio climatical architecture. It reflects not only living collectively, conviviality, solidarity and exchange between inhabitants but also a specific culture and architectural identity.

Figure 1: Traditional house with inner courtyard [3].

2.2 Standardized modern housing

Nowadays, structures have taken on complex and sophisticated forms as the results of adding or subtracting simple forms such as colonial houses, villas, apartment buildings and slums. Today's housing in Tunisia has several advantages such as vertical extensions, contemporary features, comfortable equipment, and high security features. Unfortunately, the way we currently think about collective housing has negative consequences. It is difficult to find accommodation in the metropolitan areas. The spaces are small and not affordable. The housing model is standardized, there is a lack of identity and social interactions, and it does not promote cohabitation and social collectivity.

The same building model is designed all over the continent. It is not related to geography, history and location. On the one hand, it is only a question of standardizing apartments in buildings, and on the other hand, of juxtaposing individual houses over kilometers. Additionally, existing buildings are demolished, and natural spaces are destroyed in order to apply the current model. Nowadays in Tunisia, housing is often the adaptation of the European, modern, universal model to different constraints within global typologies. The only interest is for facades and the outer shell. The main goal is to design the shell of the project in order to create a striking and attractive facade and ignore the rest of the design process. This approach tends to reduce the current housing model to a standardized design, disconnected from its context. It does not take into consideration the two fundamental elements of housing such as the inhabitant and its context. While they are not totally ignored, they are in fact involved in an abstract way and as quantitative criteria. They are known as modern buildings in reference to "Le Corbusier", but they are not on stilts, do not utilize an open plan or long windows, nor an outside terrace. They are built as quickly as possible on vacant sites without taking into account urban planning policies. Architects are asked to build small cubes at a given location with a given number of floors, given facades, standards with a series of constraints that limit creativity and new ways of thinking. It is in fact an absolute design cloning by using software to design a building that uses the same process and only modifies a few parameters from one design to another. Today, we are facing homogenization, standardization, and insensitivity in our approach to urban housing, resulting in a loss of cultural identity.

Figure 2: Collective habitat in Tunisia [4].

Rym Zaabar, general architect, in the urban planning department of the ministry of equipment, affirms that urban planning tools do not make it possible to take into account the differentiated situations of cities. Too prescriptive and standardized, they lack the flexibility needed to adapt to local specificities. The result is due not only to a lack of political will and involvement of civil society, but also to the absence of planning tools commensurate with the issues in question [5]. Bessaad confirms that operational urban planning tools are standardized and do not sufficiently take into account the diversity of situations and realities. The PAU is more like an urban planning document. It is a very rigid document with binding provisions. The revision process, extremely long and complex, weighs down and even slows down, the slightest modification [6].

Nowadays, we are questioning the design process of housing. It is often neither adapted to social and demographic changes, nor adapted to climate issues. Therefore, it is necessary to revise our habitat design process so that it can respond to the actual economic, environmental and social needs. In this regard, the main questions are the following. How to offer collective housing with higher quality of use and flexible standards for individualized homes? How to rethink the status of the individual house and living collectively? How to reinvent the way we live and how we build? How to involve inhabitants within the design process? How to think about urban density in a sustainable way?

3 TOWARDS AN EVOLUTIONARY APPROACH TO ARCHITECTURE

Establishing sustainable and treasured cities is not a luxury requirement but a right for every citizen, and this vision engages the architect within the design process in regard to the urban environment. Due to a variety of new research and perspectives about the concept of habitat, some reflections have revolutionized the way of living and building around the world. These reflections have tried to improve and renovate the habitat of today as well as to promote living together and making urban housing flexible for its inhabitants and adapted to the evolution of families and to climate changes.

3.1 Reliving the past and involving people within the design process

The architect is asked to design and get the inspiration from the past and to understand the present to conceive the future. To continue to build and renew without expanding, this is the challenge of the cities for the future. That is why the renovation and expansion of buildings are becoming options increasingly considered by project owners. Solutions can make it possible to build affordable housing, but also can offer new perspectives for old buildings. “Not to impose, not to destroy, but rather to reveal, consolidate and improve”, this is the belief of the architect Christophe Hutin who for more than 20 years has been critically reflecting on the evolution of the city and its systemic exclusion and segregation within habitats [7]. His main goal is to help residents regain control of their built environment to better appropriate their cities. This will enhance better living, sharing and social exchange.

Such is the example of the project entitled “Transformation of 530 dwellings Grand Parc Bordeaux”, which won the EU Mies Award, and was realized by Lacaton and Vassal Architects, Frédéric Druot Architecture and Christophe Hutin Architecture. These three architectural firms managed to transform the apartments and improve space and services while keeping construction costs as low as possible; so much so that it was not necessary to increase the rent for tenants – but above all, the residents were not forced to leave their homes during the work, thus minimizing the inconvenience. The architects also provided the apartments with balconies and verandas, considerably increasing the amount of natural light in each unit [8].

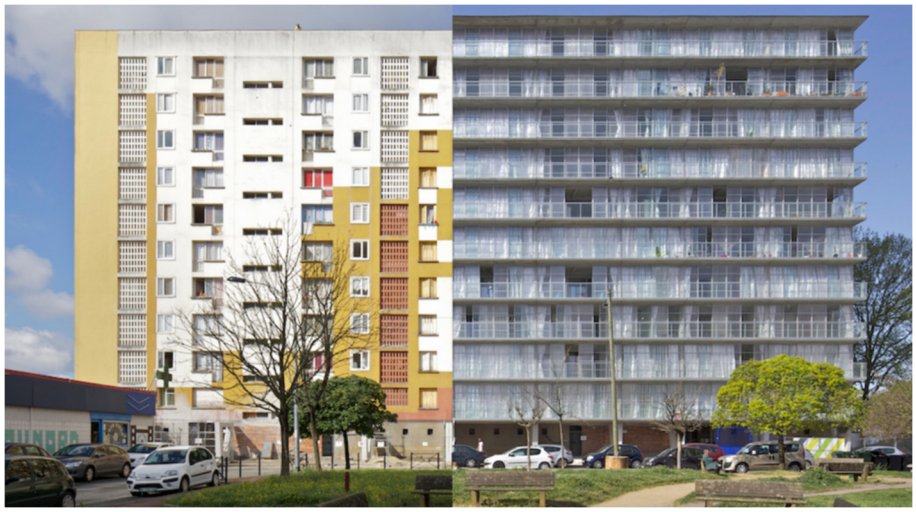

Figure 3: Transformation of 530 dwellings by Lacaton and Vassal, Druot, Hutin, Bordeaux, France, 2017. *(Source: Lacaton and Vassal Projects.)*

Christophe Hutin also tried to reinvent the profession by not finishing the project, and it was up to its inhabitants to write their own story and finish conceiving their homes. According to Hutin, a flexible and simple architecture allows appropriation. Hutin involves the inhabitant within the design process. In Bègles, for example, with his collaborators, he thought of a project with a vertical subdivision, creating a shelf for houses. A minimalist concrete structure integrating canalization and piping giving the opportunity to its inhabitants to build their own houses in a restricted volume. They designed a concrete structure so people could buy a volume and build a two-story house with an architect or to do a self-built [9]. From an economic point of view thanks to this project, it is now possible to buy real estate in an urban environment at the equivalent price of a plot of housing estate far from the center. This project is about individuality, not to be confused with individualism. It provides a home that is appropriate for human needs while contributing to a comfortable, dense and accessible city; a place where we spatially experience our individuality on a daily basis, but also our relationship with others, family, neighbors, neighborhood and the society in general.

Figure 4: The highlands by Christophe Hutin [9].

Building with the people and for the people was the main concern of Hassan Fathy, precursor and visionary of vernacular architecture, at the service of human beings [10]. Hassan Fathy developed a whole philosophy of living based on the reuse of ancestral construction techniques in order to design a new vernacular language. This architecture involves humans with the design process. Fathy affirms the value of the identity of each country or urban space and its unique character to ensure a unique habitat specific to each context. That is why he proposed the reuse of old construction methods to build the village of Gourna by using innovative construction processes and guaranteeing the authenticity of the local architecture and the cultural values of the village.

Rethinking housing design begins with understanding the lifestyles of its inhabitants and its environment by taking into account the climate, culture and the local materials available on site, making them an asset. In fact, the climate has a considerable influence on the type of building and materials in each region. Additionally, this allows for effective ergonomic and thermal management of the space.

3.2 Living collectively and developing social exchanges

Due to the housing crisis, demographic growth and ecological and economic crises, it is essential to rethink expensive housing, which can be standardized and disconnected from its environment, and consider new forms of grouped housing. In fact, grouped housing promotes living together, cohabitation and social exchanges between inhabitants. Co-housing, grouped housing or participatory housing are new ways of living collectively. It is in fact, highly developed in Europe. Living together and shared housing are the basis for each project. From kangaroo housing to senior-student shared accommodations or inter-generational buildings, there is a need to think about housing with elderly people and not just for the elderly. Let's consider a group of people (elderly people, young couples, families, singles) who want to live in affordable housing on a low budget in a good location that is eco-responsible and that can evolve with the needs of each family. They can live in a community, share life between themselves and be promoters of their own projects. The cooperatives are formed not only by an architect to design the project and lead the construction site, but also by a project management assistant to lead the project [11]. In cooperation with these experts, the future inhabitants meet regularly to create their residence and promote living together in individual houses. They all agree with this principle of life by acting responsibly and inventing new uses and shared spaces. It is a way of living based on social diversity and exchange between neighbors with a common house "meeting place": a way of life based on human dimension of sharing expertise and transmitting it from one generation to another. They know each other very well. It is a collective habitat where they share a lot of conviviality, solidarity and a neighborhood. Sharing your home means sharing a large garden, a common house, a reception room, a collective laundry room, etc. These solutions can only strengthen the social exchange.

I cite the example of the K'hutte building and its colorful balconies, located in the Brasserie eco-district in Cronenberg. It is the largest building built in self-promotion, consisting of 23 apartments on five floors. Depending on the wishes of the inhabitants and their means, the project responds to a common desire to promote sharing, benevolence and social diversity [12].

These participatory habitats revolt against the traditional form of buildings, towers, and skyscrapers of collective housing. Another example that I find revolutionary in its time is Habitat 67 in Montreal at the Cité du Havre, in Canada, designed by the architect Moshe for

Figure 5: K'hutte, Participatory housing, Strasbourg, 2015 [12].

the 1967 World's Fair [13]. The architect, only 23 years old, said that Habitat 67 is really two ideas in one. One is about prefabrication and the other is about redesigning apartment buildings in the new paradigm. He succeeded in creating a new housing typology that is both efficient and adaptable to the site. Habitat 67 pioneered the integration of two housing typologies: the suburban garden house and the economical apartment building. He explored the possibilities of prefabricated modular units to reduce housing costs and enable a new housing typology that could incorporate the qualities of a suburban home into an urban tower.

3.3 Adaptive lifestyles

Today, we live in apartments built more than 40 years ago. Since then, lifestyles have changed and so has our way of occupying space. The evolution of mores and family models as well as ecological and economic crises lead to the evolution of the habitat to follow the rhythm and adapt it to family changes such as births, aging and anticipation of a reduced income or a disability [14]. Nowadays, the pandemic has changed the purpose of buildings by transforming houses into offices or a place of education. Facing this reality, Éric Cassar "Habiter l'infini", tried to re-question the ways of living. It is based on the one hand, on past and present experiments (shared housing, participatory housing, etc.) and on the other hand, on the opportunities offered by the progress of technologies and techniques [15]. He said, "If we succeed to better manage this time layer on the space layer, we will certainly find space". Housing in infinity means reducing the intimate sphere of the apartment and adding shared spaces (either all together or one after the other). This gives the impression that we live in spaces larger than reality. The space is flexible by renting out part of the accommodation, allowing people to reserve a space via smart phones and internet applications. People are connected, the whole city is connected and thus, we are talking about "smart buildings" and "smart cities".

It is an inter-generational shared housing model. It is neither a participatory habitat nor a community habitat but a habitat where the area of the intimate sphere is reduced in favor of shared spaces managed by digital technology. This increases both the living space and its uses in order to promote social exchange between inhabitants. The modular, recyclable and

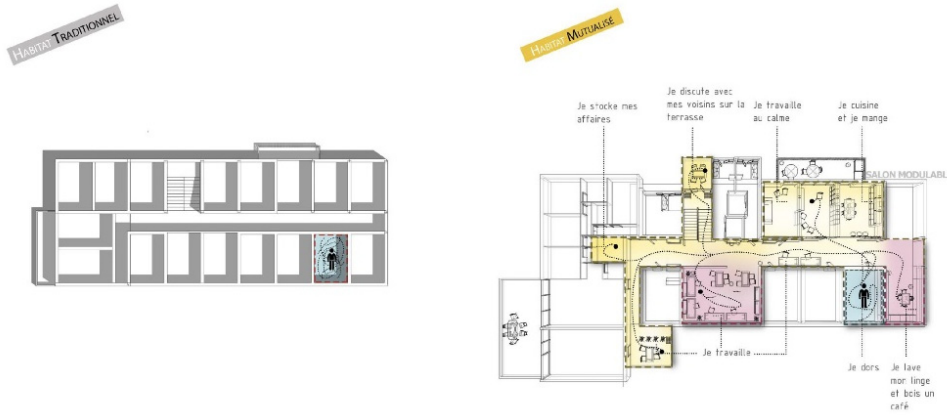

Figure 6: Living in infinity by Éric Cassar [15].

movable habitat is a solution that offers more flexibility to the space. For example, imagine the possibilities available by adding an extension and then changing the use of it or moving the wall partitions in order to make the building evolve according to the needs and to change vocation of the building over time.

4 TOWARDS AN ECOLOGICAL APPROACH TO ARCHITECTURE

Nowadays, the issues discussed are often about housing as well as neglected and non-ecological cities. This crisis must encourage public authorities and architects to build differently and to design cities differently. There is also an interest in living environments that have for too have been neglected until recent times. Due to weeks of confinement following the epidemic, this has affected the relationship between citizens and their place of residence and work, especially those who live in apartments without a terrace and without outdoor spaces.

Nowadays in Tunisia, everyone has ancestors who live in the countryside. Having a small house with landscaping and a small garden has become a dream for every citizen. Therefore, the concept of the "RubixHome" by the architect Thierry Rampillon of the CR&ON agency, "Terrace for all" brings the village to the city and integrates nature within the city [16].

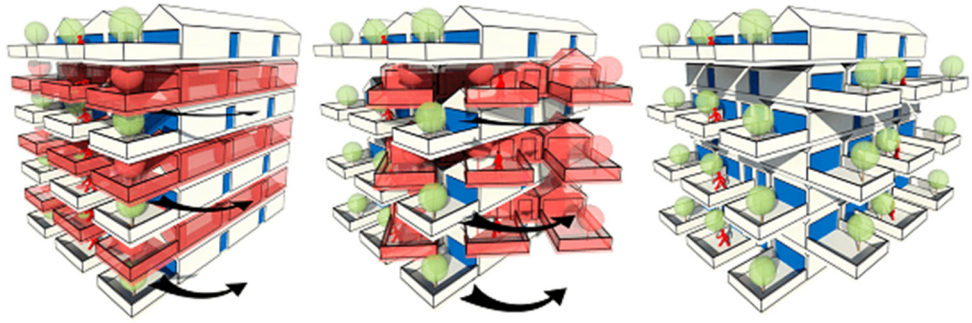

Figure 7: Rubixhome, new generation of collective housing [16].

Inspired by plants with leaves that are arranged in staggered rows to capture the sunlight, the Rubixhome concept provides buildings with terraces organized throughout the entire structure, offering 25m^2 of open air to each resident at affordable costs. The staggered organization of the terraces is created in order to superimpose large terraces over the entire height of the building and reduce the sunlight. The staggered arrangement has many benefits. First, the advantage of having a terrace on every two floors allows the sunlight to pass through. Second, the Rubixhome buildings face southeast or southwest. In summer, the sun can be a source of excessive heat, but its heat is tempered by the shade generated by the terrace above. In winter, the sunshine dives into the apartments and make it warm. Adding to this bio climatic arrangement are terraces of deciduous trees, which provide shade in summer and allow the sunshine to pass through in winter.

CR&ON Architects agency proposes a project under study "îlot B4", within the ZAC Vigny Musset in Grenoble. This project, with 37 housing units, is based on the Rubixhome concept. Each unit in the tower has a living room, kitchen, terrace, indoor–outdoor space of 50 m^2, united by a continuous floor without a threshold and a 3 m wide bay window. The arrangement of these staggered terraces offers a height of 5 m under the ceiling of the terraces. The organization of the housing is based on an economical and efficient construction system structured according to a basic plan of three circles: a vertical interior distribution, a circle of interior spaces and a circle of exterior extensions [17].

Figure 8: Îlot I B4, ZAC Vigny Musset, Grenoble [12].

In fact, a habitat that respects its environment uses the natural resources within the design process and integrates sustainable development technologies. It is necessary to take into account the location, the orientation, the architectural form, the interior design organization and the technologies in order to succeed in re-regulating the climate and living in symbiosis with nature. Plants are a climate regulator (protection against sunshine in summer and

protection against rain and wind in winter); they protect the south facades with shade and filter dust. They also protect against hot wind and oxygenate the air. Ecological housing is the main concern of housing construction for the future. It means building intelligently and ecologically, capturing natural light, using efficient insulation, controlling the temperature and utilizing landscape design. Some architects design housing using local materials while others conceive of ecological neighborhoods that respond to the needs of its inhabitants "to live, work, have fun, and move around while still respecting the environment".

This architecture is linked to nature and its components by considering the natural environment within the design process. Moreover, it allows for dialogue between human beings and the natural environment by simulating different emotions and sensations. Opacity and transparency, natural and artificial light, outdoor and indoor spaces and landscape are the fundamental components of housing towards a sustainable and eco-responsible approach.

5 CONCLUSION

Finally, through unique reflections, research projects and achievements, experts (architects, urban planners, designers, engineers, economists, promoters, sociologists and philosophers) can respond today to live tomorrow. Several solutions could be taken into account to improve the city for the future; at the habitat scale, to improve the living conditions, as well as at the urban scale. There is a need to integrate landscaping and provide new solutions for a modular, recyclable, movable architecture which is respectful of the environment with a low energy impact. The city of tomorrow must offer quality of life and involve its inhabitants within the design process, and it must be smart, connected and eco-responsible. The challenge today is the complexity of life, which means we all share different lives, different social status, different generations living under the same roof in the same city [18]. The city of the future should offer modularity to respond to the complexity of our life paths: a life where you can both live and work. A multifunctional architecture, connected to its environment, involves its inhabitants, develops social exchange, and fights against exclusion. It also integrates new technologies and new uses and provides a better service to individuals. Housing for the future should be environmentally friendly and easily accessible with a mix of uses. The same building can change its uses during the same day or the same period by adapting it to social change. The city of the future promotes social and cultural exchange and integrates technology. It is completely responsible to the environment by developing actions against the danger of climate change towards a low-carbon city. Considering these solutions will have positive effects on the user and his well-being because a valuable architectural structure can only produce a valuable citizen, even a fulfilled and united society. This architecture responds to specific context as well as the needs of daily life.

REFERENCES

[1] Simay, P., *Living in the World*, Actes Sud/ARTE edition, p. 256, 2019.
[2] Jonas, A. & Rihn, L., *Living in the World*, de la Martinière Jeunesse, p. 69, 2019.
[3] Viviane, B., *The Medina of Tunis: A City of the Arabian Nights*, Edition Gallimard: Paris, 2007.
[4] Ben Abdallah, H., *Entre-soi et repliement social ou les nouvelles formes de sociabilité, Le cas d'Ennasr II à Tunis,* pp. 89–105, 2009.
[5] Ben Ayed, A. & Turki, S., *Round Table: The Urban Quality of your Cities, Under Discussion*, Archibat No. 34: What future for our cities? p. 45, 2015.
[6] Bessaad, J., *For a New Housing Strategy*, Archibat No. 34: What future for our cities? p. 55, 2015.

[7] Hutin, C.H., *Communities at Work*, Catalog of the French Pavilion of the Venice Architecture Biennale, 320 pp., 2021.
[8] Floornature, Transformation of 530 dwellings Grand Parc Bordeaux wins EU Mies Award, 2019. https://www.floornature.com/transformation-530-dwellings-grand-parc-bordeaux-wins-eu-mie-14609/#.
[9] Hutin, C.H., The highlands by Christophe Hutin. *Architecture Review Today*, AA no. 433 – Social housing, a French exception? 2019.
[10] Fathy, H., *Building with the People*, Sindbad, Éditions Actes Sud, 305 pp., 1996.
[11] What exactly is participatory housing? France 5. www.youtube.com/watch?v= JoWurnfiheE, 2015.
[12] Parasote, B., *Participatory Housing for 20 Families*, La Maison Écologique no. 93, 2016.
[13] McIntosh, A. & Carter, J., *Habitat 67*, L'encyclopédie Canadienne, 2018.
[14] Bazin, B., *Towards Modular and Scalable Housing*, LinkedIn, 2021.
[15] Cassar, É., *Living in Infinity, New Habitat in the Digital Age*, Arkhenspaces, 2015.
[16] Rampillon, T., Rubixhome, new generation of collective housing. *UP Magazine*, 2015.
[17] Creon.archi, îlot I B4 – Zak Vingny Musset – 37 Logements à Grenoble. http://www.creon.archi/6-projets-a-la-loupe/ilot-i-b4-zac-vigny-musset-38-logements-grenoble/.
[18] Urban Revolutions: The Smart City according to Carlo Moreno, Daniel While, Véronique Pappe, Charles Ragons, Fabien Cauchi, 2019. https://www.primonialreim.fr/fr/revolutions-urbaines-la-smart-city-selon-daniel-while-episode-2.