Planning the rural-urban interface under sustainable principles: a methodological proposal

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Abstract

Among the problems that cities face are rapid growth and dynamics in the peripheral and suburban areas of medium size towns, characterized by mixtures of residential neighborhoods and squatters' settlements with wide differences between levels of urbanization and public services. There is also an important flow of commuters, loss of productive and conservational lands and management among several municipalities. Thus the objective is to present a methodological proposal to address the rural-urban interface from a sustainability perspective. To achieve this, six issues were considered: migration and socio-demographic changes, economic growth of the city-region, urban mobility and residential change, settlement morphology and functions, use and depletion of resources and urban and environmental management.

Keywords: sustainable cities, urban environmental planning, peri-urban interface, rural urban fringe, urban environmental assessment.

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1 Introduction

Rural-urban migration, together with industrial development, has originated positive impacts in cities with regards to achieving better life conditions. As a contrast, it has negatively impacted the areas it interacts with, considerably modifying the landscape and its qualities. These processes and environmental impacts worldwide have been increasing due to the fact that the urban population is continuously growing – from 33% in 1976 to 50% in 2007 [1].

The United Nations has pointed out that urban growth trends are going to be maintained according to the current urban development policies they are promoting. It is estimated that by 2050 urban population will represent 66%. This situation will affect the labor market and the need for infrastructure and public services in the different cities of the global urban network.

Those cities that show the highest growth rate are large metropolis and mid-size cities. They are the ones facing a rapid change in even shorter periods of time. Those changes are concentrated in the city surroundings, which are the ones that suffer the most significant changes with different urban expansion patterns.

The perspective of urban centers as isolated objects has recently changed; nowadays cities are seen as open systems that keep different relations with their hinterlands to produce networks among them. Thus urban centers are aware of the inputs they need from other places to cater different population demands, as well as the outputs they have produced like goods and services and the negative impact of pollution over the territories. These interactions or exchanges are key concepts within sustainable development, besides the integration of social, economic, environmental and governance factors into the analysis of contemporary cities. Another element to take into account is technological change in the communications field, it has facilitated the access to different goods and services which has allowed a decrease in commuting, transportation time, and has also fostered distance working.

As cities expand their territories, they will face the challenge of land use planning and management with other municipal, state, or international administrative jurisdictions, which regularly differ in their objectives, goals, priorities, economic and human resources. As well as to deal with governments from different political ideologies, thus making the common regional land use planning more difficult. In addition, the rigidity of bureaucratic systems and time consuming procedures to make and approve urban and regional plans, both surpass the ability of local authorities to supply public utilities and services for a growing population.

The present work tries to deal with this ever changing framework, whose purpose is to design an instrument that will be able to analyze and assess the dynamics of the rural-urban interface in mid-size cities in order to implement strategies and actions for the planning and management of such areas. This document is structured in two sections: the first section is a review of the work done by different authors on the topic of the rural-urban interface and their problems from different disciplinary perspectives. The work done in the first

section had made easier the identification of main topics and variables to carry out the analysis and assessment of the rural-urban interface. Meanwhile the second section concentrates over the design of the methodological proposal, working on a list of variables to be analyzed and over the design of the survey.

2 Rural-urban interface

The development of cities is a result of processes that have taken place throughout history and consolidate through time regarding the levels of urbanizing, but cities have the need to expand and grow to consolidate once again mostly in areas close to the cities. These criteria followed certain rationality in decision making based on the infrastructure supply, public services, and means of transportation under a central city form. This rationality is transformed by the demographic dynamics and the urban expansion on the rural-urban fringe that exert external pressures from global economic restructuring, demanding a fragmented development of manufacturing processes, technological changes in production processes and the development of human settlements, the progress in the fields of communication technologies and transportation which contribute to decrease friction in the territory, as well as considering the regional and local social-economic pressures [2].

Parallel to this change of continuous expansion in the cities has given place to the expression of another urban morphology that goes from being a central city to being polycentric; whose growth patterns can take the forms of conglomerate clusters, archipelagos, spine and corridors. Expansion areas are farther and with diffused limits, this transformation of the cities has strengthened and promoted the construction and consolidation of networks between cities [3].

It can be seen that the growth and morphology of contemporary cities according to this new rationality, has had a direct impact in the speed and intensity of the changes in different urban hinterlands that demand to be addressed with different policies for planning and management of resource preservation and development.

There are several ways of referring to these zones: metropolitan strip, rural-urban fringe, rural-urban continuum, metropolitan peripheries, rural-urban interface, suburban areas, expanded peripheries and peri-urban areas. But what they have in common is that they are "transition zones or interaction zones, where urban and rural activities are juxtaposed, and landscape features are subject to rapid modifications, induced by human activities" [4]. It means a particular pattern of inconvenient land use mixtures that mark the territory which have to be improved in the future. Besides, these areas due to the proximity to cities, they have to cope with pollution, environmental risks and disruption of habitats or productive lands.

Another point of view over the rural-urban interface is provided by Gallent and Shaw [5] that they have seen these areas more as an opportunity for planning rather than as problems, since they offer a bridge between the urban and the rural or as an entrance and exit to the city. This space can be planned in order to establish health centers, education facilities, recycling and renewable energy

production centers, productive landscapes, cultural or historical heritage, a space for the preservation of natural resources, spaces for recovery and regeneration, as well as housing and industry spaces.

The common denominator in every definition is that they are areas that present significant short term changes, continuously evolving areas, they do not have fixed limits, and they have two dynamics: whether it is for the growth along areas that tend to connect in the city and for the absorption of rural settlements due to the expansion of the urban area.

Several authors are certain that the rural-urban interface is characterized by the following problems:

There is a mixture of land uses that usually conflict with each other: industrial, residential, commercial, recreational, infrastructure, productive, and preservation; along with the fact that they are areas with low levels of infrastructure and public services. We might say that they are unplanned zones from the ecological, productive, and human settlement perspectives.

Cities or settlements that function as dormitory spaces, due to the every day commuting of their inhabitants to their workplaces in the central city. Such settlements usually do not have public transportation services and rely on private transportation in order to commute, thus increasing the level of motorization and vehicle overload on the roads.

It is a heterogeneous space socio-economically speaking since precarious and high level residential settlements interact in it. The urbanization levels in such settlements vary greatly, and there is also the issue of illegal land ownership.

Another feature is environmental degradation due to land, water, and air pollution as a result of the waste produced in the central city, along with those that are already established in the area or new developments located there. There is also a habitat fragmentation due to roads and different types of infrastructure lines, low densities, location of warehouses, derelict extraction areas, city dumps, abandoned buildings, low-quality constructions, noise production by several land uses and the location of special urban services like federal o state prisons or risk facilities. It is also common to find human settlements or certain developments placed on areas that are vulnerable and subject to risk.

New developments tend to occupy areas with little or insufficient regulations together with the fact that the decisions that are made are fragmented offering a short term view and little or non-existent coordination with the government. Such process has produce areas with a high urban growth in even shorter periods of time. Despite this rapid growth not enough jobs are being created for the immigrating population.

These areas are subject to two types of policies: on the one hand we have those that promote economic development in these areas, based on new uses of the land or the relocation of those activities that pose a risk for the population in consolidated urban areas. On the other hand, we have weak agricultural and environmental preservation policies to sustain productivity and environmental quality, where both cannot compete against economic pressures from developers increasing land values.

When a city expands there is a jurisdictional conflict with other authorities. This situation complicates planning and management in these areas since several authorities are involved in the territory and they lack coordination. At the same time, they also face financial problems since actions and resources are channeled by sectors without an integrated perspective of their problems.

The process of population expulsion towards the hinterlands, whether it is by social pressures product of migration, or due to industrial or housing development projects, bring decadence problems to the central areas in the city.

Lastly, the rural-urban interface represents dichotomy areas that do not have the same level of information to cover environmental, social, and economic aspects. The lack of data means higher costs for local authorities at the time to make the planning and management of small towns.

3 Methodology

In order to define the methodology of the rural-urban interface project, we considered the city-region concept posed by Breheny and Rockwood [6] and afterwards developed by Ravetz [7] to deal with sustainability assessment (figure 1). This is an approach that despite the fact it is not specifically suggested for the study of the interface, it does analyze different interactions that the city has with the hinterlands regarding the flows taking place, besides the comprehensive view of planning and management within the sustainable development framework. In addition, this proposal is enriched by the experiences developed in other rural-urban interface studies that have been previously cited.

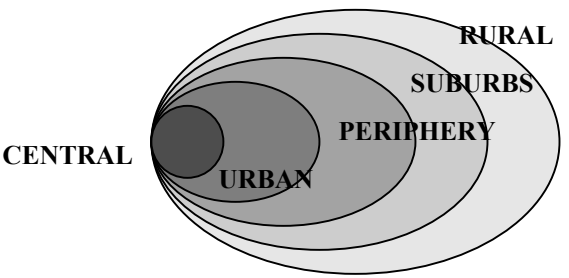

Figure 1: The city-region concept shows different spatial interactions.

The methodology has selected and adapted several indicators to the availability of local statistical information produced by censuses, along with other government institutions. However, as any other research project it will have to face the lack of local information at a municipal level for rural populations located on the interface. To address this problem, a survey was designed to be applied in the interface area so that it will be statistically representative.

Variables were classified according to six main topics covered in the literature reviewed shown in table 1:

a. *Characteristics of the Population:* Migration towards the cities is a key issue in this type of studies. Then it is important to make a social and demographic profile of population. Information that is valuable to produce different levels of well-being and social exclusion considering socioeconomic variables, together with the conditions in which the housing and the services are. Data will be obtained mainly from population and housing censuses of the analyzed periods.
b. *Economy of the City-Region:* In this section, we will analyze changes of economic sectors at municipal level to identify the trend in the city-region. At the same time we will also cover issues regarding the occupied economically active population and their income levels. This information will be worked from population, economic and agricultural censuses.
c. *Mobility and Residential Change:* Another key issue of interface analysis is population mobility in two senses: the first one, expressed through the house-work, house-commerce and house-services flows regarding the central city and/or with other towns in the system. The second, residential mobility that the population has undergone and the reasons for these changes. Because there are no available data about these topics, it is deemed necessary to survey it with field work. Information about transportation and roads will be based on municipal database of vehicle records and urban/suburban public transportation routes.
d. *Land Planning and Management:* The planning and management of development in these areas usually include different municipal jurisdictions that are sometimes involved with urban and regional/urban planning, obeying different objectives, priorities, economic resources, regulations, and ways to conduct land management. Where local stakeholders are usually excluded from the planning and decision making processes. Hence the interest of taking into account topics related to the public management structure at different government levels, and so their plans, programs and projects that impact the areas of the study. Due to the lack of local community participation, it will be considered to identify the role of community involvement in decision making along the planning and management of its own settlement. Information of this section will depend on the survey results and the interviews conducted with community authorities and stakeholders.
e. *Urban Morphology and Functions:* It is of great interest to this project to analyze the spatial pattern taking place in the physical expansion of the city, and the change in central functions of the city. As well there is an interest to place the city within a broader regional perspective that will allow looking at the interactions taking place in the interface settlements with other cities within the municipal urban system. This analysis will deal with levels of public services provisions, densification, urbanization levels, reclassification of settlements from rural to urban and changes in land uses over the period. This information will be obtained from different government sources, censuses, the survey, aerial photographic material, and satellite images.

Environment: It focuses on the input output flows of products to the city, and the impact they have on the modification, fragmentation, or loss of natural and productive ecosystems and the pollution affecting the quality of surface and groundwater. There are different sources of air pollution, where the consumption of fuels plays a fundamental role in the operation of towns by means of power stations, public utilities and services, industries, transport, cooling and heating of housing. Land pollution seen through the loss of vegetation cover and as a reservoir of municipal solid wastes.

Table 1: Variables considered in the rural-urban interface study.

7.	**Economy of the city-region**	**Mobility and change of residence**	**Land planning and management**
1. Total population. 2. Annual middle growth rate. 3. Population by sex. 4. Population by age. 5. Immigration in the last 5 years. 6. Population born in the community 7. Provision of services at housing level. 8. Housing tenure 9. Social exclusion index	1. Tertiary sector. 2. Secondary sector. 3. Primary sector. 4. Employed population. 5. Employed population by economic sector. 5. Incomes.	1. Origin-destination. 2. Accessibility: roads and transportation 3. Traveling time. 4. Change of residence in the last 5 years. 5. Means of transportation. 6. Vehicles per family. 7. Age of the vehicles. 8. Coverage of the urban and suburban public transportation network. 8. Internal and suburban road structure.	1. Current plans and programs. 2. Organization and institutional management. 3. Community organizations and implemented development projects 4. Decentralization of functions. 5. Extra regional cooperation networks. 6. Empowerment of local governments.
Urban morphology and functions		**Environment**	
1. Population density. 2. Settlement classification (urban hierarchy) 3. Annual middle growth rate by area. 4. Urbanization level by area. 5. Settlement growth patterns. 6. Land uses. 7. Land tenure. 8. Land use reserves and their occupation. 9. Land regulations (city limits). 10. Precarious settlements. 11. Land values.		1. Water-sewage: aquifer recharging, water consumption per capita, water consumption by land use, potable water capacity, wastewater volume and sewage water treatment capacity. 2. Air: pollutant monitoring: co, co^2, o^3, so^2, pm10 and respiratory diseases. 3. Energy: electrical energy consumption by land use, energy consumption per capita, fuel consumption by activity, gas consumption by activity, and diesel consumption by activity. 4. Solid wastes: volume of wastes per day, waste production per capita, percentage of recycled wastes, capacity of the landfill, clandestine dumps, volume generation of hazardous wastes. 5. Risk and vulnerability: areas subject to risk by flooding and earthquakes. 6. Change of vegetation cover, areas subject to erosion, sand and gravel extraction areas. 7. Preservation: water bodies, protected natural areas, cultural and historic heritage and distinctive landscapes.	

Another element for the analysis is risk and vulnerability assessment of the area by different types of phenomenon. There is a lack of environmental information available at municipal and urban levels, but in order to assess the aspects of environmental quality in the interface we will require field work, a survey, interviews, and data from satellite images.

Information from settlements located in the rural-urban interface was crucial, therefore it was designed a questionnaire addressing points of interest to the project and to carry out a qualitative assessment of the general topics of the study. Table 2 shows a synthesis of the group of questions developed in the questionnaire.

Table 2: Main topics of the questionnaire.

Topics	Content
Population	1. Time of living in the settlement.
Housing	2. Size and physical state of the house.
Education	3. Use of the education services available within or outside the settlement, and quality of the education.
Health	4. Use of the health services in the settlement, their quality, food sufficiency at home, and most common diseases.
Well being	5. Income distribution and degree of family well-being.
Public services	6. Availability and quality of the municipal public services: power, water-sewage, public transportation, waste collection, security, telecommunications, roads and pavements, and administrative services.
Change of residence	7. Place of birth, change of residence, and the reasons.
Mobility	8. Origin-destination, traveling time, means of transportation, and the reasons to travel.
Economics	9. People that work at home, occupation, economic sector, and place.
Environment	10. Perception of environmental quality in the settlement: air, water, land, green and recreational areas, lack of security.
Risk	11. Risks and vulnerability of the settlement and the direct impact on the families.
Public participation	12. Social organizations and their participation in planning tasks and community management projects, and their opinions about government performance with the management of development projects.

4 Conclusions

The interface is a complex space with its own problems and full of opportunities for development, posing important challenges regarding planning and coordinated administration, which will direct actions towards common goals and

objectives between government, private, and social stakeholders. It is important to consider that these areas will become part of the cities at a mid and long term and just like the rest of the city, they will have to adapt to the economic, social, and environmental dynamics they will be part of.

Sustainable development has become a suitable framework to approach the rural-urban interface, because of its comprehensive view of environment and the analysis of multiple interactions within the city-region system. However, it has a major challenge related to the implementation and monitoring of management proposals, under complex governmental administrations.

The issue of interface dynamics is crucial when talking about cities that present a rapid growth in their populations, such as large worldwide metropolis and mid-size cities. Dynamic which can also be modified depending on the technological development in telecommunications, the positioning of cities in the global network system and the environmental determining factors for the production of goods and services.

Finally, this proposal presents an interdisciplinary view of the interface where as a result of thorough analysis and assessment, it will be able to formulate planning and management schemes that will allow a smooth transition from the rural to the urban development.

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