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ID 1424 | HOW TO APPROACH URBAN COMPLEXITY, DIVERSITY AND UNCERTAINTY WHEN INVOLVING STAKEHOLDERS INTO THE PLANNING PROCESS

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1 CHARACTERISTICS OF CONTEMPORARY CITIES

Complexity, diversity and uncertainty are three key attributes of contemporary cities which mark their recent evolution and strongly condition the task of urban planners and public officials (Fernández Güell et al., 2016; Fernández Güell, 2006; Camagni, 2003).

The first common feature of all large and medium-sized cities is the high level of complexity of the operational processes that take place within the city and in its hinterland. Complex systems such as the climate and the economy are characterized by being spontaneously self-organizing and adaptive to changes that happen in their context (Holland, 1995; Stacey, 1995). Just as well, it is widely accepted that cities are one of the best examples of complex systems (Portugali et al., 2012; Allen, 1997). As a rule, complex cities experience unpredictable non-linear dynamics and they are capable of self-transformation in order to adapt to changing contexts. Therefore, urban problems are multidimensional and complex since they emerge in an intricate dynamic network of relationships from societal, economic, environmental and political issues.

The operational complexity of cities has been a recurrent handicap for urban planners because it complicates urban analysis and policy making. In the past, planners have tried to deal with complexity with either sophisticated mathematical models or just plain narratives, in both cases without much success. Despite its challenges to analysts, the phenomenon of urban complexity should not be obviated or simplified in excess; on the contrary, it should be conceptually understood as much as possible. The understanding of complexity can facilitate a more informed and evolutionary vision of cities than the standard reductionist and static approaches of many planning processes.

The second feature inherent to any big and medium-sized city is social diversity. This important, but elusive feature has been analyzed by well-known authors from different perspectives such as architectural design (Alexander, 1965), neighbourhood fabric (Jacobs, 1961) or participatory process (Innes and Booher, 1999). As a matter of fact, diversity is not just about ethnic or geographic origin. It is also about social diversity, different cultural expressions and multiple economic interests. Basically, urban diversity is generated by the disparity and heterogeneity of local and supra local agents who intervene in the socioeconomic activities of a city. In addition, cities are diverse because they are inhabited by a wide spectrum of citizens who are not as well organized as large stakeholders, but who have the right to be involved in city affairs.

Diversity and governance are intrinsically linked. In a democratic urban community, political decisions are the outcome of diverse interest groups with different levels of power, with the elected politician as the catalyst for local consensus. On the one hand, a high level of diversity complicates the governance system for concealing multiple interests, but on the other hand, urban diversity may have positive effects on social cohesion, economic performance and social mobility. In brief, diversity is an important asset of cities in so far as conflicting interests of urban stakeholders are accommodated by mutually satisfactory negotiations.

The third attribute of the urban realm is contextual uncertainty, which influences most decisions regarding city development. All kinds of changes constantly affect cities, generating growth, stagnation or decline. Changes obviously bring a large dose of uncertainty to planners' forecasts (Klosterman, 2013; Abott, 2005). All those responsible for foreseeing the long-term evolution of a city are limited by current forecasting tools. Most of these difficulties are due to the highly complex and dynamic nature of contemporary cities, which prevents the precise and reliable foresight of events. This situation is aggravated when the city operates in a turbulent and changing context such as economic recessions or natural catastrophes.

Faced with the difficulty of foreseeing the future, many planners simply give up long-range planning and focus on contingency planning, which means an unconditional surrender to unexpected changes in the urban context. Although the future remains unpredictable, urban development can be foreseen and alternatives can be designed. Without the ability to anticipate the future and interpret alternative scenarios, cities are in a weak position to face coming challenges. Therefore, by learning to manage uncertainty we might be able to prepare for the future and try to shape it actively.

Finally, it is important to note that the three above mentioned urban features retrofit each other. For instance, a city with a high level of diversity augments its operational complexity while the accelerating rate of socioeconomic change intensifies the degree of uncertainty and complexity of cities.

2 NEED FOR A FRIENDLIER APPROACH TO URBAN COMPLEXITY

2.1 PREVIOUS ATTEMPTS TO APPROACH URBAN COMPLEXITY

Since the 1960s, a traditional approach to deal with urban complexity has been systems theory. The pioneer work of Ludwig von Bertalanffy on General Systems Theory (1968), Jay W. Forrester on Systems Dynamics (1961) and Charles West Churchman on Systems Approach (1968) opened the door to specific contributions toward a systemic understanding of the city. In that respect, the works of John McLoughlin on the application of systems approach to urban and regional planning (McLoughlin, 1969), Jay Forrester on urban dynamics (Forrester, 1969) and Ira Lowry on transportation modelling (Lowry, 1964) are well known. These innovative contributions to the understanding of urban systems produced the first generation of "large-scale urban models" in the 1960s and 70s.

These early attempts to understand urban systems raised great expectations in the planning field, but they had dubious practical results. In fact, the planning literature has recorded recurrently how the application of sophisticated quantitative models during the 1960s in urban renewal programs of large American cities was a resounding failure (Lee, 1973; Brewer, 1973). At that time, large scale urban models emerged as part of an effort to modernize planning and make the field more scientific; however, they were severely criticized. In short, they demanded large volumes of data and offered little detail, they did not behave reasonably with respect to variables for which no data were available, they reinforced command-and-control planning, and indeed they were very expensive (Batty, 1994; Lee, 1994). And above all from our present perspective, early large scale urban models were unable to interpret and simulate complex urban functions.

Three decades after the failure of those early experiences, the Institute of Santa Fe, in New Mexico, began to work with the concept of complex adaptive systems (Gell-Mann, 1994; Kauffman, 1995; Waldrop, 1992). Soon the Santa Fe scientists realized that the city was one of the most complex adaptive ecosystems because it encompassed a multitude of different agents interacting among themselves and the environment. Researcher Geoffrey West considered that the city exhibited capabilities for creating emergent structures and for self-organization (West, 2010). This new concept certainly enriched the original systems approach, but it further complicated urban analysis, making very difficult to predict the evolution of the city.

More recently, the science of complexity driven by smart city initiatives has embraced an integrated systemic approach that brings together a broad spectrum of powerful techniques and concepts that may be applied to the urban context. These include agent-based modelling, cellular automata, network theory, multi-scale thinking, field theory, statistical physics, and scaling theory. The new integrated approach intends to address transdisciplinary issues such as adaptability, robustness, resilience, regulation, and conflict in the urban realm. Nonetheless, little progress has been done in developing real integrated smart projects as some researchers admit (Mattoni et al., 2015; Lombardi et al., 2012).

In brief, after the early models of the 1960s, urban planners have dealt with complexity using narratives, conceptual models and sectoral simulation models, but most of the time they have carefully avoided large integrated quantitative models (Roo and Silva, 2010). Nevertheless, as cities evolve, an understanding of urban dynamics, networks and complexity is becoming increasingly important for planners to successfully guide their visions and policies.

2.2 TOWARDS A NEW APPROACH TO URBAN COMPLEXITY

Most quantitative approaches based on systems theory, while academically interesting, are not always easy to implement in a collaborative process with stakeholders from multiple professional backgrounds due to the high level of technical skills required as to their limited capacity to sketch out complex issues (Carlisle et al, 2016). Confronted with these circumstances, planners should be capable to develop more qualitative and friendlier conceptual frameworks in order to interpret city's complexity in a more holistic way and, at the same time, facilitate effective involvement of local stakeholders along the planning process. Accordingly, the new conceptual framework should fulfil four basic requirements.

Firstly, planners should be able to display the complex nature of cities by depicting all major sectoral systems, local stakeholders and functional relationships in a comprehensive and holistic manner. Conceptual maps and process diagrams could help to structure complex phenomena by displaying graphically all the variables of a problem and the role of diverse stakeholders.

Secondly, planners should develop new communication tools that facilitate the involvement of local stakeholders in the process of collaborative planning when analyzing complex urban issues. These tools should enable the search of consensus among urban stakeholders as well as the management of conflicts and dissent among them.

Thirdly, planners should incorporate foresight tools into the planning process to produce holistic future visions of the city. These tools would enable them to act in co-evolution with the ever-changing urban context. By co-evolution we understand the continuous reconfiguration of actor-networks and city systems as a consequence of continuous societal, economic, technological and environmental changes.

Fourthly, planners should develop innovative research approaches capable of handling fuzzy inter-connected problems with the aid of collective intelligence and qualitative tools, instead of trying to solve clearly defined problems through standard quantitative tools. These approaches should respond creatively to fuzzy agendas based on a process of evolving collective intelligence.

In brief, a new model framework based on the former premises could provide conceptual support for spatial planners who are currently struggling to gain a holistic understanding of a city's structure and operations, while it evolves in an uncertain context.

2.3 A NOVEL CONCEPTUAL FRAMEWORK

One way to deal jointly with the complexity, diversity and uncertainty that are intrinsic to contemporary cities is to conceptualize the city as an evolving functional ecosystem, capable of adaptation and self-organization in response to context changes (Fernández Güell et al, 2016). Additionally, the systemic approach should be reinforced by foresight tools as part of the planning process, thus helping planners and stakeholders to look beyond their short-term problems.

Thus, a city may be regarded as a complex ecosystem of connected elements or parts with common purposes, in which human activities, linked by communications, interact as the system evolves dynamically in a given socioeconomic and physical context (Berry, 1964; McLoughlin, 1969). In other words, a city is built from multiple singular initiatives taken through time by a great number of players who are tightly interconnected among themselves. In this ecosystem, any spatial or structural alteration to one of the elements can modify the other parts of the system.

The technique of concept mapping (UN-Habitat, 2007) was used to explain the complex operation of a contemporary city. A schematic model was designed in which the urban ecosystem was synthesized and visualized as a set of different interrelated subsystems (see Figure 1).

Urban demand subsystem. This subsystem, composed of citizens, economic stakeholders, societal institutions and visitors, is placed in the centre of the model. All the demand segments place a number of requirements on the resources, services and infrastructures provided by the urban subsystems so that they can live and work in a city under good conditions.

Urban supply-side subsystems. From the supply side, the societal, economic, environmental and political subsystems of the city strive to interpret and satisfy requirements from demand segments. Each subsystem is described by its resources, operating agents, the services that are provided and the technology that is used.

Figure 1 – A city's functional system (Author's elaboration)

Spatial subsystem. The societal, economic, environmental and political subsystems request specific physical conditions from the spatial subsystem in order to operate properly. Thus, the so-called spatial subsystem, regulated by urban planning, is responsible for providing basic infrastructures, transport systems and a wide range of community facilities and housing units.

Technological subsystem. All the previous functional subsystems and demand segments are serviced by a technological subsystem made up of multiple platforms, which ideally should be horizontal in nature, although they may only operate for a single sector.

External trends. Finally, the overall urban system is subject to external change factors such as demographic transformations, economic cycles, technological innovations or environmental impacts, which affect its functional balance. Foresight studies provide a wide range of techniques for identifying and assessing all kind of trends.

Although it may be perceived as reductionist, this systemic conceptualization of the city has several advantages: it displays a simplified, intelligible abstraction of the inherent complexity of our urban reality; it emphasizes functions and processes rather than spatial patterns; it expresses schematically the dynamic evolution that a city may undergo over a given period of time; it critically analyzes the diverse relationships between urban components; it provides the bases for decision-making processes; and it exposes the dominance or dependence of stakeholders over functional subsystems.

This systemic approach can help to achieve a better understanding of the underpinnings of the urbanization process and establish a common ground for collaboration among local stakeholders.

2.4 RESEARCH METHODOLOGY

A new systemic approach to cities was developed and validated with various Spanish experts in city sciences and stakeholders over a four-year period. Research was based on a mix of consulting and academic activities which progressively added value to the final research product. The chronological sequence of the validation process was roughly as follows.

The author’s personal experience for many years in university teaching and leading consulting projects showed the need for a comprehensive user friendly systemic approach to cities which could be useful not only for professional urban planners but also for a wide range of urban stakeholders. A preliminary systemic model began to take shape during 2013 as the result of desk analysis.

In 2014, a foresight exercise financed by a multi-national consulting firm was undertaken to envision how Spanish cities should desirably evolve towards the horizon 2030 in order to avoid urban development malpractices that generated a real estate bubble during the 2000-2008 period (Fernández Güell & Collado, 2014). This exercise involved four stages. First, a systemic conceptual model was developed to understand the city in a holistic way. Second, a foresight exercise was undertaken using scenario design and visioning. Third, the resulting desired vision for Spanish cities and its foreseeable impact in the urban functional system was discussed with diverse urban stakeholders around Spain.

In 2015, the systemic conceptual model was submitted to the judgement of academics and urban professionals at presentations in two international conferences and subsequent publications in scientific journals. As a result of those external assessments and fruitful discussions, additional refinements were incorporated into the urban functional system.

By the beginning of 2016, the usefulness of the systemic model was validated in the city of Madrid. Preliminary research outcomes –functional system and vision’s implications-- were shared with and validated by various Madrid urban stakeholders and planning officials through personal interviews. By mid 2016, confidence was gained about the usefulness of combining a systemic and foresight approach to make the foreseeable evolution of cities more intelligible to wider audiences.

3 IMPLEMENTING THE CONCEPTUAL FRAMEWORK TO DISPLAY THE RECENT AND FUTURE EVOLUTION OF SPANISH CITIES

In order to check its operational feasibility, the proposed urban functional system is implemented to characterize the recent evolution of Spanish cities. Firstly, the model is used to explain the real estate bubble experienced during the 2000-2008 period; secondly, it displays the crisis experienced by most Spanish cities during the 2009-2014 period; thirdly, it envisions the desired future urban development model in the 2030 horizon. The above mentioned retrospective and prospective exercises are supported by secondary sources and specific contributions made by experts in the last three years of continuous research projects.

3.1 THE REAL ESTATE BUBBLE (2000-2008)

The urban functional system shown in the conceptual framework was used to characterize the development model followed by most Spanish cities during the 2000-2008 period, when the country enjoyed a long economic bonanza that nurtured a huge real estate speculative bubble. The successes and excesses made at that time constitute an interesting experience to study before formulating the future model. The following retrospective analyses are synthesized from secondary sources (Gaja I Díaz, 2015; Naredo and Montiel, 2011; Jiménez, 2009) and contributions made by experts.

In those years Spanish cities were operating as follows (see Figure 2).

Urban demand: Its major segments were fragmented and scarcely connected among themselves. Businessmen behaved opportunistically with short-term actions, contemplating the city just as a chess board in which they could easily make multiple speculative and profitable deals. Regarding citizens, most of them were self-satisfied with the socio-economic context, so they were unconcerned with urban issues. Tourists would arrive at city destinations expecting all kind of facilities and services to fulfil their highest aspirations, regardless of the environmental or social impacts they might cause.

Economic subsystem: It showed good performance indicators in growth and employment, but it also suffered from low productivity levels and excessive financial leverage. Except in big metropolises, like Madrid and Barcelona, most municipal economic bases were dominated by small and medium enterprises in mature industries which had low technological intensity and were mainly oriented to the national market.

Societal subsystem: The social fabric of many Spanish cities revealed the tensions generated by the progressive ageing of urban populations, the wave of scarcely qualified immigrants from developing countries, and the emergence of new family structures. As a result of the previous tensions, social capital was not significantly strengthened in the cities.

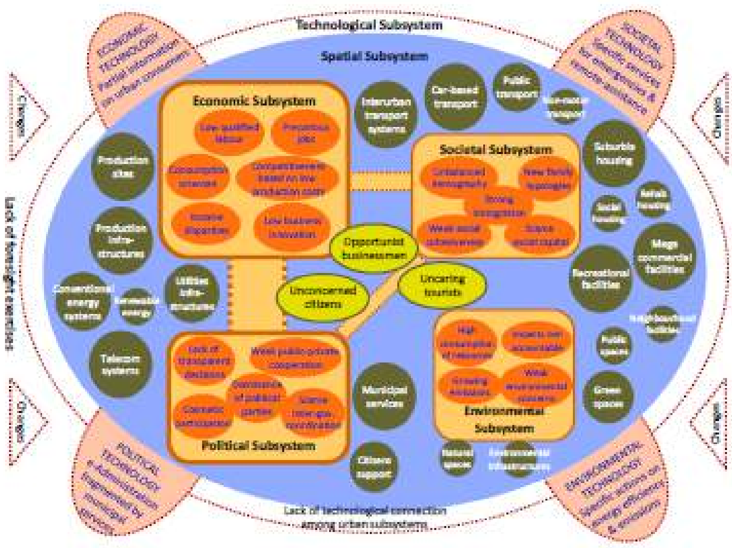

Figure 2 - Spanish cities functional system in the pre-crisis period (2000-2008) (Author's elaboration)

Environmental subsystem: It was relegated to a secondary position within urban priorities during this period. The prevailing economic dynamism gave impulse to the aggressive urbanization of urban outskirts as well as to the construction of large transport infrastructures and commercial facilities. Due to rapid urban growth, numerous environmental impacts occurred in the environs of cities.

Political subsystem: At that time, local governments held positions very closed to the economic subsystem. There was an evident collusion of interests between economic stakeholders and local politicians in big real estate operations, favoured by the lack of transparency in the municipal decision making process. This state of things gave place to numerous episodes of corruption.

Spatial subsystem: Cities were overbuilt increasing their ecological footprint. Large areas were urbanized in the city fringes, big transport infrastructures were built in most metropolitan areas, costly commercial mega facilities were developed in the suburbs and more houses were built than needed.

Technological subsystem: During those years, Spanish municipalities made a significant effort to improve their management systems by incorporating new information and communication technologies (ICTs) to satisfy sectoral needs of specific municipal services.

External trends: Few foresight exercises were drawn during this period. Scattered initiatives, mostly sponsored by sectoral stakeholders, were undertaken to foresee the future evolution of the Spanish society. Some municipalities carried out vision and scenarios exercises as part of their strategic plans.

Not all the city functional subsystems were effectively interconnected during this period. A strong relationship was developed between the economic and political subsystems due to their shared common interests. The societal subsystem had weaker connections with the economic and political realms; in fact, connections were activated on intermittent bases according to pressing needs such as political elections or labour unrest. Regarding the environmental subsystem, it operated in a rather isolated mode because other sectoral policies did not show much concern for environmental issues.

3.2 THE URBAN CRISIS (2009-2014)

By 2009, macroeconomic indicators showed that the economic crisis was in full swing, producing a tough shock to most Spanish municipalities. At that point, it was clear that previous urban practices have aggravated the intensity and scope of the recession, generating a huge real estate bubble.

Urban demand: It was strongly hit by the economic recession. Citizens, faced with long-term unemployment and diminishing social protection, blamed politicians and speculators for their economic misfortunes. Angered citizens turned into social activism, giving strong support to new social movements, which in turn created new political parties. Most businessmen were stranded by the depth of the crisis and the changing economic global context. Despite an initial decline in tourist arrivals, visitors kept choosing Spanish destinations because of their competitive prices, good facilities and lack of safety problems. Though demand segments suffered severely during this period, they were not able to establish links to develop joint actions.

Economic subsystem: The crisis evidenced the fragility of the Spanish economic fabric. Small and medium sized enterprises were particularly affected, generating a huge volume of unemployed people. Those businesses with export opportunities in foreign markets had a chance to survive, while the rest were forced to foreclose or undercut their operations to a minimum. Most local economies faced a profound reengineering process of their economic activities in order to improve their low level of productivity and lack of innovation.

Societal subsystem: Against all odds, the social fabric of Spanish cities resisted the crisis thanks to the strength of the family unit. Family regrouping took place to help the unemployed. Immigration flows reversed and young Spaniards began to leave the country in search of job opportunities abroad. Fertility rates hit records low, aggravating the ageing of urban populations. To counterbalance spending cuts in public services, self-organized citizens began to take grass roots initiatives to provide social coverage to the needy. Social capital seemed to strengthen in cities with big social problems.

Environmental subsystem: As a result of the crisis, the health of the environment became one of the first priorities of politicians and citizens. As a counter reaction to the former real estate speculation spree, a general consciousness emerged in favour of diminishing environmental impacts, caring about emissions and recovering natural spaces. Due to the economic recession, the ecological footprint growth was slowed.

Political subsystem: Widespread economic scandals and political corruption hit hard traditional political parties, opening the door to the emergence of new political groups. Citizens expressed their discontent with traditional power structures by organizing sit-ups in public squares and by supporting social movements. Local governments were blamed by their lack of transparency and accountability in their decision-making processes. Citizens demanded more empowerment and open participation.

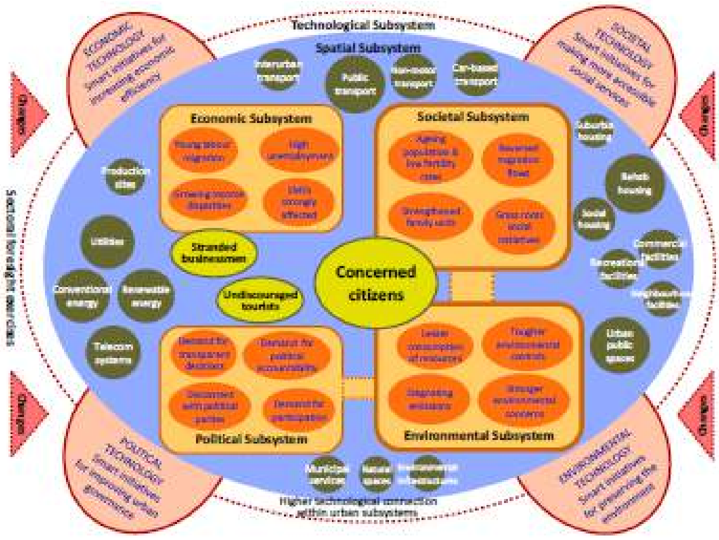

Figure 3 – Spanish cities functional system in the crisis period (2009-2014) (Author's elaboration)

Spatial subsystem: The excesses of the previous period left numerous scars in the Spanish cities. It was common to observe unfinished building skeletons, undeveloped urbanized lots, empty toll highways, oversized airport terminals, underused high-speed trains, and plenty of flats for sale. Traffic congestion diminished and large commercial projects were abandoned. Rehabilitation appeared as a reasonable alternative to new residential development, but the lack of public support slowed down many projects. All kind of large infrastructure projects were revised and many were either delayed or dismissed.

Technological subsystem: Limited by cut spending and diminishing revenues, local politicians found in the so-called smart city initiatives an alternative path for modernizing their cities by reducing emissions, improving energy efficiency and facilitating public participation. These initiatives were promoted by high-tech corporate business and by the European Union through its Smart Cities and Communities Programme. Nevertheless, most smart projects operated under the format of technological silos without much interaction among government departments and other city systems.

External trends: Multiple forecasts, dominated by pessimistic visions, were drawn during the crisis years as a reflection of the Society's awareness about the present problems and the coming challenges. Mostly private organizations developed future scenarios for anticipating the evolution of sectors such as energy, transport, industrial production or environment. Nevertheless, few municipalities were interested in carrying out foresight exercises to foresee their development alternatives.

An overview of the urban functional system unveils that abrupt changes happened in regard to subsystems interconnections. The economic and political subsystems no longer enjoyed privileged links among themselves and gained some sort of isolation respect the other urban subsystems. Instead, the societal subsystem gained momentum and tried to establish stronger links with the environmental subsystem as well as with the concerned citizens. Nevertheless, radical changes were taking place among citizens and local stakeholders that would certainly determine future patterns of power relationships within the urban realm.

3.3 THE FUTURE VISION (2030)

If Spanish cities had to recover in a near future, despite amending past mistakes, they should be able to anticipate and assess the foreseeable impact of forthcoming change factors. Thus, a foresight exercise was due to envision the model of the future city in the 2030 horizon.

After successive discussions with stakeholders and experts, it was agreed that the future desired vision was to be guided by five driving principles (Fernández Güell & Collado, 2014): (1) create an equitable and cohesive social fabric; (2) develop an innovative, competitive and resilient economic base; (3) preserve a healthy and sustainable environment; (4) establish a collaborative and transparent governance system; (5)

build a compact and sustainable urban structure. Those five principles support the urban functional system which displays the desired future vision for Spanish cities (see Figure 4).

All the functional subsystems will be tightly interconnected among themselves and they will take into account the needs, demands and aspirations of the diverse urban demand segments in pursuit of a more integrated model. City managers will avoid dominant positions among the subsystems by establishing relatively well-balanced positions among demands and urban functions. This will compel urban planners to maintain fluid communications and negotiations with different stakeholders.

Vision of urban demand: In the year 2030, Spanish cities will be inhabited by citizens, businesses and public organizations capable of facing problems and challenges in a creative and innovative way. Business will be very demanding on location requirements, but at the same time they will show a collaborative attitude with public officials for improving the city. Citizens will be empowered to exercise their rights and they will be very much involved in public debates. Tourists will show high expectations regarding the environmental quality and social cohesiveness of city destinations.

Vision of the economic subsystem: In 2030 will be more balanced than in prior times. Economic development will be intelligent (based on knowledge, innovation and creativity), sustainable (efficient use of resources and concern for the environment) and cohesive (high level of employment and social

responsibility). Sectors with well articulated clusters of business, technology centres, advanced services and entrepreneurs will flourish and will be more resilient to economic downturns.

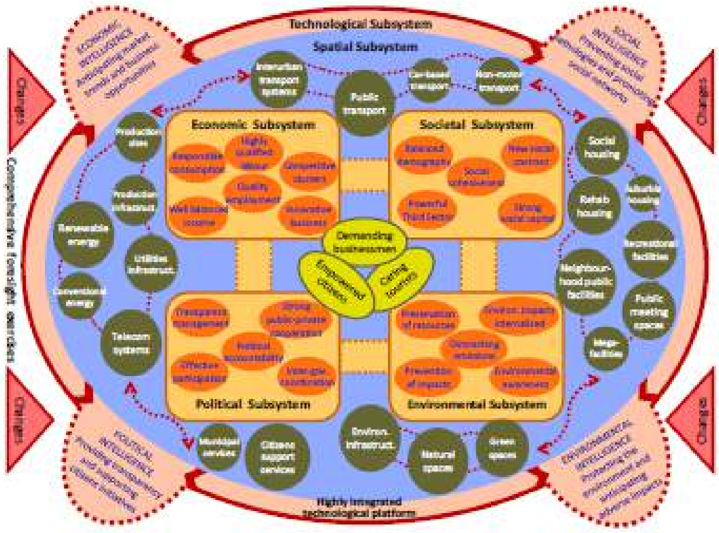

Figure 4 – Future vision of Spanish cities functional system (2030) (Author's elaboration)

Vision of the societal subsystem: In the future, it will handle significant challenges such as the ageing of population, the emergence of new exclusionary pathologies, and a growing multicultural society. Cities will establish a new social pact among generations and genders so as to provide adequate assistance to the most needed and handicapped. Resources will be redistributed in an equitable and efficient way to attend social needs and minimize social gaps.

Vision of the environmental subsystem: In 2030, Spanish cities will prosper in economic and social terms, but at the same time they will reduce their ecological footprint by diminishing the consumption of energy, water, soil and other natural resources. Success will be due to technological innovations which will minimize environmental impacts, but also to the growing environmental consciousness of citizens who will have significantly reduced their consumption levels.

Vision of the political subsystem: Advanced governance will be a must in the cities of the future. Local administrations will be more intelligent, innovative, transparent, accountable, participative and inclusive because citizens will be more empowered and socially active as ever before. The increasing involvement of citizens in city matters will give rise to an improved and responsible political class, capable of responding to social demands with adequate policies.

Vision of the spatial subsystem: In 2030, cities will shape their physical elements according to strict sustainability criteria. Spanish cities will opt for compact and complex urban models over sprawl models.

Urban mobility will be dominated by public transport and non-motorized modes. Carefully designed public spaces and community facilities will foster the social encounter of citizens.

Vision of the technological subsystem: The effective development of truly Smart Cities will require the coordination of numerous agents and technologies as well as the long-term involvement of local stakeholders. In this visionary model, the relations among demand segments and functional subsystems will be supported by complex technology platforms which will supply fluid communications in real.

External trends: Cities will scan constantly the context in which they are operating. Scanning will mean to monitor and anticipate all the geopolitical, societal, economic, technological and environmental change factors that may affect the city's development. Those foreseeable changes will be analyzed not only by advanced quantitative models but will be contrasted by experts who will give qualitative opinions.

In brief, the forthcoming challenges will impel cities to interconnect and coordinate their functional subsystems. Consequently, the city of the future will have to be planned and managed under a holistic approach, making sure that all urban functions and city agents operate in an integrated and related way.

4 CONCLUSIONS

4.1 IMPLICATIONS OF THE PROPOSED APPROACH

Implications for comprehensive policy making. The proposed systemic model can be used as a transversal tool to coordinate strategies and actions among the different public bodies --either intra-municipal or supra-municipal-- involved in the urban planning process. On the one hand, coordination is necessary among multiple sectoral units within a single municipality when formulating comprehensive urban policies. On the other hand, complex cities require intense and continuous efforts to coordinate public actions, whether be vertical (national, regional and local levels) or horizontal coordination (various municipalities within a metropolitan area). Just as well, this model can provide useful insights to urban analysts before gathering data and running sophisticated mathematical models that tend to oversimplify complex realities.

Implications for collaborative planning with local stakeholders. An intelligible systemic approach can be of great help for facilitating stakeholders' involvement into the planning process. In fact, participant stakeholders along the research process expressed their support for the systemic model. Firstly, they welcomed the graphical display of the structure and functionality of complex urban systems to which they could easily refer to and understand. Secondly, participants gained an improved insight into the relational complexities of cities. Thirdly, the conceptual model eased the collaboration among diverse stakeholders and public officials. Fourthly, the proposed approach appeared to be user friendly for decision makers and stakeholders, and quite manageable for technicians.

Implications for foresight studies. Both the systemic and foresight approaches used along the research process worked well together to envision the dynamic evolution that a city may undergo over a given period of time. Confronted with the display of the city functional subsystems and their evolution over time, consulted experts were capable to assess the accuracy of past and present situations as well as the plausibility of the projected future vision. In brief, the conceptual framework provided systematic guidance on the foreseeable evolution of the urban functional system by mapping intelligible future visions.

Implications for innovative educational processes. Jay Forrester (1995) suggests that systems thinking should be introduced in planning schools so that students can familiarize themselves with integrative approaches to urban complexity. Systems thinking could provide a unifying basis to connect mathematics, environmental, economic, social and urban studies, which will help students to break down boundaries between disciplines. Nevertheless, explaining to university students the concept of urban complexity is not an easy task for any professor. Therefore, the proposed conceptual framework is a useful first step for students to grasp urban complexity, before analysing in-depth the functional relationships among urban subsystems.

4.2 LIMITATIONS OF THE PROPOSED APPROACH

However, in its present state of development, the proposed model has several limitations. First and foremost, it is just a generic and conceptual framework that needs to be applied to real cities in order to test rigorously its feasibility. This test will enable researchers to check the plausibility of the approach and will provide planners with a road map for improving urban analysis.

Second, more exploratory work should be done with stakeholders' involvement in interpreting the functional system to guarantee that they can add value into the planning process. Further work needs to be done in identifying appropriate methods of enquiry to better understand network interrelations among stakeholders. Likewise, the degree to which this kind of foresight exercise facilitates capacity building among key urban stakeholders remains to be checked.

Third, the conceptual framework, as it is right now, does not contemplate the possibility of plugging in quantitative models that would certainly enrich the whole approach. A concurrent use of quantitative and qualitative tools would improve the accuracy of the method. Thus, quantitative tools could be employed to support and lend coherence to the process, but they should never drive it because the method would lose its eminently qualitative nature and would discourage stakeholders' involvement.

The above mentioned limitations expose clear opportunities for further lines of enquiry that bring together academicians and professionals working in urban planning. Execution of further research will enhance the potential for incorporating a systemic approach and foresight tools as an undisputed work package in the urban planning process.

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