CONTRIBUTION OF RESILIENCE THINKING TO THE SPATIAL PLANNING OF DISPERSSED TERRITORIES

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Abstract

The research work presented in this paper focuses on peri-urban systems of dispersed territories here understood as complex adaptive systems. These territories have been suffering turbulences along the decades that left socioeconomic and spatial marks, and this way, short, medium and long term answers are being required. The research is based on the assumption that “resilience thinking” can offer an analytical framework that enables the understanding of the phenomenon of the impact of these turbulences and ultimately, help to identify adaptation and innovation processes. Thus, further studies on this subject will contribute to minimise and hopefully prevent the effects of possible crises in these territories.

A relevant issue is then to question about the resilience mechanisms of a dispersed territory that allow it to better face the impacts of a crisis, or more difficult times.

A case study in the “Vale do Ave” region, in the North of Portugal, has been chosen, having in mind the determination of the degree of resilience in a peri-urban area, evaluating, as well, the changing capacity of its morphogenetic matrix. Having this into account, a methodological framework, based on panarchy models and adaptive cycles, as well as resilience attributes – diversity, connectivity and redundancy – has been developed. This framework allows us to monitor the influence of a built environment in the adaptive capacity of peri-urban systems.

The research points out that by understanding past phenomena and by connecting them with periods of turbulences, better future planning strategies can be implemented. Those strategies should ensure the capacity of some performers to adapt themselves to slow changes. Innovative policies can, then, be built according to specific territory characteristics.

Finally, it is argued that building a set of “resilience thinking” criteria can positively facilitate and guide the strategic and prospective evaluation of peri-urban systems.

Keywords: peri-urban dispersed territories, resilience thinking, built environment
1. Introduction

The scientific community has studied the causes and impacts associated to natural disasters and catastrophes, climate changes, economic and social crisis, among others. Despite the speed and unpredictability of these phenomena, it is possible to study them in a field of probabilities, looking for answers that can relieve some of their impacts.

Due to these events, experts of several fields of knowledge have been researching on how to prepare the territories and their population for unpredictable impacts or gradual changing. In this context, “resilience thinking” emerges, helping us understand change and disruption that occur over time due to these impacts.

This research intends to study territories according to a systemic perspective, to understand how the several elements of a territorial system interact, as well as, to deepen the spatial dimension of the resilience concept, connecting it with the form of dispersed territories.

From the literature review, some works on this theme, deriving from different fields (from ecological to social and economic sciences), have been developed in several specific perspectives: ecological, economic, socioeconomic and morphological. The need to present a more integrated study, equating the spatial and socioeconomic dimension of the dispersed territories, has led this investigation to interpret the form of the territory in different spatial scales, having into account its appropriation by population over time. However, the study will be centred on a morphologic perspective.

The emphasis of the theoretical approaches, having into account “resilience thinking” as the conceptual field, has been given to the ecological resilience concept argued by Holling (1973, p. 12) as: “a measure of the persistence of systems and their capacity to absorb change and turbulences, and keeping the same relations among populations and the state variables”.

From Holling theories (Holling, 1973, 1996), it was possible to approach the resilience concept beyond ecological borders (Adger, 2000) and expand it as a property that features the evolution of ecosystems and societies, compared to a unique system with porous and floating borders. It should be taken into account that this dynamic socioecological resilience perspective is common to other theories related to territories considered as complex systems (Cumming, 2011; Grimm et al., 1992). This argument emphasizes key questions about how complex systems self-organize and change over time (Anderies et al., 2013; Meerow and Newell, 2015) when they are subjected to unpredictable turbulences.

Based on a conceptual broadening of resilience, a reflexion has been made about territorial systems in a dynamic perspective of systems that interact at different dimensions and scales. In this context, we have considered different points of view from several theorists (Anaut, 2005; Hamel and Valikangas, 2003; Rebotier, 2007), related to territorial resilience as the capacity of a territory to respond to turbulences, adapting itself, allowing the system to reorganize and reinvent itself, or the capacity of a socio-spatial system to go on functioning despite anomalies due to its experience and its learning capacity.

The current work focuses on a dispersed territory, seen as a complex and adaptive system. Its characteristics allow us to analyse the impacts of productive cycles and to evaluate the adaptive and innovative capacity of its subsystems. The analysis of these impacts enable us to find out the resilience mechanisms of this territory that allow it to better face future impacts by reinventing itself. The “Vale
do Ave” region, the case study, in the north of Portugal, will be used as a sample to evaluate the morphogenetic matrix of dispersed territories, by relating it to its changing and innovative capacity.

Thus, it is proposed an analysis of peri-urban systems of the region of “Vale do Ave”, by using a methodology based on an ecological conceptual approach in other words, in panarchy models and adaptive cycles. In practice, the methodology is focused on processes of morphological analysis, i.e. the evolution of changing dynamics of the built environment - its diversity, connectivity and redundancy.

This work is divided into four parts. In the first part, a general vision of the issue is presented, over the study of peri-urban systems in dispersed territories considered as complex adaptive systems. In the second part, complexity theories, path dependent, panarchy models and adaptive cycles related to “resilience thinking” are at issue, having in mind their appliance in the evaluation of dispersed territories. It is believed that from the identification of permanencies and discontinuities of a territorial system, it is possible to analyse the endurance of its identity and to determine the resilient mechanisms. The third part is dedicated to the methodology developed to evaluate the capacity of adaptation of a territory under study through the built environment, having as instruments panarchy models and adaptive cycles, as well as resilience attributes, such as diversity, connectivity and redundancy. At the end of the work, the three phases of the methodology are explained, a quantitative and qualitative evaluation, in view of a comprehension of phenomena associated to the resilience of dispersed territories, hoping that this knowledge contributes to the development of planning strategies that ensure the capacity of some performers to adjust themselves to slow changes, building innovating policies according to the specificity of the territory.

2. Literature review on resilience thinking

In a context of quick and sudden changes – crisis with unpredictable consequences to mankind that induce imbalances and disruption in different systems – several theories about resilience arise, giving focus to the need to understand how systems can be affected and the extent to which they can recover from the impact of these phenomena.

Resilience thinking allows an approach, a way of thinking that presents different perspectives to guide and organize the analysis of systems. Thus, we refer to Batty (2013, p. 571) that argues: “The notion that systems can be robust but fragile, how quickly they bounce back from disruption, how they can evolve to more resilient forms, and how they can amplify both good and bad changes through positive feedbacks, are all features of this new way of thinking which applies to many varieties of system”.

The resilience concept comprises the idea of change as an essential factor to deal with disturbances, as well as a more embracing and deepen understanding of the multiple interactions among the ecological, social, political and economic systems in their different levels or scales.

The dynamics and flow of time, lead us to question if systems in which we interact are resilient, namely urban systems, since disturbing phenomena can cause ruptures of unpredictable consequences. Indeed, the acceptance of transformation and the preview of the unknown create the need to adopt the resilience concept in an “urban planning”, as the process of interpretation of the dynamics of urban systems.

If resilience is understood in its ecological meaning, ecosystems, the relations between human societies and ecosystems, as well as urban systems, can be analysed, as if each of the systems fluctuate around a balance point and come back to that same point, in a relatively short period of time when
there is a disturbance. This way, the works of Folke et al. (2004) and Walker et al. (2004) define resilience as the capacity of a system to absorb disturbance and reorganize itself while suffering changes, as to withhold essentially the same function, identity, structure and feedback.

Some authors share the idea that territorial resilience is the capacity of a territory to answer to disturbance adapting itself, allowing the system to reorganize and reinvent itself; or the capacity of a socio-spatial system to go on working before anomalies due to its capacity of learning and to its experience (Anaut, 2005; Hamel and Valikangas, 2003; Rebotier, 2007). It is important to state that the interest in territorial resilience came out of the analysis of politics that are developed in order to give feedback to the increase of economic, technological, geopolitics and environmental changes, in a world that has become increasingly uncertain (Simmie and Martin, 2010).

Thus, territorial resilience is connected to, on the one hand, the capacity of some territories to create dynamics of self-organization, revealing the capacity to adapt to change, allowing them to keep or return to their basis of development and to their specificities before more or less rough impacts. On the other hand, it relates to the capacity of anticipation before turbulence or of conversion after turbulence, or even, without suffering turbulence, as the complexity of territories owns the probability of changing dynamics.

Understanding complex territories through complexity thinking allows us to consider the territory not as a scattered and isolated space but as a multidimensional system subjected to interactions and interdependencies and to changes. As Morin (2001, p. 109) says “the whole is in the part, that is in the whole”. The concepts of complexity and resilience converge as they both assume dynamic interactions. Holling (2001), as well as Cumming and Norberg (2008), consider that the complex behaviour of systems comprises phenomena such as: “non-linearity”, feedback, the existence of thresholds, capacity to interchange stable states, self-organization and turnabouts in changing paths. However, these paths are dependent paths or paths with an evolutionary dependency, as past events can give birth to causality chains that influence present time.

To understand the mechanisms of these complex systems it is important to consider the initial conditions that influence new cycles (of growth, accumulation or decline and renovation), considering that these adaptive cycles happen and interact in different spaces and time, so, according to a hierarchical structure of panarchy.

We have to consider the initial conditions of the process of changing of territories, without forgetting their creative aptitude to changing, what, sometimes leads to the reinterpretation of the relation of urbanization patterns and its environmental performance. In this context, it is believed “that not forms but principles of formation are key to this relationship. A compact city can be equally resilient as a dispersed urban settlement, as long as it maintains a synergic relationship with its environment” (Forgaci and Van Timmeren, 2014, p. 6).

This paper intends to point out and understand the relation between the morphogenesis of a territory and its capacity to adapt to change, seeing it in a systemic dimension, leading to focus on the built environment, on the built and the non-built parts of the environment, namely on urban tissue, topographic and hydrographic systems.

The research in urban morphology shows that authors such as Conzen (1960, 2004), Whitehand (1972), Anderson (1978), Vernez-Moudon (1986), Salat et al. (2010), among others, have always given importance to the capacity of adaptation of territories, enlarging this research field by studying the floating processes of territories through time and space, by studying the nature, extension and
mechanisms of urban change. Nevertheless, by comparing the different theories, we find that the form of a territory, considered as a socioecological system, indicates some fields of analysis of the changing of its shape. By studying the complexity of territories taking into account a non-linear dynamics, we understand the formal and functional changings of several subsystems facing the unexpected.

This way, the goal is to understand the resilience mechanisms of the territory that allow it to have the capacity of adaptation and changing to attain different states of stability, in other words, “(...) ability of space to assume a variety of functions as well as meanings, to be owned and inhabited in a variety of ways without major disruption of the principles of the structure of that space. Resilience balances continuity and change in space” (Vernez-Moudon, 1986, p. 15).

To make the resilience concept operational, it is necessary to put into action ways of measuring the capacity of adaptation and changing of territories, in other words, to verify their degree of resilience. In 1972, Kevin Lynch has asked: “What are adaptability and resilience, how can they be measured, monitored and archived? How effective are they in facilitating the response to change?” (Lynch, 1972, p. 234).

Resilience has started to be measured by quantified assessments. Taking into account the transdisciplinarity of the concept, as an example, and having an ecosystem as reference, we can consider the extinction of some species as a measure of the impact of a catastrophe on that system. On the other hand, the time of return to equilibrium after disturbance can also be considered as a quantitative indicator when the risks of a system are being studied. Thus, resilience can be measured by the greater or lesser length of recurrence. If the time of recurrence after a catastrophe is long, it can be said that the system is less resilient. On the other hand, if the time of recurrence is short, the system can be considered more resilient. Recurrence time also depends on the amplitude of disturbance and on the capacity of adaptability of the systems.

In complex systems, such as disperse territories, resilience is measured by the capacity of that system to self-organize by keeping the functionalities of their several subsystems, namely their complex networks. It is believed that even when there are disruptions in any of the subsystems, the structure of the complex system keeps in itself the capacities to create dynamics that bridge them. As Batty (2013, p. 571) claims “There are different ways in which such a measure of resilience can be determined, but it is usually based on some measurable difference between the state of a system in its unperturbed form and the actual state which a disruption will move the system towards.” This author underlines the possibility of measuring resilience in complex systems, even though some of their characteristics are difficult to define.

Nevertheless, some characteristics of resilience allow us to ground its technical approach in several areas, such as diversity, redundancy, memory, self-organization, modularity, individual capacity, spatial and temporal interactions, innovation, self-sufficiency and feedback (Walker and Salt, 2006).

In relation to the “modus operandi” of resilient regions and cities, these characteristics underline the spatial dimension of the resilience concept, making it plausible and possible to evaluate and measure the resilience of a territorial system. It can be done through qualitative and quantitative analysis of the built environment, as one of the modellers of physical patterns of the urban form.

The confrontation of the models of analysis of the ecological resilience and the approach of the urban form allow us to outline conceptual basis and to view the territory under study, “Vale do Ave”, by rising some more specific questions: “Which are the permanencies and discontinuities of a peri-urban
system that define the resilience of that system?”; “How do the resilience mechanisms influence the capacity of adaptation of that system over time (diversity, connectivity and redundancy)?”

The answers to these questions will facilitate the definition of the resilience mechanisms of the built environment, using three attributes – diversity, connectivity and redundancy –, and answer the hypothesis: “it is possible to measure and evaluate the capacity of socio-spatial adaptation and innovation of a peri-urban system”.

3. A Proposed methodological framework for assessing resilience of a peri-urban system

3.1 Case study: “Vale do Ave” region

“Vale do Ave” region (Figure 1) is a territorial unit in the north of Portugal, north of the Oporto metropolitan area and south of river Cávado, named as NUT III of Ave. As a result of a territorial reconfiguration, in 2008, this territorial unit unhands two previous counties of the old NUT of Ave that now integrate the Oporto metropolitan area. However, the study region is made up of eight counties belonging to the old NUT, with an area of 1.245,9 Km2.
This territorial unit is marked by the Ave river hydrography and defined as a heterogeneous space with very different geographic and occupational characteristics, which allow us to identify distinct morphological areas (Figure 2). Sá and Domingues (2002) mention that “Vale do Ave system” is on a territory organized around the Ave and Vizela river banks, urban occupation going approximately till the altitude of 300 m, where mountain formations are physical barriers to urban occupation and define the borders of the system. On the other hand, Sá (1986, p. 51) identifies the “Medium Ave” saying that in this area there are three morphological unities matching urban systems with different characteristics.

Even though topographic and hydrographic characteristics may condition the occupation patterns, this system presents subsystems, namely road systems, that allow linkages (inside-outside) strengthening it as an open system. On the one hand, this opening condition is implied in the complexity of the system. On the other hand, open systems also create complex dynamics and the interrelation between their subsystems emphasizing their complexity and dynamics structures.

Based on these theories, we may consider “Vale do Ave” as an open and complex urban system where we find occupation patterns of compact and dispersed forms, artificial and natural forms and diversity of uses, that reinforce its identity.
Moreover, this territorial unity can be defined as a peri-urban area or, as Portas et al. (2003, p. 16) explains a “territory-city”, that sets itself “mainly for the relations between parts or differences, more than any other global form or tissues homogeneity, as would be, or we thought would be the gatherings that gave origin to it”. Piorr et al. (2011, p. 22) consider a peri-urban area as “the dynamic transition zone between the denser urban core and the rural hinterland, consisting of a lower density discontinuous urban fabric and a mix of residential, commercial and leisure-related land uses”. This transition zone has suffered desindustrialization phenomena since the 70s, which has led to dysfunctional open spaces.

According to these interpretations, this research work studies the “Vale do Ave” region as a peri-urban open system with post-industrial characteristics.

3.2 Methodology for the analysis of the resilience of a peri-urban system

The evolution of post-industrial peri-urban systems subjected to impacts, reflects marks that last over time. Indeed, the understanding of the transformation process of these systems demands their structural analysis having in mind complexity and “resilience thinking”.

This way, the methodological proposal is based on concepts from socio-ecological sciences, panarchy and adaptive cycles, believing that the path of a system can be seen as a reference factor to the analysis of resilience.

We try to analyse the capacity of adaptation and change of the urban system of “Vale do Ave”, by identifying permanencies and discontinuities as markers of identity persistence. We also evaluate the degree of the system’s resilience through diversity, connectivity and redundancy - resilience attributes - whose spatial dimension allows its appliance to the built environment. The operationalization of this methodology, apart from the previous criteria, is based on, the definition of a timeline where relevant happenings and specific patterns are registered, making it possible to study the evolution of the system. Indeed, the proposed methodology aims to answer the following question: “What are the resilience mechanisms of a peri-urban system that stand out in dispersed territories?”

The procedure for the application of the methodology is explained and is divided in three steps.

**Step 1. Setting the boundaries – defining the “focus area”**

Having in mind the framework proposed by Resilience Alliance (2010), the first step in evaluating the resilience of a socio-ecological system should be to define its borders, both spatial (an area or region) as well as temporal (over a five or fifty year period), and to understand what is called “focal system”, i.e., the “focal area” of the study region. On the other hand, in order to define limits, it is necessary to identify the questions for evaluation and the components that interact within the system, having in mind that it is influenced by endogenous and exogenous factors.

**a. Spatial boundaries**

For the analysis, the focal area is limited to a square (11x11Km) (Figure 3), although we are aware that there are no defined limits. These territories balance between urban and rural areas, thus evidencing porous boundaries. Also, we should have in mind that there are interactions at different spatial scales, as well as, the fact that there is no coincidence in administrative, dynamic and spatial borders, as Meadows and Wright (2008, p. 95) says “*systems rarely have real boundaries*”. 
A selection process defined the spatial boundaries which have taken into account the social, economic and institutional and morphological structures of the system, by using statistic data interpretation, cartography and aerial and satellite images, without forgetting subjectivity and interactivity as Nell et al. (2013) suggest.

**b. Temporal boundaries**

In order to analyse the evolution of physical, institutional and social systems of the wider regional system, it has been necessary to define a time line according to a retro regression criterion, from present time till the 50s of last century. The reason for this period of time is associated to the different productive cycles of the “Vale do Ave” region.

It is believed that past events influenced the system’s present behaviour and framed its urban form. On the other hand, the context and conditions in which some events have occurred will help to better understand the factors of change. The analysis of the changing process of the focal area implies spatial and temporal boundaries, identifying permanencies and discontinuities. Nell et al. (2013, p. 7) claim that: “Throughout this process it is important to begin to identify spatial and temporal patterns that
repeat themselves. The history of the focal system should be done as far back as possible, while remaining plausible and relevant to the study.”

**Step 2. Application of panarchy models and adaptive cycles**

**a. Qualitative evaluation using timelines**

In this second step, firstly, we intend to qualitatively evaluate the system under study, relating the evolution of elements of the built environment, as a component of the urban system, with events that occurred both in a national and a regional context.

After the definition of the spatial and temporal boundaries, we, secondly, intend to understand the evolution of the socio-economic and institutional structure, at a national and regional level, since the 50s. Such as Garcia (2013) refers, the morphogenetic studies of Conzen (1960); Whitehand (1967), and Slater (1990) have demonstrated that the morphogenesis of a city is connected to the socio-economic forces that act as changing factors of an urban system, contributing to the definition of change phases.

However, according to Garcia (2013), the definition of the phases of changes in the system is determined by the analysis of events and state changes of that system, at different temporal and spatial scales, which allows the evaluation of change in identity (equilibrium) within the system.

At first, we identify the different “adaptive cycles” – growth, maintenance, collapse and reorganization – by which passes the system under analysis in its process of adaptation and change, by recognizing behaviour, structure and characteristics that allow it to adapt to change. Nevertheless, the transitions between the four phases of the adaptive cycle do not always follow the same sequential pattern (Resilience Alliance, 2010). In order to identify the cycles, it is necessary to distinguish changes according to the extent of the effect of certain events and distinguish the types of changes that happened (socio-economic, institutional, physical). FIGURE

Thus, taking the adaptive cycle as a model (Folke, 2006; Folke et al., 1998; Gunderson and Holling, 2002; Holling, 1986; Holling, 2001; Resilience Alliance, 2010) and using the timeline with the records of changes of the system, we can identify the phases and/or phase of behaviour of the system over time (60 years), by analyzing the characteristics of the phase in which the system is in (degree of diversity, connectivity of performers, among others).

In general, it can be said that the phases of change of the wider structure at a national or regional level, can be differentiated from the phases of change of a local system, as well as, that higher scales tend to have lower speed changes, while lower scales have shorter cycles of change. Related to change, some authors emphasize the relation between scales and change rhythm, saying that smaller structures are grouped at smaller scales and change more and faster than bigger structures that are grouped at bigger scales (Garcia, 2013). Others, refer that “perennial” structures (streets and plots) change less than “volatile” structures (buildings and their uses) (Serra and Pinho, 2011).

In order to reinforce the analysis and to better understand the behaviour of the system under study, we can also use the panarchy model (Gunderson and Holling, 2002). We tend to equate the events and changes at different spatial scales, namely national, regional or local, city or street, considering that the events in lower scales can have an impact over events at a higher level or vice versa.
b. Quantitative evaluation using timelines

At a second moment, looking at the physical structure of the system under study, we intend to quantify changes in space and time, through the evolution of its buildings, roads, and hollow areas (Figure 4). This process uses cartography overlap of municipal digital cartographies and the Portuguese Military Map (scale 1:25 000) (Pinho and Oliveira, 2009; Serra and Pinho, 2011; Silva et al., 2012; Silva et al., 2009).

![Figure 4. Changes in Focal Area](image)

c. Analysis of the adaptive capacity and changing in peri-urban system

With a strategy of quantitative and qualitative correlation of changes it will be possible to analyze the “dependency paths” of the system at a detailed scale, giving information about the capacity of adaptation and change of the peri-urban system in what concerns the following elements: roads, buildings and spaces “between” buildings.
It is believed that through this process we will understand the extent to which the morphogenetic matrix of this system has shown adaptation and change capacity over time, highlighting their permanencies and discontinuities.

**Step 3. Evaluation of resilience mechanisms**

On this phase, having as a basis the analysis of morphological changes in the built environment of the focal system under study, referred to on step 1, we try to verify which of its characteristics have influenced the stability of the system, or else, the persistence of the identity of the system. When trying to understand the influence of the system’s form in its changing dynamic, three characteristics of resilience have been chosen as evaluation criteria: diversity, redundancy and connectivity. The reason is that we recognise the measurability and adequacy to a morphological approach of the territory (system).

It is believed that the capacity of adaptation and change of the peri-urban system is influenced by diversity, connectivity and redundancy of its road system. This way, we intend to make an interpretative analysis with the intention to correlate the degree of change of the system under study with the morphological change of its road system over time, which will allow the identification of continuities and discontinuities of the system under study.

In the urban system, diversity can be interpreted, at a certain scale, by its variety and mixture of objects of the same type, for example: mix of uses or diversity in the dimension of dwelling units. Diversity concentrates itself in the proportion of different objects (Salat et al., 2010). In this sense, we try to find analytical tools that can measure diversity with precision, in order to compare and evaluate different urban areas. According to Batty et al. (2004), diversity can be measured according to the variety and uniformity of urban functions. Other more common ways of measuring diversity, in ecology, are Simpson’s index and Shannon-Wiener’s index (Kajtazi, 2007). In this research, the number of routes hierarchies is considered as an indicator of diversity of the urban form (Salat et al., 2010).

Connectivity, in the urban system, matches the relative accessibility or the spatial interrelation of a system or web. It describes the number of different ways to go from a point to another point (Salat et al., 2010). As regards description and evaluation of road connectivity, there are different approaches that are supported by (1) the measurement of average properties of street crossings; (2) the density of crossings, size of block and cul-de-sac by area, proportion of forms of intersections, crossing rates for cul-de-sac, relation of “nodes” connections or average distance between intersections; (3) walking in the area of influence around a destiny of particular importance or a variety of available routes from surrounding origins to relevant destinies; (4) the accessibility of all parts of a network into consideration to each individual element of a street (Trova, 2012). The indicators of connectivity of urban form are considered to be the intersection density, the street density, the connected node ratio and the grid pattern (Dill, 2004).

As what concerns the last criterion, we can say that even when there are faults within the subsystems, the system as a whole still functions, if there is redundancy. This is common in engineering systems (in light or heavy infrastructures) and biological systems. Corson (2010) analyses leaves and tree structures, showing that redundancy inside the leaves increases tolerance to damage. The result has direct involvement in the transports networks and can also be applied to other kinds of urban networks: electricity, energy, water and waste (Salat and Bourdic, 2012). Sevtsuk et al. (2013) have developed a tool to analyse the redundancy of an urban system which allows us to find alternative paths between an origin and a destiny, within a certain short way and the optional segments or routes.
In this research work, the number of alternative paths that connect houses to different road infrastructures networks is indicator of the redundancy of the urban form (Lhomme et al., 2013).

In this phase, we try to verify whether diversity, connectivity and redundancy, are attributes of the built environment system and influence changes of the peri-urban system, contributing to generate alternatives in moments of crisis.

3.3 Conclusions

Having into account that peri-urban systems in dispersed territories become more susceptible to uncertainty and liquidity of time, we have questioned: “What are the resilience mechanisms of a dispersed territory that allow it to better deal with unpredictable impacts?”; by thinking about the adequate methodology to give an answer to this question.

Several concepts related to “resilience thinking” have been approached, starting with the deepening of the resilience concept. The concept has been embraced as the capacity to adapt, the capacity to absorb a shock in a systemic perspective, as well as the capacity to reorganize in order to find a new balance.

To operationalize “resilience thinking”, we will use a study case where the applicability and measurability of some resilience attributes can be possible. The “Vale do Ave” region, considered as a complex and adaptive urban system, and here briefly presented, is our case study for future application of the methodology. This region will required an approach of the theory of complexity and of panarchy models and adaptive cycles as instruments able to interpret changes in the study system, giving focus to the morphogenetic matrix of the system.

Due to the complexity of the study case, interpretative strategies have been defined that have combined qualitative and quantitative analysis of the spatial dimension in the urban system of “Vale do Ave”. Correlating these analyses, we are convicted that some mechanisms are possible to be read, such as diversity, connectivity and redundancy, which turn the study system into a resilient system, undergoing a change process.

With this research work, we hope to contribute with a better understanding of the region, in particular, evidencing that some past phenomena, namely the economic model based on the transition from agriculture into industry, have had effects on a social and economic organization that is reflected on the dispersion of houses and of employment, still visible nowadays.

Nevertheless it was necessary to ask: “In what way has the past of the system, which comprises the sample in analyses, influenced its morphogenetic matrix?” Thus, a triangulation of methods has been developed: (1) method 1 – ecological panarchy model; (2) method 2 – ecological method of adaptive systems; (3) method 3 – morphological approach. The first two methods will highlight dynamics of change, which take into account the events that attain a system, even locally, or regionally or nationally. On the other hand, the morphological approach will allow an analysis of the spatial transformations of the sample being analysed, at a micro scale. This is important because of the complementarity it gives to the analysis and because it reinforces the triangulation of the methodology to be applied.

It is believed that this research work can build a set of criteria taken from “resilience thinking”, which may help several regional and local performers, and use them in contexts similar to “Vale do Ave”
region. The methodology presented aims to contribute to future research works that seek to build tools of measurement and evaluation, simultaneously qualitative and quantitative of resilience, for dispersed territories.

- References


