Urban Resilience – The social perspective

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Thesis to obtain the Master of Science Degree in

Environmental Engineering

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November 2014

Acknowledgements

Abstract

The present dissertation studies the urban resilience through a social perspective, through the understanding of how urban resilience can incorporate a social perspective, of what socially drives the urban system and what social disturbances and changes affect the urban system resilience, why and how. The social perspective concerns the urban system social dynamics and is represented by the evolution of demography, social vulnerability, mobility and city attractiveness, in order to allow the assessment of this perspective contribution to the urban system resilience.

A literature review is performed on social-ecological systems resilience, urban resilience and social innovation concepts, through which is developed the adopted methodology and is incorporated the social perspective into urban resilience context. The adopted methodology consists in five steps – translation of the social perspective into the urban resilience; definition of the focal scale; identification of indicators; development history and interpretation from the perspective of long-term resilience – and is based on the methodology developed by Kumagai which considers a long-term perspective of urban resilience and takes into account the governance actions and the people associated to the urban system. The translation of the social perspective into urban resilience is performed through social dynamics and social innovation concepts, and the characteristics associated to a city urban development. The adopted methodology is applied to the city of Lisbon, the city governments' policies are analyzed and the social drivers and the social disturbances and changes affecting the urban system resilience are identified and assessed.

According to the results it is concluded that demography, social vulnerability, mobility and city attractiveness are what socially drives any urban system of the same type as the one studied, a city associated to an urban development. It is also concluded that the city of Lisbon has been facing over the last 50 years a mix of desirable and undesirable qualities. The desirable qualities have been facilitating the urban system transition to a sustainable behavior and therefore are building urban long-term resilience while for the undesirable qualities the current city government implemented policies present an opportunity to reverse the city social disturbances negative trends.

KEYWORDS: Urban Resilience, Long-term Resilience, Social Dynamics, Social Innovation, Lisbon.

Resumo

A presente dissertação estuda a resiliência urbana através de uma perspectiva social, através da compreensão de como a resiliência urbana pode incorporar uma perspectiva social, do que conduz socialmente o sistema urbano e de quais as perturbações e mudanças sociais que afectam a resiliência do sistema urbano, como e porquê. A perspectiva social refere-se às dinâmicas sociais do sistema urbano e é representada pela evolução da demografia, vulnerabilidade social, mobilidade e atractividade da cidade, de modo a permitir a avaliação do contributo desta perspectiva para a resiliência do sistema urbano.

Uma revisão da literatura é realizada considerando os conceitos de resiliência de sistemas sócio ecológicos, resiliência urbana e inovação social, através dos quais é desenvolvida a metodologia adoptada e é incorporada a perspectiva social no contexto da resiliência urbana. A metodologia adoptada consiste em cinco passos – translação da perspectiva social para o contexto da resiliência urbana; definição da escala focal; identificação de indicadores; desenvolvimento histórico e interpretação pela perspectiva da resiliência de longo termo – e é baseada na metodologia desenvolvida por Kumagai, que considera uma perspectiva de resiliência de longo termo e tem em conta as acções da governança e as pessoas associadas ao sistema urbano. A translação da perspectiva social para o contexto da resiliência urbana é realizada através dos conceitos de dinâmicas sociais e inovação social e das características associadas a um desenvolvimento urbano de uma cidade. A metodologia adoptada é aplicada à cidade de Lisboa, as políticas de governança dos governos da cidade são analisados e as forças motrizes, as perturbações e as mudanças sociais que afectam a resiliência do sistema são identificadas e avaliadas.

De acordo com os resultados, é possível concluir que a demografia, a vulnerabilidade social, a mobilidade e a atractividade da cidade são o que conduz socialmente qualquer sistema urbano do mesmo tipo que o estudado, uma cidade associada a um desenvolvimento urbano. É também concluído que a cidade de Lisboa tem vindo a enfrentar nos últimos 50 anos um conjunto de qualidades desejáveis e indesejáveis. As qualidades desejáveis têm facilitado a transição do sistema urbano para um comportamento sustentável e estão portanto a construir resiliência urbana de longo-termo enquanto que para as qualidades indesejáveis as políticas implementadas pelo actual governo da cidade apresentam uma oportunidade para reverter as tendências negativas das perturbações sociais.

PALAVRAS-CHAVE: Resiliência Urbana, Resiliência de Longo Termo, Dinâmicas Sociais, Inovação Social, Lisboa.

List of Abbreviations

SES	**Social-Ecological System**
LMA	**Lisbon Metropolitan Area**
LUMP	**Lisbon Urban Master Plan**
MMP	**Municipal Master Plan**
LSP	**Lisbon Strategic Plan**
LMMP	**Lisbon Municipal Master Plan**
SVL	**Strategic Vision for the city of Lisbon**
ISOCARP	**International Society of City and Regional Planners**
EEC	**European Economic Community**
WTA	**World Travel Awards**

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1   Introduction

1.1   Scope and objectives

The world has been facing a staggering population growth and a continuous increase in the number and size of its urban areas. According to the United Nations (2014), the world has, currently, a population of 7.2 billion of which over half (54 percent) lives in urban areas, being projected an increase in population up to 9.6 billion by 2050 with 66 percent of the population being urban. Thus, the urban areas across the world are the ones expected to absorb this projected population growth over the next four decades while at the same time draw in some of the rural population. Furthermore, most of the population growth expected in urban areas will be concentrated in the cities and towns of less developed regions (United Nations, 2012).

Cities are the growth drivers of our future and as engines of economic growth offer opportunities for sustainability, but at the same time also present many challenges, such as poverty, pollution and disease. There are already several developed initiatives attempting to meet these challenges, such as *UNESCO's initiative on Urban Biosphere* (which applies the biosphere reserve concept to urban areas) and the *World Bank's Cities Alliance and Cities in Transition* (source of financial and technical assistance to developing countries around the world, comprising the *International Bank for Reconstruction and Development* and the *International Development Association*), among other related integrative initiatives. Still, there is a need for examining urban systems in terms of theirs resilience – system capacity to adapt and respond to change and disturbances without collapsing.

Resilience Alliance (2007) states that recent ecological and social disturbances (for example, natural disasters and loss of population, respectively) have highlighted the need for urban systems to cope with unexpected disturbances, and that while there are emerging research focus on sustainable cities, remains a poor scientific understanding of the processes and factors that make some cities vulnerable to disturbances and others resilient. Thus, through the study of urban system and their disturbances, opportunities will arise for investigating new ways of changing the urban systems in line with the changing needs and requirements of urban populations.

Clearly, there is an emerging need of examining urban systems in terms of theirs resilience, disturbances and changes to allow a better and deeper understanding of the growing urban areas and respective population. Thus, the present dissertation has as objective to study the urban resilience through a social perspective, through the understanding of how urban resilience can incorporate a social perspective, of what socially drives the urban system and of what social disturbances and changes affect the urban system resilience, why and how. For this purpose, is adapted an existing methodology, Kumagai methodology, to allow the assessment of urban resilience through a social perspective that is further applied to a case study, the city of Lisbon, regarding a specific urban system where the social drivers and the social disturbances and changes affecting the urban system resilience are identified and assessed. Thus, in the present study, the social perspective concerns the urban system social dynamics and is represented by the evolution of demography, social vulnerability, mobility

and city attractiveness, in order to allow the assessment of this perspective contribution to the urban system resilience.

1.2 Methodology and dissertation structure

In order to achieve the defined objectives, the present dissertation followed four main steps represented in figure 1.
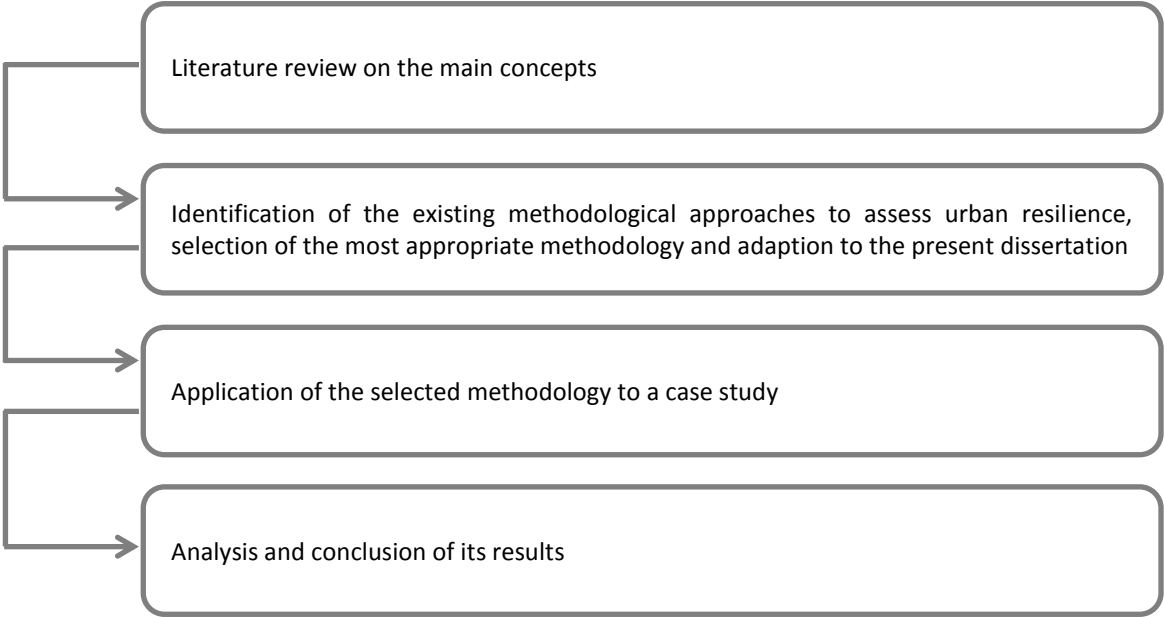
Figure 1: Scheme of the present dissertation research methodology.

First, to allow the study of urban resilience through a social perspective is developed a literature review on three main concepts: social-ecological systems resilience, urban resilience and social innovation. Social-ecological systems resilience is addressed to provide a theory background based on ecological resilience fundamentals that allows the resilience assessment of any social-ecological system (any dynamic system that emphasize the *human-in-nature* perspective, where the ecosystems are integrated with the human society), including urban systems. The urban resilience concept, although based on the theoretical fundamentals of social-ecological systems resilience, is addressed to provide a narrower approach of the assessment of urban systems resilience and to introduce a social perspective through social dynamics. Social innovation is considered to complement the social perspective under study and to allow the understanding of which programs, products or processes change the social system (social innovations).

Secondly, are identified and analyzed two main methodologies based on the previous literature review that allow the assessment of urban resilience through a social perspective, the Resilience Alliance methodology (Resilience Alliance et al., 2010) based on social-ecological systems resilience theory and the methodology developed by Kumagai (Kumagai et al., 2010) based on urban resilience fundamentals. Then, Kumagai methodology is selected because is specifically designed for urban systems, considers a long-term perspective of urban resilience, and takes more into account the governance stakeholders actions and the people associated to the urban system, being more adequate to study the social aspects of urban resilience. At last, is

developed the translation of the social perspective into urban resilience, the only adaptation required to apply to Kumagai methodology for assessing urban resilience through a social perspective.

Third, is applied the adopted methodology to an urban system case study, the city of Lisbon. The choice for Lisbon as the urban system to be studied has to do with the fact of it being the most important city in the country (the capital) with characteristic social disturbances, as the loss of population. The presentation of the city is followed by the development of the city government policies over the last 80 years, through the analysis of the Lisbon Urban Master Plan of 1948 and the Lisbon Municipal Master Plans of 1994 and 2012 objectives. Other two Lisbon Urban Master Plans (of 1959 and of 1967) could have also been analyzed, but once they focus, as well as the first master plan, on the city emerging needs regarding infrastructures and road network they would not add new information to the social perspective under study. Then, a set of 17 indicators is defined and analyzed to further allow the interpretation of the social perspective in the context of long-term urban resilience of Lisbon. The set of indicators only allows the analysis of the city social perspective over the last 50 years, due to the lack of previous data, being this the timeline under analysis.

Fourth, is developed the interpretation of the analysis of the case study social perspective through the long-term resilience context over the last 50 years, and are established the possible conclusions about the social perspective of urban resilience.

Therefore, the present dissertation is divided in six chapters:

- **Chapter 1 – Introduction**: presentation of the dissertation scope, objectives, research methodology and structure;

- **Chapter 2 – State of art**: Literature review regarding social-ecological systems resilience, urban resilience and social innovation concepts;

- **Chapter 3 – Proposed methodology for assessing urban resilience through a social perspective**: identification, analysis and comparison of the two main methodologies that allow the assessment of the resilience of an urban system, Resilience Alliance and Kumagai methodologies. Selection of the most adequate methodology to study the social aspects of urban resilience, Kumagai methodology, and development of the needed adaptation to allow the present research;

- **Chapter 4 – Case study**: Application of the adopted methodology to the city of Lisbon. Presentation of the city government policies over the years, identification and analysis of a set of indicators that allows the further interpretation and assessment of Lisbon social disturbances through the perspective of long-term resilience;

- **Chapter 5 – Interpretation of the perspective of long-term resilience**: interpretation and discussion of the results obtained with the application of the adopted methodology to the case study and

- **Chapter 6 – Conclusion**: conclusions and possible recommendations.

2 State of Art

2.1 Social-Ecological Systems (SESs) Resilience

The term resilience has a Latin root, *resilire*, meaning rebound or recoil (Latin Dictionary) and has been introduced in the English vocabulary around the 17th Century (McAslan, 2010). Thomas Tredgold published in 1818, *On the Transverse Strength of Timber*, what today is considered as the first academic work using the resilience term. Tredgold used resilience to describe a timber's property and to explain how some types of wood were capable of supporting extreme loads without breaking. Four decades later, Robert Mallet developed a resilience measure, the *modulus of resilience*, to evaluate a material capacity to tolerate severe conditions (McAslan, 2010). The *modulus of resilience* was firstly defined by Mallet as the needed energy to a material rupture after the application of a force (McAslan, 2010), and nowadays Gere and Goodman (2009) defines it as "the ability of a material to absorb and release energy, within the elastic range".

Crawford Stanley (Buzz) Holling introduced in the ecological literature, in 1973, the word resilience to describe and characterize, along with the stability concept, the behavior of ecological systems along time (Gunderson and Allen, 2010). Holling (1973) states that resilience – the measure of an ecosystem capacity to absorb changes and disturbances and continue to exist – and stability – the system capacity to return to the equilibrium state after suffering some temporary change or disturbance – are two important properties of an ecological system and proposes that the relation between these properties characterizes the ecological system behavior.

In the ecological literature, the system resilience may be defined as engineering or ecological resilience, reflecting two different aspects of stability (Gunderson and Allen, 2010; Holling, 1996). Engineering resilience focuses on efficiency, constancy and predictability (Holling, 1996), and is defined as the "rate or speed of recovery of a system following a shock" (Gunderson and Allen, 2010). Ecological resilience focuses on persistence, change and unpredictability (Holling, 1996), and is defined as "the magnitude of a disturbance that triggers a shift between alternative states" (Holling, 1996, 1973).

While in the 17th century the resilience concept was mainly associated to the civil, mechanical and naval engineering field, and in the 20th century it started to be applied to ecological and environmental systems, since then it has been used in other areas of study, as presented in table 1.

As can be seen in table 1, almost all the definitions of resilience applied to a varied range of study areas are based on the initial concept of resilience. Except for the application to disasters, the resilience definitions (including social-ecological systems resilience) consider the system's capacity to deal with changes or disturbances without losing its functions. On its turn, the application to disasters takes into account the system's capacity to prevent and protect against changes or disturbances, instead of the system's capacity to deal with them.

Table 1: The definition of resilience for various areas of application.

Area of application	Resilience definition
Ecology	"A measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationship between population or state variables" (Holling, 1973).
Physics	"The ability to store strain energy and deflect elastically under a load without breaking or being deformed" (Gordon, 1978).
Population	"The rate at which a population's density returns to its equilibrium level after being moved away from it" (Pimm, 1991).
Social	"The ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (Adger, 2000).
Urban Systems	"The degree to which cities tolerate alteration before reorganizing around a new set of structures and processes" (Alberti et al., 2003).
Disasters	"The capability to prevent or protect against significant multihazard threats and incidents, including terrorist attacks, and to expeditiously recover and reconstitute critical services with minimum damage to public safety and health, the economy, and national security" (TSIP - The Infrastructure Security Partnership, 2006).
Psychology	"Process of adapting well in face of adversity, trauma, tragedy, threats or significant sources of stress" like economic, health or family problems (APA - American Psychological Association et al., 2011).
Regional Economy	"The ability of a region to recover from an economic downturn within a relatively short period of time" (Augustine et al., 2013).
Social-Ecological Systems (SESs)	"The magnitude of change or disturbance that a system can experience without shifting into an alternate state that has different structural and functional properties and supplies" (Resilience Alliance et al., 2010).

Social-ecological systems (SESs) can be defined as dynamic systems that emphasize the *human-in-nature* perspective, where the ecosystems are integrated with the human society (where social, ecological, political, cultural, economic, technological, and other components interact with each other) (Berkes et al., 2003; Resilience Alliance et al., 2010). Resilience Alliance et al. (2010) add to this definition that SESs are made of several different parts that interact to form a more complex one, as can be seen in the scheme presented in figure 2.

Figure 2 also presents SESs elements – human system and ecosystem – and the way these are linked – through actions/interventions and ecosystem services.
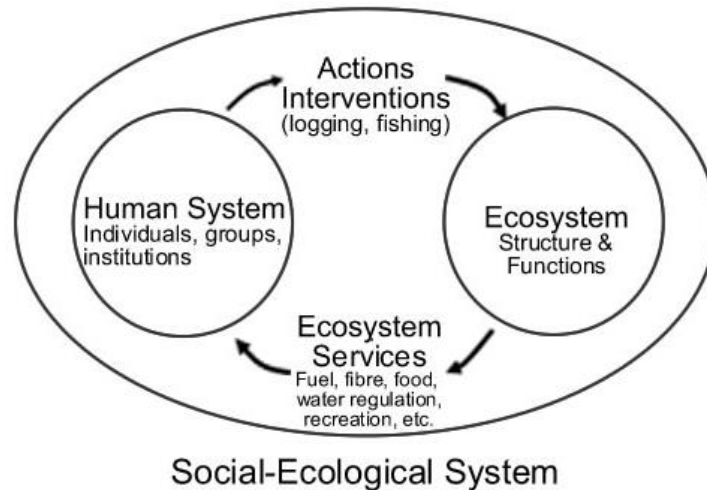
Figure 2: Conceptual diagram of SESs elements. Source: Resilience Alliance (2014a).

Although there are other definitions of SESs resilience (Carpenter et al., 2001; Walker et al., 2004), besides the one presented in table 1, they have some similarities. They all consider the disturbance that the system can undergo or absorb, and highlight the importance that the possible shift of state has to the concept of resilience.

Disturbances – can generally be thought as anything that causes system disruptions – and uncertainty around the timing and magnitude of such events present challenges to the SESs management and to the reliability of the ecosystems services supply. In SESs, disturbances can include natural disasters, diseases, economic collapses, revolutions, innovations and also human interventions, and can occur as a relatively discrete event in time or as a more gradual or cumulative pressure. Understanding the pattern of a disturbance event over time can inform how to work with it instead of attempting to control or prevent it, which may ultimately weaken a system's resilience. Disturbances patterns can also change over time, having an inherent degree of uncertainty. There are events that are impossible to predict, for example the exact moment when a lightning bolt may begin a fire in a forest. Still, is possible to help reduce the level of uncertainty around the timing and size of a future fire through the estimates of fuel load, degree of connectedness to surrounding forests, and weather conditions (Resilience Alliance et al., 2010).

Carpenter et al. (2001) state that is very important to consider the disturbance magnitude that a system can tolerate before transitioning into another spatial state. Taking this into account, Berkes et al. (2003) consider three kinds of system resilience:

- *Health*: capacity to deal with and absorb small disturbances and to maintain normal operations under normal environmental conditions;

- *Recovery*: capacity to cope with change and to turn back from large disturbances and

- *Self-organization*: capacity to continue the current rebuilding and transforming processes after major disturbances or collapse situations.

The possibility of state shift is highly connected to the SESs resilience concept and can be represented by the distance between a system state – state in which the system with a certain set of social and ecological variables

is – and a critical threshold – when the system transitions from one state to another (Resilience Alliance et al., 2010). Therefore, Walker et al. (2004) define four essential aspects to understand and characterize SESs resilience:

- *Latitude (L)*: the maximum load that a system is able to change before crossing a critical threshold and losing the capacity to recover;
- *Resistance (R)*: the systems resistance to change;
- *Precariousness (Pr)*: the system trajectory and how near it is to a threshold and
- *Panarchy (Pa)*: how latitude, resistance and precariousness are influenced by (sub)systems dynamics and states at different scales.

In order to explain this four characteristics application in SESs, Walker et al. (2004) use the concepts of *system state space* – defined by the system state variables –, *basin of attraction* – state space region where the system tends to remain - and *stability landscape* – the diverse basins that may be occupied by the system and respective boundaries.
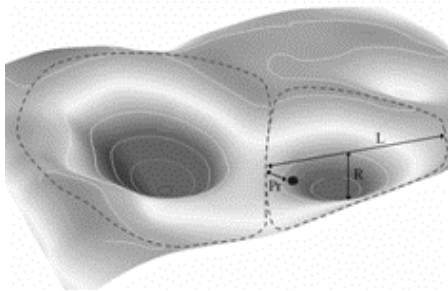
Figure 3: Three-dimensional stability landscape with two basins of attraction. Source: Walker et al. (2004).
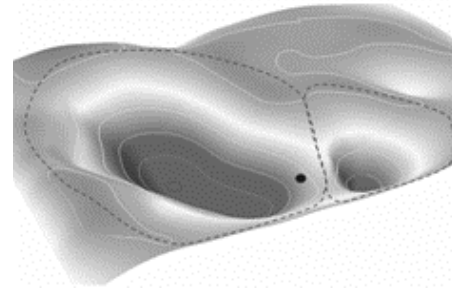
Figure 4: Stability landscape change. Source: Walker et al. (2004).

Figure 3 presents a 3D stability landscape with two basins of attraction and the representation of the actual system resilience. Figure 4 shows that changes in the stability landscape and consequently in the basins shape do not necessarily lead to a change in the system resilience, demonstrating adaptability (Walker et al., 2004).

Folke et al. (2004) recognize the importance of the four aspects presented by Walker et al. (2004) in resilience of ecosystem management, Resilience Alliance et al. (2010) highlight the need to know the actual, past and potential future system state in order to understand a SES resilience, and Berkes et al. (2003) emphasize the need of adaptability to achieve a SES sustainable management.

2.1.1 The Adaptive Capacity

SESs are constantly buffeted by disturbances, stochasticity, and people actions. The management of SESs resilience faces uncertainty and unpredictability issues, needing an adaptability capacity by those who manage and participate actively in this process (Gunderson and Holling, 2002). In a simpler way, Walker et al. (2004) defines adaptability as the capacity of humans to manage resilience.

Human actions dominate in SESs, once are the individuals and groups that act to manage the system. Either their actions are intentional and/or unintentional they affect ultimately the systems resilience, and make of adaptability mostly a social property. How SESs resilience is managed will determine the system's capacity to

avoid crossing into an undesirable state or to be able to go back into a desirable one (Walker et al., 2004). Folke et al. (2004) and Walker et al. (2004) consider that is possible to accomplish this capacity through modifications (performed by the individuals and group actors) in latitude (change thresholds away from or closer to the system state), resistance (turn the threshold more easy or difficult to reach), precariousness (move the systems state away from or closer to the threshold) or panarchy (manage cross-scale interaction in order to avoid or generate resilience loss at the most unfavorable scales). Thus, the human, individually and collectively, ability to control and modify each of the resilience aspects is a measure of adaptability.

The adaptive capacity of a SES can be considered as the way the system deals with and responds to a change and it respective impact (Berkes et al., 2003), which implies a constant learning and flexibility from the system to respond to disturbances, changes and shocks with novel solutions adaptation (Carpenter et al., 2001; Mccarthy et al., 2011), creating an opportunity to self-organize towards social-ecological sustainability (Resilience Alliance et al., 2010).

Sometimes, systems are in an undesirable state and efforts to go back into a desirable state are no longer possible. The option to resolve this situation is the transformation of the existing system into one of a different kind, with a different panarchy, with new variables, new ways of making a living and different scales (Resilience Alliance, 2014b). Thus, transformability is the capacity to create a fundamentally new system when ecological, economic, social and also political structures make the existing system untenable, vulnerable, and unable to adapt or self-organize, needing to be transformed (Resilience Alliance et al., 2010; Walker et al., 2004). Novelty, diversity and human capital organization are some of the attributes that may be required for successful transformability (Walker et al., 2004).

More specifically, in SESs, sometimes societies or groups may find themselves trapped in an undesirable basin that has started to become so wide and deep that the reconfiguration of the existing basin or the movement to a new one becomes very difficult. So, at some point it may be necessary to configure a new stability landscape with new state variables or the old ones supplemented by new ones. Some examples of SESs that have turned untenable to transform until it has been too late are salinized agricultural systems, dams, floodplains and flood control (Walker et al., 2004).

2.1.2   The Adaptive Cycle – A conceptual model of change

SESs, as dynamic systems, do not tend to an equilibrium state (Carpenter et al., 2001) and can experience progressive and/or rapid changes (Resilience Alliance et al., 2010). In order to better understand these systems dynamics, the adaptive cycle was introduced in the SESs resilience management (following the ecological resilience literature, once the concept of the adaptive cycle is central to resilience thinking).

The adaptive cycle, represented in figure 5, illustrates how a system changes along time through four enchained phases:

- **_Rapid growth or exploitation phase (r)_**: growth phase that merge into conservation phase (k);
- **_Conservation or maintenance phase (k)_**: slowly, resources start to be more unavailable, and consequently, the system becomes less flexible and less reactive to external shocks moving into collapse phase (Ω);
- **_Collapse or release phase (Ω)_**: chaotic phase that rapidly turns into reorganization phase (α) and
- **_Reorganization or renewal phase (α)_**: where innovation and new opportunities may occur.
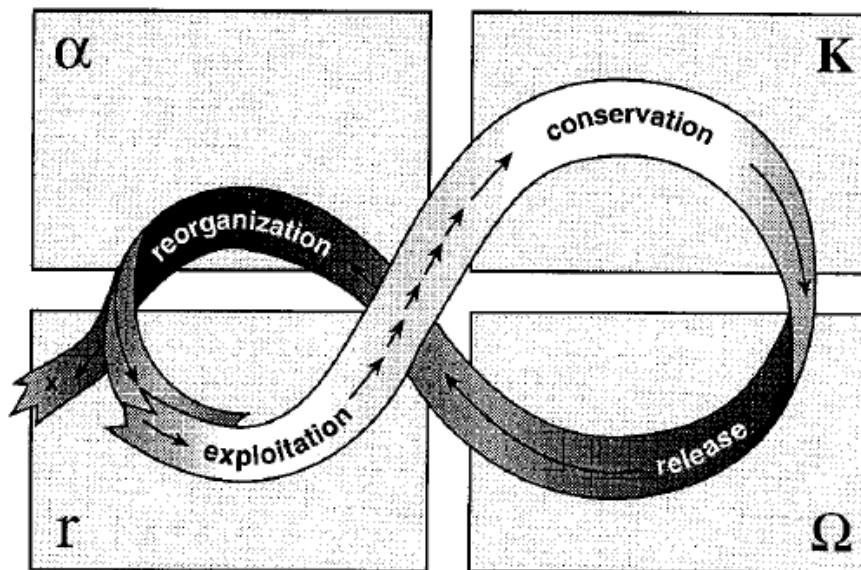
Figure 5: The adaptive cycle. Source: Holling (2001).

One of the fundamental features of the adaptive cycle is the alternation between relatively brief periods (from release to reorganization), in which major changes occur and opportunities for innovation may occur, and long and slow progressions (from exploitation to conservation) of slow accumulation and resources transformation (Carpenter et al., 2001; Gunderson and Holling, 2002; Holling, 2001). The release and reorganization phases are usually called the _back loop_, being characterized by its unpredictability and uncertainty and where the novel recombinations may lead to innovations in the next cycle, while the exploitation and conservation phases are usually called the _front loop_, where change is gradual and more deliberate, turning the phase more predictable as it evolves (Carpenter et al., 2001; Holling, 2001; Westley and Antadze, 2010; Westley, 2008).

Resilience Alliance et al. (2010) and Walker et al. (2004) alert that although the adaptive cycle is representative of the system behavior (observed changes), it does not mean the cycle trajectory is fixed. A system can transition between the adaptive cycle phases and do not follow the sequential pattern presented above, moving back from conservation phase toward exploitation, moving directly from exploitation phase to release or even moving back from reorganization phase to release (Resilience Alliance et al., 2010; Walker et al., 2004).

The application of the adaptive cycle to SESs resilience can be very useful to the management of these systems resilience. Understand and evaluate correctly the system behavior (disturbances, internal changes, and vulnerabilities) through the adaptive cycle phases enables SESs managers to intervene sooner and faster.

However, it is also necessary to know when and how to intervene or not. Actions may affect the system differently, depending on the adaptive cycle phase they are being taken and on the opportunity windows (that might be brief) (Resilience Alliance et al., 2010).

Understanding how SESs change through time, its drivers, vulnerabilities, the past disturbances and respective responses allows a perception of what may be the systems evolution into the future (Folke et al., 2002).

2.1.3 The Panarchy – Cross-scale interactions

A SES, as most other systems, does not exist alone, interacting with larger-scale systems in which it is integrated and with smaller-scale systems of which it is comprised (Resilience Alliance et al., 2010). In order to understand this cross-scale interactions, Gunderson and Hooling (2002) introduce the panarchy concept. The panarchy is a term used to describe the dynamics evolving hierarchical systems with multiple interrelated elements, being represented by linked adaptive cycles interacting across scales, as presented in figure 6 (Berkes et al., 2003; Gunderson and Holling, 2002; Resilience Alliance et al., 2010).
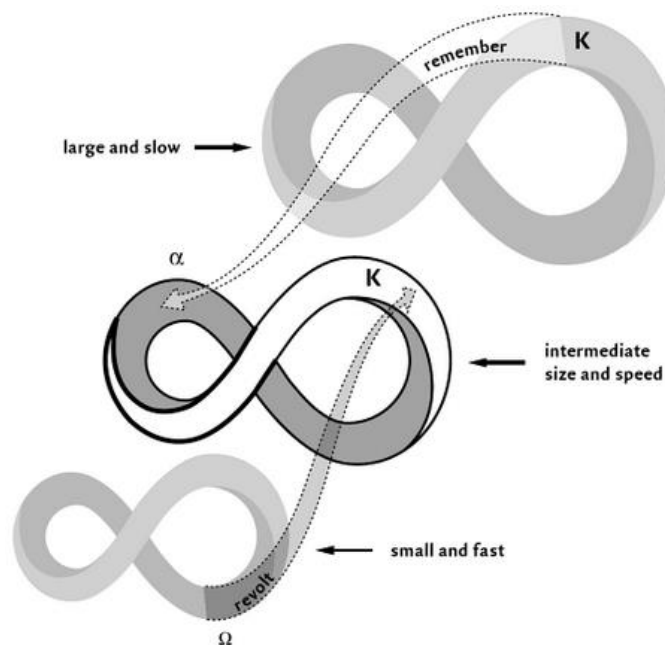
Figure 6: Panarchical connections. Source: Berkes et al. (2003).

Panarchy representation has two key features: the adaptive cycle – specially the α phase which is considered the variety motor and new experiments generator within levels – and the connections between levels – designated as revolt and remember are two types of cross-scale interactions that become important at times of change (Resilience Alliance et al., 2010). Revolt connection may cause a critical change in a larger and slower cycle cascading up into a vulnerable phase, while remember promotes renewal through the accumulated potential that has been stored in a larger and slower cycle (Gunderson and Holling, 2002). Thus, what happens in a system at one scale might affect what happens at other scales (Resilience Alliance et al., 2010).

SESs function as hierarchical structures, so is important to understand what happens at multiple scales and how the focal system reacts to the constraints or to the innovations imposed from larger and smaller scale

systems (Berkes et al., 2003; Gunderson and Holling, 2002; Resilience Alliance et al., 2010). The larger and slower cycles usually constrain the smaller and faster ones, being generally responsible for the integrity of the systems due to the cross-scale interactions. Regarding a specific system focal scale – SESs spatial and temporal boundaries – its resilience will depend on the states and dynamics of the systems at scales above and below it (Resilience Alliance et al., 2010).

2.1.4   Adaptive Management and Co-management

Adaptive management is an inductive, social learning based approach combining ecological literature with active human interventions in nature and considering human response processes knowledge. It deals with the unpredictability associated to social-ecological interactions (Berkes et al., 2000), emphasizes *learn-by-doing* approaches (Berkes et al., 2003), is designed to decrease and determine uncertainty key sources (Gunderson and Allen, 2010), and views policies as suppositions and actions as ways of testing them (Resilience Alliance et al., 2010).

An active adaptive management requires a social context with flexible and open institutions and multi-level governance systems that allow learning and adaptive capacity increase (Folke et al., 2002), and an active resilience adaptive management is needed to develop desired states of ecosystem (transform deteriorated ecosystems into new and more desirable configurations) (Folke et al., 2004).

Adaptive co-management is considered an evolving and self-organizing approach for SESs governance that offers considerable appeal in light of complex systems view. Adaptive co-management novelty comes from the combination between the adaptive management learning and the collaborative management in which rights and responsibilities are shared, and involves cross-scale interactions and complex and dynamic learning processes, fostering more robust SESs**.** Adaptive co-management key features consider (Resilience Alliance, 2014c):

- *Learn-by-doing focus*;
- *Different knowledge systems synthesis*;
- *Collaboration and power-sharing among community, regional and national levels* and
- *Management flexibility*.

The presented adaptive co-management key features can promote an oriented and emerging governance approach in which strategies – including communication among interested groups, complex institutions development, and institutional strategies that facilitate testing and learning through change – are sensitive to social and ecological feedbacks towards SESs resilience and sustainability. Some other issues are addressed by adaptive co-management as processes and results assessment improvement, social capital role, relevant interactions, and trust building as the basis for SESs governance (Resilience Alliance, 2014c).

2.2   Urban Resilience

Urban systems are complex and dynamic systems with ecological and human issues depending on each other at multiple scales, where ecological functions are modified to accommodate the human structures and activities (Kumagai et al., 2010). Cities (urban systems) as *living systems* – dynamic, connected and open systems – are continuously evolving through internal interactions and external factors influence (Bai, 2003), and are considered as one of the best examples of a social-ecological system (Levin, 1999).

Cities may change abruptly and faster than the human capability to understand the factors influence on those changes (Resilience Alliance, 2007), demanding a profound knowledge on cities complexity and development, and capacity to adapt (Batty et al., 2004). Resilience Alliance (2007) considers that cities abrupt changes depend on spatial and temporal perspectives and that what may appears to be an abrupt change to a certain system may be a gradual or insignificant to another. For example, the urban gentrification process can take decades, market cycles in housing prices crashes over months and sometimes years, stock markets crashes over days, while urban traffic jams occur over minutes (Batty et al., 2004).

Resilience applied to urban systems can be defined as the "degree to which cities are able to tolerate alteration before reorganizing around a new set of structures and processes" (Alberti et al., 2003), and measured by the way cities balance simultaneously ecosystem and human functions (Resilience Alliance, 2007). The decrease of resilience increases vulnerability, leading to the urban system exposure to greater risks of the vagaries of surprise and uncertainty (Folke et al., 2002). Generally, the resilience decrease takes progressively smaller shocks to cause crises or chaos on systems. This is a cumulative process that tends to shift a systems towards criticality (Resilience Alliance, 2007).

Building resilience is particularly important in areas highly impacted by humans, as cities, coastlines, agricultural land and industrial zones. These areas are the most valued (economically and aesthetically) by people, turning the society dependent on them (Resilience Alliance, 2007). Being also important to know the sources that build resilience, is possible to identify six resilience sources (Berkes et al., 2009; Kumagai et al., 2010; Norris et al., 2008):

- *Diversity*: biological, social, landscape, cultural and economic;
- *Flexibility and variability*: to cope with surprise;
- *Supportive linkages* and *modularity* (multiple components able to function independently if necessary) and *redundancy*: to prevent system collapse;
- *Information* (especially regarding trends and thresholds): to anticipate possible future states;
- *Social capital* (including networks, innovation and mutual trust) and
- *Integration of social, ecological, and other considerations*.

The concept of urban resilience is based on the theoretical fundamentals of social-ecological systems (SESs) resilience presented in the previous section, once urban systems are SESs. Although they are both complex and dynamic systems with ecological systems integrated with human issues, urban systems are more restrict once

all urban systems are SESs but the contrary does not verify. Thus, the present section only addresses issues regarding urban resilience that have not been addressed in the previous section.

2.2.1 Building Long-term Resilience

Many applications of resilience to urban systems have been dealing with the potential future changes and disturbances that may affect the system, disregarding whether or not the results contribute to a sustainable behaviour. Sustainability includes, as one of its crucial elements, lasting well-being which can be understood as the "decent life for everyone based on integrity of socio-biophysical systems and maintenance of their support functions, while paying attention to intra- and inter-generational equity" (Gibson, 2006; Kumagai et al., 2010). Intra-generational equity requires ensuring that sufficient and effective choices are pursued for all in ways that reduces dangerous gaps in sufficiency and opportunity – and security, health, social recognition, political influence, and so on – between the rich and the poor, while intergenerational equity requires favoring the present options and actions that most likely will preserve or enhance the opportunities and capabilities of future generations to live sustainably (Gibson, 2006).

In order to differentiate from those applications, Kumagai et al. (2010) developed a methodology to assess the resilience of urban systems regarding lasting well-being, the system transition to a sustainable behavior and governance activities through the perspective of long-term resilience. Their methodology consists in understanding what drives the urban system under assessment, what characterizes it, how did the urban system developed/changed through time and in analyzing it through the lens of long-term resilience.

The long-term resilience of an urban system is "the system capacity to respond to change and disturbance and to enhance the conditions for well-being, based on careful attention to the complex interrelationships of all factors and to the specifics of particular contexts through governance combining adaptation with transition" (Kumagai et al., 2010).

Kumagai et al. (2010) identifies as one of the urban resilience study major problems the fact of resilience might be desirable or undesirable. The ecological literature tends to assume resilience – the maintenance or re-establishment of system capacities to maintain structure and function – as positive, but when considering human systems such assumption is more difficult to do and is considered as regrettable. For example, the resilience of systems that support organized crime and perpetuate racism or high-consumption habits is undesirable because it would not promote lasting well-being of the urban system. It can be assumed that every urban system has a mix of desirable and undesirable qualities and that is not always desirable to have a resilient system (Kumagai et al., 2010).

Building long-term resilience of urban systems requires that the efforts to enhance the resilience of systems delivering desirable services be accompanied by, and integrated with, efforts to facilitate transition to systems that foster and support sustainable behavior.

Building long-term resilience also requires governance structures and practices and can be achieved through five governance activities (Kumagai et al., 2010):

- **Recognition** (by governance arrangements) of complex system in terms of boundaries, contexts, interdependency, fast and slow variables, modularity, and interactions;
- **Anticipation** (based on recognition) of future possible disturbances and vulnerabilities;
- **Active transition** (enabled by anticipation) to act previously to disturbance;
- **Adaptability** against inevitable surprising disturbances and
- **Communication** backed by trustworthy networks, willingness to learn and change, and structural flexibility must support and enable the other four activities.

To maintain long-term resilience, systems must integrate *health*, *recovery*, and *self-organization* capacities (defined in 2.1 Social-Ecological Systems Resilience), to deal with different degrees of internal and external disturbances that may lead to different types of consequences. The incapacity to make transition needed to deal with anticipated changes further reduces the potential adaptive capacity of the urban system (Kumagai et al., 2010).

2.2.2   Urban Resilience Four Cores

Considering cities as complex and adaptive systems (as SESs and more specifically as urban systems) and the need to better understand the resilience of urban systems and landscapes, Resilience Alliance identifies four major subjects:

- **Metabolic flows** in preserving urban functions, life quality and human well-being;
- **Governance networks** and society capacity to learn, adapt and reorganize to meet urban challenges;
- **Social dynamics** of people as communities members, citizens, services users, products consumers, and their relationship with built environment and
- **Built environment** that defines urban physical patterns and their spatial relations and interconnections.

The main interest of identifying these four subjects is the study of the urban system resilience (as a whole) and the study of the specific resilience of each of the four components of the urban system. Figure 7 illustrate the relation between the four themes, as individual systems, and their interconnectivity towards urban resilience, providing a multi-level understanding of urban systems resilience (Resilience Alliance, 2007).
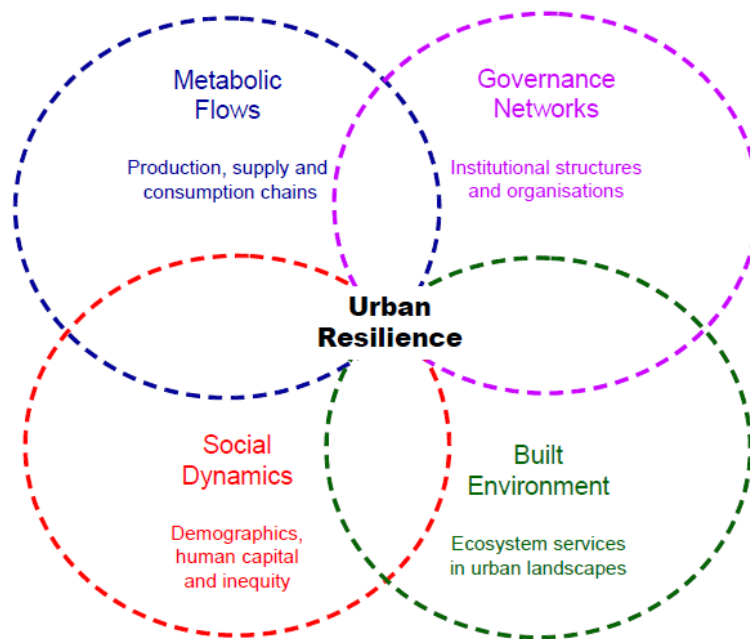
Figure 7: Four interconnected research themes for prioritizing urban resilience research. Source: Resilience Alliance (2007).

Metabolic flows consider production, supply and consumption chains. Consumption can be considered as an essential driver of urban change. Urban inhabitants depend on the ecosystems capacity to produce different energy, material goods, and non-material service flows that preserve urban life quality and well-being (Folke et al., 1997). A characteristic of production, supply and consumption chains is the fact that they do not start or complete within the city, turning cities highly dependent on other systems and cities resilience related to other places resilience (Resilience Alliance, 2007).

Governance networks include institutional structures and social organizations. The challenges related to urbanization rapid rhythm and associated environmental impacts require networks and institutions capable of learn, adapt to social-ecological changes, and built ability for long term monitoring perspective. Local, regional and international networks are expected to define common basis on institutions and governance systems required for sustainable management. Governance and institutional structures have to consider, more and more, collaborative participation approaches. Urban decision-makers usually do not have the ability to influence other ecosystems management on which their cities depend (Resilience Alliance, 2007).

Social dynamics consider demographics, human capital and inequity. Urban populations can grow through three ways – *natural increase*, *rural-to-urban migration*, and *incorporation of surrounding rural areas* – and growth rates are directly related to the development of social and economic levels (Resilience Alliance, 2007). Urban individuals and their interactions, as groups or communities, with urban landscapes are influenced by a cultural set of patterns determined as *social order* – considers three principal mechanisms for behavior ordering: *personal identities* as age, *norms* as behavior rules, and *hierarchies* as wealth or power (Force and Machlis, 1997).

Some urban phenomena are becoming major issues of concern. In some countries, populations are growing faster than cities economies are able to management and support, deepening some and creating others serious

social problems as unemployment and underemployment, poverty, deficient social and human services, inadequate infrastructure and housing, and ecosystem services degradation. The emergence of *megapolitan* areas also constitutes an issue of concern. These areas are cities that absorb towns and respective surroundings – rural and non-urban landscapes – becoming extensive SESs with common ecology, geography and culture (Resilience Alliance, 2007).

Built environment includes ecosystem services in urban landscapes, being modeled by the process of urbanization which creates new types of landscapes (often diverse mosaics of different land-uses and habitats). Urban landscapes are usually subjected to complex patterns and processes interactions, fast change rate, constant and continuous disturbances, and exotic species elevated rate. When fragmentation is added to these changes, the urban ecosystems capacity to continue creating ecosystems services that preserve urban quality of life is affected (Elmqvist et al., 2004). Urban planning is relatively static, unlike urban landscape which is dynamic, and occurs in a political philosophy with the purpose of inform decision making processes about time. Understanding the role of time and how it affects future urban options is a very important part in urban resilience (Resilience Alliance, 2007).

Pereira (2013) highlights the fact of the built environment circle appears to have no interaction with the metabolic flows circle (which also appears to happen with social dynamics and governance networks circle) as a limitation to the urban resilience four cores scheme, presented in figure 7.

2.3   Social Innovation

The first understanding on social innovation in the academic literature was shaped by Max Weber and Emile Durkheim which considered social innovation as "innovations in the organisation of work and of society". Max Weber defined a relationship between the concepts of social order – set of social structures, institutions and practices which linkage aims to maintain and apply behavioral and relationship ways – and innovation – improved solutions application to meet new, in-articulated, and/or current market needs (Maranville, 1992) – as the social change impact of certain behaviors considered, in the beginning, as uncommon or unexpected (Hubert et al., 2010).

Afterwards, social innovation re-emerged as a concept and practice to deal with economy restructuring implications, changes introduced by the development on information technology and mass unemployment (Hubert et al., 2010). Since then, several definitions and considerations on social innovation have been developed in the last years. Table 2 presents an overview of several authors perspective on this issue.

Table 2: The definitions and considerations on social innovation from the perspective of several authors.

Author	Social innovation definitions and considerations
Cloutier (2003)	"New responses to pressing social demands, which affect the process of social interactions".
Nussbaumer and Moulaert (2007)	"Can be macro or micro, structural or local, they are introduced by an entrepreneurial spirit and through solidarity, either to improve the functioning of the organisation or to transform the organisation into a social enterprise, an enterprise with social objectives, an organisation pursuing social objectives or to empower it with a more participatory governance system".
Hubert et al. (2010)	"Innovations that are social in both their ends and their means. New ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. In other words, are innovations that are not only good for society but also enhance society's to act".
Mulgan (2006) Mulgan et al. (2007b)	"Innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organisations whose primary purposes are social". In a simpler way, "new ideas that work to meet pressing unmet needs and improve peoples' lives", in an attempt to solving societies' problems, improving their capacities, and considering that social innovation results are everywhere.
Hämäläinen and Heiskala (2007)	Required in "organisations, policies, rules and regulations as well as in collective norms, values and cognitive frames to complement the more traditional technology and economic innovations, in order to reach systematic synergies, productivity growth, increasing returns and steadily growing incomes".
Phills et al. (2008)	"A novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals", and as the greatest assembly to the comprehension and generation of lasting social change. May be a product, a process of production, a technology, a principle, an idea, a part of a legislation, a social movement, an intervention, or some combination of these.
Westley and Antadze (2010)	"A complex process of introducing new products, processes or programs that profoundly change the basic routines, resource and authority flows, or beliefs of the social system in which the innovation occurs".

All the above definitions on social innovation consider the relationship between innovations to address social problems or demands and although they might be defined in slightly different ways, the direct or indirect reference to social system is common to all. Thus, to better understand the social innovation concept is imperative to have a structured and clear definition of social system. Westley and Antadze (2010) define social system as "any organized assembly of human resources, beliefs, and procedures united and regulated by interaction or interdependence so as to accomplish a set of specific functions" with its own boundary and character or identity – culture, political and economic structure, and social interactions – established. The aspects characterizing the social system identity are profoundly connected to institutionalization and are generally referred as institutions (Giddens, 1976).

Parsons (1951) argues that social systems to be healthy and functional must have a strategic approach with outlined ambitions and goals, being able to adapt to both known and unknown changes and to maintain the

system integration and social memory. Being complex systems and having several elements interacting with each other, social systems need to be adaptive to survive and to integrate continuously novelty to remain resilient (Westley and Antadze, 2010; Westley, 2008). Arthur (2009) highlights the importance and dependence of the existing elements for novelty generation, while Westley and Antadze (2010) emphasize the relation between novelty, social systems and human beings as crucial to better understand social innovation.

Christensen et al. (2006) states that a social innovation with a broad or durable impact will be disruptive, catalytic, and will challenge the social system and social institutions as well as will enable some changes in their convictions and governance ideals. In other words, Westley and Antadze (2010) and Westley (2008) refer to a broad or durable impact social innovation as a successful social innovation that must have a wide scope, crossing as many social levels as possible, and reaching different scales.

Huddart (2010) states that social innovation "opens up new approaches to addressing complex problems and covers a lot of ground, but is still taking shape", and proposes twelve principles to guide strategy around social innovation after developing an analysis of initiatives considering environmental, economic and social spheres:

1. ***Work at scale requires long time lines and strategic intent***: in complex problems, focus and adaptability balance is crucial to accomplish results;

2. ***Strategy is phase and scale dependent***: an innovation in an initial phase requires systems mapping, diverse partners gathering and new approaches learning, and in an advance phase involves mentality shift and resources redirection;

3. ***"Listen to the system"***: innovations development usually involves the appearance of "surprises" which give important tips on where to focus attention;

4. ***Reflect***: crucial when working with non-conventional practices and helpful in linking ongoing strategy to a bigger purpose;

5. ***Trust***: essential issue that is constructed through public good commitment, transparency and accountability;

6. ***Learn to work across sector***: rich innovation source;

7. ***Commit to social inclusion***: vulnerable populations inclusion leads to more wide solutions and enduring results;

8. ***Set minimum specifications***: especially when working at space and scale multiple levels, allowing others to adopt freely;

9. ***Share information***: an open and transparent approach enhance new partners and new connections;

10. ***Work with diverse professionals***: brings new and multiple contributions;

11. ***Effective use of the media***: helpful on setting the public agenda, creating a common sense of identity across different jurisdictions, and developing new mentalities and

12. ***Acknowledge the personal dimension***: understanding and accepting our role in problems and respective solution is fundamental to overcome conflicts.

The social innovation definition of Westley and Antadze (2010), social innovations are " a complex process of introducing new products, processes or programs that profoundly change the basic routines, resource and

authority flows, or beliefs of the social system in which the innovation occurs", will be the one adopted to develop the next sub-section regarding social innovation and social-ecological systems resilience and to further identify social innovations regarding the case study analysis.

2.3.1 Social Innovation and Social-Ecological Systems Resilience

Social-ecological systems (SESs) resilience concept has been reviewed in chapter 2.1 where was highlighted that these systems are dynamic, emphasize *human-in-nature* perspective and integrate ecosystems with human society (where social, ecological, political, cultural, economic, technological and other components interact with each other).

Resilience Alliance et al. (2010) define society, as "a myriad of rules, some formal, others informal such as cultural practices that determine how people interact with the ecosystems around them" and Westley and Antadze (2010) and Westley (2008) emphasize that the ability to explore new opportunities to be developed, produced or to be changed is intrinsic to the human species, once human beings are a social, creative, and deeply dependent (on each other) species, especially regarding the existence and conservation of the world as we know it.

Westley (2008) alerts for the challenge of social systems to keep their identity and, at the same time, be able to adapt to change and novelty. This concern is due to the possible precariousness that some changes may cause in social systems. Westley (2008) provides two examples for better understanding this, the cease to change and the excessive or extremely fast change. While the first may turn the social systems into fragile and vulnerable systems to external disturbances, the second challenges the social systems identity – culture, political and economic structures, and social interactions – over which human beings depend.

Any society capacity to generate a steady flow of social innovations is an important contributor to overall social and ecological resilience. In a broad sense, Westley and Antadze (2010) and Westley (2008) look at social innovation as part of the solution for the complex problems regarding SESs over the world. The hypothesis of a *perfect storm* – "the intersection of rapid climate change, decreasing fossil fuel supplies, food shortages, and economic collapse" – can be considered as complex social-ecological problems with dynamics of difficult comprehension (Carpenter et al., 2009). Westley and Antadze (2010) and Westley (2008) present the example of vulnerable populations' re-engagement (community reintegration of lonely, homeless, mentally ill and poor people) as a frequently addressed subject in social innovation agenda and as a contributor to resilience increase. Contrarily, the exclusion of some population from primary services, for example, leads to a loss of resilience, a decrease of resistance to the *perfect storm* hypothesis, and also to the exclusion of these population opinions, points of view and diversified experience. Therefore, Westley and Antadze (2010) and Westley (2008) conclude that social innovation serves and is served by vulnerable populations, stating that their re-engagement in social systems identity as persons of interest and involved ones is linked to social-ecological resilience, which relationship is presented in figure 8.

Arenas for Social Innovation:

Sustainable development

Species conservation

Specific management approaches

Building Capacity for Social Innovation:

Social innovation is linked to both vulnerability and resilience in that it offers the continuous novelty key to resilient systems and draws on the diversity and abundance of engaging vulnerable and excluded elements.

Sources of Novelty:

Process: new forms of management; whole complex adaptive system approaches; new forms of knowledge production.

Technical: new forms of energy, food production, species conservation, policy and economic instruments.

Knowledge based: resilience, vulnerability and innovation are all context specific. Our capacity to ask questions, frame issues and approach these in novel ways in itself can be transformative.

(Re) Engaging Vulnerable Populations:

From a social innovation perspective, vulnerability is a measure of those cultures, social groups and ideas that are disenfranchised from resources and are threatened with extinction. They represent a key source of diversity which could be lost and is an important resource for social innovation (bricolage). (Re) engaging vulnerable populations increases the diversity of the whole.

Building Linked Social-ecological Resilience:

From a social innovation perspective resilience is, like sustainability, linked to the capacity to balance a healthy environment with a vibrant economy with social justice. It suggests, however, a focus on continuous change and a cross-scale dynamic rather than a stable state at any scale.

Figure 8: Social innovation, resilience and vulnerable populations' re-engagement relationship. Source: After Westley and Antadze (2010) and Westley (2008).

Figure 8 provides a correlation between social innovation and SESs, considering the vulnerable populations reengagement as an active contributor to build capacity and resilience respectively. The social innovation capacity is built through the diversity and novelty given by the re-engagement. And the SESs resilience is increased not just by novelty as well as by the decrease of the system vulnerability.

According to the study of the innovation concept, appears that innovation has a variety of phases and stages that might be illustrated through the adaptive cycle model (already presented in 2.2.2 The Adaptive Cycle – A conceptual model of change applied to SESs) (Westley and Antadze, 2010). For easier comprehension, Westley (2008) considers the model as a representation of a unique innovation evolution from idea to maturity. When the idea reaches maturity/conservation phase, a release of resources is needed to create novelty or to change and re-engage in order to continue to be resilient (Westley and Antadze, 2010; Westley, 2008).

Westley (2008) states that social innovation might be partly represented by the adaptive cycle if considered the ideas regarding social products, processes or programs that demand idea to maturity evolution and organizations to deliver them, and that social innovation is required to build social and ecological resilience due to the constant and complex challenges to political, economic, cultural and social institutions.

3 Proposed Methodology for Assessing Urban Resilience through a Social Perspective

The methodology adopted in the present research on urban resilience through a social perspective is based on existing methodological approaches to resilience assessment available in the literature. Two main methodologies were selected, the Resilience Alliance methodology (Resilience Alliance et al., 2010) and the methodology developed by Kumagai (Kumagai et al., 2010), both based on resilience theoretical aspects. These were the only two available methodologies in the literature allowing the assessment of urban systems resilience. The following sections identify the major similarities and differences between the two main reviewed methodologies, select the most appropriate methodology and present the adaptation developed for framework adopted in the case study in this dissertation.

3.1 Resilience Alliance Methodology

The methodology advanced by the Resilience Alliance assesses the resilience of social-ecological systems as lakes, forests or cities, among others, through three main steps: setting boundaries, system dynamics and cross-scale interactions (Resilience Alliance et al., 2010). The first step, the most important in the assessment, consists in describing the present, linking it to the past and determining the system critical components through the definition of the system boundaries:

- **Focal scale establishment**: determine the spatial and temporal boundaries. For example, the Grand Canyon (spatial boundary) over the last century (temporal boundaries);

- **Main issues identification**: establish the motivation for the development of the assessment considering stakeholders perspective, and identify the system attributes that can be valued by stakeholders. The main issues to be addressed in the focal scale may be one central issue or a set of related issues. For example, the recovery of endangered species and the restoring and retaining sediments within the system (main issues) and native biodiversity (valued attribute);

- **Key components identification**: resilience of what? Identify what are the key components of the SES that are relevant to the main issues, including social (economic, political and cultural) and ecological factors, classify them according to their use (direct or indirect) and recognize which are the involved stakeholders inside and outside the focal system. For example, conservation uses (direct use), provision of clean water (indirect use), national government (inside focal system stakeholder) and water users living downstream from the catchments (outside focal system stakeholder);

- **Disturbances, disruptions and uncertainties identification**: resilience to what? Identify the disturbances affecting the focal system in the past and in the present as well as the disturbances that will potentially affect in the future, classify them according to the events occurrence (pulse as singular and press as continuous disturbances) and characterize them over time (frequency of occurrence, time to recovery between occurrences, most affected components, magnitude of

impact and changes in the past years or decades). For example, hurricanes (press disturbance) and continuous shoreline erosion (pulse disturbance) and

- **System expansion – multiple space and time scales**: define which systems are at scales above and below the focal system and characterize them regarding their social and ecological dimensions that interact with the main issues. Then sketch the focal system historical profile in a time line including different eras of historical transition, three spatial scales and the identified disturbances, in order to understand if the disturbances were connected or not through time and space and to identify the most critical interactions between the focal system and systems operating at smaller and larger scales.

The other two steps of the assessment concern the application of the resilience theory to the critical components of the system identified before. The second step concerns the system dynamics, allowing the understanding of how the focal system changes over time through the application of the adaptive cycle, how it responds to change defining the system multiple states, and how it can learn to facilitate transitions to achieve desired outcomes through the establishment of the system thresholds of potential concern and possible transitions.

The third and last step of the assessment concerns cross-scale interactions, allowing the identification of potential vulnerabilities and opportunities in the focal system through the application of the panarchy, the understanding of how system variables might be expected to interact through the interaction of thresholds of potential concern and cascading change, and the assessment of both general (does not consider any particular type of disturbance) and specific resilience (resilience "of what and to what") to avoid the decrease of the system's capacity to cope with the unexpected.

Figure 9 represents a scheme of the Resilience Alliance methodology for assessing social-ecological systems resilience.

Setting boundaries
1. Focal system
2. Main issues
3. Key components
4. Disturbances, disruptions and uncertainties
5. Multiple space and time scales

System dynamics
1. The adaptive cycle
2. Multiple states
3. Thresholds and transitions

Cross-scale Interactions
1. The panarchy
2. Interacting thresholds and cascading change
3. General and specified resilience
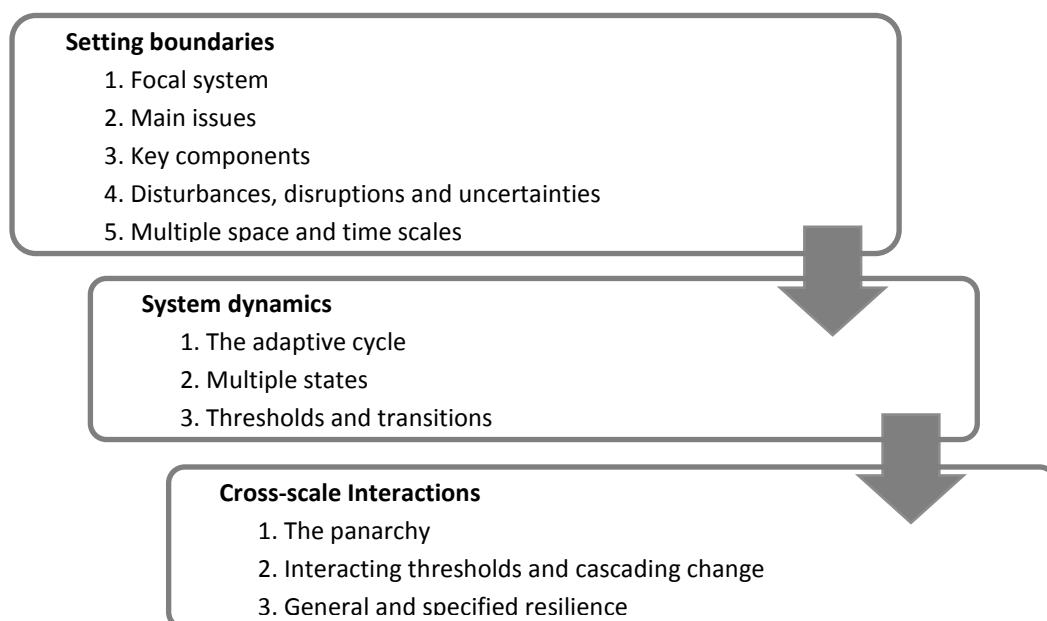
Figure 9: Scheme of Resilience Alliance methodology for assessing social-ecological systems resilience. Source: After Resilience Alliance et al. (2010).

3.2   Kumagai Methodology

The Kumagai methodology assesses the resilience of urban systems through a long-term perspective, considering people well-being and governance actions (Kumagai et al., 2010). It allows the understanding of what drives the urban system and how it can be translated into the assessment of the system resilience through five steps:

- **Translation of resilience into urban context**: establish the necessary framework for performing the assessment of the resilience of an urban system, allowing the understanding of what drives that urban system and/or similar ones. Considering, in advance, which will be the type of urban system for analysis, identify the elements that characterize and drive the urban system for translating resilience into urban context. For example, the tax revenue (element) that benefitted from the urban redevelopment of post-industrialized cities (as the Tokyo City Region – the focal scale that will be further defined);

- **Focal scale definition**: establish and contextualize the urban system (case study) to be assessed and to which the identified elements that translate resilience into urban context will be applied. Define spatial and temporal boundaries. For example, Tokyo City Region (spatial boundary) over the last 50 years (temporal boundary) and geographical location, population and urban limits (contextualization);

- **Indicators identification**: convert the identified elements into indicators that can be analyzed and applied to the focal scale. For example, taxable income by taxpayer in Tokyo City Region (indicator) to allow the analysis of the tax revenue (element);

- **History development**: apply the identified indicators to the focal scale, develop their analysis and analyze their evolution/change and disturbances throughout its history development. For example, the analysis of the taxable income per taxpayers demonstrates that the municipalities with lower values have been experiencing a reduction in their tax base over that period of time and

- **Long-term resilience interpretation**: assess the long-term resilience of the focal scale according to the indicators evolution/change through the concepts of building and maintaining long-term resilience and considering people well-being and governance activities. For example, from the perspective of long-term resilience, government and other people of interest in Tokyo City Region have not paid attention to long-term well-being because of a single view into the economic growth, a one-dimension way of looking into the urban system, which may lead to a loss of long-term resilience and to a failure of future objectives.

Figure 10 represents a scheme of the Kumagai methodology for assessing long-term resilience of urban systems.
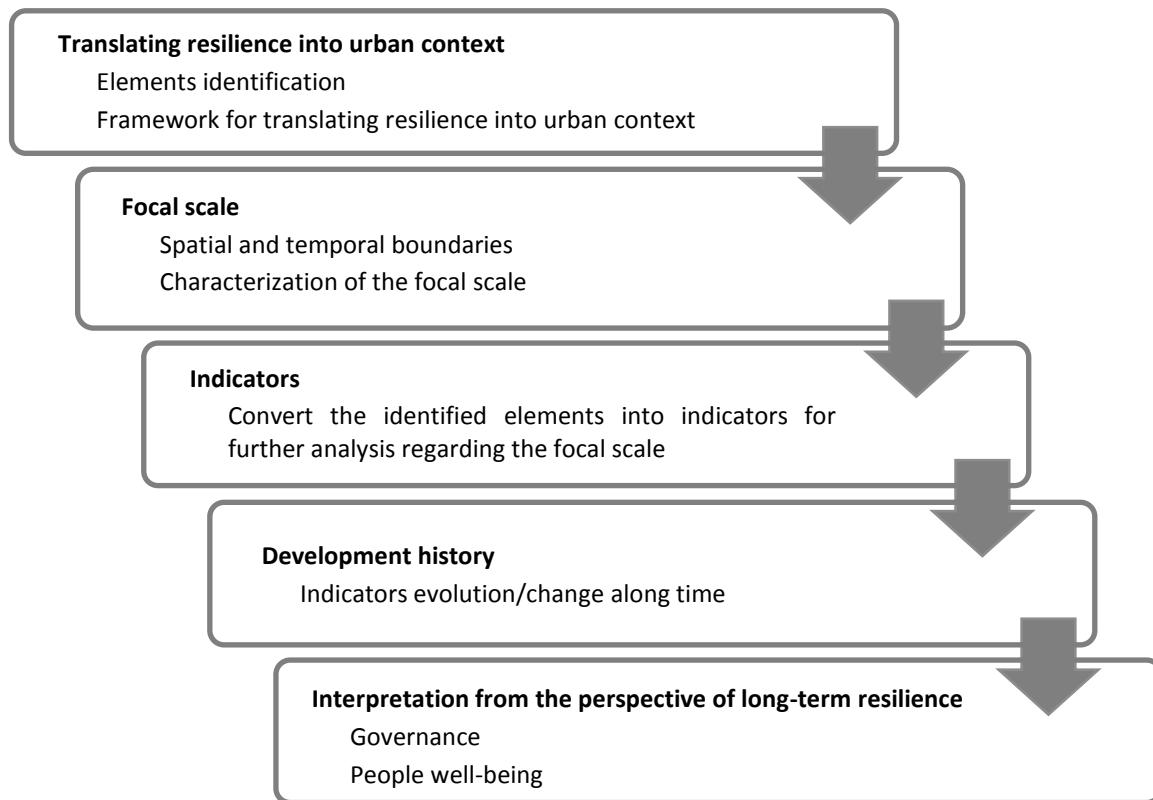
Figure 10: Scheme of Kumagai methodology for assessing urban long-term resilience. Source: After Kumagai et al. (2010).

The two methodologies presented above have similarities and differences. In relation to the similarities, both methodologies define a focal system or scale to be assessed, identify the need to recognize what drives the system, which disturbances it suffers and why. The two methodologies also highlight the importance of understanding the interaction between the system drivers and disturbances and take in consideration the stakeholders role, although in different ways.

As for the differences, the Resilience Alliance methodology addresses social-ecological systems and applies more aspects of resilience theory, like the adaptive cycle or the panarchy. It has a wider scope of application, it is more theoretical and uses a methodology that is more often applied to ecological systems where causal chains are better known and easier to delimit, while Kumagai methodology is specifically designed for urban systems to consider people well-being, governance and a long-term perspective. It is narrower in terms of the possibilities of application (only urban systems), considers long-term well-being and takes more into account the people associated to the urban system. It seems therefore more adequate to study the social aspects of urban resilience.

Thus, the Kumagai methodology for assessing urban long-term resilience was adopted to assess urban resilience through a social perspective in this investigation and case study. Since the Resilience Alliance methodology was not adopted in this investigation and case study, the literature concepts in which it is based (as the adaptive cycle and the panarchy) were also not considered in the next chapters. The following section outlines the main methodological adaptation to develop the case study analysis in this dissertation.

3.3 Translating the Social Perspective into Urban Resilience

Kumagai et al (2010) studied how resilience could be translated into an urban context and uses Tokyo City-Region as their focal scale. The authors identified four elements for translating resilience into the urban context and considered the following four features that help to relate resilience to the urban redevelopment of post-industrialized cities (as their case study – Tokyo City Region):

- **Demography**;
- **Mobility**;
- **Tax revenue** and
- **Resource-efficiency**.

In the case of this dissertation the investigation was rather different since it looked at how urban resilience incorporates a social perspective. So the focal scale was the city of Lisbon and four features were identified for translating the social perspective into urban resilience:

- **Demography**;
- **Social vulnerability**;
- **Mobility** and
- **City attractiveness**.

The selection of the above features, or elements, was performed considering the state of the art regarding social dynamics and social innovation, and the urban development associated to a city (as the focal scale of the case study, to be developed in the next chapter). Social dynamics was previously addressed (in chapter 2.2.2 Urban Resilience Four Cores) as one of the four cores of urban resilience and presented demographics, human capital and inequity as its driving forces for the analysis of the resilience of an urban system, which have led to the selection of demography as one of the elements for incorporating a social perspective into urban resilience. Demography allows the understanding of how and why population has been changing and provides an analysis of the emerging demographic issues that must be considered by governance.

The principles of social innovation (presented in chapter 2.3 Social Innovation) identified social inclusion commitment as a contributor to social innovations larger solutions and enduring results, and Westley and Antadze (2010) and Westley (2008) highlighted the re-engagement of vulnerable population as a contributor to the increase of the resilience of the system (chapter 2.3.1 Social Innovation and Social-Ecological Systems Resilience). This, along with the need of also representing the other two drivers of social dynamics, human capital and inequity, have led to the identification of social vulnerability as another feature for translating a social perspective into urban resilience. Social vulnerability allows the understanding of the population emerging needs and risks and provides an analysis of the population social state that must be one of governance priorities.

An urban center has distinct and characteristic commuting patterns and its development is usually related to the expansion of accesses, railways and transport network. This led to the selection of mobility as an element that provides the analysis of the socio-economic relationships between the urban system and its surroundings

and of the population access and use of the transport network.

Associated to the urban development of a city is also the improvement of old and construction of new facilities, the creation of conditions to house more people and to accommodate more business companies, and the possibility of considering the people well-being along the process of development. Thus, the selection of the city attractiveness as a feature for incorporating a social perspective into urban resilience intends to assess how attractive is the urban system, to allow the analysis of the city strengths and to understand how the governance is managing such strengths.

As for the governance actions considered in Kumagai methodology, will be analyzed, in the next chapter, the policies and active measures developed by the city governments over time as well as the actions and initiatives developed by organisations and institutions that add relevant information to the assessment. These will allow the analysis of the governance regarding the urban system, presented in the next chapter, through a social perspective and will also allow the identification of developed social innovations.

4 Case Study

4.1 Focal Scale

The focal scale of the present case study is the city of Lisbon. Lisbon is the capital of Portugal and one of the municipalities of Lisbon Metropolitan Area (LMA). Portugal is located in the southwest of Europe, in the west of Iberian Peninsula, with a population of 10 427 301 inhabitants (INE - Instituto Nacional de Estatística, 2013a) and a surface area of 92 212 km^2. LMA agregates 18 municipalities (Alcochete, Almada, Amadora, Barreiro, Cascais, Lisboa, Loures, Mafra, Moita, Montijo, Odivelas, Oeiras, Palmela, Seixal, Sesimbra, Setúbal, Sintra, Vila Franca de Xira), has almost 3 million inhabitants (about 25% of portuguese population) and represents 3,3% of portuguese territory, being the country biggest population center, the 11th most populous urban area in the European Union. Economically, LMA has about 25% of portuguese active population, 30% of national companies, 33% of employment and contributes with more than 36% of national Gross Domestic Product (AML - Área Metropolitana de Lisboa, 2014).

Figure 11 shows the location of Lisbon in LMA and in Portugal.
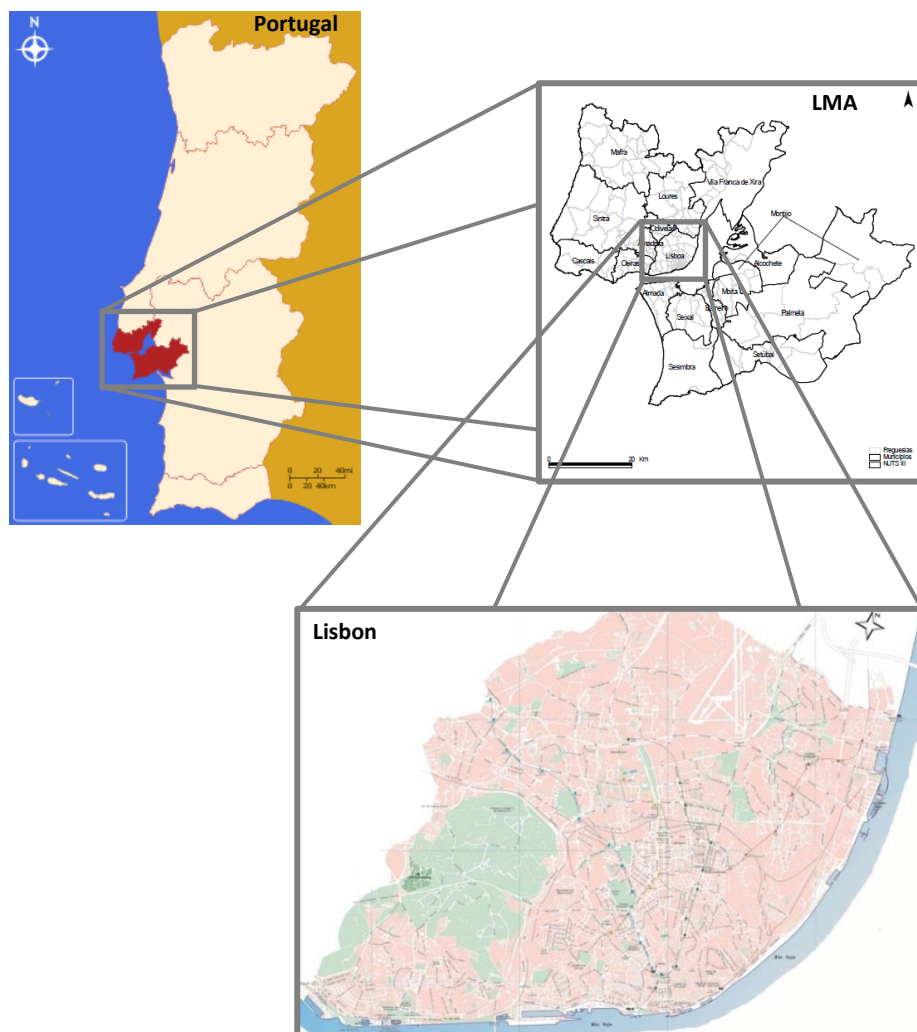
Figure 11: Location of the focal scale – the city of Lisbon.

Lisbon is the most populous city of Portugal, with a population of 520.549 inhabitants (INE - Instituto Nacional de Estatística, 2014a) within its administrative limits, on a surface area of 100 km^2 (IGP - Instituto Geográfico Português, 2014). After an administrative organization initiated in 2012, Lisbon territory suffered a geographic change with its 53 parishes being reduced to 24.

Owner of a characteristic charm and located across Tagus River, Lisbon is considered a global city due to its financial, commercial, artistic, educational and touristic importance, and the country's main economic and urban center. Within its limits, Lisbon has the biggest and busiest airport – Portela Airport – and the oldest underground subway in the country – Lisbon subway.

During the last 80 years, Lisbon urban area has been evolving according to the major directives of development defined in the city master plans. About 80 years ago, the country and the city governments "initiated" the expansion of Lisbon through the construction of roads and new housing neighborhoods, economic housing neighborhoods and housing for poor. The need of developing a city master plan was recognized, but the urgency in the constructions did not allow it to be done in advance, leading the city government, afterwards, to admit that with the knowledge of a master plan, several problems would have had different solutions than the ones adopted. Thus, in 1938 the city government (under the administration of the Engineer Duarte Pacheco) hired the urban architect Étienne de Gröer to, along with municipal technical services, define the major guidelines of the city expansion and develop the first master plan of Lisbon, which was concluded in 1948, the Lisbon Urban Master Plan of 1948 (LUMP 1948). Figure 12 presents the only published plant of LUMP 1948 and table 3 presents the objectives of the LUMP 1948 as well as the reasons for considering them and their implantation proposals.

Figure 12: The plant of Lisbon Urban Master Plan of 1948. Source: CML - Câmara Municipal de Lisboa (1948).

Although for each major objective, identified in table 3, exists implementation measures defined in the LUMP 1948, this highlights the urgent need of developing an urban legislation to codify the objectives and principles of the master plan.

Table 3: LUMP 1948 major objectives, why were they considered and how were they proposed to be implemented. Data source: (Groer and CML - Câmara Municipal de Lisboa, 1948a)**.**

Lisbon Urban Master Plan of 1948		
Major objectives	**Why**	**How**
Limitation of the urban development	Mitigate the chaotic state caused by the disorganization in construction due to the fact of Lisbon city government did not hold the direction of the city development (construction depended of particular interests and desires, each land owner considered himself owner of the city and did what he wanted with it)	Organization of the population densities in a descending order from the center to the periphery Transformation and repairing of built and under construction urban parts that will not compromise the future urban development Not allowing the construction of predicted housing neighborhoods that can compromise the future urban development Establishment of single-families housing neighborhoods Application of the construction principles (proposed in the UMP regulation) in housing projection and construction Establishment of a protective rural belt to separate Lisbon agglomeration from the border municipalities agglomerations through the creation of an area of free spaces as big as possible
Regulation of the land use	Classify the city in major zones for future simplification of the city urban and growth planning	Establishment of zoning through the delimitation of the city territory in zones Application of a regulation for each zone (presented in the UMP regulation)
Establishment of the use of high speed paths	Need to evolve and plan the road network after the previous three phases of roads construction (narrow, straight and comfortable for circulation but too expensive roads) Resolve the traffic congestion	Planning of circulation paths Improvement of circulation paths through roads expansion and construction of needed tunnels Development of a traffic regulation for the city Construction of an high speed path Construction of a bridge over Tagus River
Administrative, social and cultural equipping of each neighborhood and the city	Reverse the lack of public facilities	Establishment of a primary schools network Construction of Lisbon university and colleges rectory Construction of nine supply markets Construction of a new central post, telegraph and telephone office Construction of an industrial zone associated to a port
Sanitation and improvement of dwelling and work places	Reverse the scarcity of sewage network and the deficiencies in water supply	Definition and listing of insalubrious elements to sanitize Development of a sewage network
Conservation and protection of architectonic and natural city wonders	Knowledge of the city wonders	Definition and listing of artistic elements to preserve Conservation of parks, gardens and existing free lands

In 1954, was initiated the process of revising and updating the first master plan of Lisbon through the development of a new one, which was concluded in 1959 and followed the main objectives of LUMP 1948. After this, the need of an instrument to address the increase in car traffic, the start of functioning of the subway network, the construction of the bridge over Tagus River and the city suburbs growth, led to the elaboration, between 1963 and 1967, of a new master plan, Lisbon Urban Master Plan of 1967, which became published in 1977 with some changes.

In 1990 was published the first national legislation that established the regulation for the elaboration of spatial planning municipal plans (municipal master plan, urban plan and detail plan) and that obliged the city governments to elaborate and approve their respective Municipal Master Plan (MMP). Following the legislation guidelines, Lisbon city government initiated the process of elaborating its first MMP along with the development of the first Lisbon Strategic Plan (LSP) concluded in 1994 (Lisbon Municipal Master Plan (LMMP) of 1994) and in 1992 (LSP 1992), respectively.

The LSP 1992 was developed as a long term (10 years) instrument to support decision-making, develop the city spatial planning guidelines and establish a share responsibility between decision-makers. Considering the city strengths and weaknesses, LSP 1992 established four major strategic principles:

- Make Lisbon an **attractive city** to live and work;
- Turn Lisbon into a **competitive city** within the European cities system;
- Reaffirm Lisbon as a **city metropolis** and
- Create **a modern, efficient and participatory administration**.

The strategic guidelines defined in LSP 1992 were considered in the LMMP 1994 along with the city rational division of economic activities, housing deficiencies, transport and communication network and existing facilities and infrastructures. The LMMP 1994 established the occupation, use and transformation rules of the municipal territory. However, it did not consider its implementation schedule, being mainly an administrative and supportive document. Figure 13 presents the plant of urban space classification, a part of the planning plant, of the LMMP 1994 and table 4 presents the objectives of the LMMP 1994 as well as the reasons for considering them and their implementation proposals.

Figure 13: The plant of urban space classification of Lisbon Municipal Master Plan of 1994. Source: GEO - Gabinete de Estudos Olisiponenses (2014).

Table 4: LMMP 1994 major objectives, why were they considered and how were they proposed to be implemented. Data source: CML - Câmara Municipal de Lisboa (1994a,1994b) and Soares (1994).

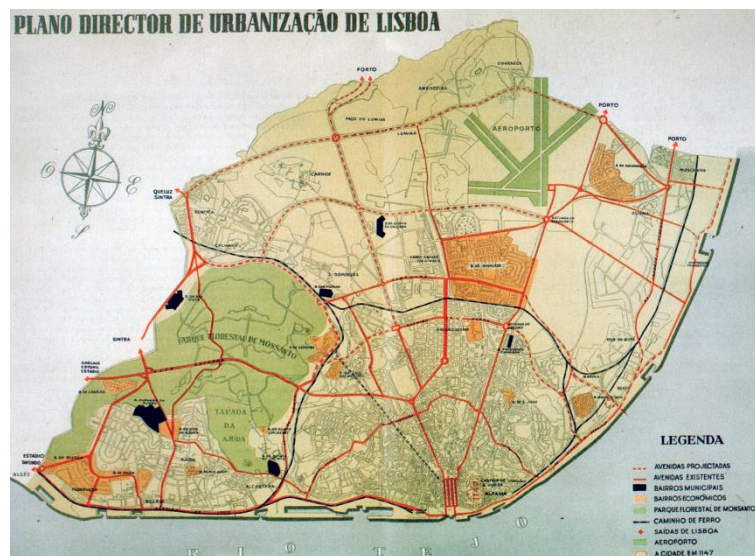| Lisbon Municipal Master Plan of 1994		
Major objectives	**Why**	**How**
Protect urban life quality	Improve residents life quality Defend and value urban environment as a condition of comfort, security and city identity	Development of the city management and urban planning considering nine essential aspects to be dealt with: • Urban ecological structure • Integrated areas in city green structure • Integrated *logradouros* in city green structure • Singular urban sets • Riverside public spaces • Views system • Historical interest nucleus and lanes • Cabo Ruivo industrial area risk zone • Highest seismic risk zone subjected to restrictions Elaboration and development of Lisbon urban environment charter
Harmonize the relation between housing and services construction	Reverse the housing function process of disqualification and devaluation Combat the degradation of old housing which is not providing comfort and security conditions	Development of an housing policy Revaluation of the housing function through the stabilization of the consolidated urban tissue
Humanize the city and its public spaces	Improve city attractiveness to live	Qualification of the east zone through the integration of Expo 98 Connection of the city and Tagus river Revaluation of the environment and patrimony through the creative improvement of the city natural and historical conditions
Improve mobility, transports and parking	Reverse of traffic congestion Improve accesses to and within the city	Creation of the transport network interfaces system Improvement of the articulation of the city central area and the rest of metropolitan territory Creation of the Lisbon Metropolitan Authority of Transport (LMAT)
Recovery and rejuvenation of the city resident population	Reverse the loss of resident population, mostly the younger population	Supply of affordable housing for younger and middle class population Reinforcement of social support and opportunities
Increase Lisbon potential as a city metropolis	Improve the city competitiveness Reaffirm Lisbon as a city metropolis	Development of economic activities as a key condition of city planning Creation of the Agency for the Development and Modernization of Lisbon Economic Base

Urban and spatial planning legislation began to be reformed in 1998 with the publishing of Base Law of Urban and Spatial Planning Policy (*Lei de Bases da Política de ordenamento do território e do urbanismo*). Since then, the legislation has been suffering changes and the current legal regime considers the MMP a planning instrument of the municipal territory that establishes the strategy for the territorial development, defines the policies for urban and spatial planning and determines the model of spatial organization for the municipal territory.

In 2001, the city government of Lisbon initiated the process of revising the LMMP 1994 and in 2002 started the elaboration of the Strategic Vision for the city of Lisbon (SVL), both concluded in 2012. Although the SVL 2012 has emerged after the LSP 1992, the city government decided not to elaborate a second Strategic Plan and opted instead by develop a document that would guarantee the coherence of the axis of urban development in the city. SVL 2012 is supported by a reduced and objective set of key ideas, and four structural axis regarding the city urban development:

- Lisbon, **city of neighborhoods**;
- Lisbon, **city of entrepreneurs**;
- Lisbon, **city of cultures** and
- Lisbon, **city of modernity and innovation**.

During the years the LMMP 1994 was under revision, the city government realized several workshops and forums of discussion for stakeholders to participate and assured, afterwards, that their contributions and opinions were considered in the development of the new MMP, Lisbon Municipal Master Plan of 2012 (LMMP 2012). Figure 14 presents the plant of urban space qualification, a part of the planning plant, of LMMP 2012.

Figure 14: The plant of urban space qualification of Lisbon Municipal Master Plan of 2012. Source: CML - Câmara Municipal de Lisboa (2014).

The LMMP 2012, the MMP currently in force, establishes the major development strategies and the urban policies for the municipal territory. It also defines its implementation schedule, acquiring a strategic character

and no longer being just an administrative and supportive document. The LMMP 2012 reflects an integrated vision of the municipal territory and aims to reinforce the city competitiveness, to ensure territorial equity and to support territorial integration and cohesion. Table 5 presents the major objectives of the LMMP 2012 as well as the reasons for considering them and their implementation proposals.

The International Society of City and Regional Planners (ISOCARP) assigned to the LMMP 2012, in 2013, an excellence award for its innovative character regarding the theme: *Frontiers of Planning – Evolving and Declining Models of City Planning Practice*. ISOCARP is an international association, founded in 1965, that gathers the most recognized and highly qualified urban planners.

Table 5: LMMP 2012 major objectives, why were they considered and how were they proposed to be implemented. Data source: CML - Câmara Municipal de Lisboa (2012a).

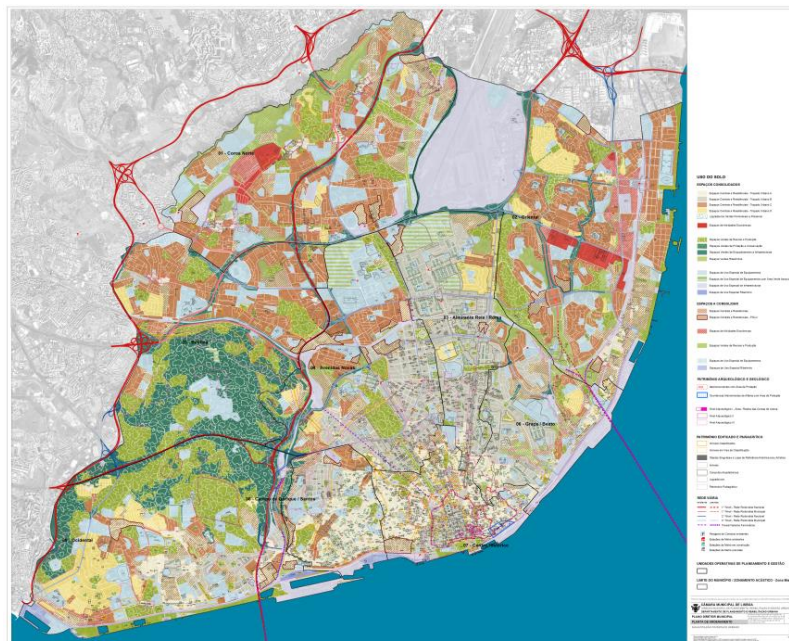| Lisbon Municipal Master Plan of 2012		
Major objectives	**Why**	**How**
Attract more inhabitants	Reverse the loss of residents, mostly the young and active one Stop new couples from exiting the city to the periphery Increase residential attractiveness Ensure the city sustainable future	Creation of an affordable housing program through an incentive system directed to the middle class, and of parking for residents, especially in the neighborhoods with an identified need Approach of work and resident places through the previous elaboration of a multifunctional MMP Protection of residential neighborhoods from high levels of noise and bad air quality air due to traffic Development of the public facilities network through: • Creation of new 1st cycle and pre-schools, rehabilitation of older 1st cycle schools and opening of nursery schools vacancies • Construction of an hospital, of health centers and continuing care units • Construction of sports equipment and rehabilitation of older ones • Construction of day centers, residential housing, nursing homes, university residences and multifunctional spaces for seniors
Attract more business and jobs	Improve the capacity to create more jobs and to install more workplaces Promote entrepreneurship and new business clusters Avoid the creation of urban and exclusively residential sectors without "life" during daytime Increase territorial competitiveness and the city economic sustainability	Location of companies being possible in any city point Reservation of space for companies in future urbanizations and supply of adequate spaces for companies installation Better use of existing business areas Intervention in the market to compete with the business clusters in the border municipalities through MMP new soil programming mechanisms Increase edificability index and reduce permissions in urban polarities and business areas Place the municipal assets in land market with rules for determining the final cost Promotion of business incubators through the continuity of the existing start-up model Support initiatives regarding the reuse of abandoned industrial spaces

Lisbon Municipal Master Plan of 2012		
Major objectives	**Why**	**How**
Stimulate urban rehabilitation	Reverse the emptying of population and oldest consolidated areas by successive transfer to newer ones Prioritize urban rehabilitation rather than new constructions Preserve the identity and authenticity of historical consolidated area Promote social and territorial cohesion Improve urban regeneration	Provision of tax incentives for the rehabilitation of buildings in urban areas classified as historical Clarification of the role of each actor in urban rehabilitation process – rehabilitation of buildings reserved to private actors and rehabilitation and requalification of public facilities and spaces reserved to the city government Acceleration of construction permits and a better use of basements, ground floors and first basements through the MMP new rules Development of Neighborhoods or Zones of Priority Intervention Program (NPI/ZPI Program) and of a program for municipal neighborhoods regeneration Encouragement of actions regarding buildings seismic resistance
Qualifying public space	Reverse the tendency of only rehabilitate buildings rather than requalify public space as well Propel the city capacity to attract more people and companies Improve public space "life" and sustainable mobility Make public space more enjoyable, visually and climatically	Reorganization of traffic through its removal from the historical center and the residential neighborhood areas Increase of circulation space for people through the reduction of areas reserved to car circulation, and of permeable areas in public space Planting more trees in wooded axis Choosing pavement that ensures accessibility, comfort and security for all Inclusion of the hills territory through the development of pedestrian pathways network to access the hills with mechanical support (elevators, for example)
Return the riverfront to the people enjoyment	Create more public spaces to overcome the lack of green spaces in the city historical center Improve public space "life" for citizens Qualify more riverfront for recreation, leisure and tourism	Reconversion of Poço do Bispo, Santos, Alcântara and Pedrouços riverfronts through the replacement of the old port use Make use of the new interventions in the river front, namely Ribeira das Naus Avenue and the new cruise terminal in Sta. Apolónia Increase of green permeable spaces and spaces for pedestrian circulation through the reduction of Arco Ribeirinho importance as a main road axis through its requalification with characteristics of an urban lane Creation of a bigger urban permeability between Tagus margin and the hills through the increase of road and railway transposition
Promoting sustainable mobility	Promote and increase collective transport use rather than individual transport Reverse of traffic congestion Leisure and daily use of bike paths Improve sustainable and	Decrease impact generated by car traffic through the creation of traffic moderation zones Increase of bike paths network, security and comfort in the use of bicycle in urban areas Creation of a bike sharing service, and of conditions to increase subway network through channels reservation to the network expansion Reduction of the number of vehicles entering the city through the control of parking supply for those who enter

Lisbon Municipal Master Plan of 2012		
Major objectives	**Why**	**How**
	multi-modal mobility	the city to work
	Increase residential attractiveness	Increase the parking supply for residents
		Modeling the supply of public use parking according to subway stations distance
	Qualification of public space	Overcome existing gaps in collective transport supply through the relaunch of fast surface electric network
Increase environmental efficiency	Reduce energy, water and material consumption	Increase of green areas, and of the presence of green and permeable area
	Climate mitigation	Provision of incentives to energetic efficiency in buildings, to reuse of buildings, and to material recycling through the reuse of materials from demolitions
	Mitigate risks of flood and ecological sustainability of land	Adaptation of the city to electric vehicles

The changes in the major objectives/directives of development defined in the three master plans of Lisbon analyzed in more detail allow the understanding of the evolution of the city demands and of the crucial problems that Lisbon has been facing in the last 80 years.

The LUMP 1948, being the first master plan of the city of Lisbon, focused more on the emerging problems and needs that the city was facing, as the disorganization in construction of buildings, the lack of land use regulation and public facilities and the scarcity of a sewage network. The LUMP 1948 emerged as the first articulated and global vision of the city of Lisbon and its respective infrastructures. The development of the LUMP 1948 on the city government own initiative launched an era of concern with the municipal territory changes and started an urban and spatial planning policy in the city.

The LMMP 1994 recognized the need of qualifying the urban areas and increase the city attractiveness. For example, the qualification of the east zone through the integration of Expo 98 contributed to the expansion of a "new" area of the city and to the construction of infrastructures and accesses. Nowadays, that area is one of the most looked zones in the city to relax and have a good time.

The LMMP 2012 appears to have a more strategic vision of the city development process and considers the population well-being and life quality in it. For example, the return of the riverfront to the enjoyment of people contributes to the re-development of an area that was losing value and to the recovery and improvement of a recreational and leisure area. It is important to highlight that all the established objectives of the LMMP 2012, directly or indirectly, lead to an increase in the city attractiveness.

The concern with the housing function and the buildings construction is addressed in the three master plans, although in different ways. The LUMP 1948 established, as one of its major objectives, the limitation of the urban development and imposed construction rules in order to be able to control the city expansion and condition the development of the city housing neighborhoods according to the directives defined in the plan. The LMMP 1994 recognized the need of harmonizing the relation between the housing function and the construction services due to the existence of a devalued and degraded housing function. The LMMP 2012, on

its turn, considers the stimulation of the urban rehabilitation as the way of reverse the tendency of emptying old and new consolidated areas and prioritizes urban rehabilitation rather than new constructions.

The traffic congestion and the loss of resident population, mostly the younger population, are the most persistent problems that the city governments have been facing in the last 80 and 30 years, respectively.

The evolution of the legislation of urban and spatial planning has been transforming the way of elaborating and developing the master plans in Lisbon. The content of this instrument has been changing to respond to the legal requirements of the legislations and to become more functional and adequate to the territorial changes. Annex I presents the evolution of the urban and spatial planning instrument content considering the fundamental and complementary elements of the LUMP 1948, LMMP 1994 and LMMP 2012.

4.2   Indicators

In order to apply the four elements that translate the social perspective into urban resilience – demography, social vulnerability, mobility and city attractiveness – to the city of Lisbon were selected a set of indicators that translate each element and allow the analysis of the city evolution. The selection of the set of indicators for each element focused, firstly, on the available indicators and respective data, secondly, on the relevance of the indicators and thirdly, on the relevance of the information that the evolution of the indicators would add to the present investigation.

To perform the analysis of Lisbon demography and understand how and why the population has been changing were selected four indicators:

- **Resident population**;
- **Ageing population index**;
- **Infant mortality rate** and
- **Illiteracy rate**.

The inclusion of an indicator regarding the population migratory movements would complement the demographic study of the population of Lisbon, but due to the lack of data on these issues was not possible to be considered.

In order to allow the analysis of the social vulnerability of the city of Lisbon and understand the population emerging needs and risks were selected five indicators:

- **Unemployment rate**;
- **Criminality**;
- **Homelessness population**;
- **Food Bank assistance to people and to institutions** and
- **Food Bank received products**.

As for the mobility of Lisbon, were selected four indicators to represent the commuting patterns and the expansion of the transport network:

- **Population entrance in Lisbon to work or study**;
- **Population exit from Lisbon to work or study**;
- **Subway network length and**
- **Subway passengers**.

The attractiveness of the city of Lisbon will be represented through four indicators:

- **Real estate valorization index**;
- **World Travel Awards assigned to Lisbon and its facilities**;
- **Bed nights at hotels and similar establishments** and
- **Startups**.

A cultural indicator – number of visitors of the museums of the *Direcção Geral do Património Cultural* in Lisbon – was firstly considered to enrich the study of the city attractiveness, but after analyzing its evolution was disregarded because it did not allow to took conclusions on social changes.

4.3 Development History

The evolution of the resident population, represented in figure 15, is characterized by two major and opposite phases: a pronounced growth up to 1960 mainly due to the rural exodus and return from African ex-colonies, and a decline that started after 1981 and can still be noticed as a consequence of the massive urban development in Metropolitan Lisbon and increase of construction price per m^2 Lisbon city.
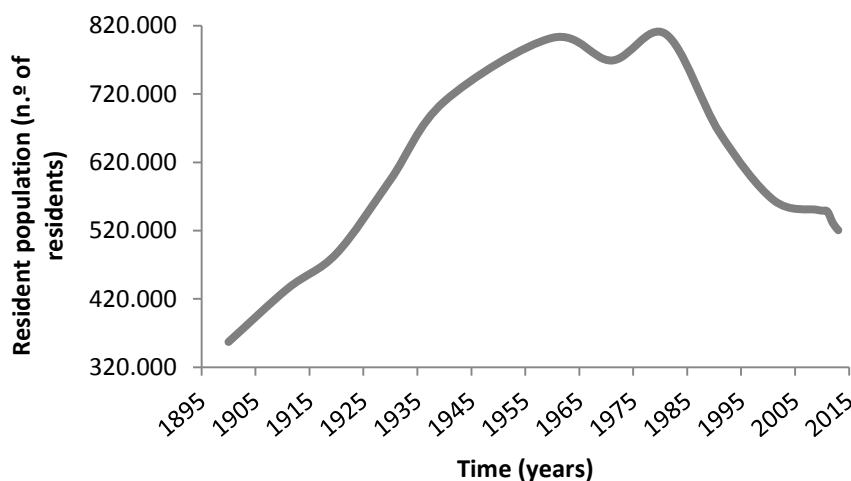
Figure 15: Change in resident population in Lisbon from 1900 to 2013. Data source: Groer and CML - Câmara Municipal de Lisboa (1948), INE - Instituto Nacional de Estatística (2014a) and PORDATA (2014).

In the 19th century, Lisbon, like the rest of the country, registered a population growth due to an improvement in education, health care and food habits, which led to an increase of birth rate and a decrease of mortality rate, especially infant mortality rate, which evolution is represented in figure 16.
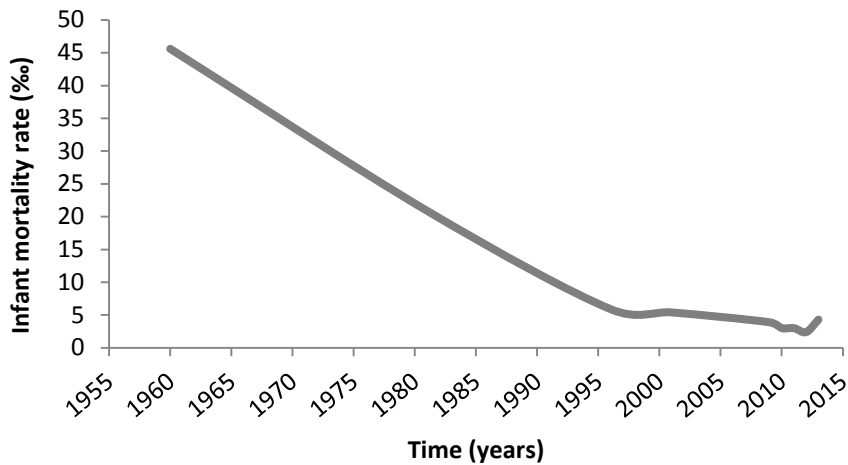
Figure 16: Change in infant mortality rate in Lisbon from 1960 to 2013. Data source: INE - Instituto Nacional de Estatística (2014b) and PORDATA (2014).

The city of Lisbon registered, until 1980, lower values of infant mortality rate than the country. Since 1980, Lisbon and the country have registered similar values of this rate. For the purpose of comparison, in 1960, Portugal registered an infant mortality rate of 77,5‰, while Lisbon registered a rate of 45,6‰. In 1981, Portugal registered a rate of 21,8‰, while Lisbon registered a rate of 20,9‰.

Around 1970, the national government initiated the education and health reforms that were accelerated after the end of the regime in 1975. This allowed all population to access to education and medical care. The decrease in infant mortality rate in Lisbon confirms the success of the health reform and consequent expansion of the public health services.

Figure 17 presents the evolution of Lisbon resident population illiteracy rate.
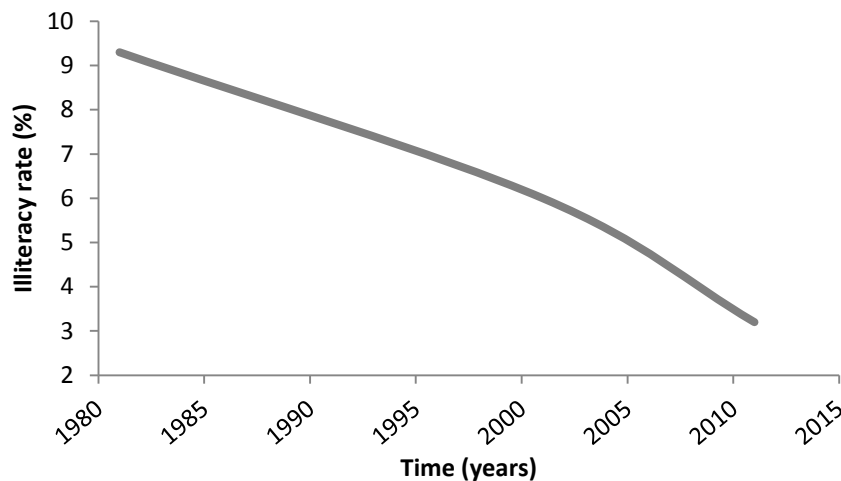
Figure 17: Change in illiteracy rate in Lisbon from 1981 to 2011. Data source: INE - Instituto Nacional de Estatística (2014c) and PORDATA (2014).

Lisbon has registered, through time, lower values of illiteracy rate than the country. For the purpose of comparison, in 1981, Lisbon registered an illiteracy rate of 9,3%, while Portugal registered a rate of 18,6%. This difference is justified with the higher literacy of population in the urban areas than in the rural and inland areas of country (Ramos, 1988).

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The decrease registered in illiteracy rate in Lisbon confirms the increased access from the population to education.

Although, the knowledge increase and the improvement in health care have contributed to Lisbon population growth, the pronounced population growth until 1960 was mostly due to the urban phenomenon that marked the second half of the 19th century and at least the first half of the 20th century, the rural exodus (Rodrigues and Ferreira, 1993). In pursuit of a better life, a lot of inhabitants left the rural and inland areas and headed to the more developed urban areas of the country, especially to Lisbon and respective periphery. Rural exodus led to the decrease and ageing of population in rural areas, to the growth of a youth population in the urban areas and mainly to a massive urban development.

An urban development is usually associated to an industrial expansion, increasing the concentration of industries and employments in the urban areas. In Lisbon, the major period of urban and consequent industrial development was from 1950 – development of base industries (steel and petrochemical industries among others) associated to an expansion model pretending to replace importations – to 1970 with strong dominance in 1960, starting to slow down afterwards (Peixoto, 1997). Costa (2000) states that besides industrial expansion, urban development also leads to an unbalance between land supply and demand and consequent real estate speculation, to land price increase, and to people withdrawal from their workplaces area. Thus, around 1965 people started to leave Lisbon in search for housing at a lower cost in the outskirts (increase of LMA resident population). This decrease trend was however inverted by 1975 with the return of population from the African former colonies. Most of them settled firstly in LMA, especially in Lisbon contributing to the highest number of resident population ever registered in Lisbon city – in the 1981 census – of 807.937 inhabitants.

Once again, population growth led to an urban expansion and to the Lisbon metropolitan area development intensification. The earlier decrease tendency was confirmed and Lisbon population enters – after 1981 – in a pure decline that still remains nowadays (CML - Câmara Municipal de Lisboa, 2009a). This population movement from the city of Lisbon to its periphery was caused by the increase in construction price per m^2 and consequent real estate valorization, which evolution is represented in figure 18.
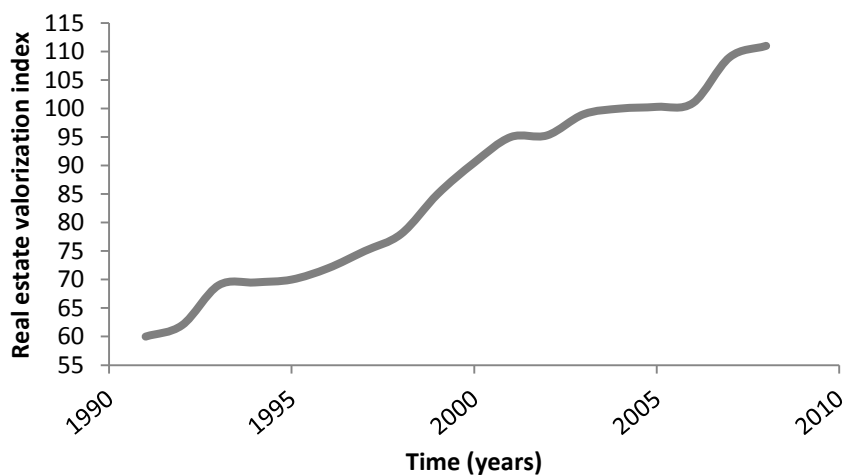
Figure 18: Change in real estate valorization index in Lisbon from 1991 to 2008. Data source: CML - Câmara Municipal de Lisboa and IST - Instituto Superior Técnico (2011).

The increase of real estate valorization index, in the 90's creates difficulties to housing access by younger population, justifying their move out of the city of Lisbon into the periphery. As the real estate valorization index keeps increasing, the access to housing in the city becomes difficult not only for younger people but also to other population with less economic power. The decrease of Lisbon resident population leads to the ageing of population, which evolution is represented in figure 19.
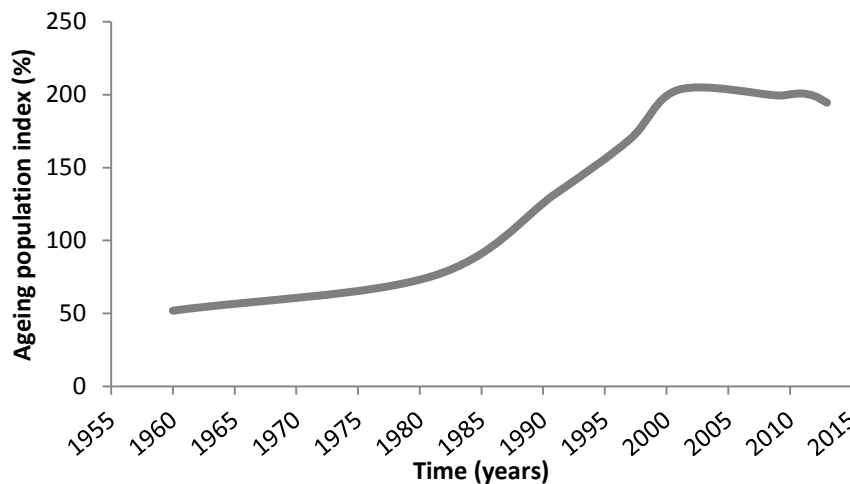
Figure 19: Change in ageing population index in Lisbon from 1960 to 2013. Data source: INE - Instituto Nacional de Estatística (2014c, 2013b), PORDATA (2014) and PROT AML (2001).

The ageing population index started to present a pronounced growth after 1981, achieving the highest value ever registered in the city of Lisbon in 2001 – 203,4%. This pronounced growth of the ageing population index is, in part, due to the exit of the younger population from the city of Lisbon to the other municipalities of LMA and consequent loss of the younger and active population group weight and increase of the elderly age group weight in Lisbon. For the purpose of comparison, Lisbon registered, in 1991, an ageing population index of 132,1% while LMA registered an index of 68,3%.

CML - Câmara Municipal de Lisboa (2009a) identifies as the other contributor to the pronounced growth of the ageing population index in the city of Lisbon the demographic tendency of ageing population registered in the all country. The decrease in the fertility rate and the increase in the longevity index are identified as the major causes for that tendency.

The local government recognized, in 2008, that the ageing tendency was achieving a critical point that could ultimately lead to this population exposure to poverty, and developed the "Plano Gerontológico Municipal" for the period of 2009 to 2013, aiming to promote an active and health ageing of elderly inhabitants through the definition and future implementation of several assistance programs.

Between 2009 and 2011, resident population in Lisbon seemed to be stabilizing when suddenly in 2012 started to decrease again. The justification here may be the emigration of the younger and active population in pursuit of better salaries, professional stability and career opportunities inexistent in Portugal (Saramago, 2014).

In 2012 and 2013, Lisbon lost 27.184 inhabitants. In the same period of time, the age group between 15 and 64 years old also registered a loss of population, while the other two age groups (less than 14 and more than 65

years old) registered an increase of population, confirming the exit of the younger and active population from Lisbon.

According to a study, still under development, on portuguese emigration, the city of Lisbon leads the most recent wave of portuguese emigration (since 2012) with 25% of the new emigrants being former city residents. The study also highlights that besides the reasons presented above, 20% of the emigrant population left the country because they were unemployed (Saramago, 2014).

Figure 20 presents the evolution of the unemployment rate of Lisbon resident population.
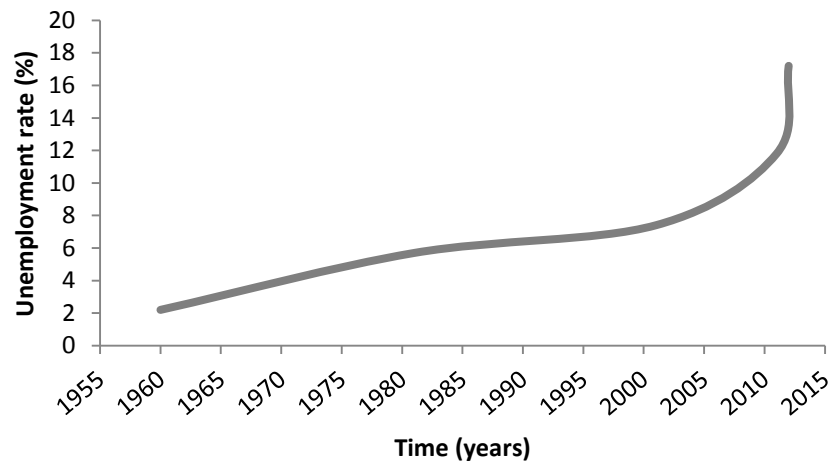
Figure 20: Change in unemployment rate in Lisbon from 1960 to 2012. Data source: INE - Instituto Nacional de Estatística (2014c), Observatório de Luta Contra a Pobreza na Cidade de Lisboa (2013) and PORDATA (2014).

The most pronounced increased in the unemployment rate of Lisbon resident population around 2010 is due to the financial and economic crisis that the country has been facing since 2009 and that appears to get worst every year. Lisbon, as the country's capital, has been severely affected.

Portugal had already lived an economic crisis in 1983/1985, but of smaller dimension than the one that have been lived since 2009 until today. First, because Portugal was in a lower economic level when the 1983 crisis began than in 2009, and second because the 1983 crisis was attenuated by European Economic Community (EEC) funds due to Portugal's entrance in it in the beginning of 1986. Portugal entrance in EEC relieved the crisis and the incoming funds make it look like it was a small crisis, as can easily be seen by the evolution of employment rate represented in figure 20.

Lisbon resident population unemployment rate increased 5,2% between 1960 and 2001 (21 years), 4,4% between 2001 and 2011 (10 years), and 5,4% between 2011 and 2012 (1 year), achieving in 2012 the highest value ever registered in the city of Lisbon, 17,2 %. For the purpose of comparison, Portugal registered, in 2012, a lower value of unemployment rate than Lisbon, 15,5%.

Even with the financial and economic crisis lived, in the last years, in the country, innovation can persist. Figure 21 represents the evolution of startups operating in the city of Lisbon.
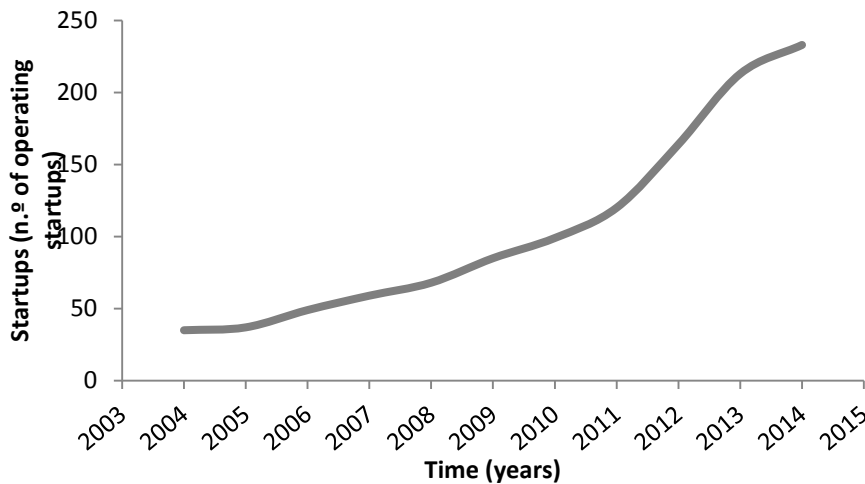
Figure 21: Change in startups operating in Lisbon from 2004 to 2014. Data source: DOCK 38 (2014), EDP Starter (2014), Inovisa (2014), Labs Lisboa (2014), Lispolis (2014), Startup Lisboa (2014) and Tec labs (2014).

The concept of startup is relatively recent and can be seen as a "company working to solve a problem where the solution is not obvious and success is not guaranteed" and a "culture and mentality of innovative on existing ideas to solve pain points" (Forbes, 2013).

The startups operating in Lisbon are relatively small and have been increasing every year. Actually there are 233 startups operating in the city and their business can be grouped into four major categories: commerce, technology, tourism and other services.

The city government has been developing a strategic project regarding entrepreneurship, which includes the provision of the needed infrastructures and support services to create an entrepreneur ecosystem visible at national and international scales. Thus, the city government created a network of incubators for startups, constituted by 11 incubators (from which only 7 are operating in the city of Lisbon), to foster the development of the business initiative and the creation of employment.

Another characteristic of an urban center, as the city of Lisbon, is to have distinct and characteristic commuting patterns. Figures 22 and 23 show, respectively, the evolution of the population entrance in and exiting from Lisbon to work or study.
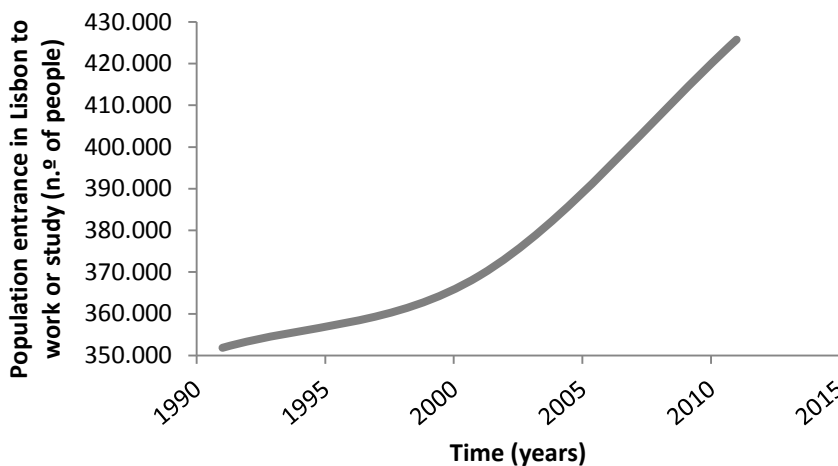
Figure 22: Change in population entrance in Lisbon to work or study from 1991 to 2011. Data source: INE - Instituto Nacional de Estatística (2011, 2003).

The number of people entering the city increases every year. In 1991, 351.846 persons (in part former residents) travelled from their residence (mostly in the others LMA municipalities) into Lisbon every day to work or study, and, in 2011, there were 425.747 persons entering in the city for the same reasons.

The continuous increase of the population entering in Lisbon to work or study between 1991 and 2011 is coincident with the period of major decline in Lisbon resident population and the period of continuous growth of LMA resident population. This confirms that most of the former residents that have left Lisbon settled in the periphery (the other municipalities of the LMA) and continued to develop their professional activities in Lisbon.

In the mid 90's, business activities started to scatter due to the development of some business clusters in the border municipalities of Lisbon, especially tied to the industrial and logistic sectors. This lead to the decrease of these sectors importance, of businesses and employments in Lisbon and to the creation of new attraction cluster in the others LMA municipalities, as Carnaxide and Alfragide business clusters in Oeiras and Amadora municipalities, respectively (CML - Câmara Municipal de Lisboa, 2009b). Thus, in the LMA, Lisbon concentrates the central services (public administration), bank, commerce and tourism while industrial and logistic sectors are concentrated in other municipalities.

With the exit of some activity sectors from the city, the employers were forced to travel to the new locations to work, leading to a rising movement of people exiting Lisbon to work or study, which evolution is represented in figure 23.
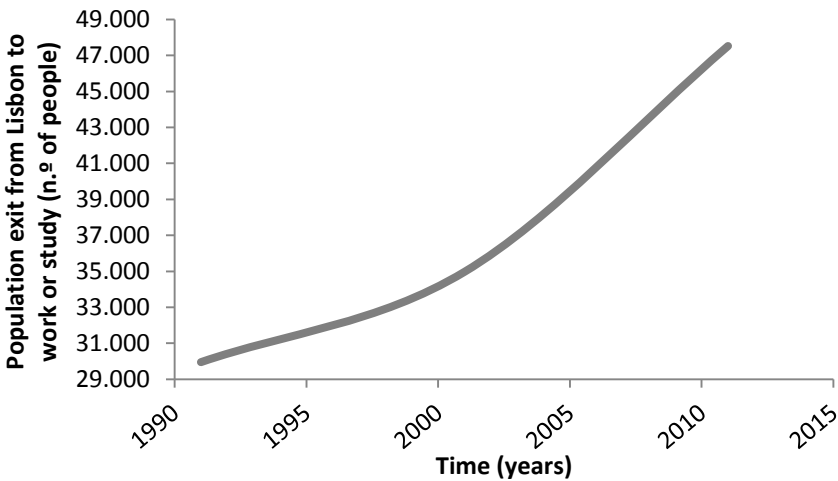
Figure 23: Change in population exit from Lisbon to work or study from 1991 to 2011. Data source: INE - Instituto Nacional de Estatística (2011, 2003).

The continuous increase of exiting people from Lisbon to work, mostly, suggests that over the years more companies have left the city to settle in business clusters as Carnaxide due to the lower rental costs, improvement of accesses and infrastructures associated to the proximity to Lisbon.

Besides the population movement inside Lisbon, either related to the commuting patterns or not, be done through individual or collective transportation (subway or bus), the development of urban areas is associated to the expansion of accesses, railways and public transportations. In Lisbon, this development led to the investment in collective transportation with the expansion of Lisbon subway through the construction and improvement of some urban railways and its connection to the suburban network that was also improved and

increased. The expansion of Lisbon subway is represented in figure 24 through the evolution of the subway's network length.
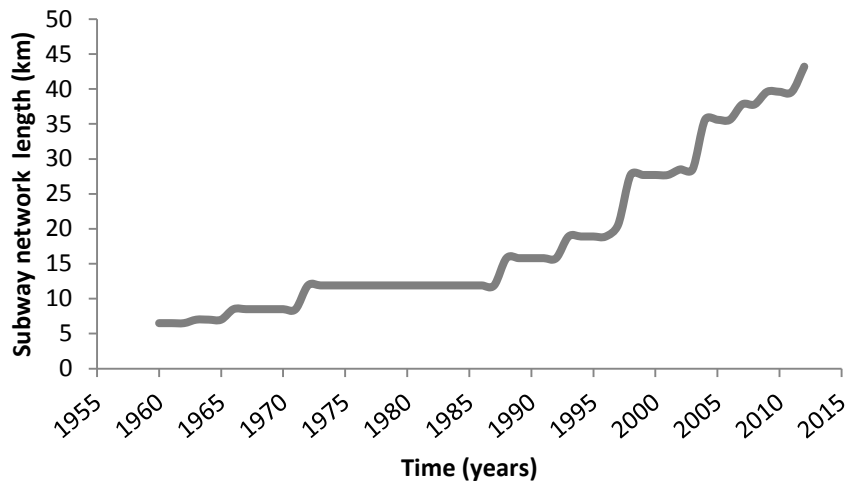
Figure 24: Change in Lisbon subway network length from 1960 to 2012. Data source: Metropolitano de Lisboa (2014a).

Lisbon subway was launched in 1959 with 11 stations and 6,5 km of length. Today, 55 years later, it has 55 stations and 43,2 km of length. The major expansion of the subway network started to occur after 1985 (due to the European funds), to respond to the urban development occurred, around 1995 to prepare to Expo98 event, and thereafter to adapt to the city needs, as for example the extension of the subway network to the airport. Currently, Lisbon subway has several projects under study with the possibility to expand the network in a maximum of 29 stations and 26,2 km of length (Metropolitano de Lisboa, 2014b). Figures 25 and 26 show the evolution of the subway network with the 1959 and 2012 (the same as today) networks drawn in city maps, respectively.
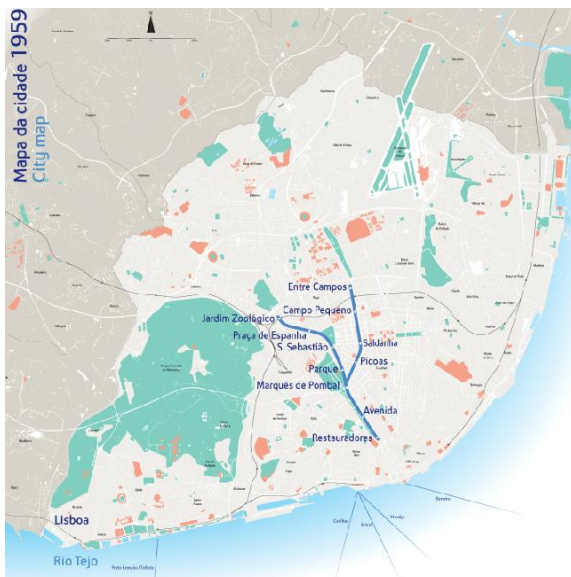
Figure 25: Lisbon subway network in 1959. Source: Metropolitano de Lisboa (2014d).
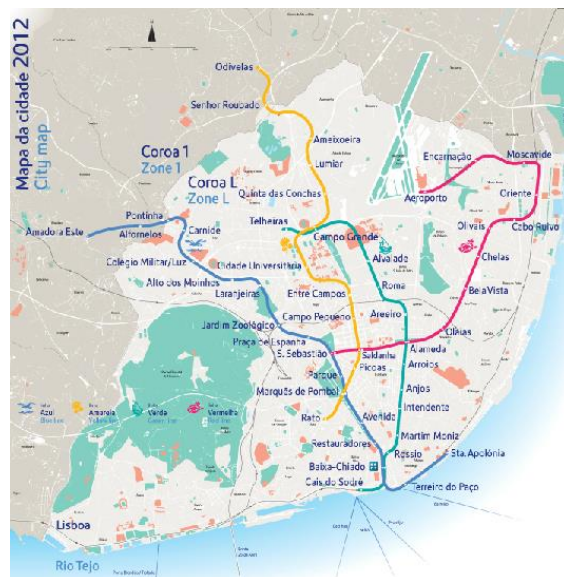
Figure 26: Lisbon subway network in 2012. Source: Metropolitano de Lisboa (2014d).

Lisbon subway always had the concern to provide public spaces with aesthetic conditions to mitigate the negative effects of the usual underground environment. For example, the first 11 stations contained, at the time, works of the architect Keil do Amaral and the painter Maria Keil. With the subway network expansion

and the renewal of some degraded stations, new opportunities emerged to innovate and make "a museum in your trip" (Metropolitano de Lisboa, 2014c), turning Lisbon subway, in the last years, in a touristic attraction due to the development of several cultural initiatives (photographic marathons, concerts, and others) – as the example presented in figure 27 – and due to the beauty and originality of their recovered and/or new stations. In 2012, Olaias station – represented in figure 28 – integrated the *10 most beautiful world subway stations* of CNN "Impact your World" (Expresso, 2012).

Figure 27: Example of a cultural initiative – second photographic marathon. Source: Metropolitano de Lisboa (2014c).
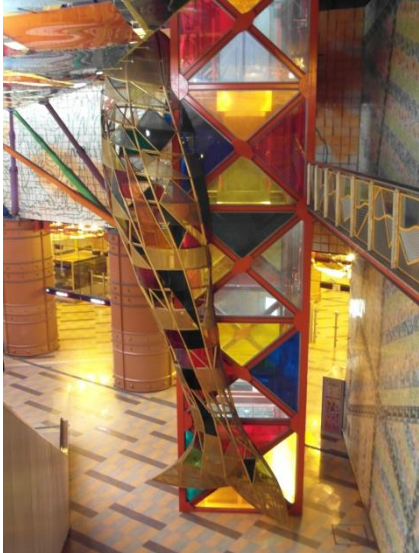
Figure 28: Detail of Olaias subway station. Source: Creative Commons (2014).

As a consequence of the subway expansion (reaching more places and more people), of the continuous increase of people entrance in the city to work or to study, and of the city increasing touristic attraction, subway passengers, which evolution is represented in figure 29, have been increasing over the years with the exception of three phases.
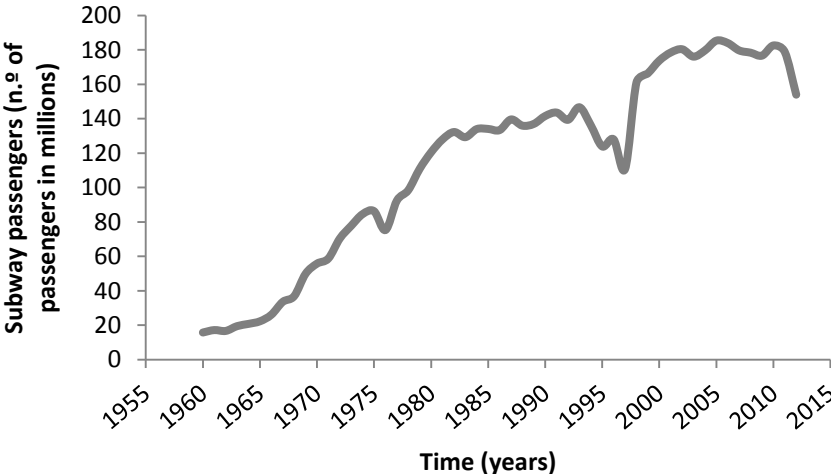
Figure 29: Change in Lisbon subway passengers from 1960 to 2012. Data source: Metropolitano de Lisboa (2014a).

The first decrease phase, although very small when compared to the other two, occurs between 1975 and 1976, probably due to the piers and trains extension and to the April Revolution and consequent end of the

regime that almost stopped the country. The second decrease phase, from 1997 to 1999, was due to the network conditionings related to the expansion constructions for the Expo 98 event. The third phase started in 2011 and seems to go on. This last one may be due to the country economic crisis and consequent high unemployment rate of the resident population, which makes the number of passengers decrease.

 The rest of the evolution of the subway use (number of passenger) is favorable due mostly to the resident population use, to the high number of persons entering in the city to work or study every day (although most of them use private transports), and to the increase touristic attraction of the city. Although the increase of passengers is not proportional to the network expansion, can be related to it because an increase of network length and stations means a higher number of covered locations and more people having access to it. The continuous decline of resident population appears to have no influence in the evolution of the subway passengers, but is necessary to consider that the much bigger increase of people entering in the city to work or study (although most use individual transportation) covers the population exiting.

Lisbon has been increasing its touristic attraction. The New York Times (2005) states that "there may be no better place on the planet to be young and bold – if only in spirit" and the CNN considers that "Lisbon has the potential to become Europe's coolest city". World Travel Awards (WTA) acknowledges and rewards excellence across all sectors of travel and tourism industry since 1994, and have in the last years rewarded Lisbon and its facilities for their excellence, as can be seen in table 6.

Table 6: World Travel Awards assigned to Lisbon and its facilities. Data source: World Travel Awards (2014).

World Travel Awards	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Europe										
Europe's Leading City Break Destination					✓	✓			✓	
Europe's Leading Cruise Destination					✓					✓
Europe's Leading Cruise Port										✓
Europe's Leading Destination					✓					✓
Europe's Leading Landmark Hotel										✓
Portugal										
Portugal's Leading Boutique Hotel					✓	✓	✓	✓	✓	
Portugal's Leading Business Hotel										✓
Portugal's Leading Conference Hotel			✓		✓	✓	✓			
Portugal's Leading Hotel	✓	✓	✓	✓		✓	✓			✓
Portugal's Leading Hotel Suite										✓
Portugal's Leading Serviced Apartments									✓	✓
Total WTA	I	I	II	I	V	IV	III	I	III	VIII

In the last 10 years, Lisbon and its facilities have been distinguished with a total of 29 WTA's, and only in 2014 got 8 WTA's including Europe's Leading Destination, which is the public recognition of the city's excellence regarding tourism sector. Besides this, the increase of the city tourist demand corroborates that Lisbon is one of Europe's preferential destination. Figure 30 represents the evolution of bed nights at Lisbon hotels and similar establishments.
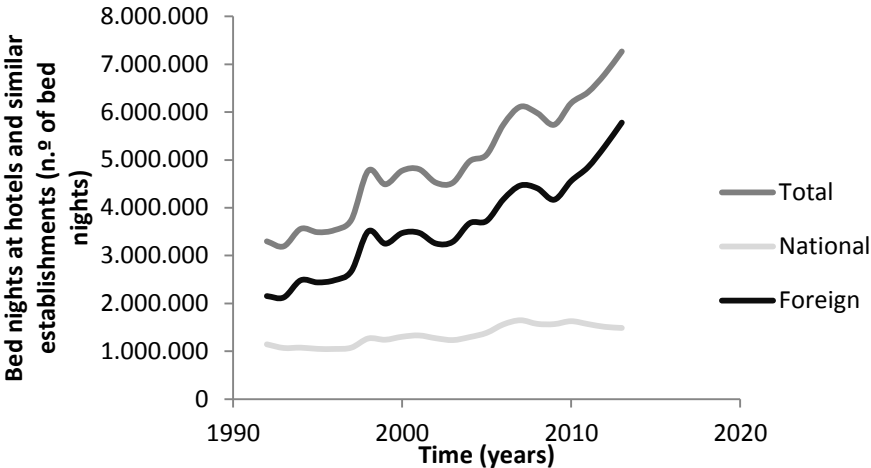
Figure 30: Change in total, national and foreign bed nights at hotels and similar establishments in Lisbon from 1992 to 2013. Data source: Brito Henriques (2006) and Observatório do Turismo de Lisboa and INE - Instituto Nacional de Estatística (2014).

The number of the total bed nights in the city of Lisbon doubled between 1992 and 2013. The continuous increase of bed nights is, in part, due to the increase of the number of hotels and similar establishments (especially to prepare to Euro 2004 and Expo 98 events), allowing more people to stay in the city, but is mostly due to the increase demand for Lisbon as a touristic destination.

As can be seen in figure 30, the total bed nights are mostly due to foreign tourist. In 2013, Lisbon registered a total of 7.268.870 bed nights at hotels and similar establishments, from which 79,5% were regarding foreign tourists and only 20,5% regarded national tourists, confirming that the majority of the touristic income is due to the foreign tourists.

Figure 31 represents the evolution of criminality – number of registered crimes per thousand inhabitants.
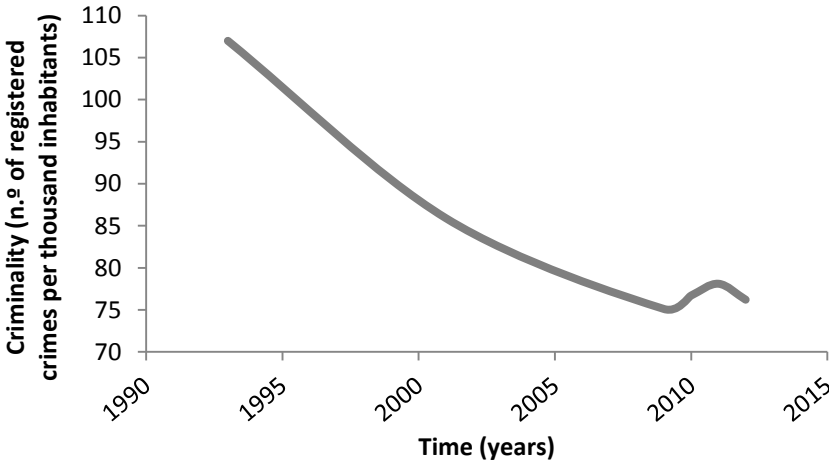
Figure 31: Change in criminality in Lisbon from 1993 to 2012. Data source: INE - Instituto Nacional de Estatística (2014a) and PORDATA (2014).

The evolution of the criminality in Lisbon is mostly characterized by an almost linear decrease until 2009, a small increase until 2011 followed by a decrease until 2012. The phase of criminality increase, from 2010 to 2011, matches the first years of the financial and economic crisis that the country is living and that caused some revolt in the population, including some protests that ended with violence. The cuts in the salaries and the increasing lack of employment are the major reasons for the population revolt and unhappiness.

The economic crisis (felt hardly in Lisbon) has not only contributed to the population revolt and unhappiness but also to their loss of economic power and to the increase of population vulnerability, as for example people living in a homeless situation and which evolution is represented in figure 32.
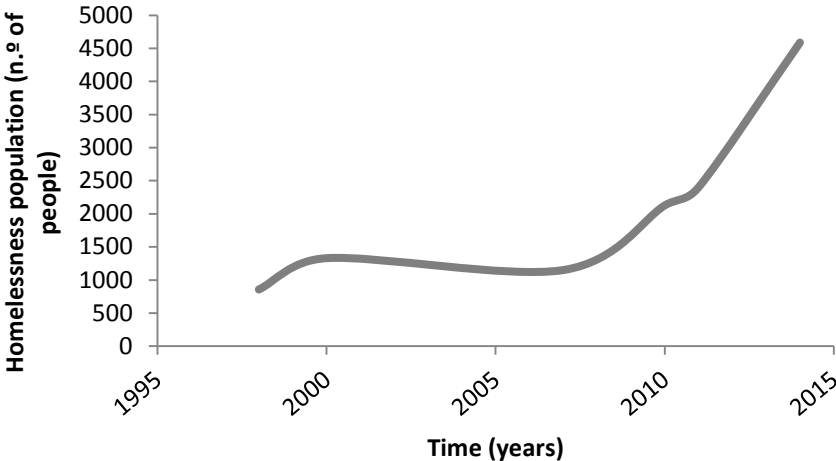
Figure 32: Change in homelessness population in Lisbon from 1998 to 2014. Data source: Carta Social (2014), Observatório de Luta Contra a Pobreza na Cidade de Lisboa (2012) and Santa Casa da Misericórdia de Lisboa (2014).

The evolution of homelessness population in Lisbon has two distinct phases: The first, from 1998 to 2007, where the number of people living in situation of homelessness population remained almost constant tending to decrease from 2000 until 2007. The second phase, after 2007 and until nowadays, presents an accentuated increase especially after 2011. Although this matches with the economic crisis period, is necessary to have into account that a new definition of homelessness – someone that is rooflessness (living in a public space, housed in an emergency shelter or being a precarious local) or houselessness (living in a temporary shelter) – was started to be used in 2009 which required a change in methodology and may have increased the number of people considered as homelessness.

The city government recognized the complexity of the social exclusion problem in its extreme way, homelessness, and the need to support, in an integrated way, vulnerable populations. In 2009, developed the City Plan for the Homelessness Person and created the Homelessness Person Platform, in order to be fully aware of the actual situation. The municipality also has a support group named the Homelessness People Group Support which consists in a street team and temporarily housing centers.

With the population impoverishment, not only people living in homelessness situation need special attention. Lower class population as unemployed population, for example, is increasingly asking for help. Figures 33 and 34 represent evolution of the Food Bank assistance to people and institutions, respectively, and figure 35 presents the Food Bank received products evolution.
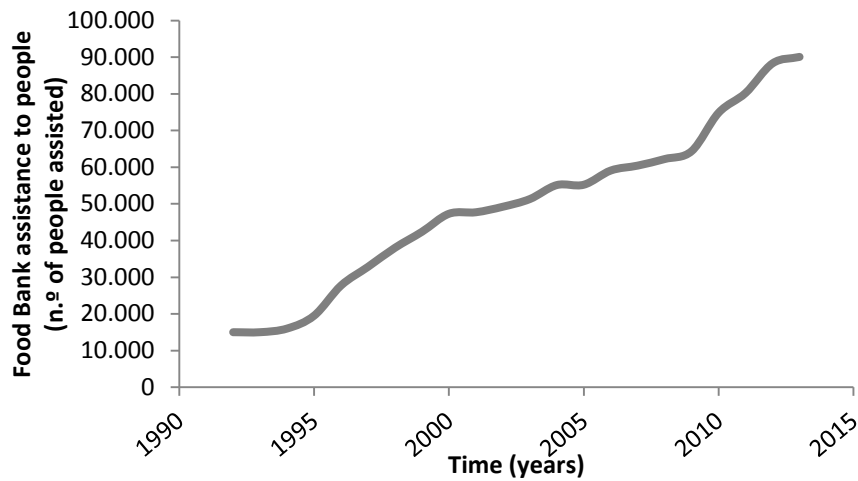
Figure 33: Change in the Food Bank assistance to people in Lisbon from 1992 to 2013. Data source: Banco Alimentar contra a fome (2014).

The number of persons being assisted by the Food Bank has been increasing over the years, achieving the highest number so far in 2013, with 90.094 persons. The increase was more pronounced between 1995 and 2000 and then after 2010. In the first case, the increase must be due to the proximity of the creation of the Food Bank, people where starting to know about it. The second phase, clearly matches the economic crisis lived since 2009, contributing to this all the factors already pointed out before.
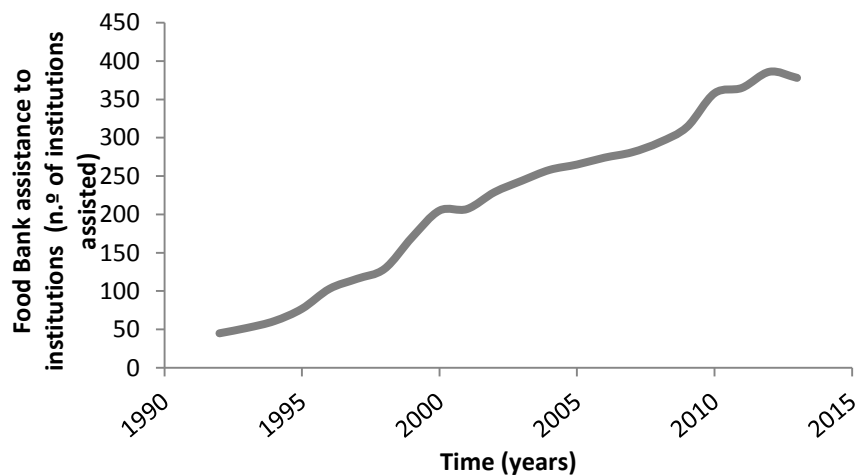
Figure 34: Change in the Food Bank assistance to institutions in Lisbon from 1992 to 2013. Source: Banco Alimentar contra a fome (2014).

The number of institutions being assisted by the Food Bank over the years has also increased, but in 2012 started to decrease due to some institutions disappearance by the lack of resources and funds.
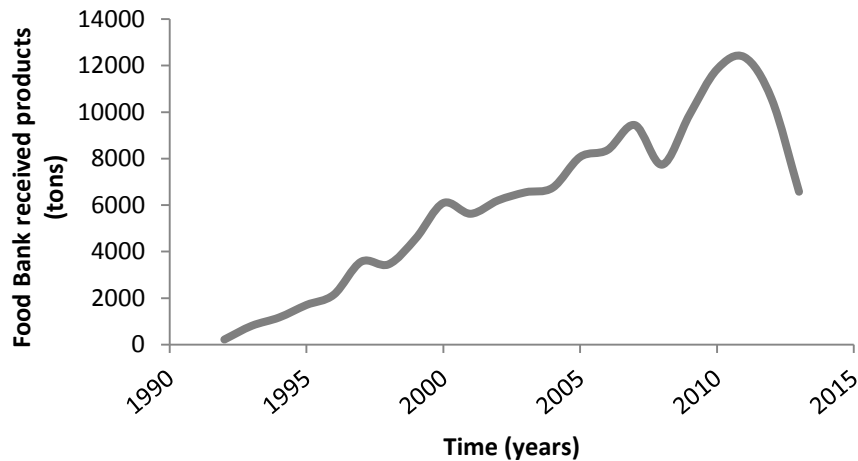
Figure 35: Change in the Food Bank received products in Lisbon from 1992 to 2013. Source: Banco Alimentar contra a fome (2014).

The quantity of received products evolution accompanied, more or less, the assisted people evolution until 2011 when after registering the highest amount ever of received products starts to decrease drastically. Again, the economic crisis is pointed as the major cause and although people continue to help it is has been a smaller one.

The city government has been developing several social policies to transform Lisbon in an open, supportive and "for the people" city, considering the improvement of population life conditions as the major priority. Adopting a prevention/minimization perspective regarding poverty and social exclusion phenomena, the city government developed measures to minimize situations of extreme socioeconomic fragility as the Lisbon Social Emergency Fund, created to financially support the needed families and the program "Direito à Alimentação" aiming to overcome the population food needs. In order to promote social cohesion and develop social integration, the local government developed a set of programs aiming children welfare, as the children beach camp program (operational since 1991) and the campaign of month of prevention against children abuse (operational since 2008).

Annex II presents all the statistical data used to perform the indicators evolution, presented above.

5   Interpretation from the Perspective of Long-term Resilience

The development history and the urban and spatial planning policies, presented in the previous chapter, show that the city of Lisbon has been facing, in the last 50 years, some social disturbances that the urban system has been more difficult to respond to, and which have been the major concern of the current city government in an attempt to revert their negative trends. Thus, is possible to identify as those social disturbances the decline in the resident population, mostly the younger and active one, and a consequent ageing demographic trend over the last 30 years, the fast increase of unemployment rate in the last years, the continuous exit of companies from Lisbon to the periphery registered over the last decade and the increasing population leaving in a homelessness situation.

Over the last 30 years the city of Lisbon has been facing a decline in the resident population, mostly the younger and active population, due to the increasing difficult to access housing by younger and lower economic power population (increase in construction price per m^2 and consequent real estate valorization). This negative trend has been recognized by the city governments as an issue of concern, and policies to revert it have been developed, in the last 20 years, apparently unsuccessfully. In the LMMP 1994, the supply of affordable housing and the reinforcement of social support and opportunities were defined as the measures to be developed to reverse the loss of younger population, but have not been enough once the declining trend remained afterwards and the younger population kept exiting from the city to the periphery. With the continuous decline in resident population after the failed attempt of the LMMP 1994 to revert it, the current city government developed, in the LMMP 2012, policies not only to reverse the population loss, mostly the younger and active one, but also to stop young families from exiting the city into the periphery and increase the city residential attractiveness. The active measures established to meet these objectives include the easier access to housing through the creation of an affordable housing program (which will also lead to the decrease of the real estate valorization index), the development of new infrastructures and equipment through the creation of parking, education, health, culture, sport and social facilities, the increase of the neighborhoods environmental life quality through the control of noise and air quality levels, the promotion of a sustainable mobility, the attraction of more jobs and consequent approach of work and resident places. This way, the current city government is trying to create response capacity in the urban system to reverse the decline of resident population but also anticipate and avoid the future exit of young families from the city, and developing active measures to foster the system transition to a sustainable behavior and create capacity to deal with anticipated changes.

The ageing demographic trend has started to stabilize since 2001, but had already reached a critical point that could ultimately lead to the elderly population exposure to vulnerability. To avoid this from happening, to foster a better quality of life for this population and promote the urban system transition to a sustainable behavior to create capacity to the system respond to anticipated change regarding elderly vulnerability, the city governments have been developing assistance programs for this population since 2008 and the current city government has also been developing new public facilities for elderly protection through the construction of social day centers, nursing homes and multifunctional spaces for seniors. The active measures developed by

the city governance, in the LMMP 2012, to reverse the loss of younger population also contribute to the reverse of the ageing population demographic trend.

The infant mortality and the illiteracy have evolved very positively over the last 50 years, being nowadays almost eradicated in Lisbon. The political reforms developed by the national governments, since 1970, allowing all population to access to education and medical care contributed, largely, to the decrease of illiteracy and infant mortality rates, promoted lasting well-being, facilitated the urban system transition to a sustainable behavior and led to the system capacity to respond to future disturbances. Nowadays, the current city government recognizes, in the LMMP 2012, the need of expanding the education and health services to ensure the city sustainable future through the creation of new 1st cycles and pre-schools, the opening of nursery schools vacancies and the construction of a hospital, health centers and continuing care units. These active measures may increase the potential adaptive capacity of the urban system to deal with future and anticipated changes regarding education and health services.

Lisbon resident population unemployment rate has been increasing over the last 50 years, but the fast increase in the last years and the drastic values registered since 2010 have created an issue of major concern that needs to be addresses and reversed. In 1983/1985, the EEC funds attenuated the financial and economic crisis, avoiding the increase of unemployment rate of the country (including Lisbon). The subsequent slow increase of the Lisbon resident population unemployment rate, until four years ago, distracted the city government who missed to foresee unemployment as a possible future disturbance, missing to develop active measures to facilitate the urban system transition to a sustainable behavior, and increase the system capacity to adapt and respond to it in the future. More specifically, in 1994, the city government recognized, in the master plan, the need to increase the city competitiveness through the development of economic activities as a key condition for city planning, but did not anticipate the continuous increase in the unemployment rate or developed actions to act prior to it. With the lack of anticipated recognition by governance stakeholders regarding the increase trend of unemployment rate in Lisbon and the financial and economic crisis faced by the all country since 2010, the city resident population unemployment rate achieve drastic values. To reverse this situation, the current city government developed, in the LMMP 2012, policies not only to improve the city capacity to create more jobs and to install more workplaces but also to promote entrepreneurship and increase the city competitiveness and economic sustainability. The active measures established to meet these objectives include the increase of the edificability index, the better use of business areas, the support of initiatives regarding the reuse of abandoned industrial spaces, the location of companies being possible in any city point, and the promotion of business incubators to improve the existing startup model program. This way, the current city government is trying to foster the urban system transition to a sustainable behavior and create response capacity in the urban system to reverse the drastic increase of unemployment rate in the last four years and also contributing to the attraction of inhabitants into the city of Lisbon.

Regarding the startup model program, specifically, the economic investment to provide the needed infrastructures and support services to propel the innovation in the business sector has been allowing anyone with an innovative mentality to create their own business. As they usually are small businesses, startups have

been creating few jobs when compared to the ones needed to start reversing the resident population unemployment. Still, the increasing number of startups operating in Lisbon has been promoting entrepreneurship and innovation in the business sector, paying attention to the intra-generational equity, and contributing to the urban system transition to a sustainable behaviour within the business sector.

Over the last decade, the city of Lisbon has been facing a continuous exit of companies from Lisbon to the border municipalities business clusters and an apparent lack of policies to avoid and revert it. Only in 2012 there was a recognition by the current city government, in the LMMP 2012, of the need to counter this exiting companies trend through the development of a policy that promotes new business clusters in the city which includes placing municipal assets in the land market with rules for determining the final cost and developing new soil programming mechanisms to allow the intervention in the market. This way, the current city government is trying to compete with the business clusters in the periphery and create capacity for the urban system reverse that trend.

The continuous increase, over the years, of people entering in and exiting from the city of Lisbon to work or study is consisting with the identification of traffic congestion as the most persistent problem that the city has been facing over the last 80 years. Being an issue of concern identified by the city governments over the years, the developed and adopted policies to revert it have been evolving from focusing on construction and improvement of infrastructures to the promotion of a sustainable mobility. In the LUMP 1948, the improvement of the road network planning, the expansion of the road network and the development of a traffic regulation for the city were defined as the measures to be developed to reverse the traffic congestion, while in the LMMP 1994, the creation of the transport network interfaces system was the only developed measure. In both cases, the adopted policies did not reverse the problem but allowed the creation of infrastructures to improve mobility and transports. With the traffic congestion remaining but with the road and transport network infrastructures already developed, the current city government, in the LMMP 2012, grabbed the opportunity of establishing a sustainable policy towards mobility within the city limits. The established actions to meet this objective include the implementation of a multi-modal mobility system, the creation of traffic moderation zones, the reduction of the number of vehicles entering the city, the increase of collective transport use and of bike use, the increase of bike paths network, the creation of a bike sharing service, the increase of parking supply for residents, and the overcome of existing gaps in the collective transport network supply. This way, the current city government is not only trying to reverse the traffic congestion but also contributing to the increase of the city residential attractiveness and to the qualification of public space, fostering the urban system transition to a sustainable behavior and trying to create capacity to the system respond to future disturbances.

The investment in the expansion and attraction of the Lisbon subway realized by the governance stakeholders has accompanied the city needs, facilitated the urban system transition to a sustainable behavior and the adaptive capacity to respond to changes regarding the subway network development and use. Thus, the decrease in the number of passengers registered since 2011 is expected to be dealt with as the other two disturbances registered in the last 50 years were. The several projects under study for the future expansion of

the Lisbon subway, even with the number of passenger decreasing, increases the potential adaptive capacity of the urban system to deal with future and anticipated changes regarding the subway use.

The increasing number of World Travel Awards assigned to Lisbon and its facilities and the continuous increase of total bed nights in the city of Lisbon show that the governance stakeholders, mainly the city government and the touristic operators, have been capable, over the years, of increasing the international acknowledge and the demand of Lisbon as a major tourist attraction. Their investment in new infrastructures to accommodate more tourists and in turning Lisbon into a tourist preferential destination have facilitated the urban system transition to a sustainable behavior and contributed to the system capacity to adapt and respond to anticipated changes regarding tourism. The current city government policy of returning the riverfront to the enjoyment of people is one of the best examples of how to increase the city attractiveness (not only to tourists but also to the resident population) and keep Lisbon in the touristic route.

The continuous decrease in criminality in the city of Lisbon has been promoting lasting well-being, facilitating the urban system transition to a sustainable behavior and creating capacity to the system respond to future disturbances.

The city of Lisbon, over the last 16 years, has always registered some population leaving in a homelessness situation, but since 2007 has been facing an accentuated increase in the number of homelessness people. This is an issue of major concern that should have been addressed by the city government in the immediate once is one of the extreme cases of population vulnerability, does not promote lasting well-being and creates an intra-generational inequity in the city. Between 2000 and 2007, when the homeless population remained almost constant, the governance stakeholders should have recognized the intra-generational inequity and developed active measures to facilitate the transition of the urban system to a sustainable behavior and to create capacity to the system adapt to the future increase of homelessness population. Although the accentuated increase, since 2007, might have been overrated by the implementation of the new definition of homelessness people and consequent methodology, the increase trend is still disturbing. In 2009, the city government recognized the complexity of the problem of social exclusion and has been developing, since then, actions to support and try to integrate this population, as the development of the City Plan for the Homelessness Person, and the existence of a street team and temporary shelters. This way, there is an attempt to reverse this situation and to combat the intra-generational inequity created.

The Lisbon Food Bank capacity to assist an increasing needed population, even with an accentuated decrease in the amount of received products, promotes lasting well-being and facilitates the urban system transition to a sustainable behavior. The city governments have also been developing actions to support the needed families, as the creation of an emergency fund and the program "Direito à Alimentação", contributing to the promotion of intra-generational equity and avoiding more population to reach an extreme state of vulnerability.

The city of Lisbon has been facing, in the last 50 years, a mix of desirable and undesirable qualities. Considering the desirable qualities those that have been fostering lasting well-being and contributing to the urban system capacity to make the needed transition to deal with future disturbances, is possible to identify the governance

stakeholders investment in the political reforms of education and health services, in the startups business model, in the infrastructures to accommodate more tourists and in turning Lisbon in a tourist preferential destination, and the decrease of criminality and the increasing Food Bank capacity assistance. As for the undesirable qualities is possible to identify the social disturbances that the urban system has been more difficult to adapt and respond to, as the decline in resident population, mostly the younger and active one, and a consequent ageing demographic trend over the last 30 years, the fast increase of unemployment rate in the last years, the continuous exit of companies from Lisbon to the periphery registered over the last decade and the increasing population leaving in a homelessness situation.

It is also possible to identify several social innovations developed in the city of Lisbon and associated to both desirable and undesirable qualities. For example, the creation of the programs for affordable housing, for assisting the elderly population, for startup business model and for support and integration of homelessness people and for the needed population, the political program of health and education reforms and the creation of the emerging fund for the needed families. Besides these, all the new programs, products or processes developed with the implementation of the LMMP 2012 that change the social system are also social innovations.

The social innovations associated to the desirable qualities of the city of Lisbon as the political program of health and education reforms have been promoting lasting well-being, contributing to the urban system capacity to make the needed transition to adapt and respond to anticipated disturbances. Other social innovations developed after the urban system has achieved the desirable state and that foster the system sustainable behavior may contribute to the increase of the potential adaptive capacity of the urban system to deal with future and anticipated changes. The social innovations associated to the undesirable qualities that the city of Lisbon has been facing over the years as the program for affordable housing may create opportunities to the urban system recover from its negative trends, may facilitate the system transition to a sustainable behavior and may create the system capacity to adapt and respond to them.

Once building urban long-term resilience requires efforts to enhance the resilience of systems delivering desirable services accompanied by and integrated with efforts to facilitate the urban system transition to a sustainable behavior, is possible to conclude that the desirable qualities of the city of Lisbon, already identified, are building long-term resilience of the urban system. Figure 36 provides an overview of the analysis of the desirable qualities building urban long-term resilience in Lisbon.

To prevent the desirable qualities to turn into undesirable is necessary that the governance stakeholders keep recognizing the highly sensitive complex systems and considerations regarding social issues along with the foster of lasting well-being. This can only be achieved by the sharing of integrated information, about social trends and thresholds, through communication supported by trustworthy networks, willingness to learn and change, and structural flexibility.

Indicators with positive trends	Infant mortality rate almost eradicated	Illiteracy rate almost eradicated	Startups increasing	World Travel Awards increasing	Bed nights at hotels and similar establishments increasing	Criminality decreasing	Food Bank Assistance increasing capacity
Governance stakeholders investment in	Political reforms of education and health services An entrepreneur business model Turning Lisbon in a touristic preferential destination Infrastructures to accommodate more tourists						

Promoted lasting well-being

Facilitated the urban system transition to a sustainable behavior

Created capacity to the urban system act and respond to disturbances

Desirable qualities

Building urban long-term resilience

Figure 36: Overview of the analysis of the desirable qualities building urban long-term resilience in Lisbon.

To better understand and analyze the undesirable qualities and their possible evolution in the future is presented the table 7, where is developed an overview of all policies and active measures developed by the city governments over the last years regarding the social disturbances with negative trends that the urban system has been more difficult to adapt and respond to. It is emphasized the distinction between the governance polices developed before the LMMP 2012, and in the LMMP 2012 and afterwards, once this is the MMP currently in force.

Through the overview of the government developed policies regarding the undesirable qualities and respective social disturbances, provided by table 7, is possible to conclude that previously to the LMMP 2012, not all the identified social disturbances were recognized. The continuous exit of companies from the city to the border municipalities business clusters in the last decade was firstly addressed by the city governments as an issue of concern in the LMMP 2012. The other four social disturbances were recognized by the city governments in both periods, but as already analyzed in this chapter, the few developed policies and active measures to address these issues, previous to the LMMP 2012, were not enough and apparently unsuccessful once the social disturbances remained afterwards.

Table 7: Governance policies and active measures developed to revert the social disturbances producing undesirable qualities, previous to the LMMP 2012 and LMMP 2012 and afterwards.

Undesirable qualities		Governance policies and active measures to revert the social disturbances	
Indicators and an issue of concern	*Social disturbance*	*Previous to the LMMP 2012*	*LMMP 2012 and afterwards*
Resident population	Decline, mostly of younger and active population, over the last 30 years	Reverse the loss of younger population through the: Supply of affordable housing Reinforcement of social support and opportunities	Reverse the loss of younger and active population, stop young families from exiting the city into the periphery and increase the city residential attractiveness through the: Easier access to housing through the creation of an affordable housing program Development of new infrastructures and equipment through the creation of parking, education, health, culture, sport and social facilities Increase of the neighborhoods environmental life quality through the control of noise and air quality levels Promotion of a sustainable mobility Attraction of more jobs Approach of work and resident places
Ageing population	Demographic trend starting to stabilize after 2001, but already in a critical point that can ultimately lead to elderly exposure to vulnerability	Development of assistance programs for elderly	Development of assistance programs for elderly Reverse the loss of younger population Development of new public facilities for elderly protection through the construction of social day centers, nursing homes and multifunctional spaces for seniors
Unemployment	Fast increase in the last years	Increase city competitiveness through the development of economic activities as a key condition for city planning	Improve the city capacity to create more jobs and to install more workplaces, promote entrepreneurship and increase the city competitiveness and economic sustainability through the: Increase of edificability index Better use of business areas Support of initiatives regarding the reuse of abandoned industrial spaces Location of companies being possible in any city point Promotion of business incubators to improve the startup model
Homelessness population	Increase since 2007	Development of actions to support ant try to integrate this population	Development of actions to support ant try to integrate this population
Companies	Continuous exit from the city into the border municipalities business clusters over the last decade		Promote new business clusters in the city through the: Placing municipal assets in the land market with rules for determining the final cost Development of new soil programming mechanisms to allow the intervention in the market

The LMMP 2012 addressed all the social disturbances and developed several policies and active measures to attempt to create response capacity in the urban system to revert them and also try to foster the urban system transition to a sustainable behavior. This way, the current city government implemented policies present an opportunity for the city of Lisbon to recover from the negative trends and to promote well-being. Figure 37 provides an overview of the analysis of the undesirable qualities and the current city government opportunity

to reverse their social disturbances negative trends.

The LMMP 2012 is more directed to and for the people than previous plans once the developed actions consider the population needs and well-being, for example, the creation of education, health, culture, sport and social facilities, the control of noise and air quality in the neighborhoods, the approach of work and residence places, the creation of more jobs and the development of programs for protection of more vulnerable population as elderly and homelessness people.

Social disturbances associated to indicators with negative trends and to an issue of concern	Decline of resident population, mostly the young and active one, over the last 30 years	Demographic ageing trend, stabilizing since 2001 but already in a critical point	Fast increase of unemployment rate over the last years	Increase of people leaving in a homelessness situation since 2007	Continuous exit of companies from the city to the border municipalities business clusters
Urban system response	Difficulty to adapt and respond to the social disturbances				

Undesirable qualities

Development of governance policies and active measures to address and reverse the social disturbances

Previous to the LMMP 2012	LMMP 2012 and afterwards
Not all the social disturbances were recognized as issues of major concern	All the social disturbances have been recognized as issues of major concern
Development of few policies and measures to reverse the identified disturbances	Development of several policies and measures to reverse all the identified social disturbances
Not enough Apparently unsuccessful	**Opportunity to reverse and recover from the social disturbances negative trends**

Social disturbances negative trends remained afterwards

Figure 37: Overview of the analysis of the undesirable qualities and the opportunity of the current city government to reverse the social disturbances negative trends.

6 Conclusion

The objective of the present dissertation was the study of urban resilience through a social perspective, which required a literature review of concepts that would allow not only the implementation of a methodology to assess the resilience of an urban system but also the understanding of how urban resilience could incorporate a social perspective and which social features would drive the resilience of an urban system. Thus, the literature review was developed regarding three main concepts: social-ecological systems (SESs) resilience and urban resilience concepts to provide the existing methodologies allowing the assessment of urban resilience, and social innovation concept to complete the social perspective (also introduced by the social dynamics of urban resilience four cores).

Then, two main methodologies were identified, analyzed and compared, the Resilience Alliance methodology (based on SESs resilience concept) and the Kumagai methodology (based on urban resilience concept). The last one, was the one selected to be used in the present study and to a case study because is specifically designed for urban systems, is based on building urban long-term resilience and promoting lasting well-being, and takes more into account the governance stakeholders policies and the people associated to the urban system, being more appropriate to study the social perspective of urban resilience.

Kumagai methodology for assessing the resilience of urban systems through a long-term perspective consists in five steps: the translation of resilience into urban context where, considering in advance which type of urban system will be analyzed (a city under or already developed or a post-industrialized city for example), are defined the elements that characterize and drive the urban system for translating resilience into urban context, establishing the framework for performing the assessment; the definition of the focal scale where the spatial and temporal boundaries are defined; the identification of indicators where the identified elements are converted into indicators of the focal scale; the history development where is performed the analysis of the indicators evolution through time; and the interpretation from the perspective of long-term resilience where is established the analysis of the long-term resilience of the urban system under study considering the governance activities to build long-term resilience – recognition of the complex issues or problems, anticipation of future possible disturbances, active transition to act previously to those disturbances, adaptability against surprising disturbances and communication.

The present dissertation adopted methodology only differed from the one developed by Kumagai in the first step, because this looked at how the urban system incorporates resilience while the present study looked at how urban resilience can incorporate a social perspective. Thus, instead of translating resilience into urban context, was translated the social perspective into urban resilience and four features were identified to allow this translation: demography, social vulnerability, mobility and city attractiveness. The selection of these elements was performed considering the social dynamics and social innovation concepts and the urban development associated to a city (as the focal scale of the case study). These four elements are what socially drives the urban system.

After, the city of Lisbon was chosen as the focal scale of the case study to allow the implementation of the adopted methodology and the understanding of how social disturbances and changes affect the urban system resilience. A presentation of the city of Lisbon was developed and included the available city government policies over the last 80 years (LUMP 1948, LMMP 1994 and LMMP 2012) to allow a further analysis of the governance activities to build urban long-term resilience. To convert the demography, social vulnerability, mobility and city attractiveness elements into indicators of Lisbon was defined a set of 17 indicators - resident population, ageing population index, infant mortality rate, illiteracy rate, unemployment rate, criminality, homelessness population, Food Bank assistance to people and to institutions, Food Bank received products, population entrance in Lisbon to work or study, population exit from Lisbon to work or study, subway network length, subway passengers, real estate valorization index, World Travel Awards assigned to Lisbon and its facilities, bed nights at hotels and similar establishments and startups. Due to the indicators lack of data for larger periods of time (mostly to the last 80 years, the available timeline analysis of the city governance), the analysis of Lisbon social perspective was only allowed to be developed for the last 50 years. Moreover, some indicators only had available data for the last 10 or 20 years, not allowing a deeper analysis of their trends.

Then, was developed an analysis of the identified indicators evolution, through which was possible to understand that the city of Lisbon has been more difficult, over the last 50 years, to respond to some social disturbances. More specifically, to the decline in resident population, mostly the younger and active one, and consequent ageing demographic trend, to the fast increase of unemployment rate in the last years, to the continuous exit of companies from Lisbon to the periphery registered over the last decade and to the increasing population leaving in a homelessness situation.

At last, was developed the interpretation of the indicators evolution from the perspective of long-term resilience, establishing the connection between the indicators trends and the city governments developed policies and active measures to build long-term resilience. It was concluded that the city of Lisbon, over the last 50 years, has been facing a mix of desirable and undesirable qualities. For the desirable qualities were identified the governance stakeholders investment in the political reforms of education and health services, in the startups business model, in the infrastructures to accommodate more tourists and in turning Lisbon in a tourist preferential destination, and the decrease of criminality and the increasing Food Bank capacity assistance. As for the undesirable qualities, were identified the social disturbances that the city has been more difficult to respond to over the last 50 years.

Then, was concluded that the city of Lisbon desirable qualities are building long-term resilience of the urban system while the undesirable qualities are being addressed by the current city government, in the LMMP 2012, in an attempt to reverse them after previous not enough and unsuccessful attempts. The current city government has been developing several policies and active measures to reverse the social disturbances, presenting an opportunity for the city of Lisbon to recover from their negative trends and promote lasting well-being.

The interpretation of the indicators evolution also allowed the identification of several social innovations developed in the city of Lisbon and associated to both desirable and undesirable qualities, as for example the

creation of programs for assisting the elderly population. It was concluded that social innovations associated to the desirable qualities have contributed to the urban system capacity to respond to disturbances while the ones associated to the undesirable qualities may help the urban system transition to a sustainable behavior and may create capacity to the system adapt and respond to disturbances.

The adopted framework allowed, this away, an assessment of the urban resilience through a social perspective of the city of Lisbon. It is also important to highlight that the adopted methodology also allows the assessment of any urban system of the same type as the one studied, a city associated to an urban development, once the incorporation of the social perspective into the urban resilience context was accomplished considering previously the urban system type, the social dynamics and social innovation concepts and the characteristics associated to a city urban development. Thus, demography, social vulnerability, mobility and city attractiveness are what socially drives any urban system of the same type of the one studied.

The inclusion of more social indicators regarding, for example, migratory movements, social protection and population well-being would enrich the study, complement the social perspective and allow a deeper understanding of the social disturbances that the city has been facing over the years, but the lack of indicators and of data did not allow it.

There is also a lack of statistical projections and estimations, which would allow an attempt of understanding if the current city government policies are really creating the opportunity to reverse the undesirable qualities or not, and would enrich the study of the urban resilience through a social perspective in the city of Lisbon.

From the developed study is possible to conclude that, although has been mentioned previously that in the urban resilience four cores framework the social dynamics circle appeared to have no interaction with the governance networks circle, social dynamics and governance networks have a clear interconnection between them.

To the development of the present dissertation were only considered two of the four cores of urban resilience, social dynamics to provide the social perspective and governance networks to allow the analysis from the long-term resilience perspective. The lack of the other two cores, metabolic flows and built environment, may affect the specific resilience of social dynamics and governance networks and the resilience of the urban system as a whole.

Regarding future developments, is possible to highlight the development of a work considering the interconnectivity of the four urban resilience four cores which would allow a deeper study of the urban resilience as a whole and would also contribute to the study of the specific resilience of each of the four elements.

The narrowing and the widening of the case study focal scale, for example a specific neighborhood of Lisbon and the Lisbon Metropolitan Area, respectively, would contribute to a better understanding of the cross-scale interactions faced by the urban system and would provide a broader analysis of the study of urban resilience through a social perspective.

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Annexes

Annex I – Evolution of the urban and spatial planning instrument content

Table 8: Change in the LUMP 1948, LMMP 1994 and LMMP 2012 fundamental elements. Data source: CML - Câmara Municipal de Lisboa (1994, 2012) and Groer & CML - Câmara Municipal de Lisboa (1948a).

	Regulation	Synthesis plant	Planning plant	Urban space classification	Environmental urban components	Operative planning units	Municipal patrimony inventory	Urban space qualification	Municipal ecological structure	Views system	Natural and anthropic risks	Infrastructure constraints	Transport and accessibilities	Constraints plant	Officially classified patrimony	Officially undergoing classification patrimony	Other easements and public utility restrictions	Administrative easements and public utility restrictions	Regulation annexes	Plant and list of existing effective urban and detail plans	Classified and undergoing classification buildings, complexes and sites	Built and landscape patrimony municipal charter list of goods	Public transport network hierarchy	Transport interfaces hierarchy and interfaces list	Road network hierarchy	Nodes matrix	Cycling networks planning criteria	Subway stations and parking zones allocation	Private and public parking dimensioning parameters	Heavy vehicles parking places dimensioning parameters
LUMP 1948	✓	✓																												
LMMP 1994	✓		✓	✓	✓	✓	✓							✓	✓	✓	✓													
LMMP 2012	✓		✓					✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 9: Change in the LUMP 1948, LMMP 1994 and LMMP 2012 complementary elements. Data source: CML - Câmara Municipal de Lisboa (1994, 2012) and Groer & CML - Câmara Municipal de Lisboa (1948a).

	Construction and housing current state analysis	Green spaces study and analysis	Lisbon region (suburbs) analysis	Study elements plants	Municipal characterization studies	Patrimony municipal charter preliminary studies	Report	Framing plant	Current situation plant	Environmental report	Financing and execution program	Urban commitments identification report	Noise map	Educational charter	Monitoring indicators
LUMP 1948	✓	✓	✓	✓			✓								
LMMP 1994					✓	✓	✓	✓	✓						
LMMP 2012					✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

Annex II – Statistical data

Resident population

Table 10: Change in resident population in Lisbon from 1900 to 2013. Data source: Groer and CML - Câmara Municipal de Lisboa (1948), INE - Instituto Nacional de Estatística (2014a) and PORDATA (2014).

Time (years)	1900	1911	1920	1930	1940	1960	1971	1981	1991	2001	2009	2010	2011	2012	2013
Resident population (N.º of residents)	357.009	435.359	486.372	594.390	709.179	802.230	769.044	807.937	663.394	564.657	550.466	549.210	547.733	530.847	520.549

Infant mortality rate

Table 11: Change in infant mortality rate in Lisbon from 1960 to 2013. Data source: INE - Instituto Nacional de Estatística (2014b) and PORDATA (2014).

Time (years)	1960	1981	1996	2001	2009	2010	2011	2012	2013
Infant mortality rate (‰)	45,6	20,9	5,9	5,4	3,9	3,0	3,0	2,4	4,3

Illiteracy rate

Table 12: Change in illiteracy rate in Lisbon from 1981 to 2011. Data source: INE - Instituto Nacional de Estatística (2014c) and PORDATA (2014).

Time (years)	1981	2001	2011
Illiteracy rate (%)	9,3	6,0	3,2

Real estate valorization index

Table 13: Change in real estate valorization index in Lisbon from 1991 to 2008. Data source: CML - Câmara Municipal de Lisboa and IST - Instituto Superior Técnico (2011).

Time (years)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Real estate valorization index	60,0	62,0	69,0	69,5	70,0	72,0	75,0	78,0	85,0	90,5	95,0	95,3	99,0	100,0	100,3	101,0	109,0	111,0

Ageing population index

Table 14: Change in ageing population index in Lisbon from 1960 to 2013. Data source: INE - Instituto Nacional de Estatística (2014c, 2013b), PORDATA (2014) and PROT AML (2001).

Time (years)	1960	1981	1991	1987	2001	2009	2010	2011	2012	2013
Ageing population index (%)	51,9	75,5	132,1	169,2	203,4	199,4	200,2	200,8	199,0	194,5

Unemployment rate

Table 15: Change in unemployment rate in Lisbon from 1960 to 2012. Data source: INE - Instituto Nacional de Estatística (2014c), Observatório de Luta Contra a Pobreza na Cidade de Lisboa (2013) and PORDATA (2014).

Time (years)	1960	1981	2001	2011	2012
Unemployment rate (%)	2,2	5,7	7,4	11,8	17,2

Startups

Table 16: Change in startups operating in Lisbon from 2004 to 2014. Data source: (DOCK 38, 2014; EDP Starter, 2014; Inovisa, 2014; Labs Lisboa, 2014; Lispolis, 2014; Startup Lisboa, 2014; Tec labs, 2014).

Time (years)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Startups (n.º of operating startups)	35	37	49	59	68	85	99	120	164	213	233

Population entrance in and exit from Lisbon to work or to study

Table 17: Change in population entrance in and exit from Lisbon to work or study from 1991 to 2011. Data source: INE - Instituto Nacional de Estatística (2011, 2003).

Time (years)	1991	2001	2011
Population entrance in Lisbon to work or study (n.º of people)	351.846	369.154	425.747
Population exit from Lisbon to work or study (n.º of people)	29.953	34.971	47.521

Subway network length and passengers

Table 18: Change in Lisbon subway network length and passenger from 1960 to 1977. Data source: Metropolitano de Lisboa (2014a).

Time (years)	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Subway network length (km)	6,5	6,5	6,5	7,0	7,0	7,0	8,5	8,5	8,5	8,5	8,5	8,5	11,9	11,9	11,9	11,9	11,9	11,9
Subway passengers (n.º of passengers in millions)	15,8	17,2	16,7	19,5	20,8	22,3	26,1	33,6	36,9	49,9	55,8	58,8	70,4	77,8	84,6	86,3	75,3	92,4

Table 19: Change in Lisbon subway network length and passenger from 1979 to 1995. Data source: Metropolitano de Lisboa (2014a).

Time (years)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Subway network length (km)	11,9	11,9	11,9	11,9	11,9	11,9	11,9	11,9	11,9	11,9	15,8	15,8	15,8	15,8	15,8	18,9	18,9	18,9
Subway passengers (n.º of passengers in millions)	98,5	110,9	120,5	128,0	132,3	129,3	134,0	134,1	133,4	139,6	136,0	137,0	141,6	143,6	139,4	146,7	136,2	123,9

Table 20: Change in Lisbon subway network length and passenger from 1996 to 2012. Data source: Metropolitano de Lisboa (2014a).

Time (years)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Subway network length (km)	18,9	20,6	27,7	27,7	27,7	27,7	28,5	28,5	35,6	35,6	35,6	37,8	37,8	39,6	39,6	39,6	43,2
Subway passengers (n.º of passengers in millions)	128,0	110,8	161,1	166,4	173,8	178,5	180,4	176,1	179,7	185,4	184,0	179,7	178,4	176,7	182,6	178,8	154,0

Bed nights at hotels and similar establishments

Table 21: Change in total, national and foreign bed nights at hotels and similar establishments in Lisbon from 1992 to 2002. Data source: Brito Henriques (2006) and Observatório do Turismo de Lisboa and INE - Instituto Nacional de Estatística (2014).

Time (years)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
National bed nights at hotels and similar establishments (n.º of bed nights)	1.144.591	1.068.475	1.075.377	1.049.858	1.048.223	1.075.448	1.267.316	1.241.033	1.303.457	1.330.798	1.272.236
Foreign bed nights at hotels and similar establishments (n.º of bed nights)	2.153.942	2.125.859	2.483.769	2.439.292	2.484.616	2.673.818	3.508.393	3.249.647	3.471.637	3.477.250	3.253.081
Total bed nights at hotels and similar establishments (n.º of bed nights)	3.298.534	3.194.334	3.559.146	3.489.150	3.532.839	3.749.266	4.775.709	4.490.680	4.775.094	4.808.048	4.525.317

Table 22: Change in total, national and foreign bed nights at hotels and similar establishments in Lisbon from 2003 to 2013. Data source: Brito Henriques (2006) and Observatório do Turismo de Lisboa and INE - Instituto Nacional de Estatística (2014).

Time (years)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
National bed nights at hotels and similar establishments (n.º of bed nights)	1.233.680	1.295.867	1.385.125	1.563.088	1.647.764	1.572.880	1.567.571	1.628.464	1.568.029	1.510.200	1.487.481
Foreign bed nights at hotels and similar establishments (n.º of bed nights)	3.289.228	3.677.572	3.724.055	4.178.953	4.465.847	4.407.808	4.168.416	4.559.615	4.848.404	5.286.305	5.781.389
Total bed nights at hotels and similar establishments (n.º of bed nights)	4.522.908	4.973.439	5.109.180	5.742.041	6.113.611	5.980.688	5.735.987	6.188.079	6.416.433	6.796.505	7.268.870

Criminality

Table 23: Change in criminality in Lisbon from 1993 to 2012. Data source: INE - Instituto Nacional de Estatística (2014a) and PORDATA (2014).

Time (years)	1993	2001	2009	2010	2011	2012
Criminality (n.º of registered crimes per thousand inhabitants)	107,0	85,9	75,1	76,7	78,1	76,2

Homelessness population

Table 24: Change in homelessness population in Lisbon from 1998 to 2014. Data source: Carta Social (2014), Observatório de Luta Contra a Pobreza na Cidade de Lisboa (2012) and Santa Casa da Misericórdia de Lisboa (2014).

Time (years)	1998	2000	2007	2010	2011	2014
Homelessness population (n.º of people)	856	1330	1150	2126	2399	4588

Food bank assistance to people and institutions and food bank received products

Table 25: Change in the Food Bank assistance to people and institutions and food bank received products in Lisbon from 1992 to 2002. Data source: Banco Alimentar contra a fome (2014).

Time (years)	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Food Bank assistance to people (n.º of people assisted)	15000	15000	16000	19500	27736	32840	38031	42392	47302	47723	49223
Food Bank assistance to institutions (n.º of institutions assisted)	45	52	61	77	103	116	129	170	205	207	229
Food Bank received products (tons)	220	809	1167	1705	2148	3566	3452	4573	6089	5628	6201

Table 26: Change in the Food Bank assistance to people and institutions and food bank received products in Lisbon from 2003 to 2013. Data source: Banco Alimentar contra a fome (2014).

Time (years)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Food Bank assistance to people (n.º of people assisted)	51325	55134	55226	59102	60445	62238	64400	74872	80263	88341	90094
Food Bank assistance to institutions (n.º of institutions assisted)	244	258	265	274	281	294	314	358	365	386	378
Food Bank received products (tons)	6551	6750	8069	8368	9441	7739	9886	11835	12366	10562	6575