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Exploring urban resilience to disasters. The role of planning in the long-term community rebuilding of Kalamata after the 1986 earthquake

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Résumé

Cette recherche explore la relation entre la planification, la reconstruction et la résilience, à travers l'analyse approfondie de la reconstruction à long terme d'une ville frappée par une catastrophe. Le but de cette recherche est de mieux comprendre le concept de résilience pour l'opérationnaliser. Premièrement, apporter une nouvelle perspective à la discussion sur la résilience en tant que concept théorique. Deuxièmement, contribuer à une nouvelle méthode d'évaluation pour explorer cette problématique, cette recherche utilise comme étude de cas une ville de taille moyenne qui a été frappée par une désastre. La ville de Kalamata, en Grèce, a été frappée par un tremblement de terre en Septembre 1986, ce qui l'a rendue dévastée. La trajectoire de développement de la ville à long terme offre une opportunité idéale pour explorer telles caractéristiques.

Cette recherche examine les interventions et les pratiques de planification qui ont influencé les niveaux d'équilibre de la résilience de la ville au cours des périodes de pré-catastrophe et après la catastrophe et met l'accent sur l'interprétation des résultats dans le processus de récupération à long terme. Il se questionne si et comment les choix de planification influencent le rétablissement de la ville ainsi que sa résilience. La concentration sur la récupération à long terme est cruciale car elle révèle le succès ou l'échec du processus de récupération et elle vient compléter un vide dans la littérature étant donné que les études sont principalement concentrées sur les résultats de récupération à court terme.

La résilience est un outil théorique largement répandu et en même temps largement contesté qui a été adopté par plusieurs domaines de recherche et utilisé différemment dans la plupart d'entre eux. Dans le domaine de la planification, la résilience est actuellement largement adoptée et est aujourd'hui un processus et un résultat très attendus dans la recherche et la pratique. La récupération à long terme et l'atténuation des risques sont les phases les moins explorées de la reconstruction post-

catastrophe. Bien que beaucoup de recherches soient orientées vers les stratégies de réponse et de reconstruction, on accordera peu d'attention à la récupération à long terme et aux phases d'atténuation des dangers.

L'innovation de cette recherche est qu'elle offre une nouvelle perspective en examinant comment la reconstruction a eu des impacts sur les lieux sur le long terme. Comment est-ce qu'ils ont amélioré leur résilience? Au lendemain d'un événement catastrophique, toutes les dynamiques sont mobilisées vers un soulagement et une reconstruction immédiats. Ces dynamiques restent malheureusement motivées pour un court terme après l'événement catastrophique. Bientôt la vie trouve un nouveau rythme et les signes de la catastrophe sont absorbés dans les besoins et les actes de la vie quotidienne. Cependant, les impacts des décisions prises après la catastrophe ne sont révélés qu'à long terme, pendant la phase de récupération à long terme. Pour que la reconstruction après sinistre soit couronnée de succès, une reconstruction résiliente à long terme est impérative.

Au sein de cette recherche, la conceptualisation de la résilience est à la fois un défi et une nécessité afin de faire un premier pas vers la découverte de ce qui constitue une reconstruction résiliente à long terme post-catastrophe. Avec cette perspective à long terme, cette recherche explore la contribution des pratiques de planification à l'amélioration de l'équilibre de résilience d'une zone urbaine. Afin d'explorer à long terme la relation entre la planification et la résilience d'une communauté urbaine, un modèle d'évaluation de la résilience dans ce cadre spécifique est proposé. L'objectif est de donner une idée de la façon dont la planification peut affecter la résilience. Finalement, l'importance des pratiques de l'atténuation des risques et d'adaptation dans la planification est soulignée.

Mots clés: Résilience, vulnérabilité, planification, aménagement, reconstruction, long terme, réduction des risques, Kalamata.

Abstract

This research explores the relationship between planning, reconstruction and resilience, through the in-depth analysis of the long-term recovery of a city hit by disaster. The purpose of this research is to further understand the concept of resilience in order to operationalize it. Firstly, to contribute a new perspective to resilience research as a theoretical concept. Secondly, to contribute to the operationalization of resilience with a new assessment method. To explore this problematic this research uses as case study a medium sized city that has been hit by a disaster in the past. The city of Kalamata, Greece was hit by an earthquake in September 1986, which left it devastated. The development trajectory of the city that is in an ongoing long-term recovery phase offers an ideal opportunity to explore such characteristics.

This research examines the planning interventions and practices that have influenced the city's resilience equilibrium levels during the pre-disaster and post-disaster periods and it focuses on the interpretation of the findings in the long-term recovery process. It questions if and how planning choices influence the recovery of the city as well as its resilience. The concentration on the long-term recovery is crucial as it reveals the success or fail of the recovery process and it comes to fill a void in literature given that studies are mostly concentrated on short-term recovery results.

Resilience is already a widely popular and at the same time extensively contested theoretical concept that has been adopted by several fields of research and used differently in most of them. Within the field of planning resilience is currently being extensively adapted and is today a much-anticipated process and outcome of planning research and practice. Long-term recovery and hazard mitigation are the least explored phases of post disaster reconstruction. Although much research is orientated towards response and reconstruction strategies, little attention is given towards the long-term recovery and the hazard mitigation phases.

The innovation of this research is that it offers a new perspective by examining how reconstruction has impacted places over the long term. How they have improved their resilience? In the aftermath of a catastrophic event, all dynamics are immediately mobilized towards immediate relief and reconstruction. These dynamics unfortunately

remain motivated for only a short term after the catastrophic event. Soon life finds a new rhythm and the signs of the catastrophe are absorbed into the needs and deeds of everyday life. However, the impacts of the decisions taken shortly after the disaster are only revealed on the long term, during the long-term recovery phase. For disaster recovery to be successful, a long term resilient rebuilding vision is imperative.

Within this research, the conceptualization of resilience is both a challenge and a necessity to take a first step towards the outlining of what constitutes a *long-term resilient post-disaster community rebuilding*. With this long-term perspective, this research explores the contribution of planning practices towards the amelioration of the resilience equilibrium of an urban area. To analyze the relationship between planning and resilience of an urban community on the long term, a model for assessing resilience within this specific framework is created. The objective is to give an insight in the ways planning can affect resilience. In this way, the importance of hazard mitigation and adaptation in the field of planning is highlighted.

Keywords: Resilience, vulnerability, planning, adaptation, reconstruction, long-term, disaster risk reduction, Kalamata

Table of Contents

List of Figures

List of Tables

Dedication

«Το χάσμα που άνοιξε ο σεισμός ευθύς εγιόμισε άνθη»

Δ. Σολωμός, Ελεύθεροι Πολιορκημένοι

«The chasm of quake at once filled with flowers»

D. Solomos, The Free Beseiged

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1. Introduction

In an era of continuous social, environmental and economic uncertainty, the present thesis explores the concept of resilience, as it becomes an important element in the development of the world's cities. The need for resilience translates to a need for flexibility, learning and adaptation to ever-changing environments and within a wide array of contexts from psychology to urban planning. Particularly in urban environments, resilience brings new ways of addressing both recurring and unpredictable challenges and risks. Since planning and resilience are both concepts that evolve and develop in macro-timing, following the long-term evolution of a city after a catastrophic event is critical for exploring the links between them.

The innovative part of the present research lies in the focus on post disaster long-term resilience assessments, a perspective with great importance over which there is little knowledge and from which new problematics on resilience can emerge. After shock, immediate reactions and impacts draw the attention and the focus but the long-term evolution of the city is often overlooked. From the widely explored short-term reconstruction phase to the less documented long-term recovery phase, a city is following post-disaster an unpredictable route. It can fail to recover the previous structures, develop over destructed ones and decay, it can follow the previous path, trying to rebuild on the exact same structures, or it can improve by rebuilding towards better ones. The question that arises is how can one understand, foresee and moreover influence this route towards an improved trajectory. In other words, how can a city's resilience be ameliorated.

Resilience is a concept introduced in planning research from the fields of ecology and social sciences (Adger 2000, Folke et al. 2002, etc.). Even though it has since been widely debated there is still no broadly accepted definition of the concept. (Manyena, 2006, etc.) A powerful tool for the cooperation of urban and development planning and disaster management towards more effective disaster risk reduction, resilience quickly became a buzzword in planning research (Porter and Davoudi, 2012, etc.). However, even though it is equally popular in policy and government agendas as it is in research, it remains unclear how it can be integrated into planning practice. Resilience is explored in the present thesis via an attempt to sustainably operationalize it for the concept to be

better understood. Thus, the aim of this work is to advance conceptually and practically the operational employment of resilience within an urban context.

1.1. The growing vulnerability of the world's urban centers and the quest for resilience.

As the world is becoming more and more a network of urban centers, their growing vulnerability to natural or/and human-made disasters is affecting everyone, more or less directly. Today, an estimated 54.5 per cent –projected to grow to 60 per cent by 2030- of the world's population lives in urban settlements, while most cities are vulnerable to at least one type of natural disaster (United Nations, 2016) The process of urbanization involves several different dimensions, it alters equally the physical environment as well as the social interactions. Thus, the dynamic of urbanization needs to be closely followed not only because it represents an ever-growing part of our communities but moreover because it impacts and influences not only the urban centers but the surrounding environment's functions as well.

The combination of continuing urbanization trends and the many challenges that the world is facing, from economic to refugee crises, terrorism, and the accelerating impacts of climate change, render cities as the most vulnerable parts of our world. These recurring challenges with the addition of the unpredictable natural hazards such as earthquakes, tsunamis and extreme weather events further increase the risks that contemporary cities are facing. These risks are frequently connected with inadequate planning practices that combined with increasingly vulnerable physical environments, lead to bigger or smaller everyday hazards and many times, to disasters.

Thus, the vulnerability of the world's urban centers, with regards both to mega-cities and to the smaller urban agglomerations, is a problem that needs to be further addressed. Since the UN Sendai Conference in 2015, that revised the previous approach of the Hyogo Framework for Action 2005-2015 on hazards and vulnerability, the resulting Sendai Framework for Disaster Risk Reduction 2015-2030 prioritizes disaster risk reduction through the implementation of resilience. According to UNISDR (2007)

Disaster Risk Reduction (DRR) is defined as, the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events

With a similar perspective, the Habitat III Conference that took place in Quito, Ecuador in October 2016 adopted the New Urban Agenda that also prioritizes strengthening urban resilience to reduce the risk and impact of disasters. Thus, in an environment of risk as best described by Beck, *a Risk society*, planning for uncertainty is imperative. By gaining knowledge on how these phenomena affect the cities we gain insight not only on how to overcome potential disturbances of urban systems but also the ability to mitigate possible risks on the long-term. Although knowledge alone is not sufficient[1], it is the effective use of lessons learnt in the past and the practical passage from theory to action that can create a positive and effective impact.

In addition to disturbing the normality of everyday urban life, disasters are widely seen as threats to the much-anticipated pathway towards the sustainable development of contemporary cities. As Hewitt (1995) argued early on, «If there could be such a thing as sustainable development, disasters would represent a major threat to it or, a sign of its failure. » In this sense, the road towards sustainability prioritizes the improvement of a city's capacity to be prepared, to face a disaster and to overcome it with minimal costs. Thus, improving the sustainability of a city should have as a priority the improvement of a city's capacity to face both the expected and unexpected, as a city that cannot prepare for possible risks cannot be sustainable. Yet, an unsustainable environment is not created by vulnerability alone but it is rather the combination of the exposure that comes from vulnerability together with the absence of an adequately prepared mitigation, response and adaptation plan that lead to the deterioration of the overall sustainability of a place. Thus, the quest for sustainability together with the acceleration of vulnerability, have prepared the grounds for the introduction of resilience in planning research and practice.

[1] See White et al. (2001) *Knowing better and losing even more: the use of knowledge in hazards management.*

In response to the above quests, research today calls for a new approach "one that sees cities as living systems, constantly self-organizing in many and varied ways in response to both internal interactions and the influence of external factors." (Resilience Alliance, p.3). Resilience, the concept that is implied and introduced in the above quote is already a widely-debated field of research in planning and at the same time it is central in the studies and the actions towards sustainable urban development. Being able to understand, predict and improve a city's resilience is crucial for the integration of risk management into the development process and moreover for facilitating the implementation of disaster prevention strategies rather than applying recovery strategies to already wounded areas.

The implementation of prevention strategies to vulnerable areas around the world and their integration in the planning process is the most important step to be taken in order to face future disasters. "Acting beforehand to mitigate natural hazard impacts is much more effective than picking up the pieces afterwards." (Godschalk, 2005) Today in the face of the accelerating trend of urban disasters, literature is calling for the exploration of disaster prevention strategies and the incorporation of the concept of resilience in these procedures (Sendai Framework, 2015-2030) Thus, planning for resilience is an emerging subject that critically compliments sustainable urban development.

1.2 Operationalizing resilience in a planning context: A merging concept between urban planning and disaster research.

Whereas the importance of the concept of resilience is widely accepted, it has also been the theme of a wide criticism due to the absence of an exact and concrete definition. In the absence of a conceptual framework and due to its multidisciplinary character the authors today explore the concept in many ways. The result is a multi-interpretated concept, difficult to define. However, even if resilience is currently being widely explored in the conceptual level, few studies have been realized towards the exploration

of resilience in an operational level. Resilience is seen as contributing to sustainability and reducing vulnerability although clear guidance as to how resilience can be promoted is lacking. (Klein et al. 2003)

Literature has long been calling for the operationalization of the concept (Bruneau et al. 2003, Cutter et al. 2008, etc.) as it is very important in order to make the concept more comprehensible and most importantly utilizable for researchers and practitioners. Thus, not many efforts have been made to this direction. "Challenges remain in the development of consistent factors or standard metrics that can be used to evaluate the disaster resilience of communities." (Cutter et al. 2008) What is interesting about operationalizing resilience in the context of planning is that it can bring together two fields of research that traditionally have not cooperated, the field of urban planning with the one of disaster research. These two fields, urban planning and disaster research, have been working in silos, without exchanging perspectives and ideas neither at research nor at practice. Thus, planning for urban resilience offers a much-needed common ground for these different approaches to develop synergies and work across silos.

In the unfortunate times when disasters occur, they create this rare window of opportunity for change in the urban system. For it to be utilizable, decision and policy makers must have the knowledge, the tools and the will to act. Planning for resilience can act as a catalyst during that brief period and set the grounds for future resilience development. Planning is a research and policy field that implies change, reform and a long-term vision for improvement. For this reason, resilience, even if it is only a "recent addition to planning's discursive repertoire" (Davoudi, 2012, p. 300), it is a concept inherent in the discipline of planning, and one that should be further explored. A valuable tool for the research in urban areas, the operationalization of resilience moreover becomes a precious tool for disaster research, with use both in the short term and long-term studies of the recovery.

1.3 Research purpose: Linking planning to resilience evolution.

Planning in a world of constant change and disruption is challenging as many times unpredicted events change the environments upon which planning is projected. Thus, such events should be takin into consideration beforehand while disaster planning and resilience need to be integrated into urban planning and development plans. As Haas (2012) argues, "disaster planning and resilience is argued to be one of the great challenges of urban development and planning" (p.11). The overall purpose of this research is to explore the dynamics of planning and resilience and to question the ways that planning can affect long-term resilience in a post-disaster situation. When a disaster occurs, it marks the beginning of the so-called, disaster cycle and the creation of a 'window of opportunity' (Burby, 2000, Berke and Campanella, 2006, Christoplos, 2006, etc.) for change. The following phases, response, recovery, mitigation and preparedness, shape the development of the disaster stricken community, although no clear boundaries exist between them. With recovery being the least researched phase of the disaster cycle (Chang, 2010, Blanco and Alberti, 2009), planners have been mostly involved in the mitigation phase.

Figure 1.1 The disaster management cycle (source: www.quora.com)

Disaster planning has been focused on mitigation pre-disaster and relief during the response phase but recovery is a phase about which we have little knowledge. Planning for resilience brings the focus to recovery as the phase where planning practices can significantly influence resilience. According to Christoplos, (2006, p.4) the window of opportunity might even be more apparent in the 'post-recovery phase' rather than the immediate 'post-disaster reconstruction phase'. Therefore, for resilience to be achieved on the long term, planners should be ready to act at the phase of recovery. The intervention of planning during the recovery phase provides a chance not only for recovery but moreover for future mitigation and finally a chance for increasing long-term resilience. This potential is created because in the recovery phase the weaknesses and vulnerabilities of the urban system are highlighted and planning can intervene in ways that would not have been possible otherwise. Therefore, it is stated here, that not only "planning can dramatically bolster a city's resilience" (Campanella, 2006, p.143) but moreover the most efficient way of increasing the long-term resilience of a community is by acting during the recovery phase.

However, for planning practices to be implemented in the aftermath of a disaster, a community must be prepared. In one of the first approaches of recovery, Haas, Kates and Bowden's (1977) work, "Reconstruction following disaster", explored the recovery phase and stated that "(…) recovery action are easiest to accomplish if plans and policies are in place before the disaster." (cited in Olshansky and Chang, 2009, p.203) The importance of plan preparedness is illustrated on the following figure where the postdisaster plan evolves from the predisaster one.

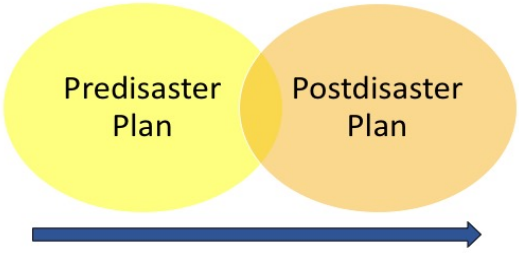

Figure 1.2: Plan preparedness (source: author)

Therefore, in order to increase future resilience, the importance is set for planners to get involved on recovery phase, and moreover, for plans to exist before the disaster. The following figure (Figure 1.3) shows the potential of a successful recovery in impacting a community's resilience. As witnessed by the figure, if it weren't for the disaster, resilience would probably retain a stable trend but would not have increased to the level it is found on the long-term recovery. Therefore, it is stated here that planning can bolster resilience in the aftermath of a disastrous event. The purpose of this research is to gain insight on the way that planning interventions affect the different dimensions of resilience in the different time-phases.

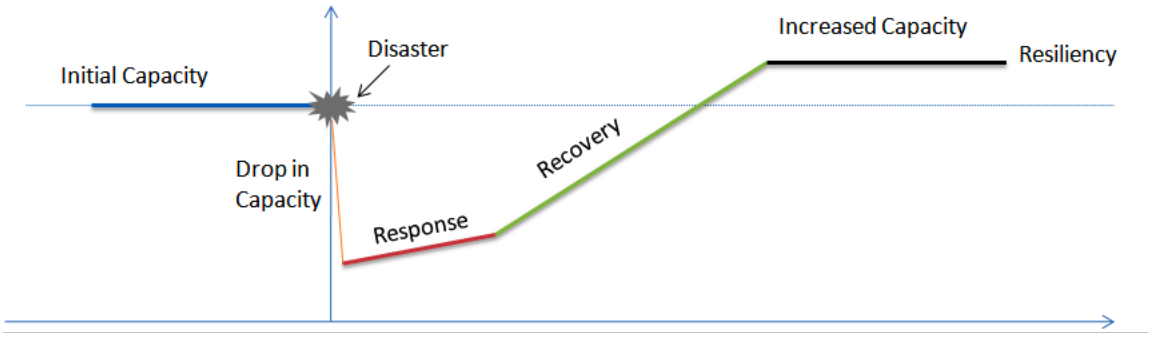

Figure 1.3: Recovery can result in increased community resiliency (source: Jordan, Javernick-Will, and Amad, 2011)

Many researchers today call for the interpretation of resilience with an outcome towards sustainability promotion. *"Resilience, includes also the meaning of the capacity of recovering from a catastrophe but while adopting a more sustainable configuration."* (Maret and Cadoul, 2008, p.114). In the same direction, the idea of bouncing forward to a different, better state is today overlapping the notion of bouncing back to a previous state, within the resilience discourse. With a similar perspective, viewing resilience not only as a capacity of a system to absorb shocks but moreover as a capacity to overcome them while improving its functions and forms, this research will explore the community resilience of an urban system vulnerable to natural disasters. Aiming to clarify, mostly in an operational level, this concept, the present research will study the resilience of a city that has experienced a natural disaster, both pre-disaster and post-disaster, with focus on the less explored long-term recovery processes in order to explore the configuration of the resilience equilibrium and the factors that affect it.

1.4 Research objective: The development of a resilience assessment model within a planning perspective

Answering to the above void in literature, the need for operationalizing resilience, this research intends to explore the characteristics of a resilient urban system within the perspective of planning. More precisely, it seeks to define what constitutes a long-term resilient community rebuilding. Even though according to Godschalk (2003) "an advantage of the goal of urban resilience is that it is not tied to a specific pattern of urban form or development" this research seeks to identify patterns of development and especially planning interventions and outcomes that include resilience characteristics within them and lead to resilient outcomes. Post disaster reconstruction and recovery is a complex issue that involves many different actors in different scales. According to Maret and Cadoul (2008) resilience is developing over three phases, infrastructure and network resilience on the short term, population recovery and economic dynamic on the mid-term and sociocultural development on the long-term. Thus, resilience is developing differently over different time-periods, an insight that this research is exploring.

Considering urban resilience as a process with the ultimate goal of long-term sustainability, this research explores the way that post-disaster recovery planning interventions influence the overall levels of resilience within an urban area that is hit by a natural disaster. More precisely, it explores the questions that arise from the following general research question: ***How planning interventions can affect the evolution of the resilience equilibrium of a city during the long-term disaster recovery?*** Having as a goal the identification of the components of resilience in an operational level and in order to explore the factors that influence the resilience equilibrium, this research intends to identify the way that planning practices and interventions influence the resilience of a city hit by natural hazard, with a perspective focused on long-term impacts. This will be achieved by the development of a resilience assessment model that will be applied in different times of the disaster cycle.

Thus, through the development and implementation of a resilience assessment model this research intends not only to identify resilient characteristics but moreover to

identify these practices that result in long-term changes and affect the levels of the resilience equilibrium of an urban area. In other words, to identify the way that planning practices are connected to future resilience in a recovery context. For the exploration of the above problematic the general research question is deconstructed into two specific research questions:

Question #1: Which are the main characteristics of long-term resilient community rebuilding?

Question #2: How can we assess the evolution of the resilience equilibrium of an urban areas and the effect that planning interventions have on it?

1.5 The case study: The city of Kalamata, Greece.

1.5.1 The culture of risk and citizenship in the Mediterranean region

Urban resilience, the key concept of this research, is very important in the Mediterranean region, which has a great history of cities and citizenship. The Mediterranean cities confront the challenge of surviving in a highly vulnerable environment, with periodic droughts and wildfires, severe storms, floods, earthquakes, etc. Moreover, the surrounding area has long been inhabited by great civilizations that have not always coexisted in peace. The ongoing conflicts in Syria are a sad example of mishandling the complexities of the area. Today the European Mediterranean region is at the epicenter of an economic crisis, and together with the recent uprising of many Mediterranean Arabic countries with the so called "Arabic Spring" and the Syrian conflicts there is an increasingly unstable geopolitical environment which has resulted to one of the greatest refugee crises of recent history. Therefore, resilience in every form and more specifically urban resilience is today more urgent than ever.

The Mediterranean basin and its surrounding area have a long history of cities that while prospering faced decline due to different reasons after which most of them have recovered but not all in the same way or at the same levels. There are multiple examples from antiquity to today. Among them, the destruction of Pompeii in 79AD after the eruption of Mount Vesuvius and the decline of the once glorious Ephesus as its seaport silted up over the years moving the commercial port city several miles inland and turning the harbor into a swamp that caused the gradual abandon of the city of 250000 inhabitants in 100 years. More recent examples include the destruction the of Beirut during the Lebanese Civil War and the ongoing destruction of Aleppo, one of the most devastating urban conflicts in modern times according to the International Committee of the Red Cross.

Even though the Mediterranean cities have been developing in such a vulnerable environment, they are conceived as *spaces of citizenship* rather than *spaces of risk.* Leontidou (2003) exposes this difference between the Mediterranean interpretation of

cities as *Spaces of Citizenship* and the North-European interpretation of cities as *Spaces of Risk.* As described in the first part of this research the element of hope rather than fear, of citizenship rather than risk, which is embedded in the conscience of Mediterranean citizens is fundamental in developing urban resilience. This unique characteristic of cultural resilience of the Mediterranean cities has been recently highlighted in relevant research. According to Newman et al. (2009) the cities of hope plan for the long term, with each decision building towards that vision, hopeful that some of the steps will be tipping points that lead to fundamental change. Thus, the element of hope rather than fear, of citizenship rather than risk is fundamental in developing urban resilience.

Figure 1.4: The Mediterranean region

(source: www.worldatlas.com/aatlas/infopage/medsea.htm)

The Mediterranean region offers an excellent area for studying disasters within the city scale, due to its long urban history, its diverse environment and moreover due to the existence of a great variety of risks both natural and manmade. Developing in such complex and vulnerable environments, the Mediterranean cities have evolved particular dynamics that paradoxically very often include strong community relationships and an equally strong sentiment of belonging. "Mediterranean development dynamics have been

based on culture and memory of strong urban identities since antiquity, rather than industrial capitalism" (Leontidou, 2003, p.1). This particularity that characterizes the Mediterranean cities translates into a strong local cultural resilience. Place attachment, collective memory and strong social networks indicate a high degree of commitment equally in times of turbulence and in normality. Thus, having a given rather elevated cultural resilience in combination with long urban history makes the Mediterranean cities valuable cases for studying the rest of characteristics of urban community resilience.

1.5.2 The evolution of resilience in the city of Kalamata after the 1986 earthquake.

With nearly 70000 residents aver an area of 440km2 and population density 160/km2 density (Census, 2011), Kalamata is a medium sized city situated in the South coast of the Peloponnese Region and it is an important economic and cultural urban center of Greece. Although the city's dynamic was importantly altered when a devastating earthquake hit the area in 1986, today, 30 years after the disastrous event, one can hardly identify the traces of a disaster of that magnitude. At the same time, a knowledgeable eye can identify the radical impact that the post-disaster planning interventions had on today's cityscape. The disaster did not affect the city's growth dynamic greatly and the city has kept this dynamic up to the day. Today, during the economic crisis that is affecting the cities of Greece since 2008, the city of Kalamata and the region of Messenia remains one of the most vibrant both economically and culturally centers of the country. This is reflected in the growth in infrastructure and tourist units' investments as well as in airport traffic.

Kalamata had the chance of a radical change due to the earthquake that altered the city's prospective. The window of opportunity that appeared post disaster served as a vehicle that the city used to recover and re-itinerate its trajectory. For these reasons, and with the focus in urban planning practices, this research intends to identify the elements

that influenced the recovery of Kalamata and how they continue to affect the city today. More precisely, the 1986 earthquake that occurred in the city of Kalamata has been chosen as a case study in order to examine the way post disaster planning regulations affected the community resilience of the city in the long term.

Even though large catastrophic events cause major disruption and draw major interest, attention must also be given to smaller scale disasters, whether these consist of small scale hazards in large urban agglomerations or large scale hazards that affect smaller urban communities. Large catastrophic events such as Hurricane Katrina 2005, or the Japan earthquake and tsunami in 2011, are much more well documented and thoroughly researched as they draw attention, affect vast urban areas and immense populations. Meanwhile, small and medium sized cities remain underdocumented even though they are of greater occurrence and importance. While these large events draw attention, it is important to recognize that most of the estimated $26 billion the United States experiences each year in damages from natural disasters comes from localized events." (Burby et al, 1999, p.247)

The case of the 1986 Kalamata earthquakes, provide an internationally exceptional example of an organized reconstruction, response, adaptability and recovery that is important to be further explored. The recovery of Kalamata has been extensively studied and applauded in terms of short-term reconstruction, being the subject of many studies and winning several reconstruction prizes. However, the long-term effects of reconstruction, where the effects of urban planning practices in the resilience equilibrium can be visible, have not been adequately addressed. This research comes to fulfill this void in literature searching to explore the long-term effects of planning practices and interventions to urban resilience trends of an urban system. In these means, Kalamata offers an exceptionally valuable case for studying as today, more than 30 years after the earthquake, the urban pattern of the city can be explored in order to identify the consequences of urban planning practices for reconstruction. An additional advantage towards the selection of the case study of Kalamata is the plethora and accessibility of the data.

Regarded as a successful example as a whole, this research aims to identify the patterns that lead to this success and into what these patterns have transformed today and finally what we can learn from these practices. Creating a method of assessing resilience in the different phases of disaster recovery, with a particular focus in the less explored but of great importance phase of long-term recovery, this research project aims at contributing in the operationalization of the concept of resilience having as an overall goal the promotion of mitigation planning together with sustainability procedures in the vulnerable areas of the contemporary urban centers.

1.6 Thesis Outline

The present thesis is structured around eight chapters. The first chapter is the Introductory one and aims at offering an overview of the emergence of the problematic around resilience in urban areas and with an orientation towards natural hazards and post-disaster reconstruction. In this chapter, the problematic of the research is stated along with the research purpose, objectives and questions. Also, the case study is presented with a brief introduction of the geographical area and its historical aspects.

After the introductory chapter, Chapter 2 explores the theoretical aspects of the concept of resilience and the origins of the concept through an extensive literature review expanding from the socio-ecological approaches to the engineering ones. Moreover, the relationship between resilience and vulnerability is questioned together with the perspective of resilience as a generator of future sustainability. The chapter illustrates the evolution of the concept of resilience from the absorbance approaches to the most recent focus on adaptation. In this chapter, the importance of learning and innovation is highlighted as well as the need for long term vision and approach.

The third chapter focuses on the approaches of resilience within the planning discipline. In a changing era, the need for innovation in planning is discussed in this chapter as well as resilience as a vehicle for change. The challenges and the critics towards the operationalization of resilience are explored as well as previous attempts on assessing resilience within similar research contexts. Further on, resilience in planning is outlined with a definition of its components and characteristics. Last, a central issue on this research, the use of the post-disaster window of opportunity is questioned.

After resilience in planning is defined, Chapter 4 presents the concept of risk in Greece as well as the historical background and the planning history of the city of Kalamata. This historic timeline is necessary for the in-depth understanding of the case study. Also, the reconstruction process of the city of Kalamata is analyzed in detail with the aim to identify preliminary elements of resilience.

Chapter 5 presents the overall methodology created for this research. More specifically it explains the general research strategy including the delineation of the theoretical grounds of the research as the illustration of the strategy of inquiry. After the theoretical positioning of the research the method of analysis is presented in detail. Mixed methods research is presented and justified as the most suitable approach since it allows for a spherical analysis of the case study. Moreover, in this section the assessment model is constructed through a thorough review of previous research attempts with similar interests. The analytical steps for the development are also presented, from the literature review to the data collection and analysis. Lastly, the strategies for the validity of the data are discussed.

The sixth chapter presents the first part of the analysis, where the resilient reconstruction of Kalamata is questioned. Each resilient component is assessed in different time periods through the developed indicators and the major characteristics of resilience for each component are identified. The assessment of resilience creates further questions for the development of the reconstruction process. Thus, through the analysis of the interviews Chapter 7 explores the major elements of the reconstruction process and the characteristics that influenced it.

Concluding with Chapter 8, the importance of further a posteriori research is highlighted. The proposed model for the assessment of resilience and the characteristics that matter in the reconstruction process conclude that the reconstruction process can follow drastically different trajectories depending choice on resilience. Thus long term perspective is not only important for a posteriori research but is moreover important as a vision for the future of the city.

2. Resilience: an evolving concept.

2.1 Tracing the origins of resilience

At the core of this thesis lays resilience, a key concept within this research and a controversial one. Tracing back to the history of the term, one witnesses an extensive span of approaches about the origin and the definition of this largely popular and equally contested concept. Resilience has been extensively used in many research fields (ecology, engineering, planning, psychology, etc.) that adjusted its meaning in different theoretical frameworks. While adopted by different disciplines resilience has always included the notion of absorbance, of reaction against perturbation. Therefore, absorbance is central to the concept of resilience. Throughout this trajectory of the evolution of resilience, the concept has moreover incorporated the notion of bouncing back to a functioning state whether a pre-existing or a new one, highlighting the importance of adaptation.

As it is the case for the definition of resilience, the origins of the concept could be nothing less than controversial. Many researchers attempt to trace back its origins by analyzing the etymology of the concept. Etymologically several authors (Alexander, 2013, Manyena, 2011, Klein et al. 2003, etc.) mark the origins of the word in the Latin word *resilio* that means to jump or bounce back. Historically, as a word resilience or resiliency and relevant variations with the same root have been used in the Romance languages although without ever gaining great popularity. It was within the field of mechanics first and psychology and ecology (Holling, 1973, Adger 2000) later that resilience started gaining popularity and getting to the point where it ultimately is as a well-known concept. Resilience is today used across many disciplines as a desired quality to overcome crises of different kinds. However, the meaning of the concept is yet to be debated. Even if the resilience discussion is "the very beginning of a new paradigm" (McEntire et. al, 2002), "'a lens or entry point'" (Manyena, 2006) or just a confusion between its several definitions, resilience "(…) is now a complex multi-interpretable concept with contested definitions and relevance." (Klein et al., 2003) While all the different approaches enrich the discussion on resilience, yet there is no common consensus in the actual meaning of the concept.

With its origins in mechanics, resilience first implied a very well defined quality, the ability to bounce back after perturbation to an original shape or situation. Klein, Nicholls and Thomalla (2003) refer to its use as a material quality but also to its more recent use 'in a more metaphorical sense to describe systems that undergo stress and have the ability to recover and return to their original state'.(p.35) Therefore, in the interpretation of resilience in the field of mechanics and later engineering one can witness a clearly defined concept that focused to the property of a material or a system to withstand to a perturbation, to absorb shock and to finally return to a previous state. Moving on to the field of ecology one of the first definitions–and among the most influential is given by Holling (1973) and describes resilience as the aspect that "determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state". These first interpretations of resilience refer to the ability of an ecosystem to absorb disturbance without serious changes, and concentrate on the ability to return to a given state of equilibrium, in a similar interpretation of the meaning of resilience around absorbance as in mechanics and engineering.

Since these interpretations, that concentrate on absorbance and are derived mostly from the early days of resilience in the exact sciences, the concept was later introduced to many different fields of research. Within the different approaches of resilience in different research and practice fields, the range and the utility of its definition and characteristics have been expanded (see Table 2.1: Resilience definitions, p.19). These differences between the interpretations of resilience in exact sciences with the ones of resilience in social sciences are among the most interesting. Whereas in physics and generally in the exact sciences resilience is perceived as the capacity to absorb and to retain function in the face of a perturbation, in social sciences resilience has a wider perception. This perception considers resilience as a system's capacity not only to retain function but also to bounce back while gaining knowledge and adapting. These last elements of learning and adaptation is what makes a great difference in the definition of resilience in the social sciences.

Table 2.1 Resilience definitions (adapted and transformed by the author from Manyena, 2006)

Authors	Definitions
Holling (1973)	Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb change of state variables, driving variables, and parameters, and still persist.
Timmerman (1981)	Resilience is the measure of a system's or part of a system's capacity to absorb and recover from the occurrence of a hazardous event.
Pimm (1984)	Defines resilience as the speed with which a system returns to its original state following a perturbation
Wildavsky (1991)	Resilience is the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back.
Blaikie et al. (1994)	Resilience to natural hazards is the ability of an actor to cope with or adapt to hazard stress.
Holling et al. (1995)	It is the buffer capacity or the ability of a system to absorb perturbation, or the magnitude of disturbance that can be absorbed before a system changes its structures by changing the variables.
Horne and Orr (1998)	Resilience is a fundamental quality of individuals, groups and organizations, and systems as a whole to respond productively to significant change that disrupts the expected pattern of events without engaging in an extended period of regressive behaviour.
Comfort (1999)	The capacity to adapt existing resources and skills to new situations and operating conditions
Mileti (1999)	Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity or quality of life without a large amount of assistance from outside the community.
Adger (2000)	Social Resilience : "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change."
Lebel (2001)	the potential of a particular configuration of a system to maintain its structure/function in the face of disturbance, and the ability of the system to re-organize following disturbance-driven change and measured by size of stability domain
Alberti et al. (2003)	urban resilience is the degree to which cities are able to tolerate alteration before reorganising around a new set of structures and processes.
Cardona (2003)	The capacity of the damaged ecosystem or community to absorb negative impacts and recover from these.
Klein et al. (2003)	Resilience is the ability that some cities have to cope and recover from external shocks.

Pelling (2003)	Resiliency is the capacity to adjust to threats and mitigate or avoid harm. Resilience can be found in hazard resistant buildings or adaptive social systems.
UN/ISDR (2005)	the capacity of a system, community or society, potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures
Resilience Alliance (2005)	Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future.
Vale and Campanella (2005)	The term resilient city implies finality, but it is always coupled with an ongoing recovery process that, for many people, will never quite end. […] the goal should be productive openness, ability to structure and confront the contradictory impulses inherent in the contested processes of recovery and remembrance.
Davis and Izadkhah (2006)	the ability of communities, their physical, social, political and economic systems and their buildings and settlements to withstand hazard generated forces and demands, to bounce back rapidly and to adapt to cope with future threats
Maret and Cadoul (2008)	Resilience, includes also the meaning of the capacity of recovering from a catastrophe but while adopting a more sustainable configuration.
Cutter et al. (2008)	Resilience is the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organize, change, and learn in response to a threat.
UNISDR (2009).	"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Gotham and Campanella (2011)	We view resilience as incorporating three factors: the ability to absorb shocks and trauma, the ability to bounce back and recover, and the ability to learn, adapt, and innovate.
Manyena (2011)	Disaster resilience could be viewed as the intrinsic capacity of a system, community or society predisposed to a shock or stress to "bounce forward" and adapt in order to survive by changing its non-essential attributes and rebuilding itself.
Miles and Chang (2011)	A resilient community is one that does not experience serious degradation in critical services when a hazard occurs and, in the event of degradation or failure, recovers to a similar or better level of service in a reasonable amount of time.

The multitude of definitions and its flexibility has been fruitful for the beginnings of the discussion of the concept and the spreading of resilience's popularity along different disciplines. As Manyena puts it in his article on resilience "(it) has gained currency in the absence of philosophical dimensions and clarity of understanding, definition, substance and most importantly, its applicability in disaster management and sustainable development theory and practice." (Manyena, 2006, p.435) However, this fuzziness of the concept that has partially promoted the expansion of its popularity today bears challenges that need to be addressed. If resilience is used in every possible context to gain attention because of its popularity, without a clear link to the concept itself, it risks becoming meaningless.

More explicitly, the extensive use of resilience across different disciplines and approaches without a careful and analytical approach risks the misrepresentation of the concept. Therefore, the use of resilience is better to be carefully defined by the detailed outlining of the theoretical framework within which resilience is to be used and by the perceptions of its users. In this way, several misconceptions and future confrontations on the meaning will be avoided. Consequently, the need to carefully define resilience is mandatory to any research exploring or approaching the concept.

In an interpretation of resilience that is relevant with the theoretical framework of the present research, Gotham and Campanella (2011) describe resilience within the field of disaster research when they address its differences with vulnerability: "We view resilience as incorporating three factors: the ability to absorb shocks and trauma, the ability to bounce back and recover, and the ability to learn, adapt, and innovate"(p.3). Therefore, in the context of an urban system facing disaster, resilience describes its ability to recover and to address change adaptively while vulnerability addresses the degree of preparedness and the exposure of the system to possible risks. The complicated relation between these two concepts, resilience and vulnerability, is further addressed in the following section.

2.2 Resilience and vulnerability: Opposites or overlapping concepts?

The relationship between resilience and vulnerability apart from a much celebrated and/or contested subject on its own is key in understanding the actual nature of resilience. Much as it has been interpretated in different ways on its own, the concept of resilience has been tightly connected with other concepts and their relation and interdependence has been the interest focus among researchers and practitioners. Among these different relations, it is the one between resilience and vulnerability that is the most pertinent and as it is the case with the concepts themselves independently, it is still extensively researched and perceived in many ways depending not only on the context but also on the perspective of the researcher.

As a concept, vulnerability has evolved from implying solely physical exposure to including a social dimension (Pelling, 2003) that is of equal importance. In disaster research, vulnerability is about the exposure to risk, the awareness of the risk and the preparedness to the possibility of facing it. “Being vulnerable is being physically exposed to risk, is presenting a certain fragility facing the disaster that might occur and it is also not considering, or wrongly considering, the means available to deal with the crisis.” (Veyret, 2004) Thus, while vulnerability is mostly about awareness and exposure, resilience is more about recovery and adaptation.

In the past, the two concepts have been perceived as opposites but recently their relationship is less exact and more indefinite. In the context of ecosystems, Holling (1995) and many other researchers have argued that vulnerability comes from a loss of resilience, implying the nature of the two concepts as antonyms. As Manyena (2006) describes their relationship, vulnerability can or cannot be related with resilience depending on the reference framework. Therefore, the perspective on their relationship is a matter of choice. When one concept is defined as positive then the other will adopt the negative role, and vice versa, and many researchers tend to address them like *opposites*. (Manyena, 2006, p.440). However, a shift in the perception of the relationship between resilience and vulnerability is witnessed lately, viewing vulnerability and resilience not as two opposites but as two overlapping or complimentary concepts.

Today it is widely accepted that they are two distinct concepts that do react with each other but not on an opposite way. (Gotham and Campanella 2011, Manyena 2006, Cutter et al. 2008) Presenting some vulnerability does not imply that there is no resilience Likewise, being resilient does not mean that there are no vulnerabilities. A system can be vulnerable while at the same time have developed mechanisms to withstand and recover from disturbances. Moreover, under some circumstances the existence of multiple vulnerabilities could foster resilience. More explicitly, the knowledge of a system's risks rise the possibilities of awareness and anticipation. Consequently, different degrees of vulnerabilities can coexist with different degrees of resilience, since the one concept cannot eliminate or prerequisite the other. Moreover, the two concepts are affected by different criteria some shared between them and some distinct. It is with this perspective that the relationship of resilience and vulnerability is adopted in the present research, as a complex intermingling relationship between two distinct but not opposite concepts.

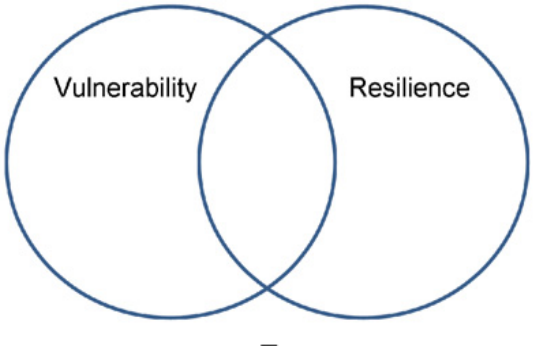

Figure 2.1: Conceptual linkage between resilience and vulnerability (source: Cutter, 2008)

This change of perceptions on the relationship between resilience and vulnerability from opposites to overlapping concepts has created another shift in orientation within disaster research that is of special interest for the present thesis. Disaster research has long been concentrated in defining and assessing vulnerability and whereas addressing vulnerability remains an important task, research is today orientating towards the definition and assessment of resilience. "There has been a noticeable shift in the rhetoric about hazards, moving from disaster vulnerability to disaster resilience (..)" (Cutter et al., 2008, p.598). The above shift has generated from the change of the

perception of vulnerability from solemnly physical exposure to the combination of exposure with conditions that create social vulnerability. (O'Keefe et al., 1976, Pelling, 2002) and the addition of adaptation through the concept of resilience.

Therefore, risk is affected by the factors of physical exposure, social vulnerability and additionally the absence of adequate resilience. The relationship between resilience and vulnerability within disaster management was first addressed by Timmerman in 1981 Vulnerability, Resilience and the Collapse of Society where he questions the link between the two concepts. Resilience completes in this way the concept of risk. Important as it is to know and address awareness on physical and social vulnerability issues, interest is shifted today towards resilience as it offers a more positive and preventive perspective in comparison to vulnerability.

Assessing vulnerability, is to count the weaknesses of a system, its shortcomings and moreover implies a notion of unavoidable. On the contrary assessing resilience forces one to discover the potentials of a system, its strengths instead of its weaknesses while implying a possibility of overcoming the possible threats. Therefore, this research chooses to address the issues of resilience as a means to not only to face possible disasters but moreover as a means to overcome them while ameliorating. It is about a shift in the perspective on how to address disasters, from a reactive to a proactive approach. This shift reflects a change of focus in disaster risk reduction, instead of focusing on the weakness of a system that is revealed through vulnerability, the focus is transferred to the potential, or in other words, resilience.

Even though the importance of vulnerability assessments is undeniable, they can offer little insight on what is to be done in order to build up towards preparedness. Therefore, resilience sheds the light to a new area within disaster research, an area that offers insight on proactive action rather than the previous, reactive approach of assessing vulnerability. However, there are different ways of assessing the concepts and different approaches to them, thus each approach should be carefully defined within the boundaries of each research and the exact definition of resilience within its theoretical framework. Moreover, the choice of suitable indicators for each dimension of the concept is of critical importance. Within this perspective on the concepts of vulnerability and

resilience the focus of this research is on the resilient characteristics of post-disaster community and the way that they are configured, not as opposites to vulnerability but as hints for pathways to future mitigation and the promotion of long-term sustainability.

2.3 Resilience: A process with a sustainability outcome.

Except vulnerability, resilience has been related in many ways with another popular concept, sustainability. Sustainability was presented as "ensuring the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987). It gained extreme popularity and fostered the production of a great amount of approaches and while it sensitized and produced awareness in the global community it failed to produce significant changes in practice. As in its turn resilience gained popularity in research and practice the link between resilience and sustainability has created another wide array of opinions concerning their relation. The concern around the two terms is ambiguous, including whether resilience comes to replace sustainability and whether the one concept is part of the other. Does resilience lead to sustainability or sustainability promotes resilience? Irrespective of how their relationship is perceived, sustainability and resilience need to work parallel (Haas, T., 2012, p.12).

Apart from the different perspectives on the way they two concepts are related, there seems to be consensus on the fact that resilience is today in the center of attention in a similar way that sustainability was in the past. "It appears that resilience is replacing sustainability in everyday discourses in much the same way as the environment has been subsumed in the hegemonic imperatives of climate change" (Davoudi, 2012, found in Davoudi, 2012, p.299) Research and practice are dominated today by ideas on resilience as it was the case with sustainability not many years before. As sustainability arose from the need for preservation of the environment, resilience arises today from the need for adaptation in the unpredictable but inevitable environmental changes.

Throughout the years, sustainability has been much less integrated in practice than it had been discussed, and concerns arise on the role of resilience. The relationship between the two concepts remains nebulous. Resilience does not replace sustainability but rather compliments it by adding another dimension to it. While sustainability was promoting the protection of the state of being, resilience promotes adaptation to the inevitable and progress towards better forms, offering new insights on the progress of the trajectory towards sustainable development. According to Lebel et al. (2006) strengthening the capacity of societies to manage resilience appears to be a key condition to effectively pursue sustainable development.

Therefore, applied in disaster research resilience embodies the need for such change, the move from rigid, non-flexible approaches towards adaptation. While disaster research has been shifting its focus from exploring disaster vulnerability to exploring disaster resilience, at the same time research in urban planning has been shifting its focus from urban sustainability to urban resilience. Within an environment of growing uncertainty, today, one can witness a shift in both fields of research, from their previous focus areas, namely disaster vulnerability and urban sustainability to the merging concept of resilience. In this way, resilience offers a common ground for disaster research and urban planning. The two research fields have followed separate paths in the past but seem to respond to the need for a new common approach in disaster risk reduction, one that resilience and more specifically urban resilience to disasters can embody.

Thus, resilience is a bridging concept between these different disciplines. In a way, resilience links disaster research's quest for adaptation and urban planning's quest for sustainability. This shift translates to a change of perspective in research towards learning, adaptation and innovation. Acting as common ground for the two fields, resilience embodies their integration and can foster interdisciplinary collaborations that activate new pathways to future sustainability. As Cutter (2012. p.2) describes, linking disaster risk reduction to sustainable goals could be a way to sway leaders to recommit to sustainable pathways. Therefore, transferring the focus from vulnerability to resilience offers new pathways to attain sustainability.

2.4 Common critics on resilience and sustainability.

Even if resilience has already been received with great popularity across different disciplines, it has also been the subject of a series of criticisms. As it is the case with the concept of sustainability that has been questioned on its actual utility, the more recent concept of resilience has been equally criticized. While the importance of the concept is widely accepted and extensively used in many disciplines, it is the lack of an exact definition and its many conceptual misunderstandings that have been the subject of many criticisms.

The sudden popularity and extensive use of the concept of resilience seems to bring alarming commonalities with the ways that sustainability has been misused in the past. Linking resilience with sustainability has been criticized for the creation of a new buzzword, resilience in the way that sustainability has been used; many authors have criticized this extensive use and popularity of resilience, and the challenges that emerge. "(..) Resilience appears to be fast replacing sustainability as the buzzword of the moment. It may well follow a similar fate and become a hollow concept for planning: an empty signifier which can be filled to justify almost any ends" (Porter and Davoudi, 2012, p.329)

Apart from the similarities in critics, resilience and sustainability share some similarities in the way they have generated major perspective changes in different fields. In a similar way that the discussion on sustainability offered in the past the ground for a much-needed paradigm shift in the perspectives on development, resilience is today creating a paradigm shift in the perspective of disaster management which is currently equally needed. However, these ideas should be carefully approached. Like sustainability, if resilience includes everything and fits everywhere it risks of ending up without offering any contribution. For this reason, the careful definition of resilience within each reference framework is a prerequisite for the elimination of misconceptions.

An important and critical choice of point of view that should be taken to explore resilience is whether it is perceived as an expected outcome or a continuous process or property of the system. As Reghezza-Zitt et al. (2012) note, even though these

approaches seem opposite they are not conflicting. It is “the intrinsic qualities of the systems, combined with exogenous factors are what will determine the process of resilience and the trajectory of the system.” (Reghezza-Zitt et al., 2012, p.2)

Within the boundaries of the present reference framework resilience is perceived as a continuous process that not only facilitates recovery but also generates sustainability. The question to be explored for resilience to be better understood is how it affects the urban system’s trajectories. “Resilience is a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance (Norris et al., 2008, p.130) More explicitly, resilience is about absorbing shocks while at the same time reorganizing and adapting to the new circumstances and trying to improve future structures towards sustainability. Therefore, a system functioning in a resilient way (the process) should lead to improved sustainability (the outcome). As Toubin et al. (2012) address the issue on their work, resilience is a tool that helps us concretize the ideas while sustainability is an ideal. In other words, the resilient city is a means to approach the sustainable city.

2.4 Not only absorbing but adapting, too.

As seen in the previous chapter, the question that has come off from the introduction of resilience in disaster risk reduction is whether resilience refers solemnly to the maintenance of previously functioning structures or whether it provides an opportunity for a critical perspective on these structures and even improvement. In other words, is resilience the capacity to absorb without changing or to withstand while recovering? To bounce back or to bounce forward? The problematic around the definition of resilience as a process with a sustainability outcome which is adopted in the present research is addressed by the focus on adaptation not instead but in addition to absorbance. Both qualities are equally important for recovery. While absorbance refers to how much

disturbance the system can withstand, adaptation refers to the ways it can recover and is therefore closer to the concept of building up future sustainability.

Absorbance has been a central quality in the resilience discussion. In one of the first approaches of the concept, Holling describes resilience as "the ability to experience change and disturbance without catastrophic qualitative change in the basic functional organization, is a measure of the system's integrity." (Holling, 1973) More recently and with a similar point of view concerning absorbance, Walker et al. (2004), define resilience as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks". while Pickett et al. (2004) argue that the emphasis is not on reaching or maintaining a certain end point or terminal condition, but on staying «in the game», and they go on defining also resilience as "the ability of a system to adjust in the face of changing conditions" already giving a hint on the importance of adaptation.

With a more defined reference framework and within the field of disaster management, while still referring to resilience from the preserving and the 'shock absorbing' point of view, Mileti, 1999, describes resilience to disasters as the ability "(…) to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life and without a large amount of assistance from outside the community." (Mileti, 1999) This definition implies that resilience is defined as the capacity of a system to return to its previous state with the minimal possible losses and the minimal assistance. This approach on resilience preserves the vulnerabilities of the past without attempting to resolve them and for this reason has been widely criticized. "Equally, resilience has been criticized for maintaining or returning the system to the pre-disaster levels of vulnerability" (IFRCRCS, 2004). With a similar perspective in disaster management but with the possibility of improvement a later approach is presented by Miles and Chang (2011) who define "a resilient community is one that does not experience serious degradation in critical services when a hazard occurs and, in the event of degradation or failure, recovers to a similar or better level of service in a reasonable amount of time."

Even though the element of absorbance is crucial, adaptation is a complimentary but of equal importance element when it comes to resilience. “Rather than seeing resilience as a process of bouncing back, a more radical deployment would view it as a “dynamic process in which change and constant reinvention provide the grounds for social, economic, and/or environmental strength” (Raco and Sweet, 2009, p.6, found in Shaw, 2012, p.310) Therefore, even though the element of absorbance remains central in the resilience discussion, many authors focus on its adaptability in addition to or even instead of its absorbing qualities.

It is the focus on adaptability that brings resilience in the interest of urban planning and disaster management researchers because it takes advantage of the window of opportunity for change through disturbance, which is very important for the function of the urban systems. In a resilient social-ecological system disturbance has the potential to create opportunity for doing new things, for innovation and for development. (Folke, 2006, p.253) Although, adaptive capacity is found in literature with many different names (adaptive capacity, adaptability, resourcefulness, etc.) the interpretation remains the same, defining adaptive capacity as the ability of the key elements of a locale, to make the necessary changes in order to accommodate stress from hazards in all levels. This last concept, adaptive capacity, is considered by many authors (add authors) a main factor for promoting urban resilience: resilience comes from flexibility, and the ability to change adaptively (Levin et. al, 1998) and it is also about the opportunities that disturbance opens up in terms of recombination of evolved structures and processes, renewal of the system and emergence of new trajectories. (Folke, 2006)

When one applies the concept of resilience at an urban system which by nature is dynamic it can be defined as follows: urban resilience is the degree to which cities are able to tolerate alteration before reorganizing around a new set of structures and processes (Alberti et al., 2003) Consequently, within urban systems, resilience as a quality provides the opportunity of reorganizing differently and bringing adaptability on the center of the resilience discussion. Within this approach, the concept of urban resilience to disasters provides the ideal concept for the fields of urban planning and disaster management to meet and to collaborate in order to ameliorate the capacity of an

urban system to face disturbance of any kind and to project itself towards a more sustainable future.

Following Godschalk's (2003) description, urban resilience encloses the two characteristics of shock absorbing and reorganization around a better set of structures, or in other words absorbance and adaptation:

> *"Resilient cities (to natural hazards) are capable of withstanding severe shock without either immediate chaos or permanent deformation or rupture (...) Designed in advance to anticipate, weather, and recover from the impacts of natural or technological hazards, resilient cities are based on principles derived from the past experience with disasters in urban areas. While they may bend from hazard forces, they do not break. Composed of networked social communities and lifeline systems, they are able to adapt and rebound to new levels of sustainability."* (Godschalk, 2003)

Thus, urban resilience refers to the ability of cities not only to absorb disturbance: but moreover to the way they react to this disturbance. Urban resilience refers to the ability of cities, as dynamic systems, to face this disturbance and to respond to it, building up a better structure. Thus, within this framework, adaptation implies learning and innovation.

Concluding, the most recent interpretations of resilience include more and more the notion not only of withstanding and of quick recovery but of a recovery towards better structures. Not only 'resilience is the capacity to adapt to stress from hazards and the ability to recover quickly from their impacts.' (Henstra et al., 2004) but moreover 'Achieving resiliency in a disaster context means the ability to survive future natural disasters with minimum loss of life and property, as well as the ability to create a greater sense of place among residents; a stronger, more diverse economy; and a more economically integrated and diverse population.' (Vale and Campanella, 2006) These improvements in the communities are characteristics that build up long-term sustainability, which is the ultimate goal of resilience.

2.5 Urban resilience to natural hazards: The goal of improving long-term sustainability.

As it is followed by a multitude of different definitions and approaches, it is very important to clearly define one's point of view when introducing resilience to the discussion. As seen in the previous chapters, being resilient does not mean that a system is not vulnerable, but that it has the capacity to overcome possible stresses and to find equilibrium around a new set of structures. While the importance of the concept is widely accepted across many disciplines, it is the lack of an exact definition and conceptual misunderstandings that causes most criticisms. According to Klein et al., 1998, to enhance resilience it is necessary to have a good initial understanding of what it is , its determinants. For this reason, resilience is defined in this chapter within the limitations and for the purpose of this research project.

Applying resilience in the urban environment, Godschalk describes successfully the resilience of an urban system as following: "The resulting resilient city both plans ahead and acts spontaneously. (…) It is aware of the hazards it faces, but not afraid to take risks. (…) It sets goals and objectives, but is prepared to adapt these in light of new information and learning. It recognizes that the quest for resiliency is an ongoing long term effort" (Godschalk, 2003). Therefore, the need for planning and adaptation are central for the long-term resilience of cities. An element that is missing from this approach is the quest for long-term improvement of sustainability that should be integrated in every aspect of resilience.

For this reason, resilience is carefully outlined and conceptualized within this research that adopts the following approach from the field of planning: "Resilience includes also the meaning of the capacity of recovering from a catastrophe but while adopting a more sustainable configuration." (Maret and Cadoul, 2008, p114). This approach of resilience as an ability to build something further, to improve, gives a whole new perspective to the concept with a positive outcome dimension. In a similar approach the importance of building up sustainability is underlined by the ICLEI: 'A resilient community is one that reduces vulnerability to extreme events and responds creatively to

economic, social, and environmental change in order to increase its long-term sustainability.

Therefore, for the purpose of this research project resilience in the urban environment is defined as follows: **Urban Resilience is the capacity of an urban community, referring both to its physical and social fabric and organization, to have knowledge, to anticipate, withstand and adapt to the possible hazard stresses and moreover to recover from them quickly while reorganizing on the long-term around a more sustainable set of structures.** This approach to resilience enhances both the element of absorbance as well as the element of adaptation. With this perspective, the idea of bouncing forward to a different, better state, is today overlapping the notion of bouncing back to a previous state, within the resilience discourse. Therefore, the shift from disaster vulnerability to disaster resilience is pivotal in building up future sustainability.

In other words, resilience is perceived in the present research as a continuous process towards sustainability. The above definition incorporates disaster management in urban planning and demands a proactive perception of planning and an elevated degree of adaptation. Ultimately, to avoid making resilience just another "buzzword", (Davoudi, 2012, Comfort et al., 2010), there is need not only to clearly outline, and define resilience but moreover to operationalize the concept of resilience in planning so that it can be clearly understood and ready to use. "(…) reframing resilience also necessarily involves operationalizing the concept of resilience and recognizing the need to directly engage with practice" (Saw, 2012, p.310).

2.6 Window of opportunity for long-term resilience?

Can disasters be perceived as catalysts for change? Many times, disasters have led to big improvements in the legislative framework, in the land use or in the actual built environment of the area. But this is not always the case. In practice, disasters more often leave the affected areas with many wounds, immediate needs, reconstruction challenges and in overall, less resilient than before. The damaged areas get immediate attention and relief funding is directed to the urgent needs of the emergency phase. Usually there is no time or space for strategic or long-term planning to address future visions.

Equally in research, authors focus on the immediate effects of disasters but little attention has been given to the long-term effects of disaster. The disasters gain the attention of the public, the media and the research community immediately as there is an imperative need to overcome the situation, however, little attention is being given and little research is being orientated towards the long-term aftermath of a disaster. Therefore, there is a lack of knowledge concerning the way a city has recovered on the long term, in other words if it recovered towards an improved state or returned to its previous vulnerabilities and faults. In other words, has the rebuilding of the community been resilient on the long term?

Likewise planning, resilience acts in a direct way but has long-term impacts, unfolding its products over a long period of time. In a post disaster concept, the short-term needs seem the most urgent and therefore long term goals are missed. However, resilience takes place in both times. According to Delladetsimas (2009) the consequences of a natural disaster are not limited in their immediate dimension but the long-term dimension is of equal importance. (p.50) Even the short-term actions impact the long-term development of the city and thus long term projections must be considered at all times. The combination of addressing short term needs while incorporating long term projections is an element often missing from reconstruction plans. According to Newman et al. (2009) the cities of hope plan for the long term, with each decision building towards that vision, hopeful that some of the steps will be tipping points that lead to fundamental change.

Using this rear window of opportunity that disasters create towards the rebuilding of more sustainable urban systems on the long-term is critical. Often it is short-term solutions that are prioritized post-disaster due to their emergent nature. However, the long-term impacts of a reconstruction are of equal importance. However, a long-term resilient community rebuilding after a disaster is only witnessed *a posteriori* and for this reason there is a need for a posteriori studies of post-disaster development. (Pigeon (2002). More explicitly, since reconstruction is a complex process that involves multiple stakeholders, its trajectory cannot be predicted. For this reason, examining closely the way that communities have been rebuilt is critical.

Exploring past examples of reconstruction offers the opportunity to identify strengths and weaknesses in the rebuilding process. According to Reghezza-Zitt et al. (2012) p.2, 'when pressing on the process, one takes in a better perspective on feedback that allows learning from the past.' Exploring in detail the reconstruction process allows the identification of the kind of interventions that create a more resilience system on the long term. In preparing for disasters in the short run (preparing for the worst), communities and nations can enhance capacities for adapting to longer term changes (hoping for the best), thus building the shared vision of global resilience and sustainability that we all seek. (Cutter, 2012, p.3)

Thus, reinforcing long term resilience can be achieved only by considering the long-term development of a place while on reconstruction and this is the reason why planning has a critical role on the procedure. For a community to be resilient on the long term after a disaster it needs not only to overcome the traumas but moreover to rebuild with resilient characteristics and recover towards a more sustainable direction on the long-term. It should be ready to use this window of opportunity created by the disastrous event to ameliorate its physical and non-physical structures towards more sustainable forms on the long term. The question that arises is whether disasters always create this window of opportunity for lasting change and how these windows are put in use?

According to Christoplos (2006) there are eight factors that contribute to the creation of this window of opportunity for disaster risk reduction: There is new awareness of risk after a disaster that leads to broad consensus, fault lines in past development policies are revealed, institutional weaknesses exposed, old vested interests

weakened, bad infrastructure is washed away, development and humanitarian agencies are reminded of disaster risks, there is enhanced political will and finally money from reconstruction funding that is usually more available after a disaster (Christoplos, 2006, p.1-2). Even if most of the above factors are present after a disaster at the same time many urgent pressures act as obstacles to the window of opportunity.

For example, faults in previous policies may be revealed but often there is little time for assessment and reflection on new trajectories. Moreover, the different stakeholders project different priorities and finding a consensus between them is not always successful. According to Christoplos (2006, p.3-4) development policies and strategic goals are often overtaken in recovery, while there is a conflict of speed versus quality and of people's rights versus sustainability, poor understanding of local risks and vulnerabilities, absence of institutions and interest of local authorities. Therefore, due to the emergency nature of a disaster the window of opportunity is often difficult to be fully used.

Together with mitigating disaster impacts, attention must be given to this rare window of opportunity that sometimes disasters create: the opportunity to recover towards more sustainable patterns. As Olshansky and Chang (2009) argue, "disasters open a rare but brief window of opportunity for effecting lasting change" (p.200). Disasters create a chance for cities to act as nuclei of change and transformation that can have long term impacts and that would not be possible otherwise. Therefore, apart from disaster impacts mitigation researchers and practitioners need to orientate towards creating long-term structural changes that will lead to more sustainable patterns of development.

The reconstruction and recovery phases are critical because they can reveal the evolution as well as the composition of resilience. An operating urban system in normalcy cannot provide information on its resilience characteristics. Moreover, it is difficult to impose changes to a system that operates in normalcy. On the contrary, when a shock occurs there is the 'window of opportunity' to change or improve the elements that need to be improved and that could lead to greater future resilience and sustainability. For the rebuilding of a place to be resilient on the long-term, it is argued that reconstruction actions should vision and act towards sustainability. "Scholarship in

the hazards field has also increasingly emphasized strategies that are needed to make communities disaster resistant while addressing long-term issues of sustainability and quality of life" (Mileti, 1999) It is important for the recovery that a place is rebuilt as quickly as possible but it is equally important for the long-term resilience of a place that the place is rebuilt sustainable. Therefore, how can recovery foster resilience and reverse?

The question that is posed here is how can a city prepare to capitalize a future window of opportunity? For the window of opportunity to be fully used planning beforehand is critical. "A community should be ready with solutions when a window opens while the importance and priority that local officials assign to hazard threats are temporarily elevated." (Berke and Campanella, 2006, p.193) Planning is a domain that gives its fruits on the long-term, and resilience is also argued to be the outcome of a long-term process (Reghezza-Zitt et al. 2012) Therefore the dimension of time, and more specifically the long-term approach to resilience is critical to explore the impact of planning on the resilience equilibrium of an urban system.

3. The quest for an increased resilience through planning.

3.1 A change of methodological orientation in planning.

In the unfortunate times when disasters occur, they create this rare window of opportunity for change in the urban system. For it to be utilized, decision and policy makers must have the tools, the knowledge and the will to act. As a research and policy field, planning has a critical role in this window of opportunity, one that this research attempts to shed the light on. To explore the role of resilience within the field of planning and how it can be strengthened. As it has been reviewed on the previous chapters, after several definitions and trajectories in many fields of research, resilience, a concept that brings together different disciplines, is currently being applied in planning theory and practice. Planning is a research and policy field that implies change, reform and a long-term vision for improvement. For this reason, resilience, even if it is only a *"recent addition to planning's discursive repertoire"* (Davoudi, 2012, p. 300), it is in reality a concept inherent in the discipline of planning.

As it is the case with many other disciplines and with most aspects of the current state of the modern world, planning has moved from an orderly, linear perception of both theory and practice towards a more complex and unpredictable perspective. As Fainstein (2000) states, planning theory moves from the rational, outcome orientated physical planning towards more integrative forms such as the examples of the communicative model, new urbanism and the just city. The introduction of resilience in planning and the concept of the *resilient city* contribute to this series of integrative forms of planning that differentiate from the traditional linear approach. With a similar point of view, Sandercock (2002) views planning as an always unfinished social project and describes the need for change from the bureaucratic or regulatory planning that has dominated the last century to an expanded, more communicative perception of planning. Therefore, as the world has been changing towards more uncertain and unpredictable futures, planning has also been moving from a linear cosmotheory towards a more complex one. The resilient city is one of the most recent examples of complexity within the domain of planning.

The introduction of resilience into the planning discourse has proved to be a vehicle for this change and has two parallel dimensions. On the one hand, resilience is a concept whose worldview and evolution cannot be described as orderly but rather complex and unpredictable. Therefore, resilience thinking in planning is positioned theoretically with the interpretive approach. As Davoudi (2012) argues, resilience thinking presents a number of emerging parallels with the interpretive approach to planning (p.299). At the same time, resilience is often explored in terms of systems thinking which clearly gives off a positivist approach. Even as the new trends call for a shift to more interpretive approaches, positivism is a worldview inherent in planning theory and practice. Therefore, being inherently positivist, it is a great challenge for the planning theory and practice to enhance an interpretive approach and the integration of resilience in planning offers the bridging concept between the two approaches.

Even though positivism is deeply embedded in planning theory and practice, new forms of interpretive approaches in planning are emerging that have been embraced by planning researchers and practitioners. The introduction of the concept of resilience in planning balances between the positivist and the interpretive planning approaches and it therefore embraces both methodological traditions. Therefore, resilience offers a new perspective for planning that follows the traditional positivist view on the field while integrating the much-needed part of interpretivism in today's planning challenges. It is more and more argued today that cities are not linear, closed systems but rather open, evolutionary systems (Marshall, 2012). Thus, the field of planning is adjusting to the emerging perspective of cities as open systems and of a fast-changing world.

This change of perspective is witnessed in one way by the introduction of resilience into the planning discourse that consists a paradigm shift of how the planning discipline perceives itself and how it envisions its future. "Planning is thus about being prepared for innovative transformation at times of change and in the face of inherent uncertainties" (Davoudi, 2012, p.304) Concluding, even though planning is inherently about order and long-term commitment at the same time it has been integrating practices of adaptation to unexpected events. The introduction of resilience in planning offers such a perspective, an alertness to sudden changes of trajectories due to events and uncertainties that dominate the world today.

3.2 Resilience as innovation in planning

Apart from integrating the perspective of alertness and preparedness to change in planning, resilience thinking has moreover the great potential of becoming a much-needed change, by making the shift from a less static to a more dynamic and flexible approach. Planning is a research and practice field that has been traditionally considered linked to order. In an era of uncertainty, where constant change is the norm, the introduction of resilience in planning is an opportunity to unleash the innovative potential of planning. "Resilience thinking offers concepts and methods for breaking planning out of its obsession with order, certainty and stasis." (Porter and Davoudi, 2012, p.330) Therefore, the perspective of improving through innovation rather than returning to previous states is at the core of the concept. 'The message for planning theory and practice is that rather than viewing resilience as bouncing back to an original state following the external 'shock', the term should be seen in terms of bouncing forward, reacting to crises by changing to a new state that is more sustainable in the current environment." (Shaw, 2012, p.309)

This shift in the way that the field of planning is approached and conceived through the idea of resilience is necessary more than ever today. As cities face many uncertainties and risks at many different levels, spreading from environmental to economic, social and even security concerns, new ways forms of decision making and governance are emerging. "Resilience should be viewed as having the potential to develop a more radical and transformational agenda that opens up opportunities for political voice, resistance, and the challenging of power structures and accepted ways of thinking." (Bay Localize, 2009, found in Shaw, 2012, p.310) Therefore, resilience brings a change of perspective but also innovation and greater access in planning.

Moreover, the shift towards resilience thinking opens the window for adaptation and creativity in planning. Even though adaptation can be challenging for planning since as a research and policy field, planning aims towards organization, planning for resilience should translate into readiness for a change of plans. Resilience in planning highlights the need for adapting creatively to new realities rather than sticking to past ideas and trajectories. "Turning a crisis into an opportunity requires a great deal of preparedness

which in turn depends on the capacity to imagine alternative futures: just such a capacity which does, or, ought to, define planning in broad terms. Planning is thus about being prepared for innovative transformation at times of change and in the face of inherent uncertainties." (Davoudi, 2012, p.304)

Applying the multi-interpretated concept of resilience in planning is a great challenge but also a great opportunity to create a shift in the way we understand planning, moving from a step-to-step linear process into a dynamic and evolutional process of continuously alternating and adapting states. This shift will demand not only a change in planning theory but moreover, a shift in the ways planning is put in practice. "Attaining urban and economic resilience will demand a paradigm shift in the way in which security policy is written and how built environment professionals add risk mitigation into their everyday practices." (Bosher 2003, Godschalk, 2003, cited in Coaffee, 2008, p4633) Thus, taking into concern resilience in an operational planning context is one of the great challenges of planning for resilience.

Concluding, planning for resilience is a much-needed shift in the way planning is currently perceived and practiced. At times of uncertainties, the world is experiencing multiple crises, from environmental to economic ones that particularly affect the cities because of their great vulnerability and that need to be addressed effectively. Cities are not only vulnerable but they can also act as clusters for change. To avoid disasters, resilience in planning can create the meeting point of two fields of research that traditionally work in silos, the field of urban planning with the field of disaster management. Therefore, through this interaction the concept of resilience offers a unique chance for the above two fields of study and research to cooperate and develop synergies, as planning for resilience can act as a common ground of action for both fields. For this desired shift to happen resilience must be introduced in planning with the combination of a firm theoretical framework and a technical, practical one. In other words, apart from the theory of resilience, its operationalization must be prioritized for the concept to be fully integrated in the planning discipline.

3.3 Is resilience always positive?

Among the numerous approaches on resilience there seems to be a consensus on its importance, on its significance as a new paradigm shift and at the same time as a challenge for planning. Researchers and practitioners moreover agree on the fact that resilience has no broadly accepted single definition (Cutter 2008, Klein et al. 2003, Manyena, 2006) Therefore, both in its theoretical and practical dimensions the vague concept of resilience has challenges that must be addressed. The absence of an exact definition nothing but discourages further misunderstandings of the concept within the field of planning. Even if many assume that resilience is a positive concept (Davoudi, 2012, etc.), whether it is good to be resilient depends on how one defines resilience and on the context within which resilience is addressed. It is therefore crucial to define within which framework and which exact spatial and temporal boundaries resilience is explored. In other words, in which unit of analysis resilience is studied

As in almost every discipline where resilience has been applied, several criticisms on the concept have accrued within the field of planning concerning the use of resilience in planning research and practice. As positive as it appears to be, the vague and often nebulous concept of resilience bears challenges that should be carefully addressed. Likewise, the critics on the concept of sustainability that has been equally appraised by research and policy institutions since the 1987 Brundtland report but according to many has not lead to tangible results and solutions (Kaika, 2017) resilience is often criticized for delivering false or misleading messages.

For some resilience is a concept too vague to be used in disaster prevention. (Manyena, 2006) Moreover, Sapountzaki (2007) has criticized the extensive use of resilience arguing that “without a concrete definition, rather than creating a positive outcome it can possibly serve as a mechanism of vulnerability transfer or transformation.” pointing out that the resilience of one actor within a system may increase the vulnerability of another. Alexander (2013) further develops this critic: “One person’s resilience may be another’s vulnerability and one would not want the concept to be used as a means of reinforcing unethical practices or hegemonies.” (p.2714)

With a similar perspective Davoudi (2012) points out the relevant challenge of resilience, questioning "resilience for whom?" while she argues that "resilience for some people or places may lead to the loss of resilience for *others."* (p.306) In a different approach, Manyena (2011) criticizes the bounce 'back notion' that dominated the first approaches on resilience, commenting that it "can be associated with strengthening existing structures and institutions to resist or withstand disasters, which may also increase community vulnerability rather than resilience to disasters." (p.419) Manyena's critic introduces the question of temporality since what is resilient on the short-term may not be resilient on the long term. Thus, authors are concerned that resilience in planning can also have a negative impact and lead to increased vulnerability.

Another example comes from New Orleans and the Stop Calling Me Resilient campaign that objected to the continuous characterization of the city and its people as resilient from the media and policy makers. According to the campaign, more stresses are about to come when someone is labeled as resilient. Rather than calling them resilient "we should focus instead on identifying the actors and processes that produce the need to build resilience in the first place." (Kaika, 2017) Alleviating the factors that produce the need for resilience is desirable but not always possible. One cannot reverse the exposure to natural hazards and in a complex interconnected world no one is immune to disturbance. Thus, building up resilience proactively is reveals preparedness. As Davoudi, 2012, summarizes this concern, "Yet it is not quite clear what resilience means, beyond the simple assumption that it is good to be resilient" (Davoudi, 2012, p.299). It is this absence of a definition that encourages misunderstandings of the concept.

Concluding, to avoid making resilience a 'buzzword' or 'an empty signifier' research and practitioners, don't need a universal definition that would risk the acceleration of this trend. According to Reghezza-Zitt et al., (2012) the polysemy of the concept is not the problem but rather the possible theoretical and operational dead-ends that it creates. What is needed is a multitude of trials and errors and different approaches on the concept depending on the perspective of each work. According to Folke (2006) "the development of specific detailed definitions and metrics within the boundaries of each case will enrich the general appreciation and validation of the concept. The multitude of definitions reflects the diversity of contexts and case studies and enriches the concept of resilience.".

3.4 The challenge of operationalizing resilience.

The operationalization of resilience is a critical step for the concept to be better understood and fully integrated in planning practice. Reviewing how other researchers have approached the fields of exploring resilience theoretically, one comes across many different approaches, including the merely socio-ecological ones (Holling 1995, Adger, 2000, Alberti et al. 2004 etc.), to the resilience-vulnerability dipole (Vogel et al. 2007, etc.), the resilience-sustainability one (Perrings, 2006). Despite the existing span of approaches to the theoretical aspects of resilience, additional knowledge is needed for the concept to be integrated and rendered useful in planning practice. Thus, the operationalization of resilience is a step that both policy makers and researchers have been calling for.

The development of a resilience assessment model is necessary and a great challenge in itself. "The identification of standards and metrics for assessing disaster resilience is one of the grand challenges (…)" (Cutter et al., 2008, p.598) However an assessment model itself is not sufficient, as empirical knowledge on actual case studies' resilience is needed for the integration of resilience in planning practice. While "linking science to practice is not a simple task" as Vogel etc. (2007), p. 359) show in their paper on vulnerability, it is nevertheless possible for resilience to become applicable so that it creates an impact in the field. The combination of different assessment approaches and their implementation efforts will provide a robust base of trial and error for enhancing and promoting resilience in planning practice.

Although it has been far less developed than the theoretical aspects of resilience, the operationalization of resilience through practical implementations and the possible ways to assess it, is a field that has already given some inputs. Thus, with a wide array of approaches, from the field of engineering (Bruneau et al., 2003) to the field of geography and disaster risk reduction (Cutter et al., 2010), the operationalization of resilience is emerging today as a popular field of research. The attempts on operationalizing and consequently assessing resilience need to be implemented on actual case studies where the approaches can be tested for their strengths and weaknesses. Concentrating in the

works that focus in cities and in natural/earthquake hazards, the most popular of these approaches are reviewed in the present chapter.

Bruneau et al.'s (2003) A Framework to Quantitavely Assess and Enhance the Seismic Resilience of Communities.

One first approach for the operationalization of resilience, concentrated on earthquake hazards and coming from the field of engineering, is Bruneau et al.'s (2003) conceptual framework for the seismic resilience of communities. Within this framework and quantification attempt, even if it is presented "for illustrative purposes only" (p.740) resilience is perceived as the ability of a system to absorb shock and to quickly re-establish itself after the shock. Thus, in this case the authors adopt the 'bounce back' approach. This perception on the concept is different from the one adopted by the present research where resilience not only is the capacity to resist to shocks and absorb them but also to envision and enable improvement and not only re-establishment of pre-shock conditions.

Nevertheless, apart from this difference in perspectives, the work of Bruneau et al. offers some interesting insights. Bruneau et al. (2003) as well as other authors such as Cutter et al, 2008, correctly emphasize the need for the quantification of resilience in order to enable and facilitate different kinds of comparative studies and moreover to identify why and how resilience changes. "Well defined and consistently applied quantifiable measures of resilience make it possible to carry out various kinds of comparative studies, to determine why some systems are more resilient than others, and to assess changes in system resilience over time" (Bruneau et al. 2003, p.745). One valuable point of this assessment approach is that in their conceptual framework and assessment model, the authors underline the importance of **critical facilities** that enable the continuous functioning of communities and prioritize their non-stop operation.

Cutter et al.'s (2010) Disaster Resilience Indicators for Benchmarking Baseline Conditions

In a different and later approach, coming from the field of geography, Cutter et al. (2010) focus on disaster resilience of cities and develop a methodology for measuring resilience. This methodology even if it is applied to county (the spatial organization level of the US) rather than city level, proposes a baseline set of indicators to benchmark conditions that facilitate resilience. This perspective on benchmarking existing conditions is shared with the present research. Additionally, the prioritization of the exploration of recovery patterns in order to learn from the evolution of resilience in past disasters is critical. Cutter et al. (2010) use the disaster resilience of place (DROP) model from Cutter et al. (2008) as its conceptual basis and choose their variables from the existing literature, with the limitation of availability and under a categorization resilience components that will be reviewed in the following chapter.

Among the most popular between different studies that present resilience assessment models is the Cutter et al. (2010) article, where the authors present a well-constructed set of indicators for the assessment of resilience on the county level and they implement their approach on 8 southeastern states of USA. This work is based on a previous work, Cutter et al.'s (2008) first attempt on operationalizing resilience. Both works will be used as resources for the development of the resilience assessment model within this research. Even though this research explores resilience on a different spatial level, this of a medium sized city, it will use as a reference the two approaches (Cutter et al., 2008 and Cutter et al., 2010) for assessing resilience, adapting them to its own characteristics and dimensions.

Resilience Alliance: Resilience Assessment Handbook

The Resilience Alliance created one of the first guide books for the assessment of resilience where it was emphasized that there are no recipes, no perfect formulas, and no right ways to conduct a resilience assessment (Resilience Alliance, 2007). What is important is that each methodology adjusts its framework and dimensions to the context and problematic of the case that it is applied. What is part of the resilience for one city may not be equally important for another. This element of adjusting every assessment attempt to the characteristics of the case study is valuable since it underlines the importance of adapted approaches.

However, having guidelines is equally important and thus within this approach four components of resilience were delineated. These are the city's metabolic flows, its governance networks, its built environment and its social dynamics. Therefore, according to the Resilience Alliance, a city's resilience depends on its metabolic flows, its governance structure, its built environment and its social dynamic but the impact of these four elements can vary across different cities.

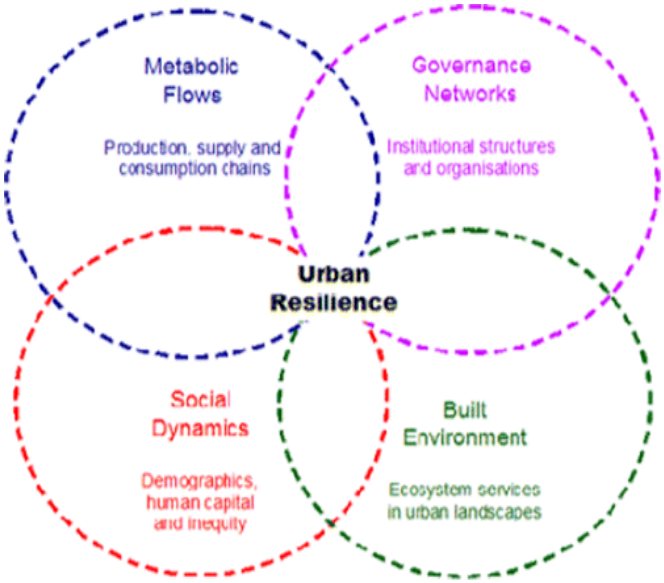

Figure 3.1: Four themes of urban resilience (source: Resilience Alliance, 2007)

100 Resilient Cities: The City Resilience Framework (CRF)

Another approach on evaluating resilience that was developed recently offers the cities the opportunity to network over the resilience problematic. The City Resilience Framework (2015) is a tool developed by the 100 Resilient Cities Initiative, that guides the participating cities in the understanding of their resilience. Divided over four dimensions and 12 Drivers it examines the resilience of cities in relation with 7 qualities, using both quantitative and qualitative data. The division between dimensions and drivers offers a new perspective on the resilient assessment approach and is valuable for the present research.

Figure 3.2 The City Resilience Framework (source: 100 Resilient Cities)

Overall, a great amount of work has been done towards the operationalization of the concept of resilience, however some important aspects of the concepts are still to be explored. In any attempt to operationalize resilience the careful outlining of the unit of analysis of the concept is critical. Together with the need for careful definition of the components of resilience that will further on define the choice of indicators for the assessment model, it is the spatial and temporal dimensions that are so critical to resilience that cannot be excluded from the assessment of resilience and that are explained in the following chapters (Chapter 3.5 and 3.6).

3.5 The components of resilience in planning.

As seen in the previous sections, resilience has a strong potential on transforming the way planning is perceived and practiced in order to face the current challenges of an ever-changing world. However, attention must be given on the way resilience is used so as to avoid common misunderstandings. Almost every single approach that explores that concept of resilience, whether theoretically or operationally, uses a different definition of the concept (see Table 1: Resilience definitions, p.25). Thus, it is crucial for every researcher to clearly define not only his/her perception of the theoretical concept but moreover his framework of research, the actual limitations within which he will be exploring the concept of resilience. In other words, the choice of unit of analysis for resilience must be carefully outlined.

Among the different approaches of operationalizing resilience that are reviewed in the present research, Bruneau et al.'s (2003) framework proposes several measures or qualities of resilience, which are then integrated in the following four dimensions: Technical, Organizational, Social and Economic (TOSE). This approach comes from engineering and is concentrated in seismic resilience, with a 'bounce back' perspective. It totally excludes the environmental part of resilience that on the contrary is crucial for the present research. In another approach, Cutter's et al. 2008 Disaster Resilience of Place

(DROP) model and resilience indicators development (Cutter et al.2010), the disaster resilience of a place is structured around the following components: Ecological, Social, Economic, Institutional, Infrastructure and Community Competence. Although Cutter et al., include the ecological component of resilience in their theoretical framework they purposefully exclude it from their further analysis due to a lack of consistent data within their study. Moreover, they divide social characteristics and community networks into two categories creating a much more complex and difficult to apply framework. In a later work, Cutter et al. 2014 divides the resilience components into Social, Economic, Housing and Infrastructure, Institutional, Community and Environmental. In a more recent approach, the City Resilience Framework differentiates four dimensions of resilience, namely the Health and Wellbeing, the Economy and Society, Infrastructure and Environment and the Leadership and Strategy. In an attempt to summarize the aforementioned approaches, the following table presents the different components of resilience presented by the different conceptual frameworks, organized in groups of similar definitions.

Table 3.1: The different components of resilience (source: author)

Component	Bruneau et al. (2003)	Resilience Alliance (2007)	Cutter et al. (2010)	City Resilience Framework (2015)
Technical	x			
Built Environment		x		
Infrastructure			x	x
Housing				
Organizational	x			
Governance		x		
Institutional			x	x
Leadership and				x

Strategy				
Social	x	x	x	
Community Competence			x	
Community				
Health and Wellbeing				x
Economic	x		x	
Metabolic Flows		x		
Economy and Society				x
Environmental				x
Ecological,			x	

The different conceptual frameworks offer different insights on how resilience is perceived by different approaches, fields of research or researchers. A conceptual difference of importance is whether these different dimensions are considered independent aspects of resilience or different components that when combined create the overall resilience of a place in a similar way that Cutter et al. (2010) approaches them. This summative table enables serves for a deeper understanding and the facilitation of the conceptual choices that will be made in the development of the methodology.

3.6 Spatial and temporal dimensions of resilience

To carefully outline the unit of analysis another part that must be carefully defined is the spatial and temporal dimensions within which resilience is explored. Resilience is a concept that embeds both spatial and temporal dimensions and that can have different expressions in different spatial levels and in different time moments. Whether one studies one particular component of resilience, or the resilience of an urban system as a whole, the spatial and temporal dimensions are of critical importance. Many critics of resilience are produced due to absence of such definitions. Therefore, likewise the resilience definition and framework, its spatial and temporal scale considerations must be carefully approached and clearly outlined since "the conditions defining resilience are dynamic and ultimately change with differences in spatial, social, and temporal scales" (Cutter et al., 2008, p.603). Hence, in order to produce credible results and avoid misconception, spatial and temporal boundaries must be well defined in advance.

The spatial dimension of urban resilience expresses the need to clearly define the boundaries of the different spatial scales of the system whose resilience is to be studied. The exact outlining of the spatial boundaries is required to prevent misconceptions of the resilience system and moreover to avoid any overview of possible transfer of vulnerabilities to other spatial or sectoral systems (see Sapountzaki, 2007, Davoudi 2012). Different studies distinguish the individual/household level, the neighborhood level and the city-wide level, (Nelson et al., 2007, p.24) while others choose to study resilience in one spatial level (Cuttter 2010- county level) The distinction of spatial levels, often changes depending on the case study, the resilience framework or the component of resilience that is being studied, therefore its clear definition is always important.

Another aspect of the spatial dimension of resilience is its territoriality. Having as a reference Bruneau et al.'s (2003) approach on critical facilities and D'Ercole and Metzger's (2009) approach on territorial vulnerability, it is argued here that within an urban system, resilience has strong territorial dimensions. D'Ercole and Metzger (2009) argued that "within every territory there exist localizable elements in position to generate

and disseminate their vulnerability to the entire territory causing effects that may affect or disrupt its operation and development." Therefore, when studying the resilience of an urban system one must consider these local elements that for the one part can generate vulnerability to the rest of the system and moreover, one should pay attention to the territorially localized elements that can preserve and moreover generate the resilience of the rest of the urban system. In the same way that D'Ercole and Metzger (2009) discuss the 'spatial root' of vulnerability of every territory, it is mportant to identify the resilience spatial roots that can generate resilience furthermore.

Apart from the spatial dimension of resilience, another dimension that enriches the concept of resilience is the temporal. How resilience evolves in time and whether different resilience components are differentiating over time is still little researched. An issue that emerges concerning temporality is how different components of a system react differently in terms of resilience. Such examples of different temporalities have appeared in the reconstruction of New Orleans where neighborhoods had very different timelines of rebuilding and as a result, very different resilience levels.

In the present research, the question of temporality focuses on the different times that the resilience of each component is unfold. Being dynamic by nature, resilience unfolds differently over time. According to Maret and Cadoul, (2008) there exist different temporalities with different duration and different dynamics in the resilience of a city post-disaster. (p.114) On the short term, resilience is dependent on the resistance and rapid reconstruction of infrastructure and networks. Midterm resilience, within a framework between five and ten years, resilience depends on the return of the inhabitants and economic revitalization, two factors closely interdependent. The long-term resilience of a city is dependent on the social-cultural development. (Maret et Cadoul, 2008) Therefore, Maret and Cadoul offer an interesting insight on the evolution of resilience, as it is reflected on its different characteristics and has different priorities over time. This research explores resilience with a focus on its temporality that is illustrated on the resilience framework developed on Chapter 5.2.2.1. Exploring the evolution of resilience over time after a catastrophic event, comes to fill a void in literature that usually perceives resilience as static.

3.7 What does it take for a community to be resilient?

> *"Resilient cities are constructed to be strong and flexible, rather than brittle and fragile. Their lifeline systems of roads, utilities, and other support facilities are designed to continue functioning in the face of rising water, high winds, shaking ground, and terrorist attacks. Their new development is guided away from known high hazard areas, and their vulnerable existing development is relocated to safe areas. Their buildings are constructed or retrofitted to meet code standards based on hazards threats. Their natural environmental protective systems are conserved to maintain valuable hazard mitigation functions. Finally, their governmental, nongovernmental, and private sector organizations are prepared with up-to-date information about hazard vulnerability and disaster resources, are linked with effective communication networks, and are experienced in working together."* (Godschalk, 2003, p.137)

The above quote describes a resilient city as strong and flexible, aware of its vulnerabilities, with applied building codes, protected environmental systems, well informed and connected institutions and private sector. This description is a valuable overview of a resilient city but how can one summarize the principal characteristics of a city resilient to disasters? Since, for those studying resilience 'it is necessary to establish the criteria to be used to say if a system is resilient or not.' (Reghezza-Zitt, 2012), many researchers have worked on defining resilience's characteristics, properties, or qualities just to name a few ways of approaching the concept. However, it is acknowledged that these attempts towards the attribution of resilience characteristics are at initial stages. (Wilkinson et al. 2010, p.39, Albers and Deppisch, 2012, p.2) A choice of different approaches covering the subject are overviewed here based on the relevance with the purpose of the present research, namely resilience to natural hazards from a planning perspective. The following Table 3.3 summarizes the difference approaches on resilience characteristics.

Table 3.2: Summative table of resilience characteristics (source: author)

Resilience principles	Godschalk (2003)	Bruneau et al (2003)	Dauphine et Provitolo (2007)	Albers and Deppisch, (2012)	City Resilience Framework (2015)
Redundancy	√	√		√	√
Diversity	√		√	√	
Efficiency	√				
Autonomy	√				
Flexibility					√
Auto-organization			√		
Decentralization			√		
Strength	√				
Robustness		√			√
Interdependence	√			√	
Adaptability	√		√		
Collaboration	√				
Resourcefulness		√			√
Innovation			√		
Learning			√		
Reflectiveness					√

Modularity				√	
Rapidity		√			
Inclusive					√
Integrated					√
Planning	√				

The works included in the above summative table were chosen for their conceptual and/or methodological relevance to the present study. Among the different resilience characteristics, in Table 3.2, there are several repetitive, overlapping or even contradictory ones. One of the first, and among the most influential of approaches to identify resilient characteristics of urban systems to disasters is Godschalk's (2003) paper on resilient cities. Viewing cities as being composed of physical and social systems, the author presents a set of principles that describe a resilient urban system and views resilience as "an ongoing long-term effort" (Godschalk, 2003, p.139).

With a similar perspective, viewing cities as being composed of physical and social systems, Bruneau et al. (2003) explore the quantification of the seismic resilience of communities, and attribute four essential properties for a system to be resilient: robustness, redundancy, resourcefulness and rapidity. Likewise, Dauphiné and Provitolo (2007) identify among the factors that increase the resilience of a system, diversity, auto organization and learning, as well as innovation and decentralization.

The more recent work of Albers and Deppisch (2012) concentrates on resilience with a spatial planning perspective and attributes eight principles to resilience. Albers and Deppisch (2012) concentrate on the spatial structure and the built environment of a city while intentionally not including the functional other half part of the city, the social system. Even though their approach excludes the resilience of the social part of the city and is concentrating on resilience to climate change rather than natural hazards it is of interest for this research as it has a planning perspective.

The latest approach of the City Resilience Framework, attributes the following characteristics to resilient cities. Redundancy, flexibility, robustness, resourcefulness, reflectiveness, inclusive and integrated are characteristics that make the system resilient. For the purpose of this research a selection of attributes that characterize a resilient system has been made with the perspective of the specific framework of this research for community resilience to natural hazards. These are presented in the following table:

Table 3.3: Resilience characteristics (source: author)

	Godschalk (2003)	Bruneau et al. (2003)	Dauphiné & Provitolo (2007)	Albers & Deppisch (2012)	City Resilience Framework (2015)	**Garis (2017)**
Diversity	√		√	√		√
Redundancy	√	√		√	√	√
Strength	√	√		√	√	√
Adaptability	√		√	√		√
Autonomy	√		√	√		√
Interdependence	√			√		√
Efficiency	√					√

One of the charcteristics that is attributed to a resilient system by most authors, is **diversity** or as Perrings (2006) expresses it, hetereogeneity, translating into having many different components that work differently so that function can be maintained in case of a disturbance. Another characteristic of equal occurrence is **redundancy** which translates into having a pleonasm of different components that work similarly. Having these two characteristics, diversity and redundancy, is essential for resilient systems as they create a safety net for continuous system function in the event of a perturbation.

Another critical characteristic of resilient systems is **strength**, which describes the ability to withstand and resist to perturbation. Some authors differentiate this characteristic into 'robustness' (Bruneau et al., 2003, CRF, 2015) in order to emphasize the element of absorbance, but within this research the resilience characteristic of strength will be perceived as inclusive of both robustness and stabilizing and buffering factors.

Together with strength and of equal importance comes flexibility. Being flexible means being able to change forms and to adapt. According to Dauphine et Provitolo, adaptability translates, into the capacity to learn and the ability to change. Within the present research, **adaptation** is perceived as including as prerequisites the additional characterizations given by different authors, namely flexibility, innovation and learning. This perspective is based on the viewpoint that a system to be adaptable must be flexible and capable of learning, and innovating.

Auto-organization (Dauphine and Provitolo, 2007) or autonomy (Godschalk, 2003), have the same meaning for the needs of this research, which is the ability to function and decide independently. Moreover, the characteristic of decentralization has similar implications, namely, the ability to function independently.

Autonomy contradicts with another essential characteristic of resilience, **interdependence**. While for a system to be resilient it has to be autonomous, to be able function independently at the same time it is essential to have strong connections within it. This complex relation is also described as modularity (Albers & Deppisch, 2012)

Furthermore, a system must be **efficient**, a characteristic that describes the ability to make the better out of the given situation and resources at minimum time. Thus, the characteristic of efficiency includes resourcefulness and rapidity (Bruneau et al., 2003)

Thus, for the purpose of this research, for a system to be resilient it must be diverse and redundant, strong and adaptable, autonomous and interdependent and efficient on the long term. It is possible however that some of these characteristics presented here are complementing, overlapping or even contradicting each other, but this heterogeneity and multidimensionality of characteristics is inherent in the of the concept of resilience. These characteristics will be used as criteria for the evaluation of resilience.

4. The rebuilding of Kalamata: A milestone for disaster planning in Greece.

4.1 Planning for uncertainty in Greece.

Situated in a neuralgic position in the Mediterranean, in a crossroad of three continents and great civilizations, Greece is a country with a great history of cities and a long history of disasters from the ancient times until today. This combination of characteristics lead to specific urban forms for the country's cities. Most Greek cities have been inhabited since antiquity and have a continuous urban history. In their modern form this ancestry translates to the existence of scattered traces of ancient monuments throughout their urban grids, many times discovered in the case of excavations, with multiple examples from ancient objects found during private building projects to the multiple historical objects that were unearthed during the excavations for the metro line of Athens that was inaugurated 2000. This plethora of underground historical traces creates numerous archeological challenges within the grid of a modern city and it often remains buried or non-reported.

On the surface, the continuity of the history of Greek cities is witnessed by their characteristics. The organic development of the urban grids and the absence of overall street plans resulted in great densities, unorganized street plans and narrow streets. Moreover, old buildings and infrastructure constructed before building codes were institutionalized, lead to dated urban frames. At the same time, the existence of building heritage from multiple periods give most historic cities monumental characteristics that are additional challenges to practitioners and policy makers. Thus, a vulnerable building environment that has survived centuries of turbulences creates a special combination of vulnerability and resilience. Planning for resilience is important in an environment that incorporates such a complexity of characteristics. Long history, important heritage, a vulnerable environment and a culture of citizenship create a unique grid that is worth preserving but can also offer lessons from its long history of coping capacities and adaptation.

The long urban history of Greek cities is also reflected in a strong sense of belonging, with extended informal social networks and a strong dynamic of place attachment. The culture of citizenship is central in the Greek conscience and likewise most Mediterranean cities, they are perceived as such *Spaces of Citizenship*. (Leontidou, 2003) At the same time, risk is also present in citizenship as most Greek cities are regularly exposed to frequent hazards with great variations in type and scale, that affect regularly not only their citizens' lives but moreover their morphology. Earthquakes, volcanic eruptions, periodic wildfires and floods but also foreign occupations, civil wars, population exchanges and huge migration flows have shaped the Greek urban history throughout time. This combination of both big and smaller scale threats and the existence of risks from multiple kinds of hazards that have been recurring through centuries create a rigid and unique collective memory and make Greek cities great cases for studying. Earthquakes, wildfires and floods are familiar to the population as most parts of the country have been facing them with a bigger or smaller regularity.

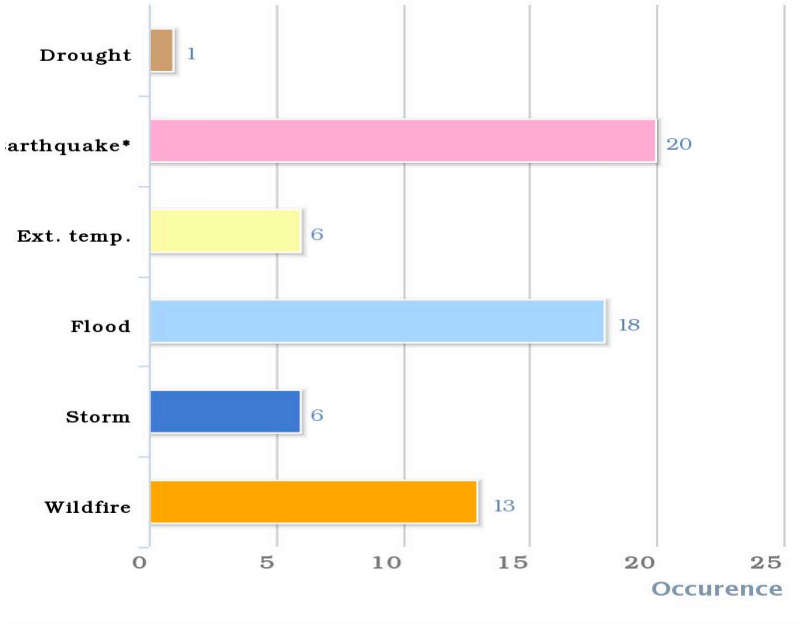

Figure 4.1: Natural Disaster Occurrence Reported (source: www.preventionweb.net)

Greece has a long history of natural disasters from the ancient times until today. Among these seismic, flood and forest fire disasters have exhibited short recurrence intervals and high levels of impacts in terms of people sufferings and economic damage. (Sapountzaki and Dandoulaki, 2006, p.78) Even though a multitude of hazard types occur in Greece, the hazards that most frequently occur and that affect the most people are earthquake hazards. Unlike most cities internationally were the hazard with the highest frequencies are floods (multiple examples from northern Europe) in Greek cities earthquakes are the most important hazard. In fact, according to OASP, Greece is the most earthquake prone country of Europe and sixth in the world. (OASP, 2016) As illustrated in Figure 4.2: The European Seismic Hazard Map, p.62, Greece is one of the most seismic prone areas of the region. In the map, seismic hazard intensity is represented by different colors. Blue colours indicate comparatively low hazard areas, yellow to orange colours indicate moderate hazard areas, and red and purple colours indicate high hazard areas. In the map, most of the country is represented in red with many parts in purple which is the higher level of seismic intensity. As a result, it is evident that most parts of the country experience frequent seismic activity. Compared to the rest of the countries that appear on the map, only Italy and Turkey presents a similar level of seismic intensity.

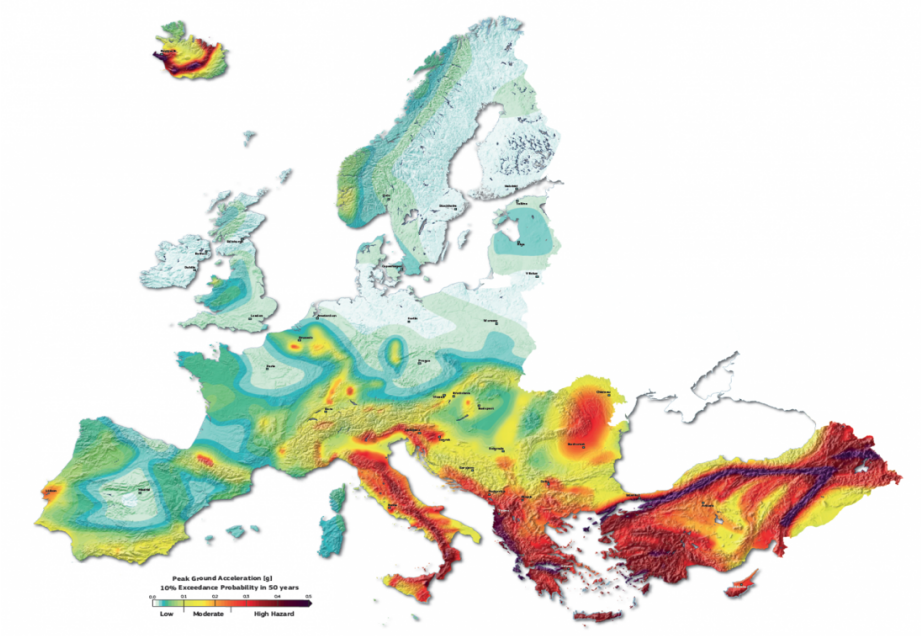

Figure 4.2: The European Seismic Hazard Map 2013. (source: © SHARE)

Developed over such an earthquake prone zone, cities in Greece are exposed to earthquakes of various scales. Even if the fatalities from earthquakes have been relatively few over the last years the consequences on the built environment and urban infrastructure are major. Moreover, the population in Greece is mostly situated in cities according to the World Bank Greece the urban population was 78% in 2015. Thus, as it is illustrated in Figure 4.3, below earthquakes affect greatly the population

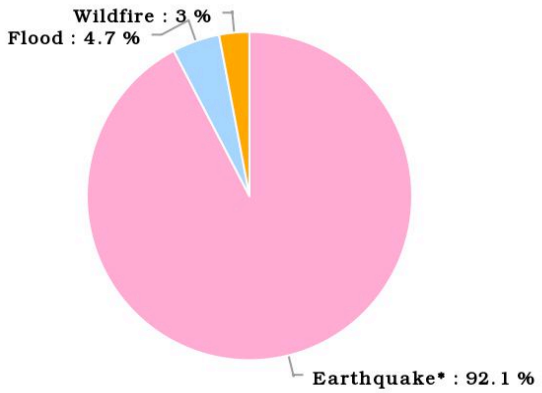

Figure 4.3 Percentage of reported people affected by disaster type
(source: www.preventionweb.net)

The long-term adaptation of the built environment to the hazards of the area is witnessed by traditional architectural styles that are adjusted to the seismic environment. Such an example is the wood framing style of the city of Leukada. The wooden antiseismic design is similar to the Baraccata traditional house in the equally earthquake prone Calabria province of Italy and to the Casa Pombalina style that was developed after the great 1755 Lisbon earthquake in Portugal, and supports houses aged 150 years in a highly seismic environment. Even though these traditional wooden constructions withstand the frequent earthquakes they are very vulnerable to fires and an important part of the historic center of Leukada was destroyed by fire in August 2016 (see Figure 4.2)

Figure 4.4: Right: Traditional antiseismic architecture in Leukada, (source: www.gosoutheast.info), Left: Traditional architecture (above) Fire in the historic city center of Leukada August 2016 (below)(source: www.huffingtonpost.gr)

In addition to the frequent earthquake activity, the Greek cities are often threatened by wildfires, mostly during the hot, dry and windy summer season and flash floods events most often during the fall season. Thus, in terms of vulnerability the Greek cities have a series of possible threats and the adaptation to hazards needs to be multifaceted. The most recent megadisasters in Greece were during the summer of 2009 when big wildfires destroyed great areas of forests, agriculture land but also parts of urban areas. In a nightmare-like repetition of the fires of 2007 that expanded all over Greece (see Figure 4.5, p.70), two years later the fires were repeated and even approached and seriously threatened Athens and many smaller cities in 2009.

Figure 4.5: Wildfires in Greece, 2007,
(source: http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=18939)

Developing in such a vulnerable environment except from the cases of successful long-term adaptation of construction to earthquakes, there are also cities that have failed to preserve their traditional architectural styles and urban heritage. Examples like the cities of Volos, Zakynthos and Cephalonia are characterized today by a lack of preserved built heritage and relatively new urban forms due to some recent history of catastrophes. These cities, were completely altered by devastating earthquakes and failed to preserve their built heritage. However apart from the physical exposure to vulnerabilities of the Greek cities, their development history has contributed to an increased 'constructed' vulnerability.

The extensive, uncontrolled urbanization in Greece's recent history has resulted in the increase of vulnerability across the country's cities. In the 1950's Greece was devastated and recovering from an intense series of events that began from the compulsory population exchange between Greece and Turkey in 1923, the destructive results of World War II (1940-1945) and the Greek Civil War (1946-1949) that had divided the country and depopulated the countryside. The country's cities were rapidly

urbanized as their population grew with unprecedented pace and the housing demands were huge. The 'Antiparohi' system that began in the city of Athens and quickly spread all over the country for the next decades came as a solution and offered low income housing and income to the population. According to this unique Greek system, the owner of a building plot is compensated with apartments in place of payment, for offering the land for the apartment block to be built.

More explicitly the 'Antiparohi' system describes an exchange system where a contractor of the construction offers a part of the building to be constructed (in the form of an apartment) to the land owner who offers the land. The result is usually a multi-storey residential building who is designed by the construction contractor, with little or non-existent architectural value and often out of context with the surrounding buildings. This way of urbanization dominated the Greek cities and radically transformed neighborhoods of rooftop houses into neighbourhoods of multi-storey apartment buildings, often with shops on the ground floor.

Since it was driven by private initiative and not centrally planned the result was uneven, uncontrolled urbanization and non-regulated streetscapes. This kind of construction fueled the Greek economy for years and at the same time created political pressures for higher built-to-surface ratio regulations. As a result, many areas were urbanized rapidly, without overall plans, with relatively poor constructions, narrow roads and no public spaces. Growing rapidly in an organic way, without central planning and advanced antiseismic building codes the Greek cities became even more vulnerable to hazards and in particular to earthquakes.

Since, the antiseismic building code has advanced hugely but little has happened in the level of planning. The unfortunate regularity and recurrence/repetition of natural hazards that impact large parts of population and destroy both the natural environment and the country's infrastructure, highlights the need to improve the planning framework. The integration of disaster risk management in planning is essential for the protection of the territory. Greek cities are among the most affected parts of the country. Small scale earthquakes, frequent wildfires, floods and landslides are on the country's everyday agenda. At the same time, Greek cities are also used to experience bigger emergencies,

caused by large scale natural events, such as destructive earthquakes, and/or man made events such as the economic crisis.

Currently Greece is going through a devastating economic crisis, during which the real GDP fell by 26% and with severe social costs, in terms of poverty and unemployment. (OECD, 2016) Thus, the country is challenged to overcome another type of disaster. Moreover, the refugee crisis that is developing on the country's border cities and the big urban centers such as Athens and Thessaloniki, create different kinds of stresses in an already stressed society. The effects of the current economic and refugee crisis will all but certainly provide plentiful material to future researchers from all disciplines. For one thing, urban development, spatial planning, transportation and lifeline networks are already affected in various ways. In such a stressed society, a possible shock like an earthquake could create severe consequences. Thus, planning for resilience is today more urgent than ever.

4.2 A disaster history of the Greek cities.

As seen in previous sections, Greece and the surrounding area have faced different kinds of disasters over the years. In many cases, disasters in Greece have been the occasions for promoting new laws on building codes and new planning regulations that were since incorporated in the country's legislative body (see summative Table 4.1, p.71) "Greece stands as an example of a country where the successive confrontation of large-scale emergencies, created by natural disasters and war conflicts, and the following recovery strategies have influenced decisively not only the development of urban areas throughout the country but moreover the development of the institutional spatial planning framework" (Delladetsimas, 2009, p.219). Thus, the present chapter not only presents the major disasters of the country's later history but its interest lays on showcasing the way these disasters shaped the national planning and disaster regulations.

Focusing on urban areas, it wouldn't be an exaggeration to claim that the urban morphology and moreover the urban planning regulations of the country were majorly

influenced by the disaster history of the Greek cities. “There are not few the cases where the devastation of a city stood out as the occasion not only for a radical reform of the city but moreover a chance for renewal of the urban planning ideas and the establishment of new building codes.” (Hastaoglou, 2007, p.182) Perceiving a disastrous event as a chance or an opportunity can be provocative to the affected community but an overview of the historic timeline of the regulations in most vulnerable countries can prove a correlation. Often, the recurrence of hazards creates awareness and motivation to act proactively. The following retrospective of the events that have led to changes in the Greek urban planning and seismic regulations is concentrated on the changes that occurred after disasters caused by natural hazards and not on the ones that were created after war conflicts or different kinds of hazard. Although the later have equally influenced the urban morphology of the modern Greek cities they are not the subject of this research.

The first urban disaster whose rehabilitation plans influenced the building and urban planning regulations of Greece, was the fire of the city of Thessaloniki in 1917. The Royal Decree of 8/5/1920 that referred to the new urban plan of the city of Thessaloniki, was used later as a reference for posterior building and planning regulations. (see Karadimou-Gerolympou, 2000) According to Delladetsimas (2009, p.112) the reconstruction of Thessaloniki lead to the overcoming of the obstacles of the traditional structures of the city and of land ownership and marked a substantial differentiation in terms of the overall content and goals of urban planning in Greece.

Only ten years later, the rehabilitation plans that followed the earthquake of the city of Corinth in 1928 and the establishment of the Independent Organization of Earthquake-hit Corinth, included an organized attempt of rehabilitation programs and the first local antiseismic regulations that were ever implemented in Greece (see, Delladetsimas, 2009, see Antoniou, 2007 and Hastaoglou-Martinidis 1994). The devastating earthquakes that occurred in Greece during the 1950s (Ionian islands 1953, Volos 1955-1957, Santorini 1957) had as a positive result the creation of the Greek Seismic Design Code of 1959. (Hastaoglou, 2007, p.195)

Later, the earthquake of Thessaloniki in 1978, hit the second-largest city in Greece and caused the emergence of a series of critical issues of post-disaster management such as debris removal and temporary housing needs. According to Dandoulaki (2007) the earthquake disaster offered the impetus for institutional changes, some of which apply to date. "In 1979 an overall administrative, economic, and technical framework for the rehabilitation of earthquake-damaged buildings was institutionalized (L.867/79) and the assigning of the responsibilities for rehabilitation of the earthquake damages to the Ministry of Public Works." (Dandoulaki, 2007 p.163) A couple of years later, the continuation of the strong seismic activity with two more earthquakes, in Volos 1980 and in Alkyonides 1981, had as a result the creation of the Earthquake Planning and Protection Organization (OASP), in 1983.

The Alkyonides earthquake, affected many surrounding areas, including parts of the metropolitan area of Athens, therefore together with the Thessaloniki (1978) and the Volos (1980) earthquakes this series of seismic activity affected three of the bigger urban centers of the country. This occurrence further highlighted the critical issues of post disaster management in urban areas and made obvious the need for modernization of the Seismic Design Code of 1959 which was updated finally in 1984. Also, it resulted to "a groundbreaking initiative of the Ministry of Spatial Planning, Settlements and Natural Environment, to include natural hazards protection into urban planning within the framework of EPA[2]." (Dandoulaki, 2007 p.164) This was the first effort of promoting the contribution of land-use and urban planning to seismic risk mitigation, under the Law 1337/1983 and according to the planning standards that had been set then, the examination of earthquake safety was a prerequisite of any new plan. (Sapountzaki and Dandoulaki, 2006 p.83) Even though it was a legal prerequisite, a seismic vulnerability map was not always included in urban plans. Such an example was the Master Plan of Kalamata.

In 1986, the city of Kalamata was hit by a devastating earthquake. The response to the earthquake was the first organized and successful attempt of immediate recovery together with long-term measures in the country's history. "After the earthquake of Kalamata, the central interest of the post-seismic rehabilitation moved from the building

[2]EPA was an initiative of renewal of urban planning practices within the framework of N.1337/83

needs to the human needs and for the first time in Greece, the urban planning reconstruction of the city after the earthquake, was revealed as a central priority." (see Benos, 2007) Moreover it was the first time that together with short-term decisions, long-term perspectives were equally taken into account. "The experience from the emergency response, the relief phase, the post disaster rehabilitation and reconstruction of the hit area could be seen as a "milestone" for seismic protection and management in earthquake prone Greece." (Ioannides, K. & Dikeoulakos, V. (2001), p.2)

The earthquakes of the region of Western Macedonia around the prefectures of Kozani and Grevena in 1995 were the occasions for another one of the recent attempts to differentiate from the logic of simple rehabilitation actions towards an overall rehabilitation plan. Almost a decade after the Kalamata earthquake the Kozani-Grevena earthquake reconstruction programs integrated the knowledge that was produced from Kalamata. "Soon after the catastrophe a rehabilitation program for the area that included immediate, medium and long-term measures was announced, (..) confirming in this way the establishment of a seismic disaster management practice that started with the Kalamata earthquake." (Dandoulaki, 2007 p.168-9)

The next major disaster, and one of the costliest in Greece, the earthquake that hit Athens (Mt. Parnitha) in 1999 was one of the most disastrous events and it seriously affected the northwestern areas of the city where it caused major problems. The earthquake of September 1999 became Greece's costliest natural disaster, despite its moderate magnitude, and occurred in an area of low seismic activity, only 18 kilometers from the city center. (Pomonis, 2002) The experience from the management of seismic disaster in the capital contributed to the review of the institutional framework of civil protection. It was only a few years before, after the Kozani-Grevena earthquakes that the Greek Seismic Design Code was finally updated and enacted as the New Seismic Design Code, in 1995, and it was revised shortly after, in the aftermath of the 1999 Athens earthquake, to lead to a new seismic code that is still in force. After the 1999 earthquake the Seismic Design Code of 1995 was updated and replaced by the National Seismic Design Code 2000.

Soon after the Athens earthquake, "a new law strengthened the role of the General Secretariat of Civil Protection[3] (GGPP) and expanded its power in all the phases of the disaster." (Dandoulaki, 2007 p.172) The attempt of updating civil protection included the decentralization of risk management from the General Secretary of Civil Protection towards the Regional General Secretaries, the Prefectures and finally Municipal and Local Authorities. The most innovative characteristics of the new law are the new philosophy of civil protection, the systematic introduction and adoption of new technologies, the empowerment of the role of the local authorities and the active involvement of volunteer organizations/NGOs in the system (Delladetsimas, 2009 p.256). Another problematic that was created after the Athens earthquake, was the emergence of governance issues and challenges. The many actors involved and the need for cooperation between them made it apparent that a plan of action in times of emergency was in need.

Not long after the Athens earthquake the dated National Seismic Hazard Map was updated and its later version (see Figure 4.6, below) includes three seismic zones and abolishes the previous zone of low seismic vulnerability. As a result, many areas that were previously in lower seismic hazard zones are now in different zones with consequent results in the appropriate building and construction codes and regulations. Among them, the areas mostly affected by the 1999 Athens earthquake. Thus, an on-time update of the seismic map could have possibly alleviate some of the destruction caused by the 1999 Athens earthquake.

[3] GGPP was established in 1995, by L.2344/95 and was further enforced by L.3013/2002

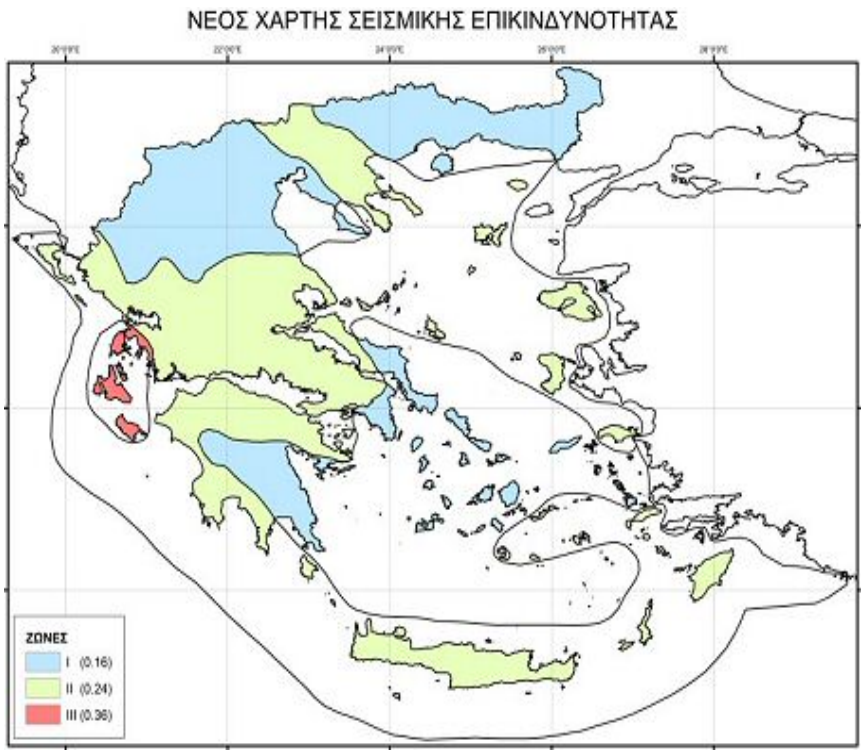

Figure 4.6: Seismic Hazard Map of Greece (source: OASP/EPPO, 2003)

Since, many disasters have occurred in the country (Leukada earthquake 2003, Kythira earthquake 2006, Wildfires 2007 and 2010, Cephalonia earthquake 2014, etc.) but have failed to contribute to the overall mitigation rehabilitation framework of the country. The new General Plan of Civil Protection[4] does not follow the guidelines of the law (L. 30/13-1/5/2002) but rather returns to previous centralized systems of disaster management. This stiffness from the central authorities makes apparent the need of initiative from the local authorities. Moreover, it is the initiatives of the local governments that have played the bigger role in disaster management until today. As Sapountzaki and Dandoulaki claim, "even though in Greece the system of public policies in risk management is largely centralized, innovative practices and the successful experiences come principally from the local level" (Sapountzaki and Dandoulaki, 2006, p.79). The following table shows the major disasters that occurred in Greece during the last century and the consequent products in terms of institutional and regulatory framework.

[4] New General Plan of Civil Protection, M.D. 1299 10/4/2003

Table 4.1: Important disasters and their institutional byproducts (source: author)

Year	Disaster	Planning products/institutions
1917	Thessaloniki Fire	
1920		Royal Decree of 8/5/1920
1928	Corinth Earthquake	Rehabilitation Plans
		Independent Organization of Earthquake-hit Corinth
1953	Ionian Earthquake	
1955	Volos Earthquake	
1956	Amorgos Earthquake	
1957	Volos Earthquake	
1959		Greek Seismic Design Code
1978	Thessaloniki Earthquake	
1979		Rehabilitation framework of earthquake-damaged buildings (L.867/79)
1980	Volos Earthquake	
1981	Alkyonides (Athens) Earthquake	
1983		Earthquake Planning and Protection Organization. (OASP)
		Inclusion of natural hazards protection into EPA Law 1337/1983
		Research and Technical Institute of Engineering Seismology and Earthquake Engineering (ITSAK) L.1349/1983
1984		Update of Greek Seismic Design Code
1986	Kalamata Earthquake	
1991		
1992		New Greek Seismic Design Code
1995	Kozani-Grevena Earthquake	General Secretariat of Civil Protection L.2344/95
1995	Aigio Earthquake	New Greek Seismic Design Code (mandatory implementation)
1999	Mt.Parnitha Earthquake	

2000		National Seismic Design Code 2000
2002		Update of General Secretariat of Civil Protection L.3013/2002
2003	Leukada earthquake	new General Plan of Civil Protection "Xenokratis" Plan M.D. 1299 10/4/2003
2003		New Seismic Hazard Map – update for the National Seismic Design Code
2006	Kythira earthquake	
2007	Greek wildfires	
2009		Integration of the General Secretariat of Civil Protection into the new Ministry of Citizen Protection.
2010	Greek wildfires	
2011		Integration of ITSAK into OASP
2014	Cephallonia earthquake	

As a conclusion we can see that the spatial planning regulations of Greece have been highly influenced by the disastrous events that occurred in the country over the last century. However, according to Delladetsimas, 2009 (p.257), "a modern approach of safety planning (development of a single system of continuous monitoring of vulnerability, urban networks of preparedness, reinforcement of social, informational and participation networks) remains far from implementable." It is very important that safety becomes a general priority and implemented on the spatial planning regulations. Moreover, safety is the element upon which the spatial planning policies and regulations of the country should be updated.

When unavoidable, as it is the case with earthquakes, disasters should be considered as opportunities to improve the structures of our urban societies and moreover, to promote them towards developing to better ones. Greece offers many opportunities for case studies in earthquake hazards research because of their frequent occurrence and the "complex and elaborated seismic risk management cycle"

(Sapountzaki and Dandoulaki, 2006, p.80) that is developed. Among them, the example of the reconstruction plan of the city of Kalamata after the 1986 earthquake stands out as an example for the combination of immediate reconstruction and long-term vision. This innovative approach together with the exemplary management from the local authorities make the Kalamata reconstruction an example for studying resilience in planning.

4.3 The 1986 earthquake of Kalamata

In September 13, 1986 a devastating earthquake of 6.2 magnitude (Richter scale) hit the city of Kalamata at 20:24 local time. The epicenter of the earthquake was only 15km from the city center. The coincidence of the event of the earthquake on a hot Saturday evening in a Mediterranean city with a strong outdoor life culture proved saving for the city. Moreover, the city was celebrating the inauguration of the maritime line that connected the city with the island of Crete in the port area that attracted an estimated crowd of 15000 people. Lastly, the freshly inaugurated linear Train Park (two weeks prior to the event) was also full of visitors. It is certain that if the earthquake had hit the city in another time the number of fatalities would be much more increased.

These characteristics that alleviated the impacts of a very strong earthquake, resulted to controlled reactions and limited panicking. However this changed two days later when a strong aftershock (5.4 M.) on 15 September, at 14:41 local time hit the city. At that time, citizens and experts were inside the buildings inspecting for damages and collecting personal objects. The strong aftershock caused further destructions to the already damaged buildings. Several buildings collapsed during this aftershock. After the aftershock the citizens of Kalamata were panicked and urged to evacuate the city as soon as possible. This panicked evacuation caused waves of congestion in a city full of heavy debris.

The coincidence of the timing of the main earthquake with the local outdoor culture and the events that attracted people in the open air, had as a result the small number of fatalities. The unfortunate 22 fatalities do not depict the extent of the disaster. In terms of building stock the city was devastated while 35000 people were left homeless. In the historic and commercial center of the city 71% of the buildings were either completely collapsed or suffered severe damages. Several multi-storey apartment buildings totally collapsed. (see Figure 4.7, below) Out of the 9.800 inspected buildings, 22% of them were demolished, 21% suffered heavy structural damage, 26% with light structural damage and 32% with no or light structural damage. (Ioannides, K. & Dikeoulakos, V. (2001)) In overall around 2500 buildings were characterized damaged beyond repair while 12.500 buildings suffered severe damages and were in need of important reconstructions.

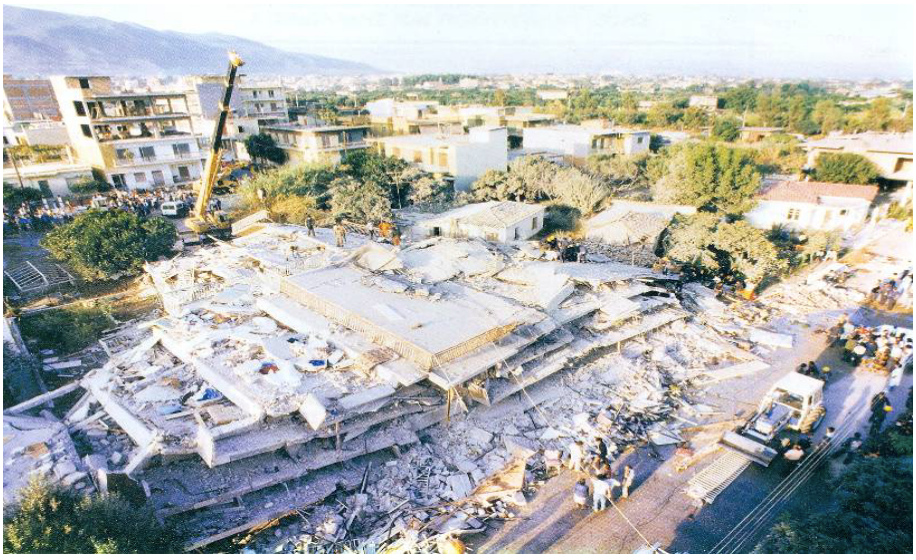

Figure 4.7: Collapsed apartment building in Kalamata, (source: Municipality of Kalamata)

The extent of the destruction to the historic and commercial heart of the city was a great wound to the built heritage of the city. The historic center of the city was the most affected area , were most of the buildings suffered great damages and many monuments were destroyed while the roads were blocked by heavy debris. The destroyed buildings were built before the building codes were institutionalized and while they carried the built heritage of the city they were extremely vulnerable. Moreover the public buildings

suffered equally great damages with 50% of them destroyed. (Diamantopoulos, 1995 p.71) The damages extended the city of Kalamata as many surrounding villages suffered great damaged. Among them, Eleohori where 113 out of its 117 buildings had collapsed. Big parts of the road that connected Kalamata with Sparti was blocked by landslides and rock falls from Mount Taygetos.

It is apparent that the economic and social life of the city were severely disrupted. In fear of aftershocks, access to all buildings was prohibited by the authorities for a few weeks while many people were affected psychologically and suffered from severe earthquake stress. International aid was offered since the very first hours of the event in terms of practical and technical support. Tents, camping equipment, medical and psychological care was offered to a city to the citizens of Kalamata. At the same time organized cultural events such as open air cinemas and activities for children helped to alleviate the stress and offered a sense of normalcy to the stricken population. Lastly, as it is often the case in such events, the disaster unveiled the inherent problems of the city.

4.4 Urban planning history of the city.

To understand the dynamics of the disaster and the reconstruction of Kalamata it is important to understand the dynamics of the evolution of the city. Thus, a historic timeline of its history from the perspective of the plans that shaped the urban morphology of Kalamata is necessary. In parallel a link to the historical evolution contributes to the understanding of the city's internal social dynamics. Kalamata is a medium sized Greek city, the second largest in the Peloponnese and the capital of the regional unit of Messenia. It is the biggest city of the Southern Peloponnese, the administrative, economic, cultural and commercial center of the region and an important port for Southern Greece. The city is situated at the head of the Messenian gulf alongside the Nedon river and on the foot of Mt.Taygetus range. It has a moderate Mediterranean climate with mild winters and hot and dry summers.

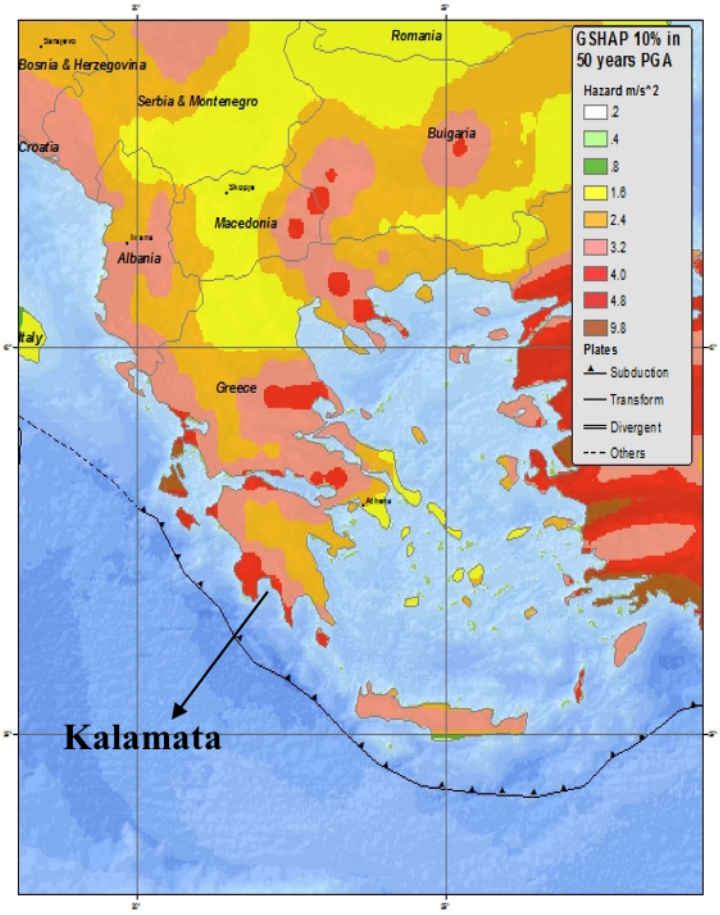

Figure 4.8: Greece seismic hazard map (source: www.earthquake.usgs.gov)

The city of Kalamata has a rich and complex history and a patchwork of influences. It is situated near the site of ancient Pharae, therefore its history traces back to antiquity. However, the first organized urban traces from the later period of urban Kalamata are being developed around the castle at the northern part of the city around 830-860 AD. The city was a Byzantine center from the 10th century, while French Crusaders established the feudal occupation of the Villehardouin family from 1208. It is around the 13th AD century that the historic center of the city is being formed around the castle area. This urban entity grew and expanded gradually around the castle but remained disconnected from the sea. The city was also ruled by Venetians and then Turks until the Greek Independence. In 1821, the city of Kalamata was the first city to be liberated and where one of the first acts of the Greek War of Independence.

During this time and until the liberation from the ottoman empire occupation the city experiences minimal growth. It is around 1860 that the historic center is expanding and that a second urban center is created around the port, formally founded under the name New Kalamai (Νέαι Καλαμαί) creating a dipole between the Castle and the Port. This is depicted in the Figure 4.7 below that shows the different chronological phases of urban growth. The dipole of the historic-center and the port is apparent in the map.

Thus, the late history of urban Kalamata begins around the beginning of the 19th AD century. In 1867 as the city is growing in population it is gradually becoming an important commercial and industrial center. The first city plan is produced to accommodate the growing urban needs of the inhabitants. This plan included only the area around the castle. A year later, in 1868 a second plan was approved for the area around the port. Four main road axes connect the port area with the city center. Thus, the first step for the corridor from the city to the sea and the port is created.

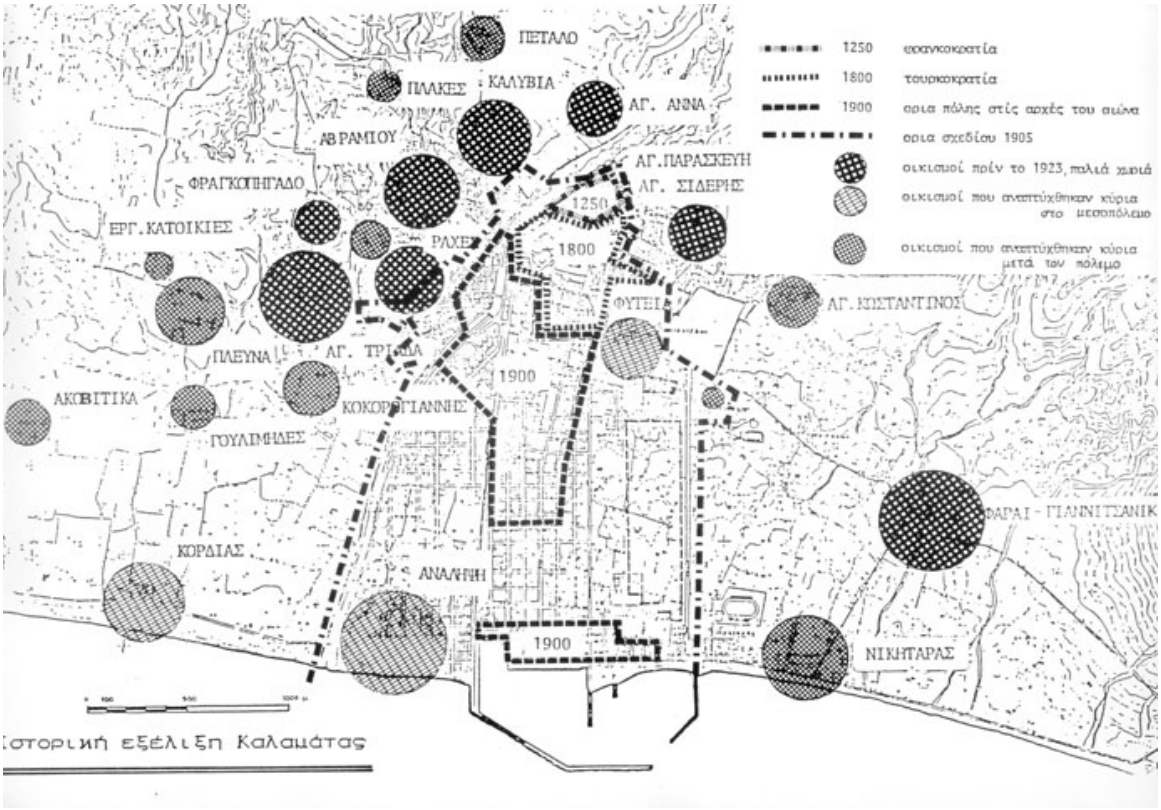

Figure 4.9: The historical evolution of Kalamata (source: Diamantopoulos, 1995)

The 1905 plan

In the beginning of the 20th century the city continues to grow and expand. Some important infrastructure such as roads and railroads networks are being constructed during this time due to the increased commercial and manufacturing activity happening in the area. Kalamata is the trade and processing point of the region and its port an important export node. The city's commerce and industry is flourishing with numerous production units of wine, raisins, tobacco, etc. As a result, the city's population is growing rapidly and new needs arise.

Therefore in 1905 the first unified plan connects the dipole between the castle and the port under one urban entity. As depicted in Figure 4.10, below, the 1905 plan is the first one to unify the city of Kalamata and to promote a coherent and operational structure for Kalamata that is by this time a vibrant and central city. The 1905 Plan puts order plots and roads and delimits the city. It organizes the public spaces and prioritizes the development of the port. The city developed under the 1905 plan's guidelines for more than seventy years, making it the longest-standing plan. The 1905 plan served the city for many years but while the city continued to grow and became a flourishing industrial city of Greece the plan quickly became outdated. Soon, the dated 1905 Plan could no longer serve the current needs.

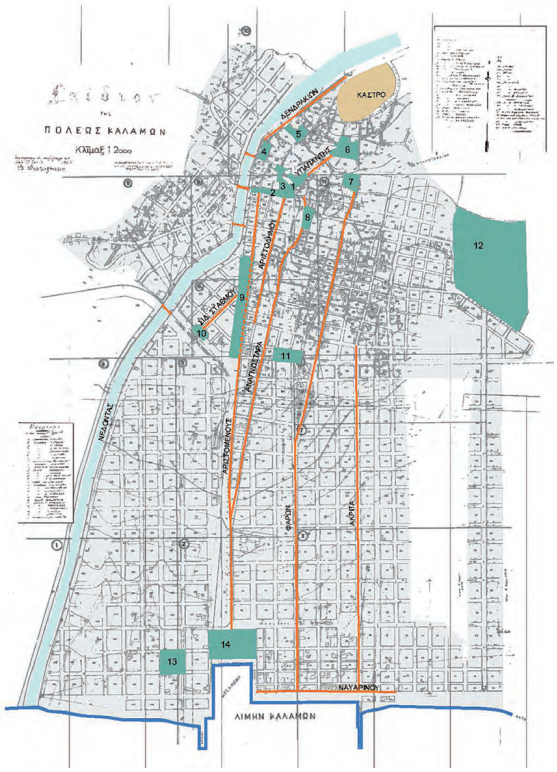

Figure 4.10: The 1905 Plan (source: General Archives of State- Prefecture of Messenia)

For the next decades, despite its growing economy and population, in the absence of an updated plan, the city suffered for a long time from the existence of many illegal buildings scattered throughout the urban grid, from the absence of drainage systems and areas without water supply, the absence of an organized road network system and many kilometers of dirt roads, the absence of organized public and green urban spaces and many more problems. The important commercial and industrial city that Kalamata had become by that time was in great need of a new Master Plan that would give the city a new direction.

Instead of the production of a new plan, the later turbulent history of Greece resulted to the centralization of the state and economic activities. The gradual centralization of most activities in the capital city of Athens, lead to the slow decline of the regional cities of the country. Among them Kalamata, that lost its previous dynamic but remained an important urban center. During this period, the Greek economy was based on construction through the *Antiparohi* system (see also p.66).

This exchange system fueled the economy for many years but had the unfortunate results of rapid and unplanned urbanization of large parts of the Greek cities. Also, it created the pressure for high built-surface ratios regulations for the building plots. The result of these regulations was high densities of occupations. that affected the cities' characters. Such an example is the city of Kalamata that was built up rapidly within some years as it is reflected in the following pictures (Figure 4.11) In the left photo the city of Kalamata in the 1950s is shown with the obvious dipole between the historic center and the port being apparent. Within a few years the unbuilt area in between was rapidly constructed and even though the urban grid seams to follow the grid from the 1905 plan the city scape was radically altered. The cityscape was transformed from one-storey rooftop houses to multi-storey apartment buildings with immediate consequences to the densities and the infrastructure needs of Kalamata.

Figure 4.11: Aerial Photos of Kalamata in 1960 (left) (source: State Archives- Messinia) and 1978 (right) (source:www.airphotos.gr)

The 1970-1986 Period and the 1986 Master Plan.

Thus, the city was in need of great changes. After the end of the dictatorship (1973) and the gradual democratization of Greece the first attempts for the preparation of a new Master Plan for Kalamata took place. From 1971 to 1985 a series of preparatory actions took place under an eventful political period for the country that delayed the institutionalization of the new Master Plan. Finally, a Master Plan for the city of Kalamata was completed and formalized in April 1986. While attending the institutionalization the local authorities had begun beforehand the implementation of some works that were included in the Master plan.

The goal for the 1986 Master Plan was to offer a solid operational structure to the city that was by then composed by 37 neighbourhoods. Therefore, the 1986 plan divided the city in nine urban units in a linear development that united the historic center with the port and expanded further on both sides of the city's coastline. The 1986 Master plan regulated the development of the city along the Aristomenous street, following the linear structure that connected the historic center and the port.

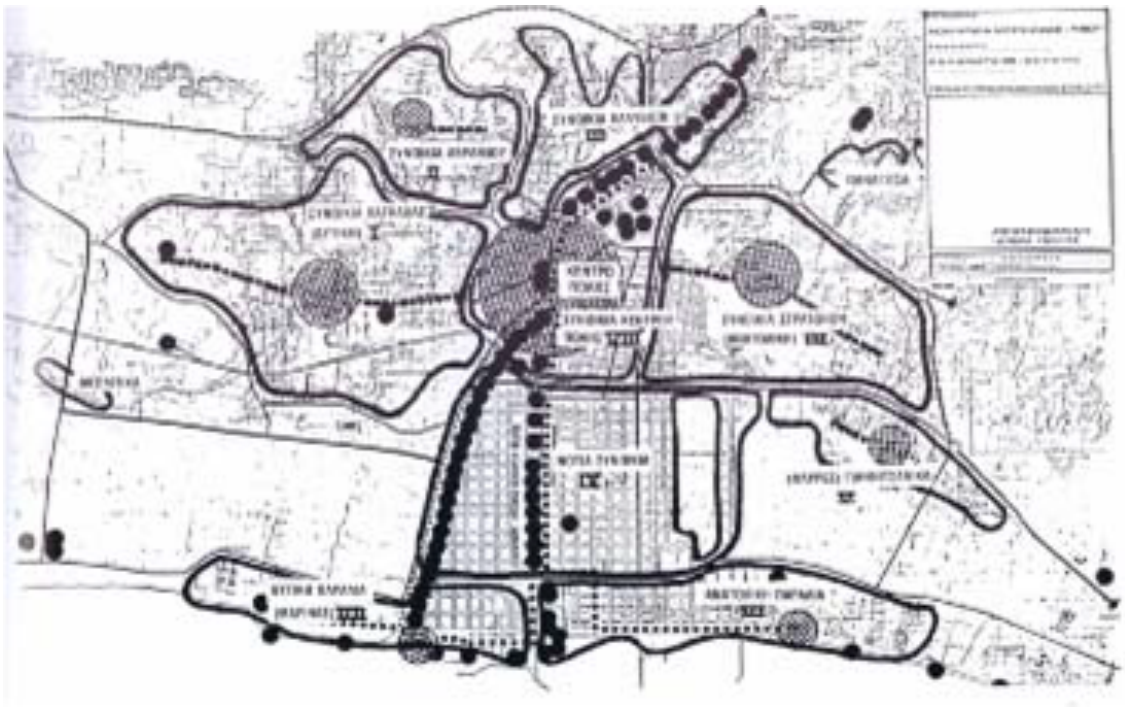

Figure 4.12: the 1986 Pre-disaster Master Plan (Diamantopoulos, 1995)

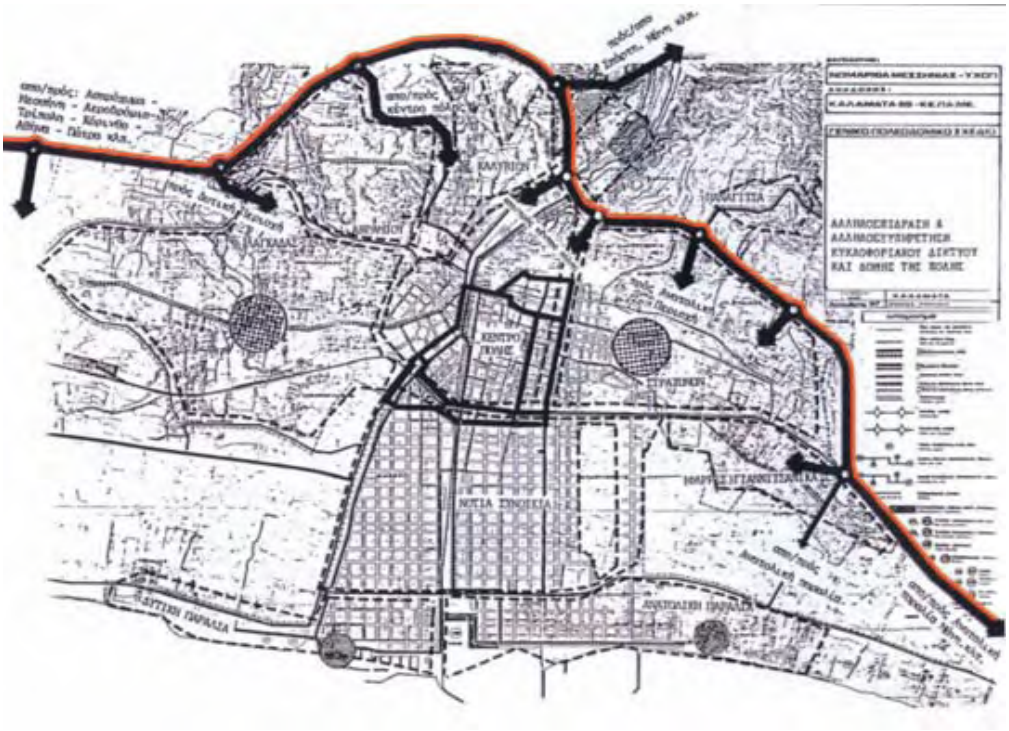

Figure 4.13: A ring road to ease circulation and access to the city center.
(source:Diamantopoulos, 1995)

While the plan was validated but not yet implemented an earthquake of magnitude 6,2 (Richter Scale) hit the city on the 13th of September at 20:24 local time on a warm Saturday evening. Two days later, on September 15th at 14:41 local time a strong aftershock of magnitude 5,4 hits the city. The city was shattered. 71% of the buildings in the historic center, 33%of the city's schools and 50% of the public buildings were destroyed or seriously damaged. Among them, the Town Hall, many public buildings, churches, cinemas and restaurants. After the catastrophic earthquake, the 1986 Master Plan was rapidly adjusted to the new needs and challenges. The implementation of the post-disaster 1986 Master Plan was extensive and shaped the city up to date. The details of the reconstruction are further analyzed in the next chapter (Chapter 4.5)

Since the earthquakes and reconstruction of Kalamata, the country experienced a period of growth that was followed by a crisis that is still ongoing and has affected Greece in unprecedented ways. The crisis has affected the population and development dynamics of Greece in multiple ways and the cities are among the most affected. Also, since the 1986 Master Plan two consecutive national administrative reforms namely

“Kapodistrias” in 1997 and “Kallikratis” in 2010, changed the shapes of the country’s municipalities as well as their territories and population dynamics. As such a result, the municipality of Kalamata expanded its limits and was in need of an updated overall plan.

This need was fulfilled with the 2011 Master Plan, that confirmed the projections of the 1986 Master Plan for the evolution of Kalamata in an important urban center. Thus the recovery of Kalamata was institutionally frameworked and practically guided by the 1986 Master plan that started before the 1986 earthquake and was the reference document for the developmeny of the city until the institutionalization of the 2011 Master Plan. Thus the present research will explore the development of Kalmata this exact period from 1986 to 2011.

4.5 The reconstruction of Kalamata: A shift towards sustainability.

Prior to the earthquakes, the city of Kalamata was suffering from degradation problems. Excessive and disorderly urban expansion and development that was not following any plan, lack of urban greenery, lack of a sewage system and a large part of the city without water supply, lack of biological treatment of wastes, high building densities and many illegal neighborhoods as well as social segregation. Moreover the signs of de-industrialization of the city were evident. It is indicative that the city had not had a recent plan and the last one dated back to 1905 (see The 1905 plan, p.80) In other words it was an "unfortified city". (Diamantopoulos, 2010)

Despite the plethora of problems, the city had recently (1978) elected Municipal leaders with a vision that prioritized development and social welfare, access to culture and education and public participation. Moreover, the wider socio-political context of the country was one of an era of change and improvement. Greece had recently emerged from a very unstable political period and had restored its democracy after the end of the military dictatorship that isolated the country for seven years (1967-1974). After the re-democratization of the country and in an effort to better support its democratic values Greece joined the European Economic Community (1981). Thus, it was a dynamic era of new ideas and visions of change for the country. This element of change towards a new direction affected everyone, from political leaders to professionals and citizens. Thus the timing of the event is not irrelevant to the discussion on its reconstruction.

The new municipality had started efforts towards the creation of a new urban plan for the city (General Town Plan, GTP) since its election in 1978. After almost a decade of efforts and obstacles finally the new GTP was complete and it was finally institutionalized in April 1986, only five months before the earthquake. This long procedure of years of studying the city had as a result the deep knowledge of the problems and the potentials of the city both from the local authorities and the planners. According to Diamantopoulos (2008, p. 6) "the seven year (1979-1986) active

involvement of KEPAME[5] before the earthquake with the urban planning issues-problems-studies for the city of Kalamata contributed significantly to the understanding of the emergency problems to be solved after the earthquake." This in-depth knowledge of the forces and challenges of the city of Kalamata proved to be a key element in the reconstruction process.

Therefore, shortly after the earthquake of 1986 a revised GTP was put in place. In combination with the access to the financial assistance of E.U. agencies for post-disaster rehabilitation programs, lead the immediate realization of a plethora of urban planning interventions that were included in the Master Plan. Together with the revision of the Master Plan, a reconstruction program was put in place. The three main actors of the rehabilitation program of the city, the local authorities, the planners and the active public participation from the citizens of Kalamata made possible the seismic fortification of the city in terms of urban planning through the post-earthquake revision and implementation of the GTP. The main concerns of the revised plan identified with the antiseismic urban planning fortification standards (see Diamantopoulos, 1995) that can be described by three main areas: a correct transportation network, the existence of many free spaces equally spread within the urban tissue, and small densities throughout the city.

However, the reconstruction efforts went much further than these areas. Apart from the urban planning regulations, the responsible actors payed great attention to the preservation of the cities monuments and cultural heritage. With urban planning as a guide, culture, education and citizen participation were prioritized and a vision for future sustainability before even sustainability existed as a concept. According to Sapountzaki and Dandoulaki, 2006 p.90, "the disastrous event of the earthquake made possible a redevelopment process that managed both self-recovery and a change of patterns and modes of development from non-sustainable to sustainable ones." It would be one year after the earthquake that the 1987 Brundtland report would introduce sustainable development, in Our Common Future paper.

[5] KE.P.A.M.E. is the center of planning studies and research that developed the Kalamata GTP.

The combination of this series of events after the disastrous earthquake with the wider characteristics of the era, led to a paradigm shift for disaster management in the country. The reconstruction of Kalamata influenced the disaster management policies of the country and moved the priority from the buildings to humans. The question that arises is how the planning and policy practices introduced by the implementation of the 1986 plan lead to the resilient reconstruction of the city and to the consequent paradigm shift in the country's reconstruction policies.

5. Methodology

5.1 General Research Strategy

5.1.1 Theoretical foundation

As it has been developed in previous chapters the purpose of this research is to explore the links between planning and resilience in a post-disaster context with specific regards to the long-term evolution of both concepts. For this to be achieved, the research objectives need to be fulfilled, namely the development of a resilience assessment model and its application in an actual case study. Developing and applying the resilience assessment model on an actual case study provides the insight that the research is seeking for, the connections between planning and resilience. For the above to be achieved a careful research design is critical in order to validate the conduction and the findings of the present work.

Research design is a critical step in the preparation of every research. It includes a positioning of the research in terms of worldview paradigms, strategies of inquiry and methods. Whereas it is important for a research to be positioned and to begin with a clear research design it is almost certain that during the conduction of the research new needs can be produced that will alter or add new elements to the initial research design. In a similar way, the present research started as quantitative approach, planning to work with variables that measured resilience. Later it became obvious that for the research questions to be answered, i.e. to explore the way different planning choices affect the assessed resilience, further explanation was required and therefore, a mix of quantitative and qualitative approach was followed. According to Creswell, (2003) quantitative approaches offer consistency and reliability while the advantages of qualitative approaches are their ability to capture complex issues. In other words, to benefit from the advantages of both approaches, quantitative and qualitative, a mixed methods approach needed to be used.

Developed as a theoretical foundation long after qualitative and quantitative research, mixed methods research is often characterized as the third movement on methodology with its own worldview, vocabulary and techniques. (Tashakkori &

Teddlie, 2003) Mixed methods research involves the simultaneous or sequential association of two different approaches, the quantitative and the qualitative. It involves the use of both approaches in tandem so that the overall strength of the study is greater than either qualitative or quantitative research (Creswell and Plano Clark, 2011) Mixed methods research is a more global way of approaching a research question as it gives access to both qualitative and quantitative approaches. In a way, mixed methods research is in the middle between qualitative and quantitative approaches and shares characteristics of both.

> *Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of collection and analysis and the mixture of qualitative and quantitative approaches in many phases of the research process. As a method, it focuses on collecting, analyzing and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone* (Creswell & Plano Clark, 2011, p.5)

The above definition, adopted in this research project, gives the essence of mixed methods research approach, which is the fusion of quantitative and qualitative approaches. This approach is selected in order to avoid any gaps or weaknesses on the validity of what could have been produced if only one of the two basic research approaches, quantitative and qualitative, was followed. The nature of the research question as well as the context within which the research question is studied guide the researcher to position the research in a paradigm or in other words, a worldview. As Guba and Lincoln (1994) explain "a paradigm is the basic belief system or worldview that guides the investigator, not only in choices of methods but in ontologically and epistemologically fundamental ways". The present research is therefore conducted with a mixed methods approach, and it belongs philosophically in the paradigm of pragmatism,

which is considered as the foundational paradigm of mixed methods research (Creswell, 2009, Creswell and Plano Clark, 2011, etc.)

5.1.2 Strategy of inquiry

After positioning oneself on the paradigm upon which a research will be developed and on the approach with which it will be conducted, one needs to select the strategy of inquiry or in other words, the research methodology that will be followed. For the purpose of this research, and because of the nature and type of the research question, a *sequential explanatory triangulation design* has been chosen. Sequential triangulation is a research strategy that, avoids the simultaneous collection of quantitative and qualitative data and rather collects and uses them one after the other, in a sequential way. By this way, sequential triangulation capitalizes on the strengths of both quantitative and qualitative methodologies. Furthermore, triangulation is used when the research question requires to 'obtain different but complimentary data on the same topic.' (Morse, 1991, p.120) Thus, sequential triangulation is fit for this research that needs both type of data but not on a simultaneous way but rather for a further explanatory analysis.

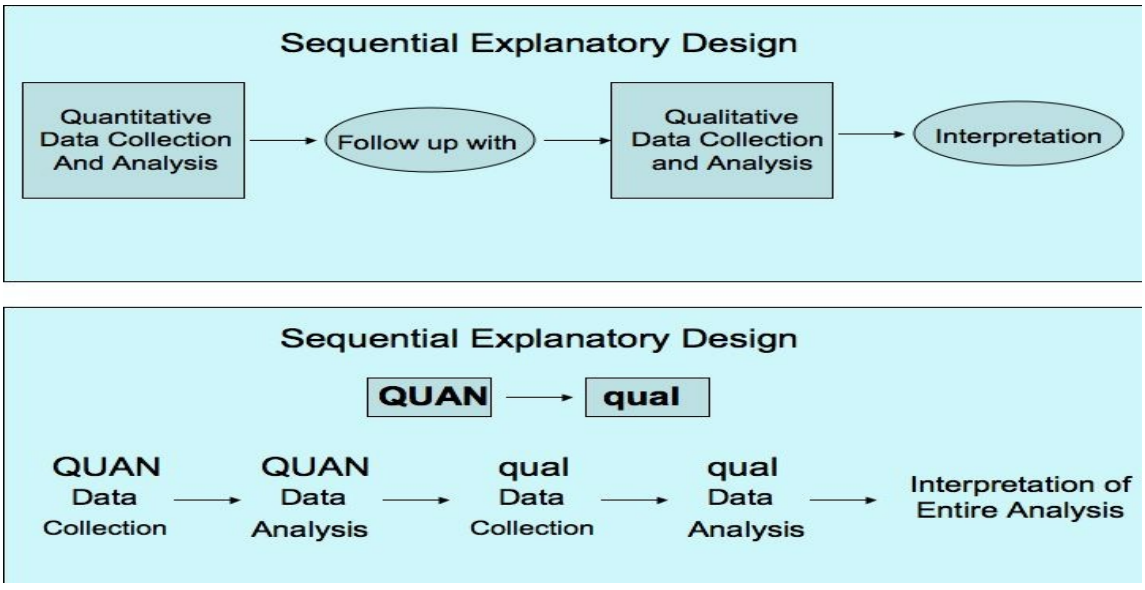

Figure 5.1: Sequential Explanatory Design (source: Creswell, 2009)

As seen in Figure 5.1 the explanatory sequential triangulation design requires a specific sequence that starts with the collection and analysis of quantitative data and follows-up with the qualitative. More explicitly, it requires the conduction of data collection in two phases, the first one for the collection of quantitative data and the second one for the collection of qualitative. The reason for using this research strategy of inquiry or in other words this methodology is that it uses qualitative data to further explain the results of the quantitative data collection. According to Creswell and Plano Clark, (2011), "This design is most useful when the researcher wants to assess trends and relationships with quantitative data but also be able to explain the mechanism and reasons behind the resultant trends" (p.82). Thus, this research strategy starts with a more quantitative approach, which as it develops further it transforms into a qualitative one.

5.2 The Research Method

5.2.1 Research Design

Research design or in other words methodology, is a crucial step when conducting a research. It sets not only the philosophical grounds upon which the research will be developed but moreover the exact methodological tools that will be used. A careful research design, though it is not restrictive, works as a guiding framework for the researcher. As seen in the previous chapter, the present research follows a mixed methods approach and is positioned theoretically in the paradigm of pragmatism.

The research question orientates this research towards the development of a model for assessing resilience. Following a sequential explanatory triangulation strategy, the first part of the analysis includes the development of the resilience assessment model while in the second part qualitative data are analyzed to explain the results of the first part. Case study research is used since the research explores in depth a phenomenon over time and relies on multiple sources.

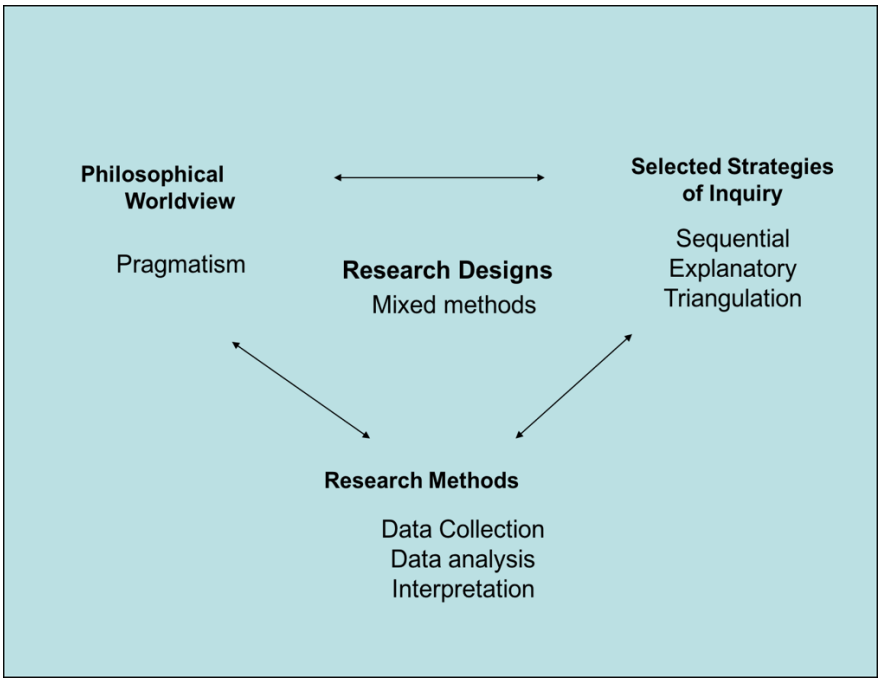

Figure 5.2: Research design framework (source: Garis, 2017, adapted from Creswell, 2009)

5.2.2 Method

5.2.2.1 Resilience framework for analysis

In the previous chapters the multitude of different approaches to resilience were reviewed to outline the evolution of the concept and the complexity of its significations. The resulting conclusion of this outline was that even if this multitude of approaches is complexing the use of resilience, it is ultimately enriching to the discussion. At the same time, it is crucial for every researcher working with resilience to clearly define his approach on the concept, his definition of resilience (see Chapter 2.5, p.40), and his framework of analysis. This framework includes the different components of resilience and the spatial and temporal dimensions upon which they will be explored. This is especially important in the case of resilience operationalization approaches as the framework of analysis is in this case the base upon which the operationalization indicators will be developed. Therefore, setting the framework for analysis is a first step towards the operationalization of resilience.

For the purpose of this research, the framework to be used for the assessment of community resilience to natural hazards, explores resilience through the following five components: the Infrastructure, the Economic, the Physical & Urban Environment and lastly the Social Resilience. These components will be studied in different time periods reflecting their influence on the city's recovery.

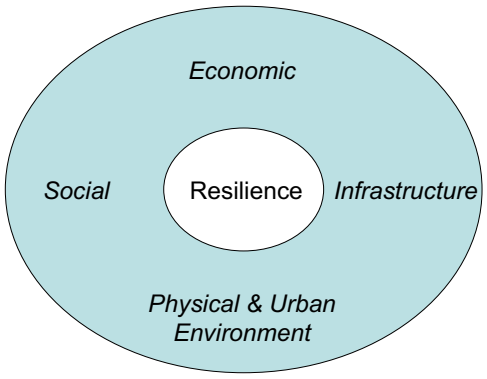

Figure 5.3: Components of Resilience (source: author)

Developing on the spatial boundaries of a medium sized city the ***Infrastructure*** component is referring to the critical infrastructure such as road networks, bridges, hospitals, electric power systems, etc. and their capacity to withstand a functional activity during a natural hazard. This component embeds the characteristic of absorbance and is critical for the immediate period after the hazard. The ***Economic*** component explores the capacity of the economic actors of the city to maintain or regain function.

The ***Physical and Urban Environment*** component of the city includes the morphological characteristics and the environmental factors that contribute to community resilience. While the infrastructure component describes the critical facilities and the building stock of the cities that are essential for the short-term resilience, the physical and urban environment component refers to the overall environment of the city. This includes public spaces, green urban spaces, open areas and to the natural environment of the city such as the river, water resources, etc. However, although ecological resilience unquestionably contributes to the general resilience of a place it is not a part of community resilience to natural hazards, explored in this research. The last component of resilience is the ***Social*** and is studied on the long term and reflects the inherent social characteristics of a city that make it resilient such us social capital, place attachment and social memory (distinguished by some authors as Community Competence (Cutter et al., 2010) that promote social resilience.

The definition of the components that compose the resilience of a city, is the first step for the development of the framework within which resilience is explored in the present research. Next, the temporal dimensions of the chosen components are developed as well as the model for the assessment of resilience. Thus, the presented model is composed by the resilience components their temporal dimensions and is accompanied by the resilience indicators (see Chapter 5.2.2.2). The model is designed to present the evolution of resilience on the long term after a catastrophic event such as a natural hazard and in a way to be easily applied on actual case studies.

Thus, after having defined the different components of resilience within which the present approach, the next question that occurs is which temporality differentiates each component of resilience. In other words, are different components more important than others in different temporalities? Following Maret and Cadoul's (2008) approach on the temporalities of resilience, the following figure illustrates the resilience framework for analysis proposed in the present research.

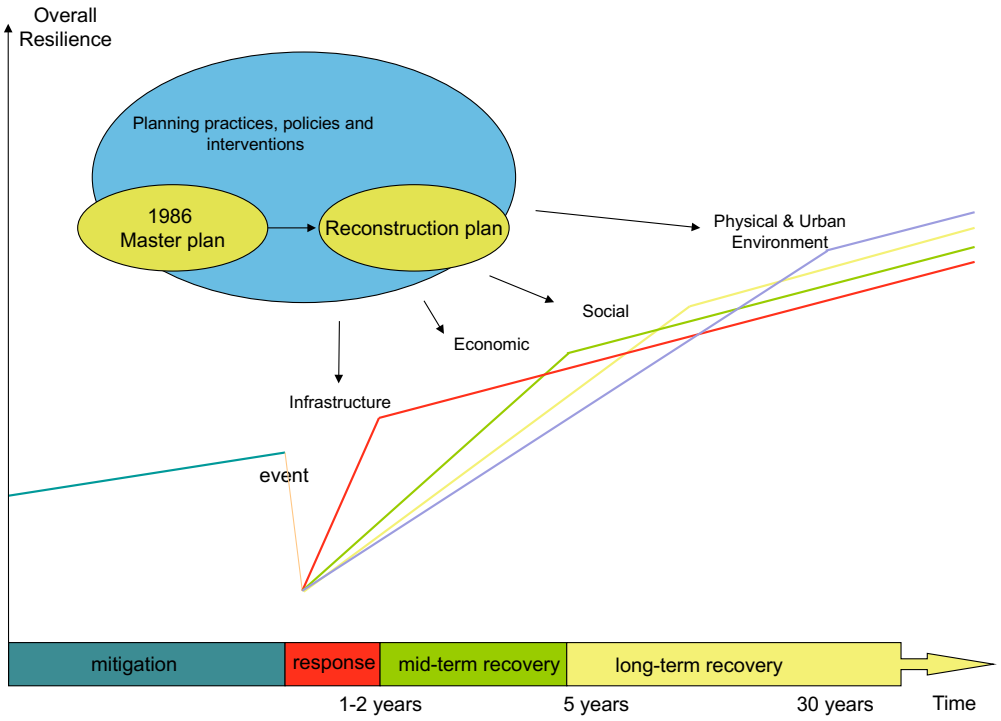

Figure 5.4: The evolution of resilience in the aftermath of a disaster (source: author)

The evolution of resilience as illustrated in Figure 5.4 is influenced by different components in different temporalities. The present research divides three time periods upon which resilience is studied, one predisaster, one post disaster on the short term and one post disaster on the long term. The figure does not concentrate on resilience within the disaster cycle but rather represents the development of a community's resilience in the case of a disastrous event and the ways pre-disaster and updated post disaster planning interventions can affect resilience and its several dimensions. This figure epitomizes the perspective of this research and the questions that it aims to explore.

The evolution of resilience is represented in blue, during the pre-disaster phase, affected by both mitigation and preparedness. In the aftermath of the disastrous event, during the response phase planning practices and interventions affect resilience mostly on the infrastructure dimension, as it is the phase during which critical infrastructure and lifelines affected are reconstructed. During short-term recovery (in green in the figure), it is the economic dimension of resilience that is enhanced by planning, while during the long-term recovery the social as well as physical and urban environment resilience dimensions are impacted. Therefore, each component is examined in relation with the disaster phase within which it represents resilience.

5.2.2.2. The indicators of resilience.

The operationalization of resilience is a step forward for the resilience scholarship and towards making the concept utilizable for both researchers and policy makers. Although far less developed than the theoretical aspects of resilience, the operationalization of resilience through practical implementations and the possible ways to assess it, is a field that has already given some inputs. (Bruneau et al. 2003, Norris et al. 2008, Cutter et al. 2010, Cutter et al 2014, etc.) However, even though there is a significant orientation in the research community towards the development of a resilience assessment model, some important aspects of the concept are yet to be mastered. As explained in previous chapters, this research explores the evolution of resilience with a long-term perspective, and for that reason the integration of different time scales in the resilience assessment model is essential.

Therefore, the focus of this research is not on developing a new set of resilience indicators, but rather to correlate a choice of selected indicators with integrated dimensions, and to test their efficiency over the dimension of time. Thus, the selected indicators in the construction of this resilience assessment model are derived from several works on disaster resilience assessment using the criterion of relevancy. Moeover, they are complemented with indicators specifically applied to the research's case study using

the criterion of representation. In the following table (Table 5.1: Resilience indicators, p.97) the robust sets of selected indicators are clustered under the defined resilience components.

The first component of resilience, **infrastructure**, which is critical during the short-term post disaster period, is described by a set of indicators that measure the extent and complexity of critical infrastructure. Critical networks and lifelines that according to D'Ercole and Metzger (2009) p.4 are 'key elements that permit the whole of a territory to function, to develop and to face an urgent situation.' Examples of such elements are the water and power supply networks. The identification of these elements strengthens not only their resilience but moreover have an accumulating effect for the resilience of the overall territory. Thus, the resilience of these elements is critical because it fosters the resilience of the territory.

The **economic** resilience dimension is assessed in the mid-term by indicators concerning, employment, income, home ownership, etc. The **social** component of resilience captures both the demographic and the community characteristics of the population. The demographic characteristics such as age, education etc., influence each person's capacity to independently respond in an effective way to a possible disruption. The community characteristics such as social networks, political engagement, place attachment etc. shape drastically the community's capacity to cooperate and to build present and future resilience. Lastly, the **physical and urban environment** component. This component is very important for this study with a long-term resilience temporality. According to Godschalk, (2003) "ample and adaptable amounts of open space surrounding buildings are of enormous value both during and after an earthquake event"

Table 5.1: Resilience Indicators (Garis, 2017)

Indicators	**Authors**
Infrastructure	
Critical Infrastructure and lifelines	**Cutter et al. (2008)** **Bruneau et al. (2003)** **D'Ercole et Metzger (2009)** **Miles and Chang (2011)**
Housing	**Cutter et al. (2010)** **Cutter et al. (2008)**
Transportation network Access and evacuation Evacuation potential	**Cutter et al. (2008)** **Cutter et al. (2010)** **Burton (2015)**
Economic	
Incom	**Cutter et al. (2008) (2010)**
Housing Capital	**Cutter et al. (2010)**
Business and Industries	**Cutter et al. (2010)**
Employment	**Pelling (2003)** **Cutter et al. (2010)**
Social	
Population	**Pelling (2003)** **Cutter et al. (2008) (2010)**
Demographics	**Pelling (2003)** **Cutter et al. (2008) (2010)**
Education	**Pelling (2003)** **Manyena (2006)** **Reghezza-Zitt et al. (2012)** **Cutter et al. (2010) (2014)**

Physical and Urban Environment	
Urban morphology	**Diamantopoulos (1995)**
Green urban space	**Diamantopoulos (1995)** **Resilience Alliance (2007)**
Zoning and building standards	**Cutter et al. (2008)**

5.2.2.3 Conduction of research

The objective of this research is to assess resilience on the long term and to evaluate how planning practices affect it over a period of time. Thus, the first step was the understanding of the urban system of Kalamata, its structure and its different dynamics. This was fulfilled by the historic timeline of the city with a focus on the planning history of Kalamata (Chapter 4). The first step towards the assessment of resilience, was the quantitative data collection. This set of quantitative data consists mainly of statistical indicators that are a useful tool not only because they are analyzable but moreover because of their availability and accessibility; "statistical data remain a vastly underutilized source of information. Such data have many important advantages: they are readily accessible, inexpensive and commonly available across cities and countries" (Chang, 2010, p.303). The first analysis of the quantitative data enabled the identification of certain trends to be further analyzed and complemented with qualitative data from interviews, photos and audiovisual sources in general, both primary and secondary.

As we have experienced form past attempts on the development of metrics to assess and monitor concepts with great similarities to resilience, as for example sustainability, the results are not always successful. "We have documented that the

pursuit of the perfect set of sustainability indicators and the pursuit of the perfect techno-managerial solutions to monitor these indicators did not deliver the relief from global socio-environmental ills we had hoped for." (Kaika, 2017) Thus, the integration of qualitative data is imperative.

Since the urban space involves complex dynamics, qualitative data are needed to further explore the questions. On a second phase, after the necessity of qualitative data was established, the conduction of interviews was the next step of data collection. The choice of interviewees was made with the criterion of their personal and professional knowledge of the case study. Thus, the interviewees are professionals that worked in research or in practice with the case study and had a close but overall knowledge of the evolution of the events after the 1986 earthquake. Their deep knowledge and personal experience from the case study outweighs partially the possibly biased perspective of an over 30 years ago experience. In overall, the interviews helped to identify the major stakeholders involved in the reconstruction of Kalamata and to understand the city's trajectory since, to understand how the plan and the different planning policies evolved over time. Thus, a thorough understanding of the city's dynamics was held through this procedure.

5.2.2.4 Data Collection

In order to explore the dimensions of resilience in different time moments and the way they have been influenced by planning, a mix of quantitative and qualitative data were needed. Although this research is studying the long-term evolution of a city after a disaster that happened 30 years ago, the data of interest were relatively available, and managed to be acquired by the researcher. The use of national Census data and other statistical data from various credible sources together with the existence of multiple researches and reports on the case study facilitated the collection of secondary data. For the primary data, the individuals that were purposefully selected for the interviews were people involved in the reconstruction and the evolution of the city of Kalamata and most

of them were eager to participate in the research. Although the time distance from the events is rather big, their professional and/or personal connections with the city proved to be crucial and they provided important information and knowledge on the case study.

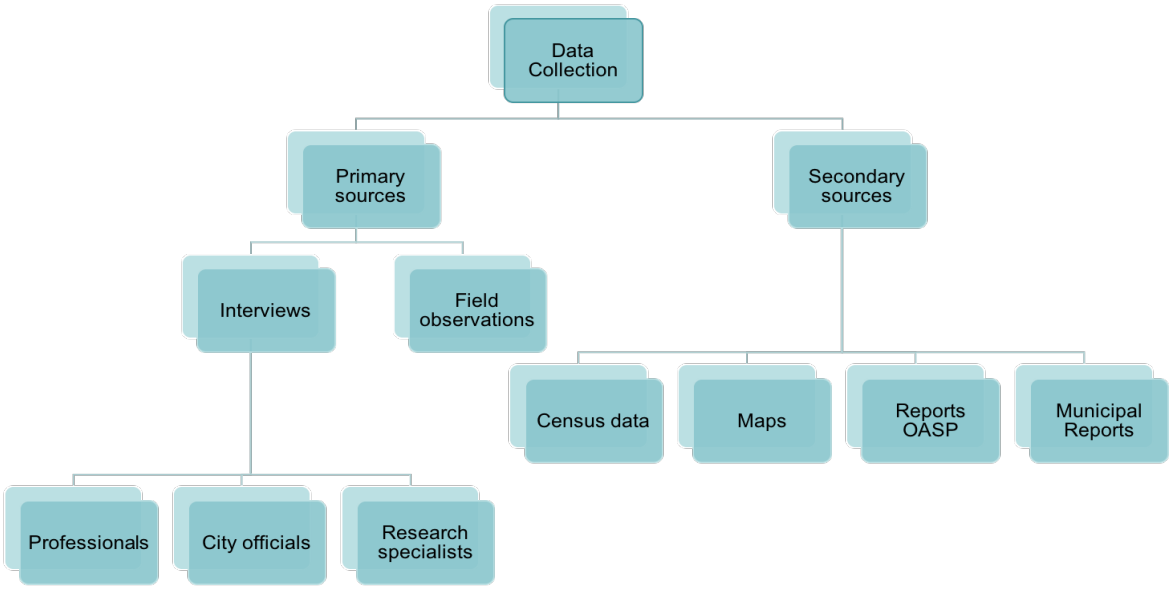

Figure 5.5: Data collection (source: author)

Concerning secondary data, both quantitative, such as **statistical indicators** and qualitative, such as different sorts of documentation for **document analysis**, the following sources were consulted after being verified for their interest and accessibility. All of the following sources were visited during two fieldtrips in Greece in June/July 2014 and September 2015.

-EL.STAT.: The Hellenic Statistical Authority (ELSTAT) is the national statistic organization of Greece, that provides the Census data that are accessible upon request and where the indicators needed for the assessment of resilience were derived from.

-Urban Audit: Urban audit is a European Union project that in cooperation with Eurostat, the European Union Statistical Institution and the National Statistical offices collects

comparable statistics and indicators for large and medium-sized European cities. It covers subjects such as demography, society, the economy, the environment, transport, the information society and leisure. The urban audit indicators are used as complimentary to the ones from ELSTAT.

-EPPO (OASP): The Earthquake Planning and Protection Organizations (EPPO/OASP) of Greece is a dynamic organization, leading and present in every disaster of Greece for the last 30 years. EPPO's archive is a valuable source where all the post-earthquake plans have been gathered from, along with more general studies on seismic protection planning policies in Greece.

-City of Kalamata: The Urban planning office of the city of Kalamata was contacted and visited and is the source of detailed land use plans of the city, both contemporary and old. Also, material concerning the reconstruction of Kalamata was found in the municipal archives of the urban planning office.

-TEE library: The library of the Technical Chamber of Greece, is an important source of the engineering profession related or originated works. Here, works related with the city of Kalamata, the earthquake of 1986 and the overall anti-seismic planning protection policies have been found.

-NTUA library: The library of the National Technical University of Athens is also a source of scientific researches on the field of anti-seismic planning protection. Studies on Kalamata and Greece seismic protection planning policy were reviewed.

On the second phase of this research, in addition to the above list of secondary data, qualitative primary data in the form of **interviews** have been collected from a variety of carefully selected specialists. This strategy of *purposeful sampling* was chosen that according to Creswell and Plano Clark (2007) describes "the intentional selection of participants who have experience with the central phenomenon or the key concept being explored." (p.112) The interviewees were carefully selected based on two criteria: their professional background and their personal experience with the case study. "Rather than selecting a large number of people or sites, the qualitative researcher identifies a small number that will provide in-depth information (…) a key idea of qualitative research is to provide detailed views of individuals and the specific contexts in which they hold these

views." (Creswell and Plano Clark, 2007, p.112) More explicitly, in terms of the first criterion of the interviewees' professional background the selection was focused on city officials, policymakers and planning professionals. The second criterion of familiarization with the case study was equally important and focused the selection on individuals that in addition to the professional background were also familiar with the case study either as a result of their on site working experience or of more personal ties with the city such as family origins etc. All interviewees that were asked to participate in the present research were explained the details and the objectives of this research and were asked to sign the consent forms approved by the Ethics Committee of the University of Montreal. The interviews were conducted in two phases, the first one in June and July 2014 and the second one in September 2015, with the approval of the Ethics Committee of the University of Montreal (No of the certificate: CPER-14-062-D, issued on June 4th 2014).

Apart from the above source of primary and secondary data the research findings have been complemented with primary data from direct **observations** during multiple visits of the researcher to the case study with the last one being in the month of July 2014. The author visited the city of Kalamata to familiarize with the city and to put into context and assess the state of being of the projects that were constructed after the earthquake. Through this visits that included numerous informal conversations with residents, long walks around the city and note taken on different subjects an overall perspective on the city was formed by the author. These non-organized observations complimented significantly the interviews and visits to the municipal archives that were realized at the same time.

5.2.2.5 Data analysis method

The data collected from the Hellenic Statistical Authority and Urban audit were gathered in groups according to the different components of resilience that they were most relevant to. The collected data were not completely in accordance with the indicators presented in Table 5.1, p.96-100 but they were organized in a similar way and covered most relevant thematics. Thus, the data were highly relevant. The above data were analyzed on a longitudinal basis to study their evolution overtime. Several preliminary insights were highlighted from the indicator analysis. At the same time, different reports and researches on the case study were collected and thoroughly researched. These were complimented with newspaper articles from national and local newspapers and different media sources. These combined analyses produced some preliminary insights on the research questions on how planning choices affected the evolution of resilience over time.

However, deeper insights were needed to fully understand the evolution of resilience and the factors that affected it. Thus, the need for semi-structured interviews became evident. The interviews were constructed on the basis of these first insights but developed furthermore. The conducted semi structured interviews were recorded and transcribed by the author. The interviews followed a prepared format but most of them developed in different directions around themes that emerged from the interviewees. They took place in two phases in June 2014 and September 2015 and each one of them lasted between one and two hours. To protect the interviewee's identities, codes were assigned for each interviewee (see Table 5.3). Next, the transcribed interviews were analyzed with the method of content analysis. Different subject and keywords appeared multiple times, such as the role of governance, the availability of the EU funding, etc.

Table 5.2: Interviewee's codes. (source: author)

Code for interviewee	Professional Background	Familiarization with the case study
CO_E_1	Civil Engineer	City official / ex-resident
CO_E_2	Civil Engineer	City official / resident
CO_A_R	Architect	City official / resident
CO_R	Sociology	City official
RS_E_1	Engineer	Engineer
RS_E_2	Engineer	Engineer
A2	Architect	
R1		Resident
R2		Resident

5.2.2.6 Validity Strategies

Internal Validity: triangulation of data

In the present research, the triangulation of the data was a very important part. The choice of the sequential explanatory design, lead to analyzing both quantitative and qualitative data in a sequential order gave the opportunity to the researcher to verify the findings. Thus, the first analysis of the statistical data reflected the evolution of the resilience of the city of Kalamata after the 1986 earthquake. This evolution was validated later by the conducted interviews that offered similar perspectives. However, the qualitative data collected from on-site observations and interviews offered more detailed information of the case study. In this way, the mix of both quantitative and qualitative data led to an in-depth internal triangulation.

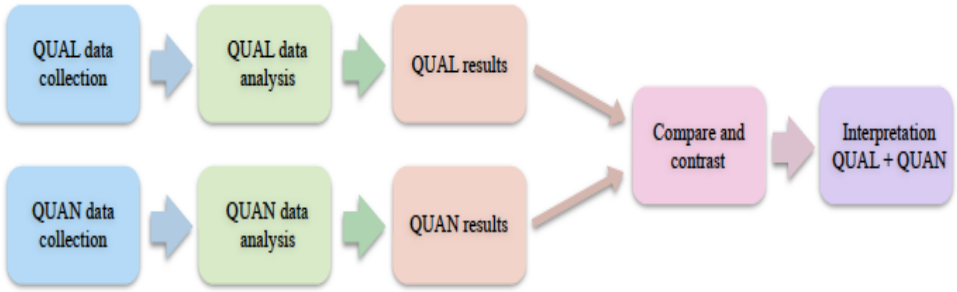

Figure 5.6: Data Triangulation Design (source: Creswell and Plano Clark, 2007)

Concluding it became evident that the mixed methods approach that was used for this research was necessary since neither the quantitative data from the statistical indicators neither the qualitative data alone would reflect the evolution of resilience in the aftermath of the earthquake. Thus, not only the internal triangulation was achieved but it was also necessary for answering the research questions of this research.

External Validity: generalizability of findings?

The most important advantage of this methodological approach is that it leads to the construction of a model for analysis of the long-term recovery that combines the spatial with the temporal resilience trends. Moreover, another advantage of this method is that (at least for the first parts of the analysis) it uses data that already exist and are easily accessed in most parts of the world. As a result, the model is easily utilizable. On the other hand, this methodological approach has also some limits.

One first limit is the concentration in one type of disaster (earthquake) without considering possible threats from other natural hazards. This choice is convenient for the case study that has been chosen, since the city of Kalamata does not face any other serious threats from other natural disasters. However, this choice may cause some inconveniences when the model is applied in urban areas threatened by multiple natural hazards threats and were a multi-hazards approach should be more adequate. A second limit is the very possible inexistence of data for disasters that have occurred over a period of 30 years ago and more. This fact limits the application of the model in disasters that have occurred within a restricted time zone. As a conclusion, the selected methodological approach offers some valuable advantages while the existing limitations don't restrict the validity of the approach nor its generalization in similar contexts.

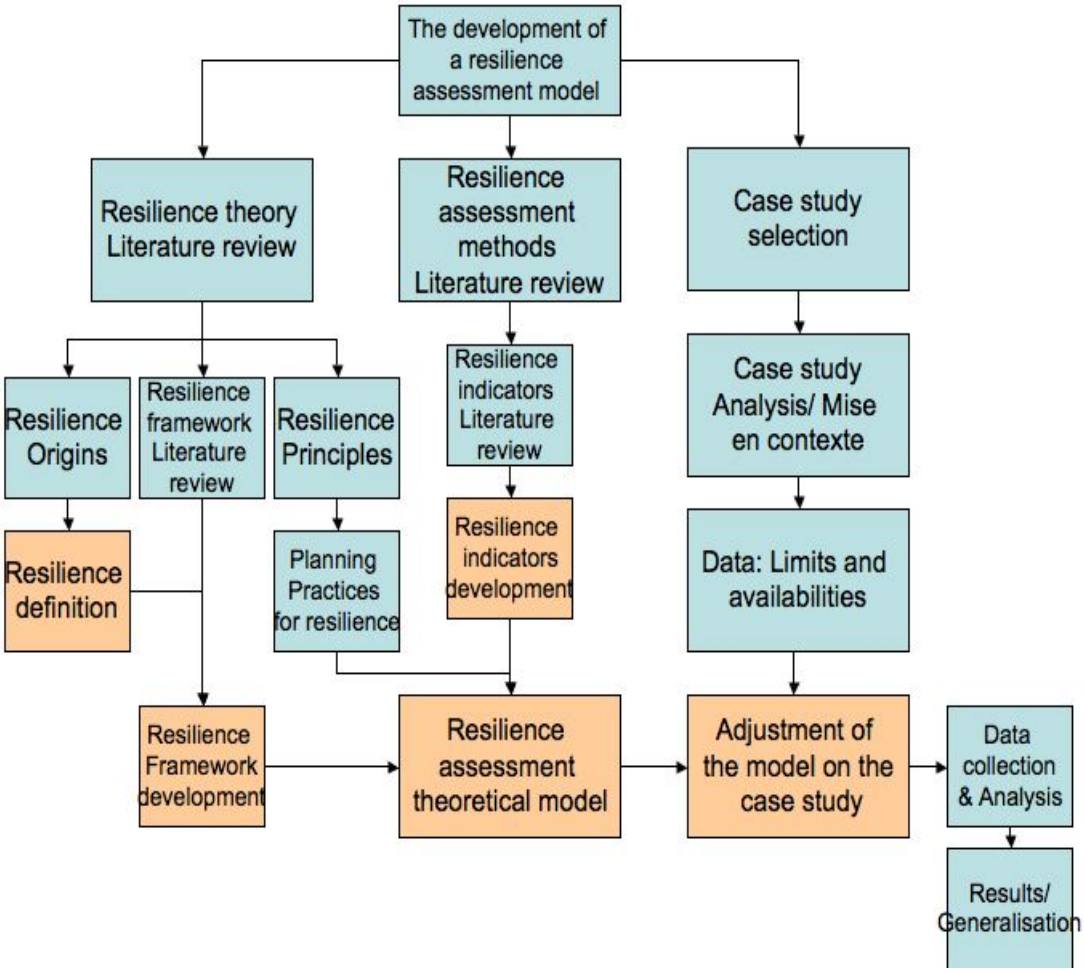

Figure 5.7: Research overview (source: author)

6. The evolution of resilience in the recovery of Kalamata.

6.1 The reconstruction plan of Kalamata.

As it happens in most cases, both the events that preceded the earthquake of Kalamata as well as the events that followed were significant to the evolution of the reconstruction. A resilient reconstruction is witnessed *a posteriori* and on the long-term. Thus, a historic timeline for the reconstruction plan of Kalamata is necessary for the case study to be fully understood and to identify the system dynamics through the criteria of the resilience characteristics (see Chapter 3.7). The question that arises is what was the effect of the reconstruction plan of Kalamata events on the trajectory of the resilience after the city was hit by a disastrous earthquake on the 13th of September in 1986.

As explained in Chapter 4, the Master Plan of Kalamata was officially institutionalized in April 1986, only months before the earthquake hit the city. The master plan had been in preparation for a long time by a team that had researched the city thoroughly over a period of seven years. Consequently, at the time of the earthquake the planning team had a detailed and up-to-date overview of the city's strengths and weaknesses. The local government, in cooperation with the planning team quickly prepared a reconstruction plan having as a base the 1986 Master Plan. Thus, the 1986 Master Plan was used as a base plan upon which the additional challenges that were caused by the earthquake were adjusted.

As a result, a series of maps and plans having as a reference the recently institutionalized 1986 Master Plan were promptly produced. The following timeline illustrates the immediate production of these maps that resulted to the reconstruction plan. (see Table/Figure 6.1, below) Thus the 1986 Master Plan served as a guide for the following reconstruction actions and facilitated the organization of the reconstruction in many ways. The following/preceding figure illustrates the evolution of the disaster cycle in the historic timeline of Kalamata's reconstruction and highlights the rapidity of the reconstruction response and the first planning products to accommodate the reconstruction needs.

Table 6.1: The historic timeline of the post-disaster planning actions.

Dates	Products
September 20, 1986	"Response to temporary and permanent needs (1)" map (1:5000)
September 24, 1986	"Emergency shelter location" map (1:5000)
October 5, 1986	"Response to temporary and permanent needs – temporary shelter (2)" map (1:5000)
October 20, 1986	"Response to temporary and permanent needs (3)" (scale 1:5000)
November 29, 1986	The adjusted urban plan of Kalamata (scale 1:5000)
	"Emergency shelter sites and refugee sapces" (scale 1:10000)
December 12, 1987	Inclusion of the reconstruction program of Kalamata in the Integrated Mediterranean Program of the EEC
December 17, 1987	Funding for the reconstruction program from the Council of Europe Reconstruction Fund and the European Investment Bank
January 15, 1987	"Earthquake damage map (scale 1:2000)
February 23, 1987	"Lots for emergency requisition" map (scale 1:10000)

More explicitly, the familiarity of the planners' team with the background of the city of Kalamata due to their long engagement with the 1986 Master Plan resulted to a quick and credible assessment of the reconstruction needs that were then adapted to the 1986 Master Plan. Thus, the challenges of the reconstruction process were incorporated in the 1986 Master Plan creating an integrated reconstruction plan that addressed the needs of the city further than the damages created by the earthquake.

The local government in collaboration with the planners promptly communicated the reconstruction plan to the Greek Ministry of Public Works that was responsible for the reconstruction as well as to the European Economic Community (EEC). As a result, the central state and the EEC had a detailed overview regarding the needs and priorities of reconstruction for the development of Kalamata only 15 days after the earthquake. The rapidity of these contacts as well as the credibility of the proposed reconstruction plan lead to the achievement of generous funding for the reconstruction projects of the city.

Thus, even though there was no specific plan preparedness for the event of an earthquake, the existence of the 1986 Master Plan provided to the local government the readiness to identify and promote its reconstruction needs and moreover to prioritize the projects included in its agenda. Not only did the 1986 Master Plan save time for the municipality to formulate its needs but it also served itself as a guide for the reconstruction plan.

The reconstruction plan of Kalamata was formulated by the same team that had prepared the 1986 Master Plan and in cooperation with the local government. Thus, the reconstruction plan of Kalamata was generated from the 1986 Master Plan, adjusted to the new needs of relief and reconstruction. Thus, the reconstruction plan was a well formulated plan that was based upon the following three axes. First, the guidance of the adjusted 1986 Master Plan that served as a base for the reconstruction plan. Second, the goal of the preservation of the city's identity and its built heritage. Third, the seismic microzonation studies that were conducted by Earthquake Planning and Protection Organization (EPPO). Seismic microzonation is an analysis of the seismic potential of an area with geological and geophysical criteria and usually includes the division of the area in zones of different levels of risk.

Except for the seismic microzonation of the area, the contribution of EPPO was critical in many senses. The recent occurrence of the 1981 Alkyonides (Athens) earthquake had put earthquake protection in the central agenda of the national policy of Greece (see also Chapter 4.2) and the newly established EPPO (1982), was eager to take action and step in for technical help.

Ultimately, the reconstruction plan of the city was divided in the three following phases. The innovative approach of the reconstruction plan was that every phase served as a preparation for the third and final phase that would be left in the city as a heritage. For this reason, the local government extended the first phase of emergence shelter, to prepare thoroughly the second phase of temporary settlements and to facilitate the long-term organization needs for the third and last phase. Thus, early on after the earthquake the city of Kalamata was planning its reconstruction with a vision on the long-term.

Phase 1: Emergency shelter (short term)

In the first phase, around 10,000 tents were distributed and installed. The tents were used to accommodate not only the citizens but moreover most public services such as schools, medical offices, shops, municipal offices, etc. This was a challenging project since in addition to the distributed tents there was need for the necessary infrastructure such as water, electricity, toilets etc. that had to be provided in the shelter areas. This phase was completed in a short period and within a few weeks the tents were fully functioning. In addition to tents, hotels and cruise ships were provided to this phase of emergency shelter.

The important element of this phase was that it was early on prioritizing the evolution of the following phases and the impact that they would have on the city. Thus, the phase of emergency shelter lasted for about a year while the citizens were being gradually transferred to the temporary settlements of Phase 2. The delay of the activation of the second phase was caused from the increased needs in temporary settlements units which had to be ordered as they were not readily available. Moreover, the careful planning of the sites were the temporary settlements would be placed, further delayed the

procedure. In the following photos examples of the short-term emergency shelter in tents are shown as well as a map with the dispersion of the tent camps sites in the city. As it is reflected from the map, the tent camps were numerous, well dispersed throughout the city of Kalamata. This was a choice with the purpose of keeping the citizens close to their homes for this short-term emergency period.

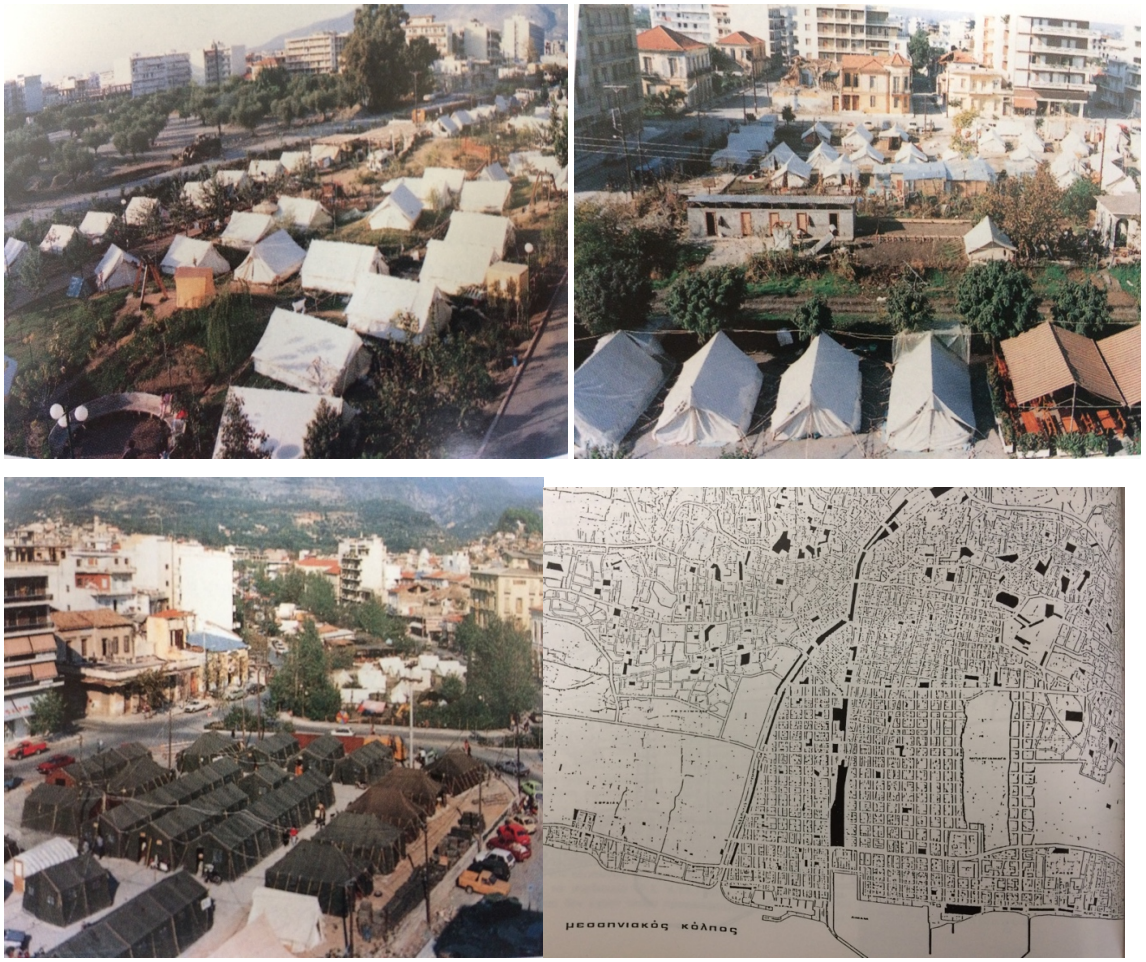

Figure 6.1: Short term tent-shelters and their spatial distribution. (source: Diamantopoulos, 1995)

Phase 2: Temporary settlements (mid term)

This phase was guided by an overall *short term reconstruction program* that provided not only housing but also infrastructure and was implemented within a year. This phase was delayed due to several obstacles in the procedure, but when completed, it included 22 organized settlements of 3000 containers and light prefabricated units, 4 commercial areas with 280 temporary shops, 10 school units with 200 temporary classrooms and several temporary units for social and cultural activities such as a conservatory, a dance school, a scouts' house, a center for the elderly population, etc. The existence of this well planned temporary –in between- phase facilitated the better preparation for the third phase of permanent and long-term reconstruction.

The different types of units that were used in this phase were carefully placed in specifically planned areas. The local government in continuous cooperation with the planning team of the reconstruction plan were aware of the dangers of long-term occupation of these temporary prefabricated units. For this reason, they carefully planned their installment in terms of placement, infrastructure and organization. As a result, the cases of long-term occupation of the temporary units remained minimal. In the following Figures examples of temporary units' settlements are presented together with the map of their distribution in the city. It is evident that the mod term temporary housing camps were much more concentrated in several peripheral areas of the city that were carefully planned with the provision of future incorporation in the urban grid.

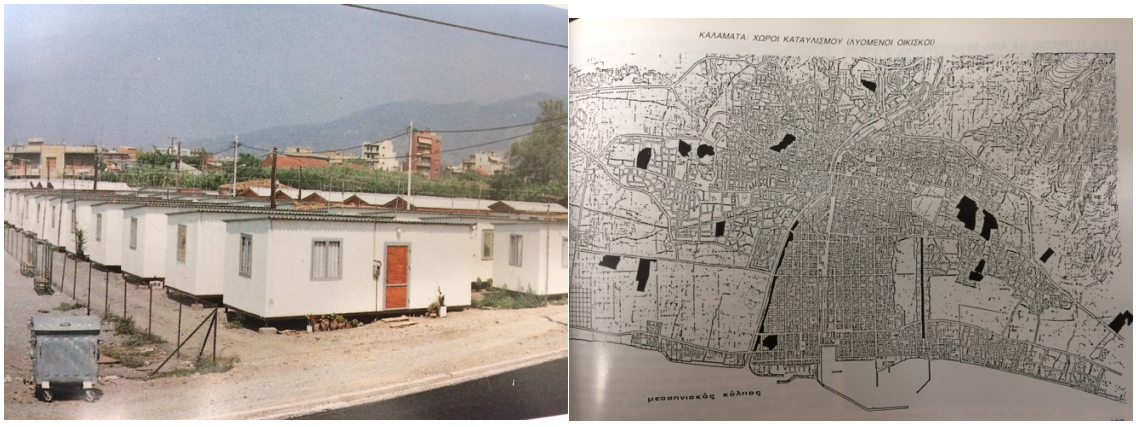

Figure 6.2: Temporary units and spatial distribution of mid-term temporary settlements

(source: Diamantopoulos, 1995)

Phase 3: Permanent housing (long term)

The third phase of the so-called *Final reconstruction* includes not only the reconstruction of the elements destroyed by the earthquake but moreover the overall development of the city through a series of residential, environmental, social and cultural projects for the development of the city. The reconstruction plan was realized by the planning team of the 1986 Master plan in continuous and direct cooperation with the local government. Having achieved funding from the Ministry of Public Works and moreover from the EEC, the final reconstruction phase of Kalamata together with the reconstruction prioritized many urban development projects.

Among the priorities that were set were: The two new district centers that would balance out the monocentricity of the city, the sewage system that was not existent before, the industrial park that would gather all the industrial activities in one area, the marina, the social housing project, the new hospital, the new airport terminal and the new courthouse. These were projects that were much needed for the city but would have small probabilities of being realized in such a short timeline. Thus the reconstruction plan of Kalamata took the shape of an overall developmental strategy for the city that had as a goal to reconstruct the destructed parts but moreover to equip the city with up-to-date infrastructure and to direct its development towards a more inclusive, just and sustainable dimension.

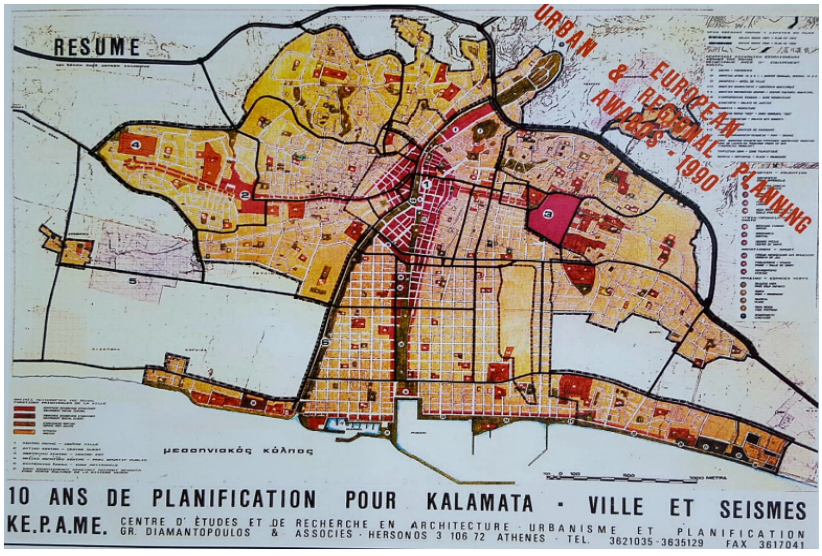

Figure 6: The revised, post-disaster 1986 Master Plan. European Urban and Regional Planning Awards 1990 (source: Diamantopoulos, 1995)

As it is illustrated in the above Figure the central morphological features of the 1986 Master plan were the T-shaped linear center and the ring road. The linear center of the city starts from the historic center and expands towards the seafront and the two main neighborhood centers, the West (Holy Trinity) and the Eastern (Camp). These areas are illustrated in red in the Plan and form a T-shaped continuum. The ring road offers multiple entry points to the city and the connection to the national road network.

Table 6.2: Projects realized in the reconstruction of Kalamata

Projects realized within the framework of the reconstruction plan of Kalamata
The completion of two new district centers, the Western Center with 110 acres and a bioclimatic residential development within the area of the ex-military camp and the Eastern Center with 150 acres and a tenement housing development
The construction of a new marina and the landscaping of the seafront along Navarinou street
The restoration of neoclassical and other historic buildings
The pedestrianizing of a central road axis (Aristomenous street)
The landscaping of the riverbend of Nedon along a total of 5km
The completion of the thematic linear leisure park of trains (54 acres of greenery) and the creation of multiple other green urban areas
The creation sporting centers and playgrounds
The construction and normal operation of an industrial park of 53 acres to abate industrial pollution in the city
The Municipal Cultural Centre
The Municipal Central Market
The Municipal Regional Theatre of Kalamata housed in a former power production plant
The works for improvement of sewerage and water supply networks
The biologic and compost treatment plants.
The reduction of the maximum building rates in selected areas of the city

More explicitly, through these projects the reconstruction plan of Kalamata not only attempted to realize the emergent reconstruction projects but moreover to implement the 1986 Master Plan in overall. According to Diamantopoulos, 1995 the goals of the 1986 Master Plan were (Diamantopoulos, 1995):

-To balance the different parts of the city, by reducing the gap between the center and the peripheral neighborhoods.

-To reduce significantly unnecessary travel within the city while at the same time increasing the time for recreation-education-entertainment-sports-cultural events

-To decongest the center of the city from traffic, directing traffic directly to their destination with the smallest possible route through densely-built sections of the city. This is a necessary plan not only for everyday life but also for an emergency.

-To strengthen the links between residents and local establishments such as schools, cultural centers, etc.), to effectively promote the institution of self-government, to improve the general living conditions of residents in the city.

The above goals, would promote the integrative development of the city but at the same time they could foster the characteristics of resilience as seen in Chapter 3.7. Thus, the question that arises is whether the projects realized in the framework of the 1986 Master Plan and the overall reconstruction plan of Kalamata generated diversity, redundancy, strength, adaptation, autonomy, interdependence and efficiency. In other words, whether the reconstruction of Kalamata created a more resilient urban structure. Using the characteristics of resilience as criteria the following chapters evaluate the development of the different components of resilience in different time periods.

6.2 Was Kalamata rebuilt more resilient? An assessment of post-disaster resilience.

6.2.1 Introduction

The case study of the reconstruction of Kalamata was selected because of the importance of the reconstruction plan and its application through the planning process with an innovative holistic and integrated approach. Because of these two elements, the plan and the process, the reconstruction of Kalamata offers the opportunity to study the recovery of a city affected by a devastating earthquake on the long term. The assumption here is that Kalamata was rebuilt in a resilient way, and the question that arises is how planning was involved in the resilient rebuilding of Kalamata? The present chapter examines if the first part of the research question, namely, whether Kalamata was rebuilt more resilient, is verified.

According to Reghezza-Zitt et al. (2012) (p. 2) resilience pre-exists the impact, it is a potential, revealed through the impact. Therefore, the earthquake of 1986 revealed the resilience of the city of Kalamata. The problematic of this research is focused on exploring how this resilience potential has developed over time. More explicitly how by different planning and policy decisions is future resilience fostered or suppressed. Thus, the resilience of the city of Kalamata is evaluated in different time periods and in different components. Using the resilience characteristics of Chapter 3.7 and applying the assessment model of Chapter ??, the following analysis offers important insights for the development of the resilience potential.

Therefore, for the evaluation of resilience the choice of the resilience components is critical. Maret and Cadoul (2008), describe reconstruction as a dynamic phenomenon with multiple temporalities of resilience. The repair of basic infrastructure, the redynamization of the economy, the return of the population and the cultural resilience are different components of this dynamic (p.123). For the case study of Kalamata's resilience dynamic this research incorporates also the component of physical and urban environment that is critical for the development of resilience on the long-term.

The following sections evaluate through different indicators the resilience of each component using a qualitative correlation with the characteristics of resilience. More explicitly each resilient component is evaluated in terms of its diversity, redundancy, strength, adaptability, autonomy, interdependence and efficiency where this is relevant. These characteristics vary in terms of importance for each component and this variation is discussed in each sub-chapter with the goal of identifying how resilience is better fostered.

The data used for this analysis are primarily derived from the Greek Statistics Authority (GSA) that compiles a census every ten years with the last one in 2011. Within this period two administrative reforms, "Kapodistrias" in 1997 and "Kallikratis" in 2010, altered significantly the country's administrative structure and the geographical limits of the municipalities. As a result, the geographical limits of the municipality of Kalamata where significantly altered making impossible the comparison of two uneven municipalities through time. Thus, where is needed different units of analysis are used to make the longitudinal study. Additional sources have been used throughout the analysis when necessary to compliment the findings.

Ultimately, building up resilience both on the short and the long term is a complex procedure that demands great changes that are not always easy to implement. Thus, this chapter examines the resilience that was revealed in the city of Kalamata by the impact of the 1986 earthquake and how this dynamic potential has evolved over time. For this reason, every component of resilience is explored through a longitudinal point of view, scrutinizing how it has evolved over time.

6.2.2 Infrastructure: Short term resilience

According to the proposed resilience framework (Chapter 5.2.2.1) Infrastructure is the critical component for short term resilience. It is the continuous function of critical infrastructure and lifelines as well as the robustness of the built environment that configure the main factors that influence resilience on the short term after a disaster. The degree to which buildings and infrastructure resist stresses and shocks and continue function determines the immediate response of a city to disruption. Thus, strength and redundancy are critical for short term resilience which mostly shaped by the state of the built environment and public infrastructure.

The case study of Kalamata offers interesting insight on infrastructure resilience. According to the proposed set of indicators concerning the evolution of infrastructure resilience through time this section studies the state of the city's critical infrastructure and lifelines, its building stock and its transportation network. Thus, these three components are explored separately while their aggregation makes for infrastructure resilience.

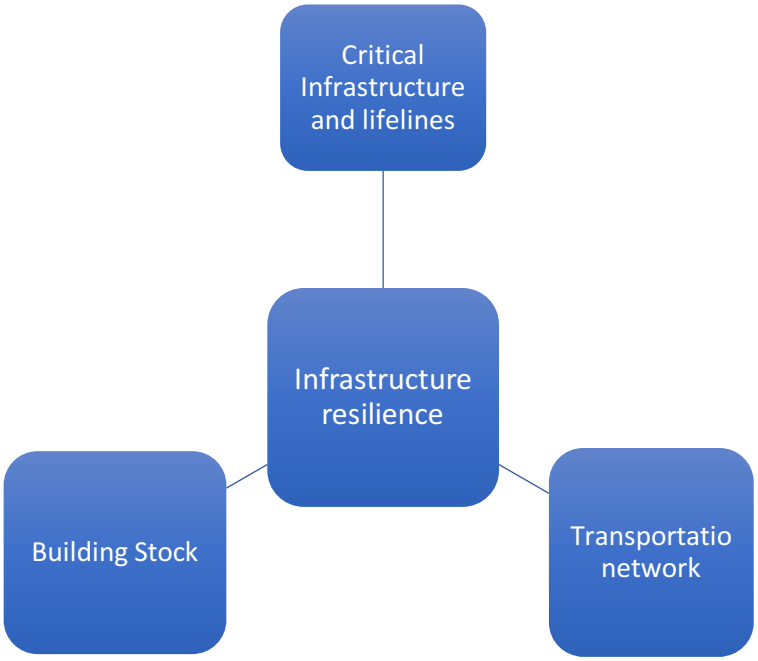

Figure 6.3 The components of infrastructure resilience (source: author)

Critical Infrastructure and lifelines

Critical infrastructure and lifelines include the networks that are essential to the normal functioning of the city and moreover are vital in case of a disruption. Such examples of lifelines are the water supply networks, the electric power supply networks and the communications network. These networks are vital to the urban system while their failures can create domino effects on the system. For example, failure in the electric power supply can cause failure to electric-power operating systems and further reduce the system's resilience. Equally, failure in the communications network will have direct effects on the rescue operations.

Similar domino causing characteristics are found in critical elements such as hospitals, schools, police and fire stations that are essential to the systems function. It is evident that the continuous function of hospitals is critical in post-disaster situations but other services are equally critical. For example, the continuous or quick restoration of school operation is important for a return to normalcy. Therefore, the resilience of such elements and lifelines is important since not only do they support the system but can also generate resilience in other parts of the system.

In the city of Kalamata, after the catastrophic earthquake of 1986 the critical networks performed in a very dissimilar way. The water supply network maintained function throughout the emergency period. The electric power supply network suffered some temporary failures that were restored quickly. Since water and power supplies are vital in case of emergency situations, failure to their systems can cause many further problems. Thus, their robustness and quick restoration were essential to the city's short term resilience. Even though both networks responded relatively well to the earthquake and proved to be strong enough for the post-disaster needs, it was the local telecommunication network that was the least resilient.

In the aftermath of the earthquake the panicked citizens attempted to communicate and the continuous waves of phone calls caused overload to the local telephone network system (OTE) that was blocked. The damages to the telecommunications network were extended and it took time and effort to restore full function of the system. The extended failures of the telecommunication network in a time

where cellphones did not exist and the local network was the only way of communication, challenged the short-term resilience of the city significantly.

In cases of emergency, communications are vital for citizens and for officials that organize and coordinate emergency response. Thus, redundancy in communication is a critical characteristic for infrastructure resilience and it was not existent in the aftermath of the Kalamata earthquake. Today, due to the multiple new forms of connecting communications are much more rapid and immediate. The existence of cellphones and the direct communication through social media alleviates the pressures from one communication system and diversifies the options which is critical for the system's resilience. Therefore, being today much more diversified redundant the communications system has improved its resilience since 1986.

Concerning critical elements such as schools, hospitals, fire stations their resilience to the 1986 earthquake presents some differences. Among them the schools were mostly housed in traditional buildings and were severely affected with 70% of them with serious structural damages that needed important reconstruction. The inadequacy of school buildings caused further effects rather than the problems of their reconstruction. Having no schools obstructed the return to normalcy for the student population and recreation outlets for the students were needed. This had an important effect on the resilience of school infrastructure but had also effects in the overall resilience of Kalamata. Although the hospital of Kalamata was not severely affected by the earthquake, the pre-existing need for new infrastructure was highlighted and among the projects realized was the New Hospital in the outskirts of the city. Fire and police station were not documented as affected.

Thus, considering the improved critical facilities including a new hospital unit, and new school units together with the increased resilience of communication network, presuming that the water supply and power supply systems will perform as well in a future disruption, the resilience of critical infrastructure and lifelines has improved since the catastrophic earthquake of 1986. The characteristics that emerged as important for critical infrastructure and lifelines are strength, diversity and redundancy. Concluding, being resistant to disturbances, having multiple diverse options, an overplus and overlap between them offers a more resilient environment for critical infrastructure and lifelines.

Building Stock

The second component of infrastructure resilience is the resilience of the city's buildings. This inherent resilience of physical structures is closely related with the application of the Greek Seismic Design Code and its evolution over the years. As a reviewed in Chapter 4.2 (p.79), Greece has developed an elaborate Seismic Design Code resulting from the high seismicity of the country and the unfortunate recurrence of seismic events. At the same time, the country has an old built heritage that dates long before the implementation of the first Seismic Design Codes (1959) and which carries the cultural history of the country. The combination of the later with the recent history of rapid and extensive urbanization that happened in Greece in the 1970s result to a complex built environment. A rather resistant and robust recent built environment that coexists with a very fragile and important old built heritage. As a result, in the occurrence of seismic events, it is usually the latter that suffers the most and thus the robustness of buildings is critical.

The case study of Kalamata is such an example. The 1986 earthquake damaged the city in a very dissimilar way. For example, the historic commercial city center with old masonry wall buildings was devastated, while damages in the western part of the city that had only been developed recently and where buildings were built according to the 1959 Hellenic Anti-seismic code, were minimal. This is apparent in Figure 6.4, that illustrates the position of the affected and demolished buildings.

Figure 6.4: Affected buildings in Kalamata (source: Diamantopoulos, 1995)

While the overall building stock of the city was severely affected, it was the monuments and the traditional buildings that suffered the most. According to Ioannides, K. & Dikeoulakos, V. (2001) p.2-3, 'among the inspected buildings, 22% of them were demolished, 21% suffered heavy structural damage, 26% with light structural damage and 32% with no or light non-structural damage. The condition was slightly better for public buildings and facilities (50% affected), although monuments and traditional structures (among them old school buildings) were severely and extensively affected (80%)'. Thus the building stock of Kalamata showed very low resilience.

The low resilience of Kalamata's buildings in the 1986 earthquakes is indicative of the state that most Greek cities were in the 1980s and can be explained by the historic timeline of the formalization of the Greek Seismic Design Code. As explained in detail in Chapter 4.2, p.79, the Greek Seismic Design Code was first institutionalized in 1959, and updated further in 1985, in 1995 and last in 2000 when the National Greek Seismic Design Code 2000 was the last one to be institutionalized. Most Greek cities however, date long before these dates and therefore most of their buildings at the time did not follow the seismic code's specifications. Moreover, the older building structures in such earthquake prone areas are most probable to have experienced multiple earthquakes that over time affect the building's foundations in unnoticeable ways. Thus, the building stock presented different variations in terms of resilience and resistance to disturbances.

Since the 1980's, the building stock has been enriched countrywide with much more recent constructions that follow elaborate seismic design codes. However, it is common that the historic centers of cities are the eldest parts of the urban grids. Since they did not follow any seismic design specifications during their construction and have probably accumulated structural damage from previous earthquakes they are often the most vulnerable. Thus, a measure of the vulnerability of a city's buildings is whether their date of construction was before 1959 (high vulnerability), between 1959-1986 (moderate vulnerability), 1986-2000 (moderate-low vulnerability) or after 2000 (low vulnerability). The following Figure 6.7 illustrates the age of Kalamata's building stock according to the Census data 2011, following the previous divisions and is indicative of the vulnerability of the city's buildings. From the figure, we estimate that today most Kalamata's buildings have been constructed after the implementation of the first Seismic

Design Code in 1959 and consequently follow the minimum anti-seismic specifications. Moreover, an important percentage (29%) is constructed after the 1985 update, and an 11% after 2001 which was the latest update of the Seismic Code. Therefore, the majority of the city's buildings are built according to the Seismic Design Code of Greece and that improves their resilience to seismic shocks.

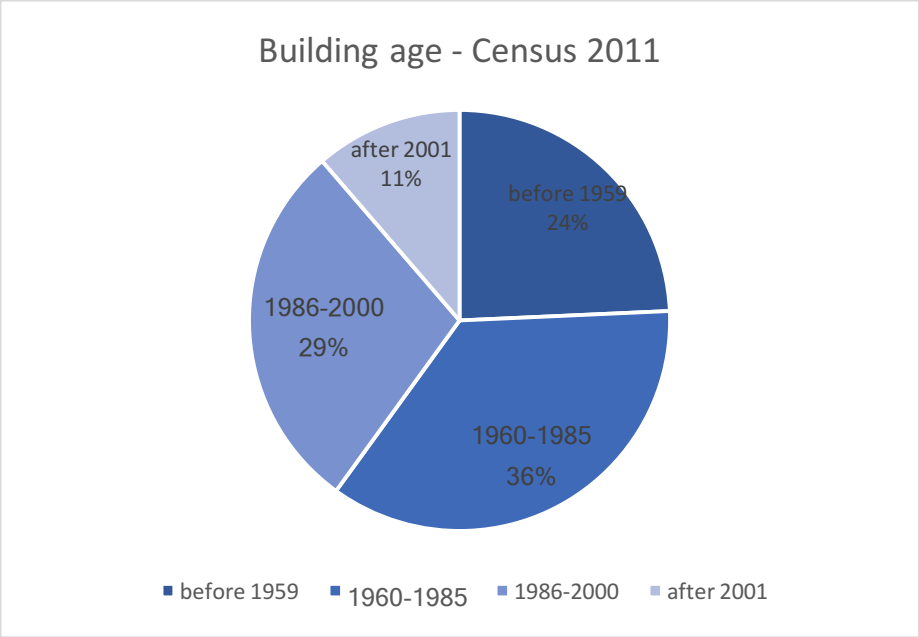

Figure 6.5 Building age according to the Census data 2011 (source: author)

Still, an important percentage of 24% of the buildings are built before 1959 which increases their vulnerability. At the same time these buildings are the ones that suffered the greatest damages from the 1986 earthquakes and were then rehabilitated. The fact that they have been rehabilitated according to the latest standards increases today their resilience. This was witnessed during the latest significant earthquakes in March 1, 2004 (M5.4) and in February 14, 2008 (M6.5) that happened near the city of Kalamata and had minimal impacts on the city's buildings. Thus, the building stock of Kalamata presents an improved tolerance to disturbances and seismic shocks.

Moreover, comparing the percentage of the buildings of Kalamata with the criteria of their construction period, to the ones in the Prefecture of Messenia and to the ones in Greece the insights are interesting. According to the 2011 Census data that are illustrated in percentages in the graphic in Figure 6.6 it is evident that the building stock of the city of Kalamata was renewed after the 1986 earthquake.

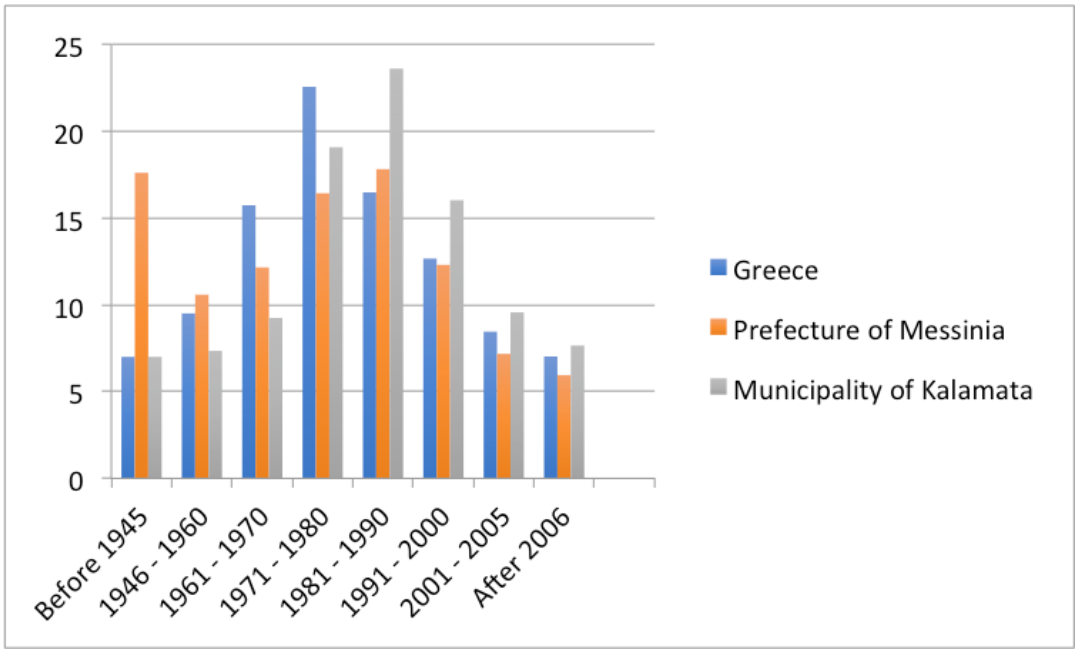

Figure 6.6: Construction Period of buildings – Census data 2011 (source: author)

Even though it is expected for the building stock of a city to be renewed after a disaster of similar extent the graph illustrates some additional points. The percentage of buildings constructed before 1945 is significantly high for the Prefecture of Messinia which is explained by the existence of many traditional villages of the area. For the same period, the municipality of Kalamata holds a similar low percentage with that of Greece. The next period, from 1946 to 1960 Kalamata maintains a similarly low percentage while both Messinia and Greece are more elevated. This is significant because the buildings of this era are built without the specification of the first Greek Seismic Design code (1959) and thus are less resilient. This trend continues for the two consequent periods from 1961 to 1970 and from 1971 to 1980 where Kalamata presents a significantly lower percentage than the one of Greece. During the next period that coincides with the earthquake of Kalamata the percentage of buildings built during it is greatly increased in the city of Kalamata due to the post-disaster reconstruction. For the following periods this trend continuous with a lower yet existent dynamic. Thus, from 1991to 2000, from 2001 to 2005 and beyond, the municipality of Kalamata has higher percentages of buildings built during these periods than the prefecture of Messinia and Greece, and thus greater resilience.

In overall, in Greece most buildings date back to the 1971-1980 period, during which the *Antiparohi* system (see p.74) was flourishing and the post war development dynamic was intense. The prefecture of Messinia follows a similar trend with lower dynamic and with the exception of a great percentage of older buildings that date before 1945. The Municipality of Kalamata follows this trend belated by a decade, having the majority of its buildings built during the 1981-1990 period. Thus, it is confirmed by the above data that the building stock of Kalamata is newer compared to the rest of the country. Consequently, it has been mostly constructed following the latest seismic design codes and it is more robust and resistant to earthquake shocks and chronic stresses and thus, more resilient.

Another element that improves the resilience of Kalamata's building stock is the compliance of the building permits to the microzonation studies. In the aftermath of the 1986 earthquake, extensive micro zonation studies were conducted by EPPO for the area of Kalamata (see also p.126) that resulted to an in-depth knowledge concerning the geomorphological conditions of the area. Thus, knowledge on the soil conditions of the city is detailed and respected up to today. This is reflected today in the new building regulations proposed by the 2011 Master Plan of Kalamata that minimizes the building coefficients in areas with unstable soils and high demands of construction such as the suburb of Verga and that are applied despite the great oppositions.

Concluding building stock resilience has been increased since the 1986 earthquake of Kalamata for both the recent and the traditional buildings of the city. Building stock resilience is reflected in the resistance of the building stock to disturbances and thus its critical characteristic is its robustness or in other words, strength.

Transportation network

The transportation network is the third component of infrastructure resilience. This element is two-dimensional. The first dimension is the need for continuous function of the city's circulatory network that is important for circulation and access both in normalcy and in emergency times. The circulation of the road network is complimented by alternatives such as urban transit systems and bicycle routes. The second one is the evacuation alternatives from the city. Thus, apart from the optimal urban circulatory system, what is also needed is 'an ideal circulatory system for the city to be rapidly evacuated, without passing through the densely populated central part of the city' (Diamantopoulos, 2008, p.135). The main element of the evacuation dimension is the road network that accesses the city and constitutes the evacuation pathways from it in case of emergency. However, other forms of transportation such as air, sea or rail travel also contribute as alternatives.

For the first dimension, the city's circulatory network, the post disaster situation was rather problematic. Since most of the damages after the 1986 earthquake were in the historic and commercial city center, this was the most affected area inside the city and the resilience of the circulatory network was low. The road network within the city of Kalamata was blocked by heavy debris from the multiple collapsed buildings (see below Figure 6.7) mostly concentrated in the historic center, the area where most of the damages were situated. Thus, the need for alternative means and trajectories to transverse through and around the city and the overall improvement of the circulatory network was revealed in the aftermath of the 1986 earthquake and became a priority.

Figure 6.7 City debris in the aftermath of the earthquake (source: Nikos Iliopoulos)

To address the problems created by narrow streets, narrow sidewalks and large building heights, the 1986 Master Plan lowered the building coefficients in large parts of the city, mostly in the center, resulting to lower probabilities of heavy debris in a future earthquake. While the idea existed prior to the earthquake, there were great oppositions to lowering the building coefficients. The devastating impact of the earthquake revealed the need for immediate implementation of lower coefficient. Thus, today's lower building coefficients increase the city's circulatory network resilience since there is less probability of heavy debris in case of an earthquake.

Except for the decreased probability of blocked roads from debris, much effort towards the optimal function of the city's circulatory system has been realized today. The public bus system, shown below in Figure 6.8 together with the expanding bicycle routes and pedestrianized network provide multiple alternatives and overlaps that further contribute to the system's resilience.

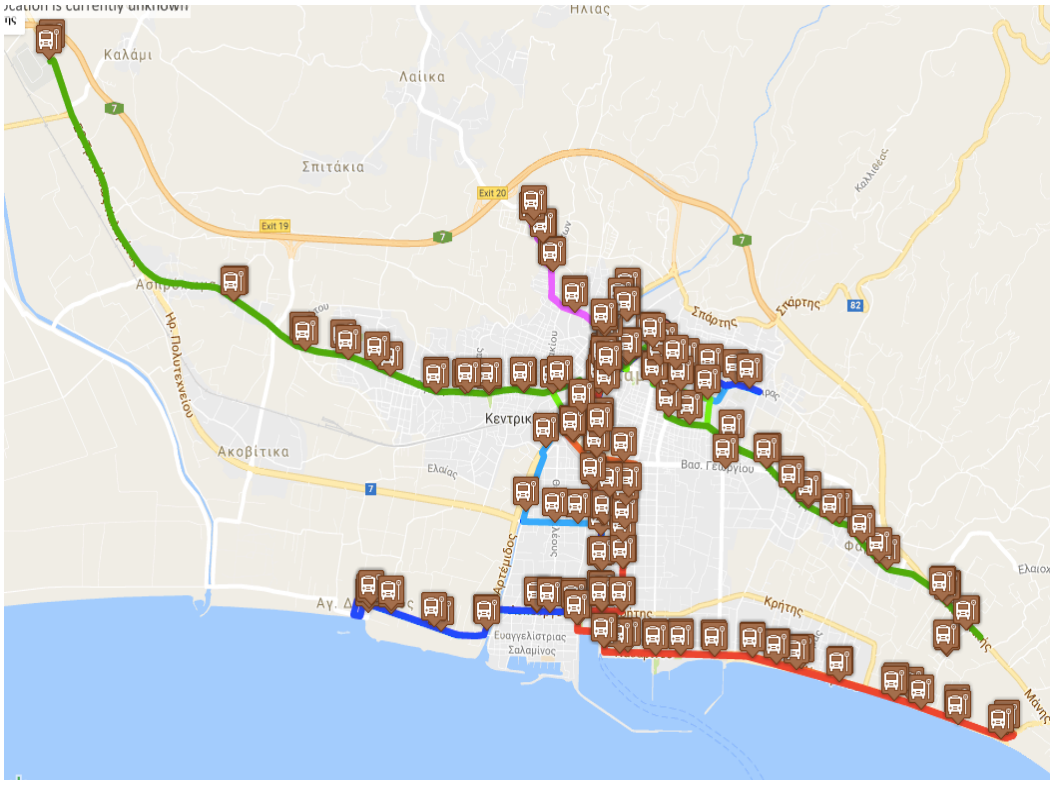

Figure 6.8 : Municipal transit system public bus system (source: www.kalamata.gr)

The second dimension of the transportation network, namely the different alternatives of accessing and evacuating the city presented different levels of resilience in the aftermath of the 1986 earthquake. Concerning the transportation facilities that serve as accesses or gates to the city such as the airport, the railway and the seaport, even though at the time they had been under-operating they were able to maintain function and to accommodate the increased emergency demands. However, the road network which is the main carrier of the evacuation traffic did not maintain function evenly. Not only within the city the road network was blocked due to heavy debris in multiple spots but also parts of the roads that connected Kalamata with Sparta and neighboring villages were blocked by landslides and rock falls. Thus the performance of the transportation network in terms of resilience was low.

The 1986 Master Plan included a ring road that provided several entrances to the city and a good evacuation strategy and that alleviated the congestion caused by the western entrance to the city. However, the ring road was not constructed until 2016 within the framework of the new national road that connects the eastern Peloponnese. The new ring road was only inaugurated in December 2016. Not only the ring road creates multiple entrances to the city but also directs regional traffic to the touristic region of Mani without passing through the city of Kalamata. Thus, even though its construction delayed almost 30 years, today the ring road alleviates traffic from the city and improves in this way the quality of life within the urban environment. In this way, it improves the function of both the circulatory network and the evacuation ways of the city.

In terms of resilience, by providing alternative ways the ring road improves the efficiency of the system and thus increases the resilience of the road network significantly. However, the delay of its construction reveals that its importance was not prioritized. Even though the ring road was one of the main elements of the 1986 Master Plan and while the need of such a ring road was revealed by the earthquake since the ring road creates the prerequisites for easy evacuation and access to the city through multiple entrance points, its creation was not included in the reconstruction projects.

The corresponding points between the ring road that was included in 1986 and the one that was finally constructed in December 2016, 30 years after the earthquake are apparent in Figure 6.9, below.

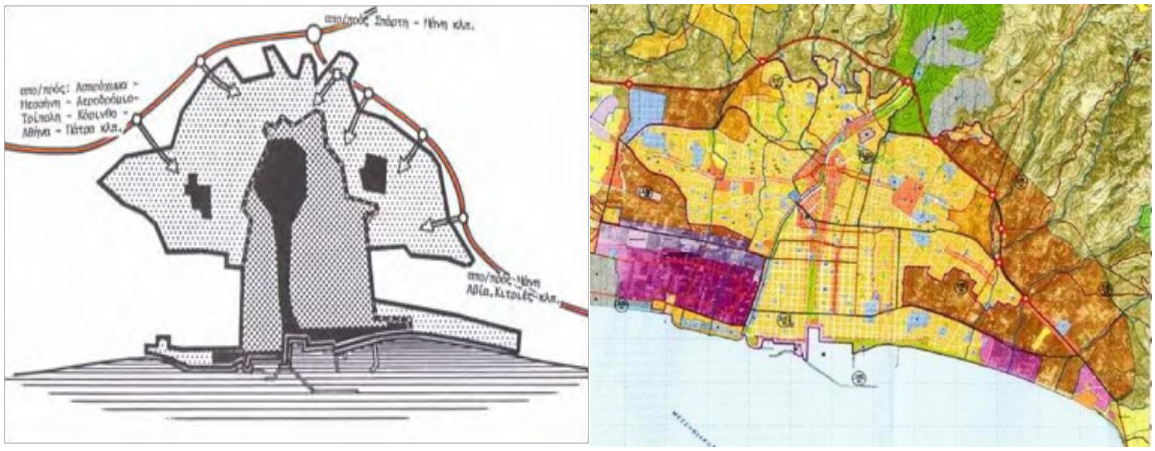

Figure 6.9: (Left) The ring road that provided several entrances to the city and a good evacuation strategy. Master Plan 1986 (source: Diamantopoulos, 1986) (Right) The ring road constructed in 2016 (source: Municipality of Kalamata)

Except for the road network which is the main carrier for access and evacuation, the alternatives transportation means create diversity and redundancy in the evacuation system of the city and consequently improve the resilience of the transportation network. Today, the developing sector of tourism in the Prefecture of Messenia has given a new dynamic to the airport of Kalamata which is currently one of the fastest growing airports in Europe. Although the city of Kalamata has had an airport facility since 1959, this was only used for domestic flights during the first years of its function. The first charter flights started in 1986, and the quickly increased demand led to the construction of a new terminal in 1991. The airport is situated in the outskirts of the city near the town of Messini and is today and important access gate not only to the city but moreover to the region and the country.

As illustrated in Figure 6.10 in the following page, today the increased traffic of the International Airport of Kalamata reflects the dynamic of the touristic section of the area. The airport traffic has been increasing with direct flights to many European cities and is proven to be one important gate for accessing the city and the region and moreover a Southern gate to the country. Thus, the airport has today a much more significant role in the transportation network of Kalamata compared to the one it had in 1986.

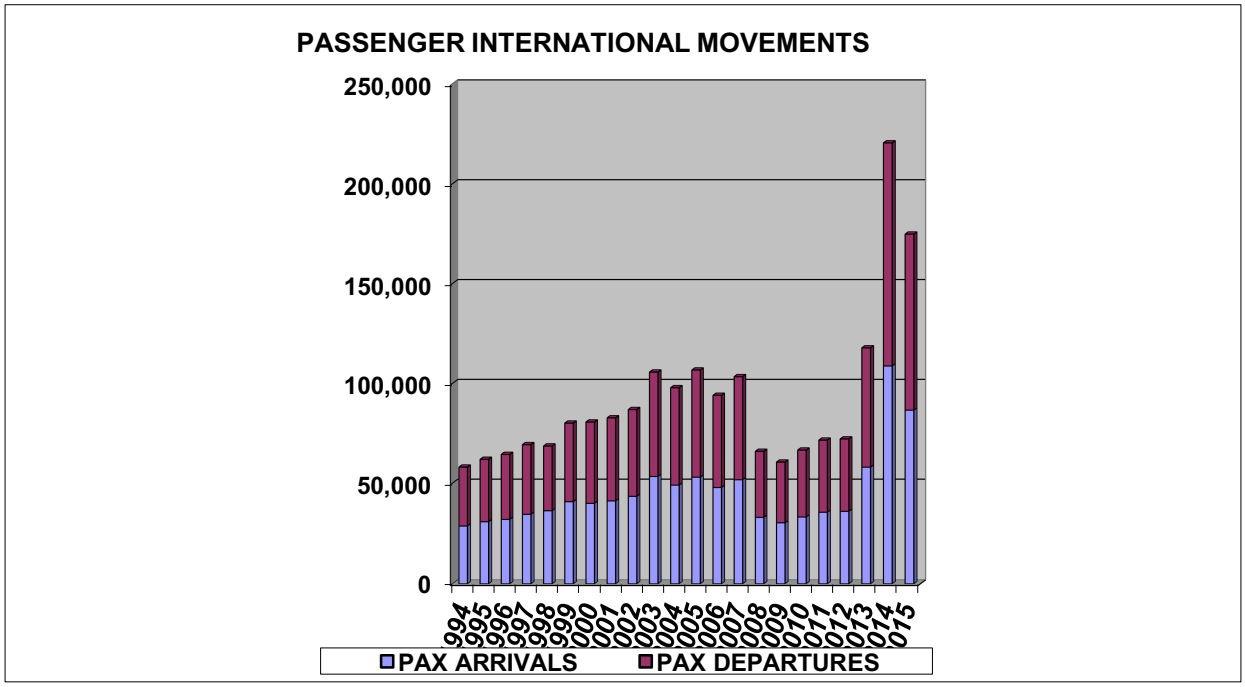

Figure 6.10: International Air traffic in the International Airport of Kalamata (source: Civil Aviation Authority of Greece)

Another important element of the transportation network is the railroad. The railroad is important in terms of infrastructure since it provides an alternative access to the city but has also significant historical value since it revolutionized the access to the city and it is strongly connected to its industrial past. Due to its historic railroad routes, buildings and scenery, and the architectural value of its stations (see Figure 6.11) the railroad network is part of the country's cultural heritage and has important potential to be revitalized for tourism purposes. Within the city of Kalamata, the linear Train Park served as shelter during the 1986 earthquake and accommodated the tents for the first, short term phase of reconstruction. Today, it preserves the connection of the city to its railroad past.

Figure 6.11: The railway station of Kalamata (source: www.kalamata21.eu)

Thus, even though its history is very connected to the city of Kalamata ith a reverse trend to the developing trend of the airport, the railroad has stopped operating in 2011. After years of mismanagement and under-operation and as a result of the budget cuts that are happening due to the ongoing financial crisis in the country the operation of the railroad in the Peloponnese is today suspended. The railroad served the city for more than a century since its inauguration in 1901 and connected Kalamata with Patra, the biggest city of the Peloponnese and Athens. Likewise, the suburban railway of Kalamata is equally suspended. Even though the railroad network was long under-operating, the continuum of its operation is critical for the preservation of the infrastructure. Today there is a long discussion on how the network could be orientated towards touristic use but the outcome is uncertain.

Another critical transportation facility of importance is the port of Kalamata. Likewise, the railway, the port had an equally significant role in the 1986 earthquake. The inauguration of a maritime line that connected the city of Kalamata to Crete was the reason that a large crowd of people attending was at the port in the open-air at the time of the earthquake. The great attendance in an outdoor event that coincided with the time of the earthquake was critical for the small number of fatalities. Moreover, in the aftermath of the earthquake the port hosted the cruise ships that served as temporary shelters for the citizens of Kalamata. Today the port that is situated in the physical termination of the

linear train park and in close proximity to the city is operating with limited passenger and commercial traffic. However, the maintenance of its operation is critical since it preserves the operational potential and the infrastructure unlike the railroad whose suspended operation has as a result the non-maintenance and degradation of its infrastructure.

An overview of the different elements of the transportation network presents a series differentiations. In terms of function and efficiency, the road network connection and the airport are improved with new infrastructure creating improved accesses to the city. The port sustains its operation while the railroad network has suspended its operation. The suspension of operation of the railway is problematic since it degrades existing infrastructure that could provide alternative accesses to the city. However, the improvement of the rest of the transportation infrastructure balance out the deficiency from the railway since as a whole the overall accessibility of the city is significantly improved.

Until recently the city was not easily accessible. Even though it is situated in close proximity to the capital city of Athens, the aged road network considerably increased travel times. At the same time the air, rail and port facilities were all under-operating. Today this trend has been reversed, the city is connected efficiently to Athens and the rest of the country via a modern national highway. The airport traffic has been steadily increasing over the last years and the port of the city is operating providing alternatives and thus diversity and redundancy for the city. Thus, with the exception of the suspended railroad network the function of the transportation network of the city is considerably improved with an efficient, diverse and redundant and thus more resilient system.

Overall Infrastructure resilience.

In conclusion, because of the immediate and increased demands of function on the immediate post disaster period, infrastructure resilience is the most important component of resilience in the short term. In the aftermath of the earthquake, the infrastructure of Kalamata responded in a dissimilar way. As analyzed in the previous chapters in detail, while critical infrastructure and lifelines –except for the telecommunications network- managed to maintain function and to accommodate the high needs of the emergency period, the building stock and transportation network did not perform as well.

From the analysis of the different components of infrastructure resilience it resulted that each one needs different characteristics. Thus, while the resilience of critical infrastructure and lifelines is fostered by the system's diversity, redundancy and strength, the resilience of the building stock is mostly dependent on the robustness and thus the strength of the structures. For the circulatory network to be resilient it needs to provide fluidity in normalcy as well as in times of emergency and consequently its resilience is fostered by efficiency, diversity and redundancy so that multiple options can provide alternatives for the continuous and optimal operation of the systems. Likewise the optimal operation of the different transportation systems that access the city, creates further redundancy and diversity and thus improves the system's resilience.

Concluding, the overall resilience of the transportation network of Kalamata, depends mostly on the criteria of diversity, redundancy, strength and efficiency. In the following table, the most important insights from the resilience assessment for infrastructure are summarized. The first column describes the component of infrastructure resilience. The second column presents a brief description of the short-term resilience presented in the aftermath of the 1986 earthquake and what is expected today. Lastly in the third column the resilience characteristics that emerged as critical for each component are highlighted with bold letters.

Table 6.3: Infrastructure resilience indicators in context

Infrastructure	Resilience assessment	Resilience characteristics
Critical Infrastructure and lifelines	**1986:** Except for the schools' buildings and the telecommunications networks most critical elements and lifelines of the urban system were resilient.	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: New ways of communications (cellphones, social media) as well as a renewed building stock for the city's critical facilities (schools, hospital) has increased the overall resilience.	
Building stock	**1986:** The building stock of Kalamata showed low short-term resilience, a large percentage of buildings were severely damaged.	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: The building stock today is more resilient due to their renewal according to the stricter building codes.	
Transportation network and evacuation potential	**1986:** The circulatory system showed low resilience due to the heavy debris that blocked the streets. Low overall resilience of the road network.	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: Today the circulatory system is improved due to the implemented regulations. Moreover, new facilities such as the new national road, the new airport, etc. improve furthermore the resilience of Kalamata.	

6.2.3 Economic: Mid-term resilience

The economic component is the one shaping resilience in the mid-term. For a city to return to normality the rapid restoration of economic activities is critical. In the research's case study, the earthquake of Kalamata caused severe disruption in the economic life of the city. The most destructed part of the city was the historic center were most of the city's commercial units were situated. The extensive destructions in this area caused not only severe damages to the buildings but also the destruction of big amounts of merchandise and professional equipment. Thus, a preliminary observation concludes that the great concentration of the city's commercial units in the city center was not very resilient. Moreover, due to the uncertainty that followed the earthquake many industries and manufacturing units stopped operating for many weeks due to fear of recurrence of strong aftershocks. Thus, the direct and indirect economic losses from the earthquake were extensive.

In terms of economy, the city of Kalamata and its surroundings have always been a strong agricultural economy with products of distinct quality that are recognized worldwide such as olive oil, olives, figs and other products. Also in the past, the city had a strong industrial sector that in the 1980's was degrading. Before the earthquake, many industrial and manufactural units were closing and the local economy was characterized by stagnation and even decline due to the de-industrialization of the city. Lastly a direction towards the services sector was apparent from that time. Thus, a new direction for the economic activity for the city was needed.

Like the rest of the components for the economic sector of a city to be resilient, it must embody the characteristics of resilience. In other words, it must diverse, redundant, strong, adaptable, autonomous, interdependent and efficient. Today agricultural economy and tourism are the two pillars of the prefecture's economy and their reinforcement and diversification is key to the city's economic resilience.

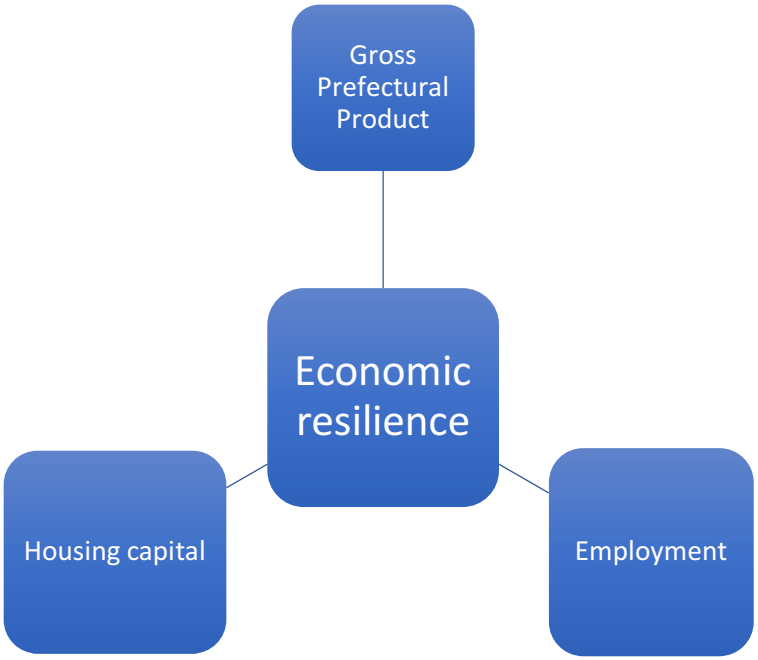

Figure 6.12: The components of economic resilience (source: author)

Gross Prefectural Product

A first indicator for the evolution of the economy of Kalamata in the last years is the Gross Prefectural Product. Compared to the Gross Domestic Product of Greece in the figures below some first observations can be made. From the two figures on the left it is observed that like the Gross Domestic Product of the country, the Gross Prefectural Product of Messenia was increasing with similar rhythm until 2008 when the Greek crisis begun. However, during the crisis, the decrease of the Gross Prefectural Product of Messenia was smoother than the Gross domestic product of Greece while it appears to be stabilizing earlier. Likewise, the per capita GDP of the prefecture of Messenia presents a smoother decrease and early stabilization compared to the one of Greece. Concluding, from the observations of the GDP evolution in the country and in the Prefecture of Messenia during the last fifteen years it is apparent that Messenia has been able to adapt to the new circumstances and has a stronger and thus resilient economy than the country.

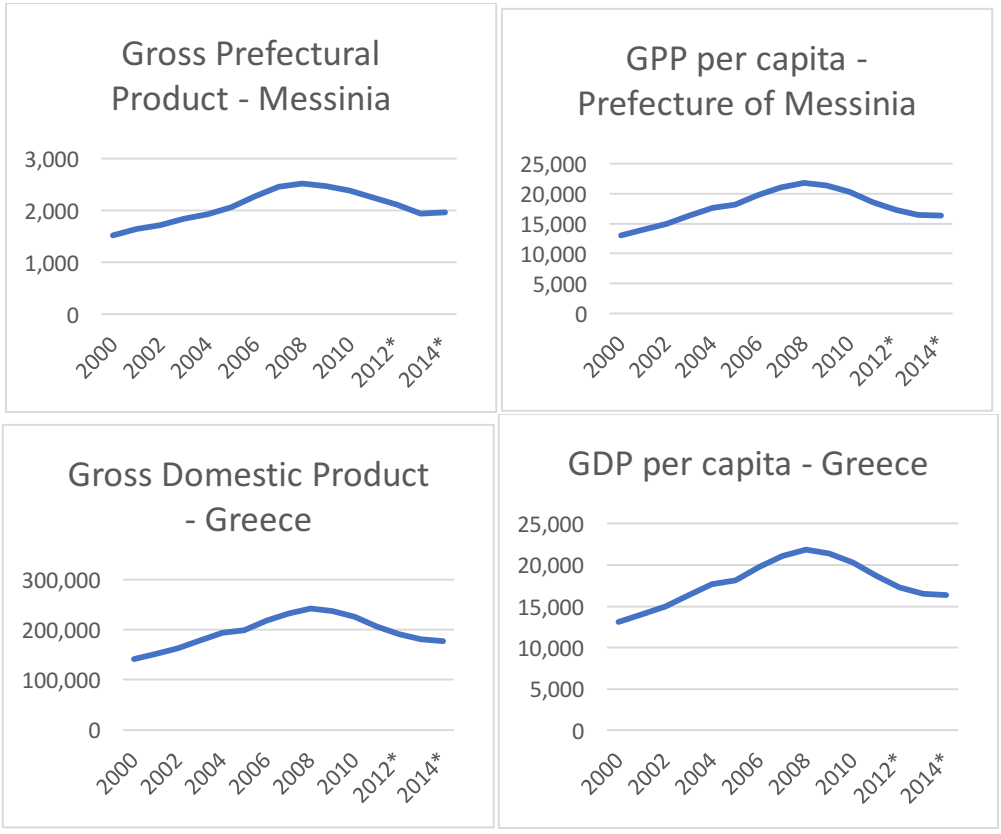

Figure 6.13: Gross Domestic product and Gross Prefectural Product, (source: Census data)

Employment

An important element for the analysis of the resilience of the economy is employment. High employment rates, diversity in the dispersion in sectors and adaptability are keys for the economic resilience of a city. The following table presents the employment data of the municipality of Kalamata from 1981 to 2011.

Table 6.4: Employment: Census data 1991-2011 (source: author)

Indicator	**Sub-Indicator**	**Municipality of Kalamata**			
		1981	**1991**	**2001**	**2011**
Employment	Economically Active	13,851	16,590	24,938	29,749
	Employed	13,288	14,989	21,878	23,967
	Unemployed	563	1,601	3,060	5,782
	Youth Unemployment	No data	802	1,549	1,928
	Non-working population	19.265	20,617	29,739	40,100
Economically active	Total	13,851	16,590	24,938	29,749
	Employers	716	1,263	3,297	No data
	Self-employed	3,520	4,002	3,576	No data
	Wage-earners	8,506	9,372	15,839	No data
	Unpaid members	612	460	677	No data
	Other	557	1,493	1,549	No data

In 1981, 95,9% of the economically active population was employed with a 4% unemployed. In 1991, five years after the earthquake of Kalamata and thus in the mid-term reconstruction phase, 90,3% of the economically active population was employed while a 9,6% unemployed. Even though the unemployment percentage increased considerably, taking into account the impact of the earthquake in the economic activities

of Kalamata and the preexisting de-industrialization of the city, the increase seems moderate. However, the unemployment percentage continues to increase in the following decade with 87,7% employed and 12,2% unemployed in 2001.

The impact of the socio-economic crisis further accelerates this trend in the following decade when according to the census data of 2011, out of the economically active population 80,5 were employed while an alarming 19,4% unemployed. Thus the unemployment percentage in the municipality of Kalamata grew from 4% in 1981 to 19,4% in 2011. This increase impacts negatively the economic resilience of the city.

Another interesting element is the percentage of youth unemployment that also greatly affects the city's resilience. According to the Table 6.3 Youth unemployment grew from 4,8% in 1991 to 6,2% in 2001 and lastly to 6,4% in 2011. Compared to the great increase of general unemployment in 2011 and amidst the economic crisis the persistence of the youth unemployment percentage to levels similar to 2001 is encouraging. Even though high unemployment affects negatively the city's resilience, low youth unemployment is encouraging and shows signs of resilience in the economy of Kalamata.

Moreover, comparing the unemployment percentage of the city of Kalamata to the one of the region of Peloponnese and to the country's it is apparent that even though in 1981 the city's unemployment percentage was equal to the country's, since 1991 Kalamata has a significantly higher unemployment percentage. This difference which is stable by 2 units shows low economic resilience for the employment sector city.

Employment by sector

The way that employment is distributed today in the economic sector is further indicating the economy's resilience. A balanced dispersion of employment between the three sectors indicates increased resilience while a one-sided economy indicates low resilience.

Table 6.5: Employment by sector, data from Census 2001, 2011 (source: author)

	2001	**2011**
Primary Sector	1,630	1,746
Secondary Sector	4,605	4,280
Tertiary Sector	14,594	17,941

	Primary Sector	**Secondary Sector**	**Tertiary sector**
Municipality of Kalamata	7,2	17,8	74,8
Prefecture of Messenia	**26,9**	**15,5**	**57,5**
Greece	**9,9**	**17,5**	**72,4**

	Economically active	Employed	Primary Sector	Secondary Sector	Tertiary sector	Unemployed
Municipality of Kalamata	29,749	23,967	1,746	4,280	17,941	5,782
Prefecture of Messenia	64,347	53,892	14,536	8,355	31,001	10,455
Greece	4,586,636	3,727,633	372,209	654,377	2,701,047	859,003

The city of Kalamata has traditionally had strong connections with the primary sector in its surrounding region. According to the table 6.5 the prefecture of Messenia has a very strong primary sector and this influence the city. Moreover, as observed from the table the primary sector of the Municipality of Kalamata increased between 2001 and 2011 by 7,1%. Even though employment in the primary sector is small in the municipality of Kalamata, this increase indicates a degree of strengthening. The following figures show the localization of the primary sector in 1991 and in 2011. From the maps, it is evident that the primary sector was well dispersed throughout the municipality in 1991 but in 2011 has concentrated in the western parts of Kalamata. The eastern parts show very low percentage of the primary sector. Thus, most agricultural activities are today concentrated in the western part of Kalamata

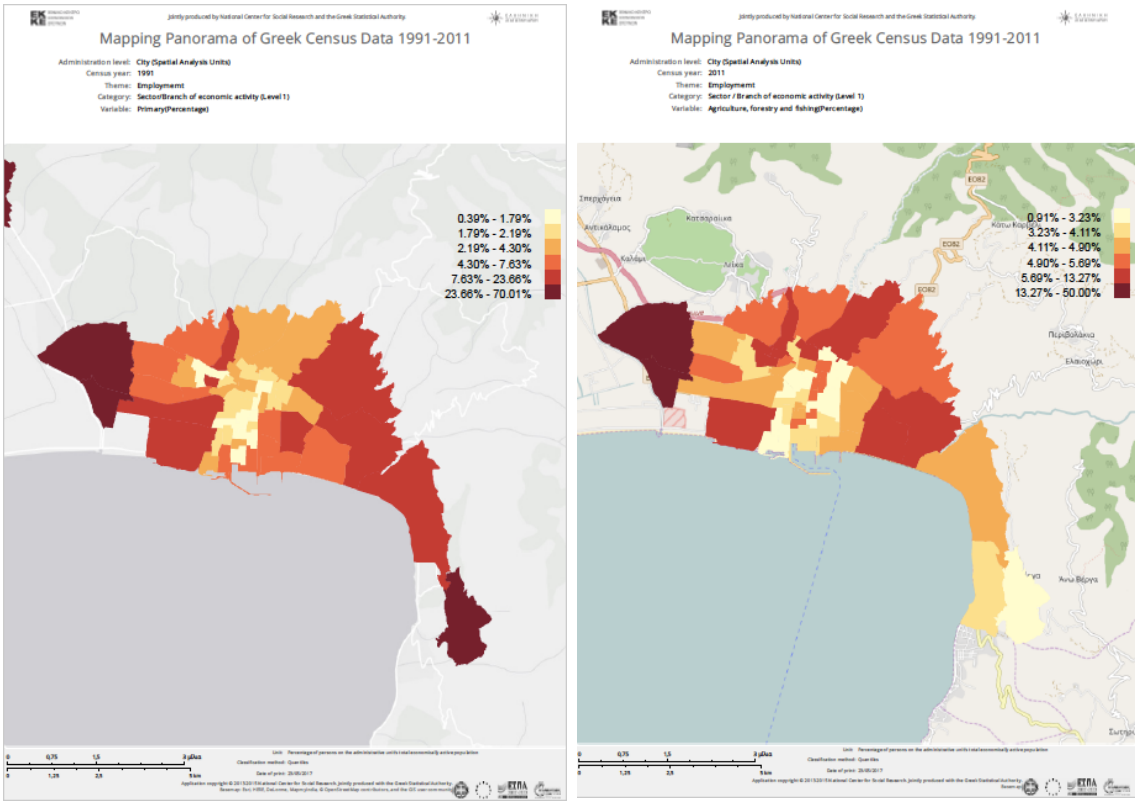

Figure 6.14: Gross Primary sector percentage - Panorama Statistic (source: author)

In the past Kalamata also had a strong secondary sector that was mostly composed by small manufacturing industries. The secondary sector of the city was facing decline at the time of the 1986 earthquake that continued onwards. The data from the table indicate that the sector continued its decline from 2001 to 2011. However, it still manages to have an important presence in the municipality's employment distribution. More explicitly, in the municipality of Kalamata the employed in the secondary sector are the 17,8% while the country's average is 17,5%.

Even though the secondary sector declined considerably from 1991 to 2011 its spatial dispersion remains relatively similar, as depicted in the maps in Figure 6.15.

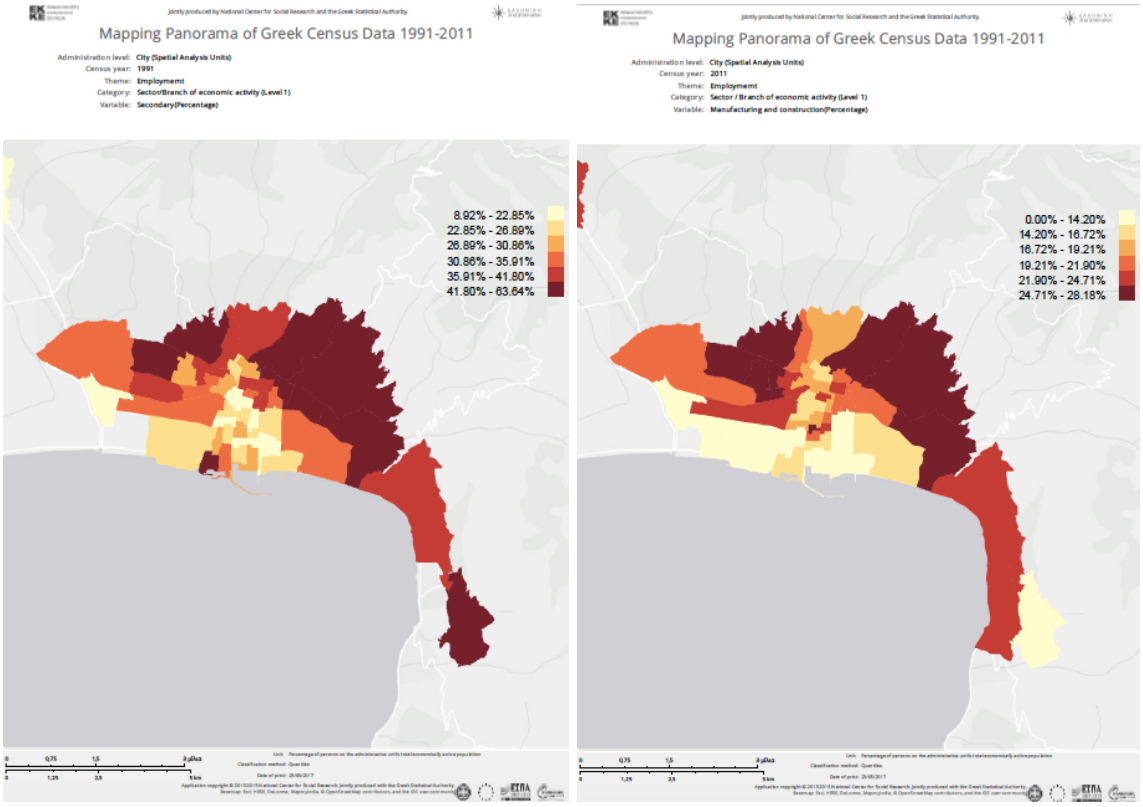

Figure 6.15: Secondary sector percentage - Panorama Statistic (source: author)

This indicates that the municipality of Kalamata preserves a small secondary sector like the country's average. This similarity is observed also in the tertiary sector that in the municipality of Kalamata prevails the economy in a great extent as it does in a national level. However, Kalamata has an even greater percentage of employment in this sector than Greece. Moreover according to the data the tertiary sector increased by 22,9% between 2001 and 2011 in the Municipality of Kalamata. Concerning its spatial distribution its evolution is interesting as depicted in the following maps. In 1991, the tertiary sector was mostly concentrated in the city center of Kalamata while in 2011 it seems to have expanded along the seafront. This can be explained by the development of the touristic sector of the city that did not exist in 1991.

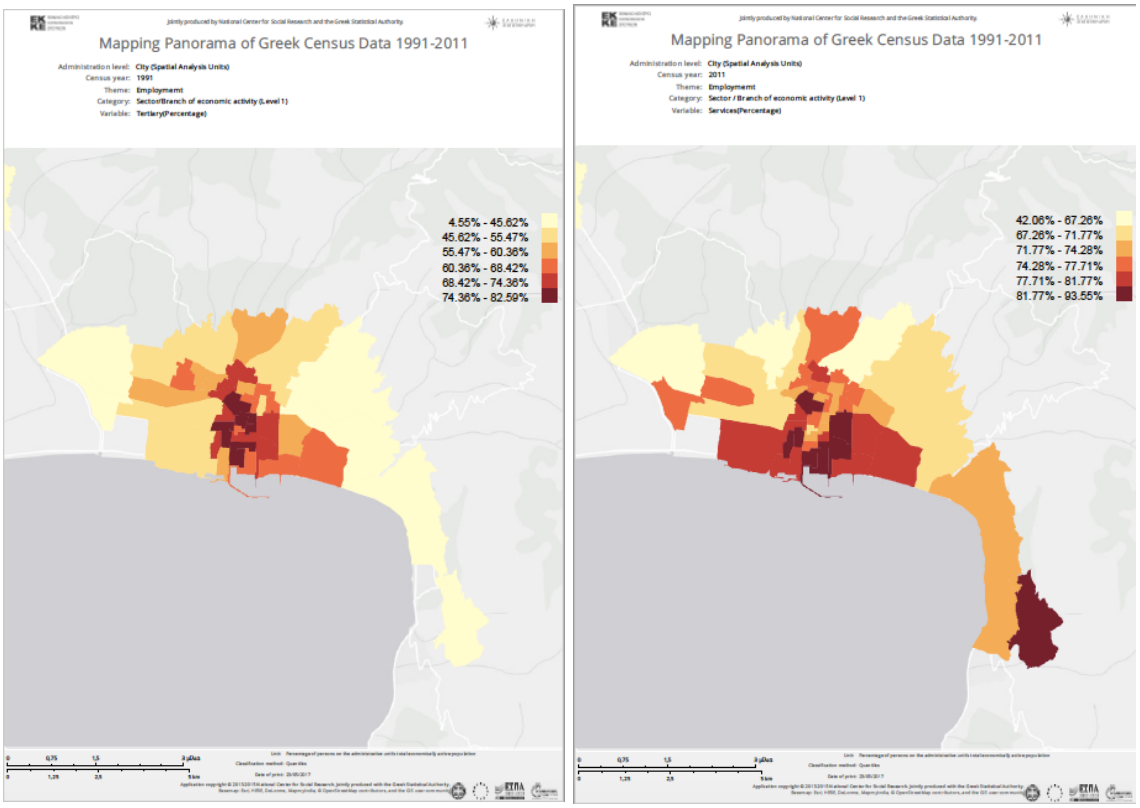

Figure 6.16: Secondary sector percentage - Panorama Statistic (source: author)

In conclusion, from data it is observed that the economy of Kalamata is very much concentrated in the tertiary sector making services and tourism the main concentration of Kalamata's economy. Even though the growth and dispersion in the tertiary sector is positive for the resilience of the city, the decrease of the secondary sector and the low percentage of the primary have negative effects. In terms of distribution, such an intense concentration in the tertiary shows a low degree of diversity that is a key element of resilience. At the same time, it creates a more redundant economy, in the sense that a big tertiary sector can possibly overlap in gaps created by the underdeveloped primary and secondary sector.

Employment by economic activity

In this section, the dispersion of the city's employment in different economic activities is analyzed in greater detail. This detailed analysis is essential for the understanding of the city's economic structure and thus its resilience. The following table composed by the author with data from the last census, presents analytically the development of the city's economic sector from 1981 to 2011.

A first reading of the table shows that from 1981 to 1991 the primary sector had significant losses. In the next decade, the primary sector marks a considerable increase. This increase is in part due to the expansion of the municipalities limits. However, although the next decade coincides with the beginning of the economic crisis the primary sector preserves its percentage. This shows its dynamic and moreover its resilience to a chronic stress such as the socioeconomic crisis. The secondary sector presents mixed trends and the tertiary sector is in general increasing throughout the last decades.

Table 6.6: Employment by economic activity, Census data 1981-2011 (source:author)

		1981	**1991**	**2001**	**2011**
Economic sector	Agriculture, forestry, fishing	1,108	741	1,778	1,746
	Mines and quarries	40	31	29	No data
	Manufacturing industries	3,445	2,329	2,116	No data
	Electricity, gas and water supply	150	240	427	No data
	Construction	1,688	2,172	2,441	2,042
	Trade	1,768	3,240	3,930	4,359
	Tourism industry			1,530	1,829
	Transport and storage services	1,360	1,105	1,399	1,009
	Intermediate financial institutions (banks, insurance companies, etc.)	549	384	582	No data
	Other services	2,833	4,473	8,005	5,425
	Youth	401	802	1,549	No data
	No data	509	1,073	1,152	No data

More explicitly, the employment in agriculture, forestry and fishing while it decreased considerably from 1981 to 1991, it then noted a considerable increase which managed to preserve during the 2001-2011 decade in the middle of which the Greek economic crisis begun. This evolution reveals a degree of adaptability and strength that both accelerate the resilience of the sector.

Concerning the secondary sector two contradicting trends are observed. Employment in manufacturing industries is decreasing throughout the years of analysis. At the same time construction is increasing continuously up to the 2001-2011 decade were it shows a small decrease. This trajectory can be explained by the continuous deindustrialization that was happening in the city before the earthquake and that continued further on. Also, the post-earthquake reconstruction needs explain the increase in construction employment and the economic crisis explains its decrease in the last decade. In conclusion, the secondary sector of Kalamata shows little adaptability and strength to disturbances.

Lastly, the tertiary sector that dominates the city's economy has been steadily increasing. The exception of a considerable decrease in general services (*other* in the table) during the last decade (2001-2011) is explained by the decrease in general economic activities due to the country's economic crisis. However, services and tourism which are the two pillars of the city's economy have been increasing during this decade showing strength, autonomy adaptability and creating redundancy for the city's economic resilience.

Comparing the economic activities distribution of the municipality of Kalamata with the one of the prefecture and the country puts into perspective and further explains the economic structure of the city. The following figure illustrates the dispersion of employment in the different economic activities for the Municipality of Kalamata, the prefecture of Messenia and Greece. The figure is composed with data from the 2011 census that are listed in the annex.

A first observation is the superiority of the agriculture, forestry and fishing sector in the prefecture of Messenia. A degree of urbanization, the low percentage of the primary sector in the municipality of Kalamata even compared to the country's, is not surprising.

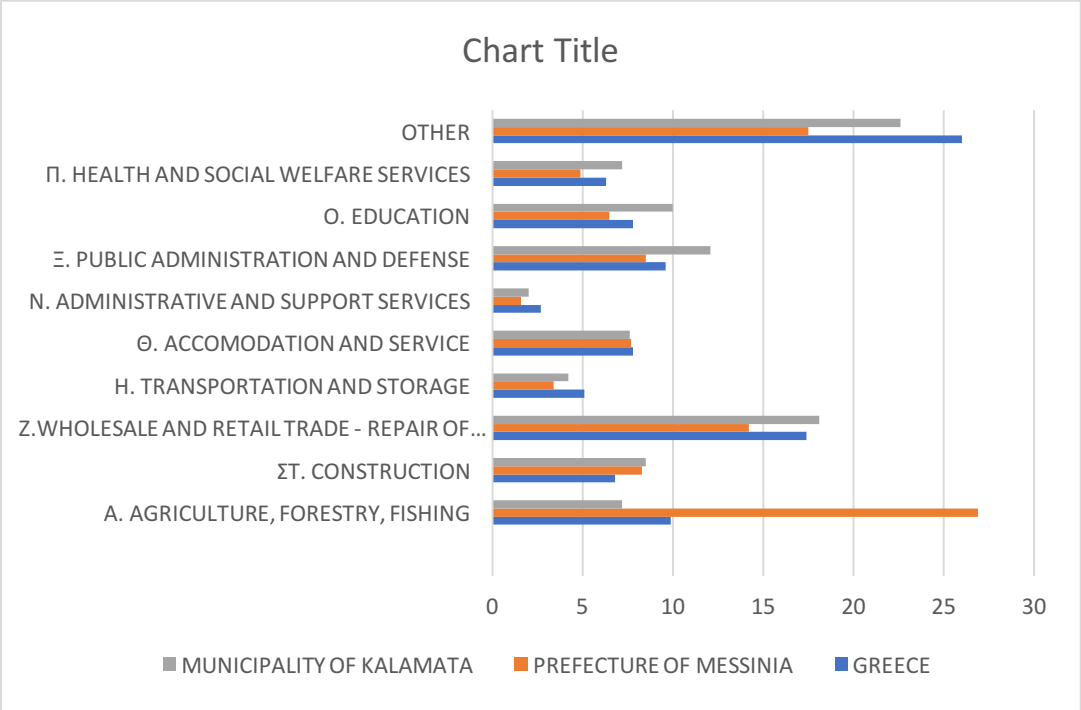

Figure 6.17: Employment by economic activity, Census data 2011 (source: author)

An interesting note is that the municipality of Kalamata exceeds the prefecture's as well as the country's percentage in employment in the sector of trade. The accommodation and service sector of the three spatial levels are equal, since all areas are greatly touristic ones. Another element is that the percentage of employment of the municipality of Kalamata in the sectors of Health and Social Welfare, Education and Public Administration and Defense exceed greatly both the prefecture's and the country's. This indicates the prevail of services but also the dynamic presence of the state through educational and welfare services. This presence shows elevated degree of resilience in the sector. In conclusion, even though it has a small dynamic, the primary sector is today more resilient than it was at the time of the 1986 earthquake. This is evident by the losses that it had in the 1981-1991 decade that imply low resilience and by the sustain of its percentage in times of crisis were all economic activities experience losses. The Secondary sector showcases low resilience throughout the analysis period. Lastly, the tertiary sector show signs of elevated resilience thanks to its strength, adaptability and redundancy.

Housing Capital

The housing capital is another component of economic resilience. Elevated degrees of home ownership show higher levels of economic resilience while other types of occupancy such as rentals show lower levels. This is explained by the fact that home ownership not only implies a greater income but it moreover shows greater attachment to the area. Thus, citizens with greater attachment to the area are most eager to participate in the reconstruction efforts. Owners have greater motivation and reason to reconstruct their properties and thus show greater resilience. This dynamic existed in Kalamata after the earthquake. Citizens cooperated and followed the proposed plan for reconstruction.

Today, home ownership remains a central value for the country's culture. According to the 2011 Census data from which the following figure is constructed, in 2011 69% of the population of Kalamata occupied their properties while a 31% occupies in rentals. Concluding, greater percentages of homeownership show an elevated degree of autonomy which is critical for economic resilience.

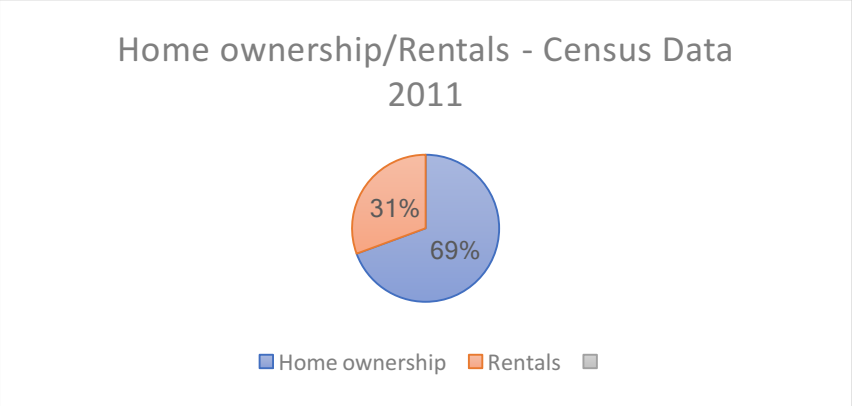

Figure 6.18: Home ownership/Rentals. Census data 2011 (source: author)

Overall Economic resilience

Table 6.7: Economic resilience indicators in context (source: author)

Economic	Resilience assessment	Resilience Characteristics
Gross Prefectural Product	**1987** An economy in the process of deindustrialization	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 The longitudinal analysis of the GPP of Messinia shows greater adaptability than that of Greece	
Employment	**1987** Unemployment was equal to the country's average**,** small primary sector, secondary sector in degradation, not very diverse tertiary sector.	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 High percentage of unemployment, small revival of primary sector great domination of the tertiary sector with great diversity	
Housing Capital	**1987** Great percentage of homeownerships create motivation for reconstruction	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 Great percentages of homeownerships show are preserved despite the economic crisis	

6.2.4 Social: Long term resilience

The social component of resilience is a critical one for long term resilience. Once reconstruction is finished and the economy is revived it is the demographic dynamic that reflects long-term resilience. The return of the citizens during the reconstruction period together with the long-term demographic growth on the aftermath of a disaster is proof of the growth dynamic of a city. Thus, it is proof of a resilient reconstruction and recovery. However, the population recovery is not sufficient for social resilience but it must be accompanied by an optimal demographic structure. For this reason, the demographic characteristics of the population of Kalamata are analyzed from the pre-earthquake time to today. Another element of social resilience is the education level of its population. These dimensions reveal the social component of long-term resilience.

The following analysis uses the census data of 1981 to identify the pre-earthquake demographics and their evolution in the following census in 1991, 2001 and lastly, 2011. This longitudinal analysis reviews the preexisting conditions (Census 1981) the first impact of the disastrous event 5 years afterwards (Census 1991) when the short-term reconstruction period was concluding and then the long-term recovery (Census 2001) and its evolution onwards (Census 2011). Social resilience is analyzed through the terms of population dynamic, demographic structure and education.

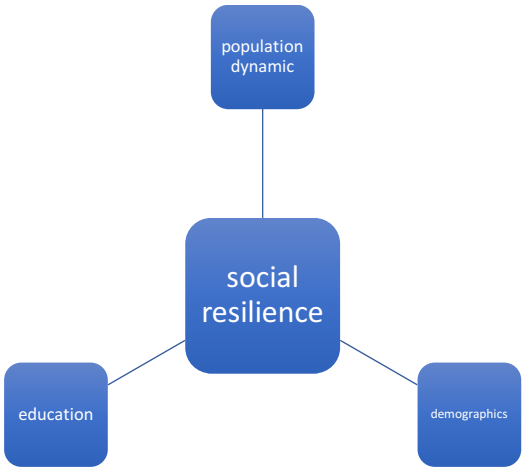

Figure 6.19: Social resilience components (source: author)

Population dynamic

The population dynamic of Kalamata is analyzed in the present chapter through the Census data provided by the GSA. The Census in Greece is realized every ten years with the last one in 2011. According to the data presented on the Table 6.6 the population of the city of Kalamata 5 years before the earthquake, was 41,369 in 1981 while in the next Census data of 1991, 5 years after the catastrophic earthquake the population was 44,052, a 6,4% growth despite of the earthquake and the ongoing deindustrialization that was going on in the city. This short-term dynamic is already important and indicative of the fact that the city did not experience great losses in its population even though on the aftermath of the earthquake the citizens were panicked and the destruction was widespread. Thus, an increased population resilience in the short-term aftermath of the disaster. However, the analysis of the onward evolution of the population dynamic is a little more complex since two administrative reforms happened in the following years that altered the structures of the country's municipalities.

In the last Census data of 2011 the population of the municipality of Kalamata was 69,849. However, since the census data of 1991 the Municipality had changed its geographical limits and thus a direct comparison is not possible. The two administrative reforms "Kapodistrias" in 1997 and "Kallikratis" in 2010, altered the country's administrative structure and as a result the data from the last two census (2001 and 2011) are not directly comparable with the previous. For this reason, adjustments to the units of analysis have been made so that an accurate representation of the populations' evolution is presented.

The following table 6.6 compares the population of the municipality of Kalamata between 2001 and 2011 with the administrative limits of 2011. More explicitly the numbers of 2001, incorporate the numbers of the municipalities that were later incorporated in the administrative reform of 2010 in the municipality of Kalamata, namely the Municipalities of Arios, Arfara and Thourias. Thus, it can be observed from the data that between 2001 and 2011 the population of the municipality of Kalamata decreased by 0,22% but this percentage was significantly lower than the Prefecture of

Messenia whose population decreased by 3,97% or the region of the Peloponnese whose decrease was 3,3%. Moreover, the decrease of the population of Kalamata is much smaller than the one of Greece (1.08%). Comparing the population dynamic of Kalamata with the prefecture, the region and the country the conclusion is that the trend of population decrease is much less present in the municipality which almost preserved its population stable. Therefore, the population dynamic of Kalamata is much stronger than the rest of the country.

Table 6.8: Population change 2001-2011 (source: Operational program of the municipality of Kalamata 2014-2019, data from HSA)

	2001	**2011**	**Change %**
Municipality of Kalamata	70.006	69.849	-0,22
Prefecture of Messenia	166.566	159.954	-3,97
Region of Peloponnese	597.622	577.903	-3,30
Greece	10.934.097	10.816.286	-1,08

Lastly, comparing the evolution of the population in the municipal unit of Kalamata which is the lower spatial unit analyzed by the census from 1961 to 2011 one notices that the urban core of the city of Kalamata has been developing with much more greater rhythm than the prefecture and the country. This translates into an existing dynamic that was only partly altered by the 1986 earthquake and is still strong to the day.

Table 6.9: Population (source: Operational program of the municipality of Kalamata 2014-2019, data from HAS)

	1961	**1971**	**1981**	**1991**	**2001**	**2011**
Urban community Kalamatas	38,714	39,462	42,075	44,000	49,550	53,491
Urban unit Kalamatas	45,693	45,211	47,890	50,641	57,620	61,670
Prefecture of Messinia	211,970	173,077	159,818	166,790	176,876	161,288
Region of Peloponese	668,323	581,997	577,030	607,428	638,942	584,989
Greece	8,388,553	8,768,641	9,740,417	10,259,900	10,964,020	10,940,777

For a more comprehensive understanding the following table presents the population change percentages. Highlighted in blue are the decreases in population while the orange are the increase percentages. A first reading of the table indicates that the city of Kalamata has been growing in population even though the surrounding area, the prefecture of Messinia and the region of the Peloponnese have been losing population. More explicitly, until the census of 1981 the city of Kalamata increased its population although both the prefecture of Messinia and the region of the Peloponnese had been losing population. However even though the population change percentage of the city was positive it was significantly lower of that of Greece. For example, between 1971 and 1981 the population of Kalamata grew by 6,6% while that of Greece grew by 11,1%.

This difference is minimized significantly in the next decade (1981-1991) in the middle of which the earthquake of Kalamata took place. During this decade, the city lost a little of its dynamic when compared to the previous decade increase by 6,6%. However, in spite of the earthquake and its consequences the city's population remained increasing even with the more modest percentage of 4,6%. During the same decade, the prefecture of Messinia and the region of the Peloponnese both reversed their previous trends and increased in population while the country's population increase percentage lowered in 5,3%. Thus, within this decade the very dissimilar population changes in the researched spatial units were almost homogenized.

Table 6.10: Population change percentage (source: Operational program of the municipality of Kalamata 2014-2019, data from HSA)

	1961-1971	1971-1981	1981-1991	1991-2001	2001-2011	1961-2011	1981-2011
D.K. Kalamatas	1,9	6,6	4,6	12,06	7,9	38,17	27,13
D.E. Kalamatas	-1,1	5,9	5,7	13,8	7,03	34,96	28,77
Prefecture of Messinia	-18,3	-7,7	4,4	6	-8,81	-23,91	0,91
Region of Peloponese	-12,9	-0,9	5,3	5,2	-8,44	-12,47	1,38
Greece	4,5	11,1	5,3	6,9	-0,21	30,42	12,3

For the next decade 1991-2001 the city of Kalamata presents remarkably higher growth percentages than Messinia, Peloponnese and Greece, all of which kept a rather stable percentage. In the most recent decade, from 2001 to 2011 the population dynamic seems to slow down. Greece experienced a small decrease in population of 0,21% while the prefecture of Messinia and the Peloponnese region experienced much lather decreases of 8,81% and 8,44% respectively. However, the city of Kalamata continued its growth dynamic with a rhythm of 7,9%. Thus, it is evident that in the post-earthquake period the city of Kalamata experienced a continuous growth in population that showcases strong resilience. Lastly, reviewing the population change percentage from 1981 to 2011, in the last column of table 6.10 p. 151, it is apparent that the urban unit of Kalamata experienced a very intense growth of 27,13% while the prefecture of Messinia and the region of the Peloponnese remained almost stable with 0,91% and 1,38% growth respectively and Greece's population grew by 12,3%. Thus, the persisting population growth of the city of Kalamata reveals the dynamic of the city and great population resilience.

Demographic structure

Apart from the population dynamic another important element for social resilience is the structure of the demographics. A well balanced demographic structure is more resilient to possible disturbances than a polarized one. For example, a big percentage of elderly population or young children is more vulnerable to shocks. Thus, the present analysis doesn't research only the evolution of the following indicators per se but also their ratio.

In terms of gender the table indicates that the ratio men to women in the total population remains rather stable without large changes with the women population steadily exceeding the men by a small percentage. In 1981 the men to women ratio in the municipality of Kalamata was 0,92, in 1991 0,97, in 2001 0,96 and in 2011 0,98. Thus, the population of the municipality is balanced in terms of gender which is positive for its resilience.

In terms of age, a balanced-out distribution of ages is equally important for the population's resilience. Even though there are no available data for 2011, the children population of the municipality decreased by 11,5 from 1981 to 1991. A small increase that is noted by the 2001 census, does not clearly depict the reality since in coincides with the municipality's expansion. Comparing the 0-14 to the next age group, 15-24, in 1991 the ratio was 1,63 while in 2001 it was 1,13 which shows a considerable decrease in child population. While the child population decreased during the analysis years the elderly (80+) population presents a considerable increase. Thus from 1981 to 1991 it increased by 28% and from 1991 to 2001 it increased by 35%. This significant increase of the elder population is negative for the population structure resilience. Moreover, if we compare the child to elder population ratio, in 1981 it was 12,6, in 1991 it was 10 and in 2001 6,6. Thus it is apparent that there is a trend where the children population decreases while the elderly population increases. This is a negative factor for the municipality's demographics and moreover for its resilience.

Table 6.11: Demographics of the Municipality of Kalamata, Census data. (source: author)

Indicator	**Sub-Indicator**	**Municipality of Kalamata**			
		1981	**1991**	**2001**	**2011**
Total numbers	Population	41,369	44,052	61,373	69849
	Households	12,230	13,715	18,207	25,905
Gender	Men	19,857	21,799	30,118	34,620
	Women	21,512	22,253	31,255	35,229
Age	0-14	11,599	10,258	10,801	No data
	15-24	5,702	6,273	9,496	No data
	25-39	8,028	10,032	13,937	No data
	40-54	7,881	7,602	12,861	No data
	55-64	3,434	4,709	5,569	No data
	65-79	3,807	3,994	7,085	No data
	80+	918	1,202	1,624	No data
Marital Status	Single	18,133	18,804	25,507	28,122
	Married	20,537	22,027	29,770	34,967
	Widowed	2,352	2,698	3,917	4,738
	Divorced	347	523	1,524	2,022
Households	1 person household	1,590	2,026	3,493	6,298
	2 person household	2,700	3,274	4,803	7,502
	3 person household	2,540	2,804	3,985	5,354
	4 person household	2,960	3,520	3,877	4,700
	5 person household	1,540	1,427	1,369	1,381
	+6 person household	900	664	680	670

Education

The following table summarizes the education level of the population of the municipality of Kalamata. Education is an indicator for resilience since higher education translates to better coping mechanisms and adaptation to stresses and shocks. A first reading of the table shows an increase in education levels. In terms of illiteracy, even though the 2011 census did not record such a category, it is evident from the previous years that the trend is a decrease in the illiteracy percentages of Kalamata. With a similar trend the percentage of the population without formal education has been decreasing from 1981 to 2001. However, an increase that appears in 2011 is probably due to the expanded municipality towards more agricultural areas where no formal education is more common. The percentages of population that have completed elementary school, high school and secondary education are all increasing. A similar trend with a remarkable increase in the higher level of education the population with university degree increased from 2,078 in 1981 to 11, 836 in 2011. Even in the expanded municipality such an increase is an asset for the population's resilience. In conclusion, the population of Kalamata is much more educated today than in 1981. Higher level of education leads to higher levels of social resilience and thus in terms of education the social resilience of Kalamata has improved since 1981.

Table 6.12: Education levels completed, Census data (source: author)

Indicator	**Sub-Indicator**	**Municipality of Kalamata**			
		1981	**1991**	**2001**	**2011**
Education	Total +10years	33,587	37,573	No data	No data
	Illiterate	2,781	2,622	2,280	No data
	No formal education	4,167	3,518	2,799	8,918
	Elementary School	14,428	14,013	15,535	14,265
	High School	4,585	4,749	7,474	9,834
	Secondary Education	5,115	8,796	14,966	18,030
	University Students	173	505	No data	No data
	University degree	2,078	3,291	6,762	11,836

Another interesting element on the education component of social resilience is its spatial distribution. The following figures illustrate the spatial dispersion of different levels of education. It is observed from the following maps that the outskirts of the city have the lower degrees of education while the center has the highest degrees. Highest education levels in the city center translate to higher levels of resilience.

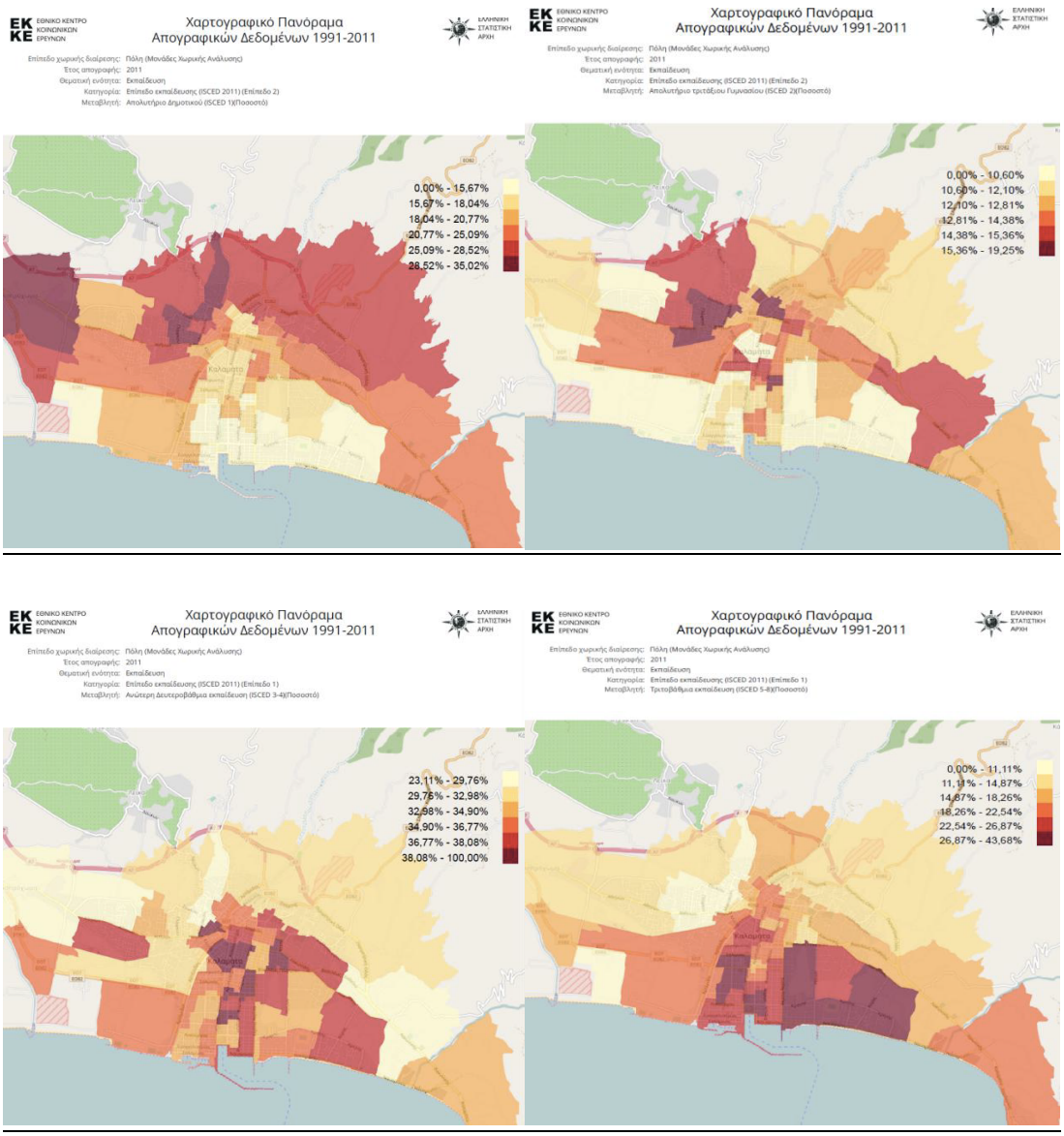

Figure 6.20: Levels of education – Panorama Statistics, Census 2011, Up left: Primary education, Up right: Lower secondary education, Down left: Higher secondary education, Down right: University degree, (source: author)

Overall Social Resilience

Thus, the city of Kalamata did not only overcome the 1986 earthquake without important demographic losses as it is often the case (ex. New Orleans after Hurricane Katrina) but moreover it has today a better demographic dynamic than the rest of the country. To suppress the trend of moving away from the city during the first post-earthquake period the local government imposed a no school transfer rule. In this way, the families did not have the choice of leaving the city but where indirectly forced to stay and reconstruct their places. This choice influenced the remain of the population on the short term. However, the population dynamic is most important on the long term where it reveals the dynamic and thus the social resilience of the city. Population growth is an important indicator for social resilience that reveals the long-term dynamic of the city. As most Southern European countries Greece is facing today a very serious demographic problem that translates into a population decline. Low fertility rates and high rates of immigration are the major contributing factors for this worrying trend. Within this reality the city of Kalamata follows this trend but with much lower dynamic. More explicitly the city of Kalamata manages to keep its population and thus showcases great social resilience facing a chronic stress of the socioeconomic crisis. Thus, the social resilience of the city has improved on the long term.

Table 6.13: Social resilience indicators in context

Social	Resilience assessment	Resilience characteristic
Population dynamic	**1987** prior to the earthquake the city had a much lower growth percentage than the country	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 today Kalamata has a much more positive population dynamic than the rest of the country	
Demographics	**1987** The data show a balanced demographic structure	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 An aging population is depicted in the Census data.	
Education	**1987** Existence of illiteracy, low percentage of higher education	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017 Increased percentages of higher education show stronger resilience	

6.2.5 Physical and Urban Environment: Long term resilience

The Physical and Urban Environment component of resilience describes the urban and natural environment of a city in terms of resilience. As it is the case with the social component and since the dynamics of these elements unfold in macro timing, this is a critical component for resilience on the long term. In the context of Kalamata this component is assessed through the evaluation of the urban planning characteristics of the city, of the preservation of its natural environment and of the preservation of its built heritage. These elements are essential to the long-term resilience of the city and moreover equally affect the quality of life. As it is the case with the previous component analyzed, the physical and urban environment of the city needs to follow the resilience characteristics. In other words, it should de diverse, redundant, strong, adaptable, autonomous, interdependent and efficient.

The physical and urban environment component includes morphological characteristics of the natural and built environment. It is assessed on the long term because the impact of the reconstruction practices on it are only revealed in the city's morphology with such a perspective. Rebuilding a city after a disastrous event offers a rare opportunity for drastic improvements that would be very difficult to be implemented otherwise. At the same time, it bears challenges for changes that cannot be reversed. 'While rebuilding, the city can absorb outlying districts that were not or badly integrated like Los Angeles did after 1933's earthquake (Davis, 1998) or, on the contrary, it can lose its traditional sphere of influence like Saint Pierre after the 1902 eruption.' (Reghezza-Zitt, 2012) However these dynamics are not revealed in the aftermath of the disaster but only once the reconstruction has been completed. Thus, the assessment of this component requires a long-term perspective.

Physical and urban environment are the legacies of past policy and planning choices. Thus, these decisions affect us on the long term. In order to explore the long-term resilience of the physical and urban environment of the city of Kalamata, three components are analyzed: urban morphology, natural environment and the built heritage.

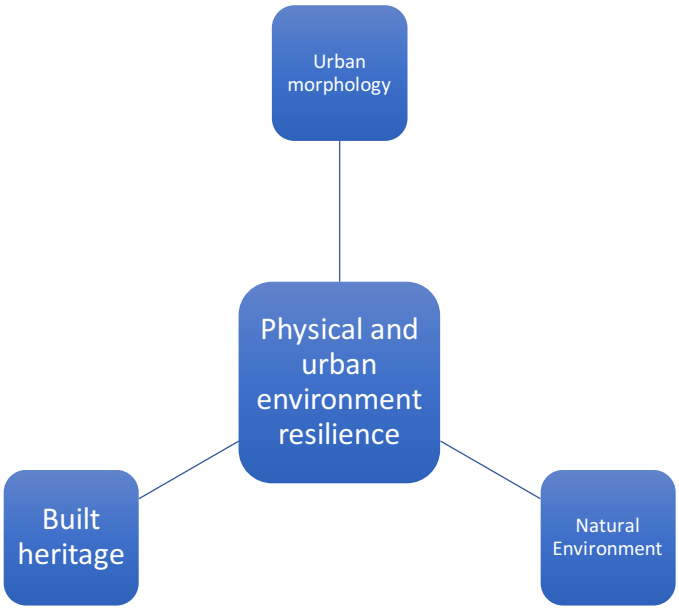

Figure 6.21: The components of physical and urban environment resilience (source: author)

Urban morphology

Urban morphology is critical for long-term resilience since it composes the general image of the city and includes characteristics that are hard to be altered since they are shaped on the long-term. As an example, a problem that is very common in older cities, narrow streets without sidewalks are common in the Mediterranean cities. These elements that are present in historic cities but also in more recent constructions are especially problematic in times of disaster. Because of the nature of this component, urban planning is key to its resilience. Moreover, improving the resilience of through urban porphology has multiple impacts. According to Diamantopoulos (2008) p.135 "most of what is needed for the urban planning seismic fortification of the city, are at the same time desires and usually unrealized dreams, for urban planning in general. Among them: wide roads and building yards together with low heights of buildings and small building coefficients for the breaches not to drop on passers-by, many and big squares, parks, stadiums and free spaces which can be converted into 'shelter spaces' after the earthquake. (..)

During the reconstruction of Kalamata, in terms of urban morphology, many interventions improved the urban grid of the city. Even before the 1986 Master Plan was officially institutionalized the local government had started implementing some of the projects. Among them the linear train park that served later as a shelter, shown below in Figure 6.22.

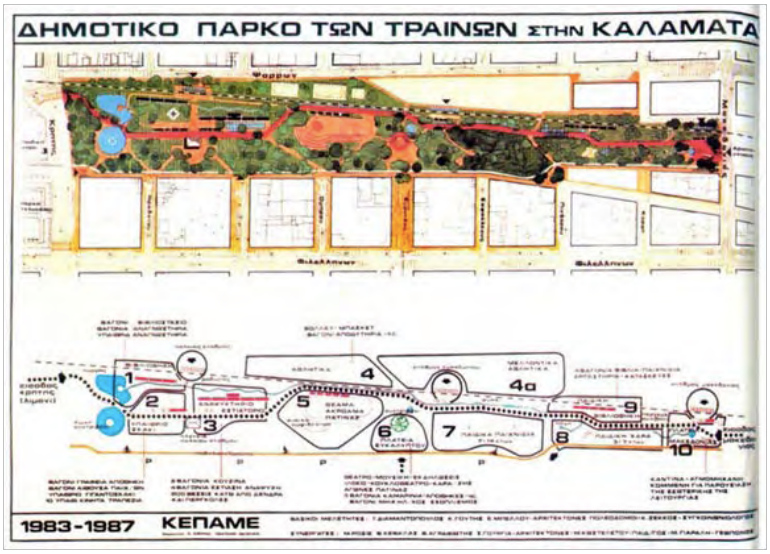

Figure 6.22: Linear train park (source: Diamantopoulos, 1995)

The lower coefficients in the city center and the new planned urban areas were measures that were taken in the aftermath of the disaster but can only be witnessed in the long-term. New public spaces and parks and open areas were created that in times of normalcy improve the quality of life in Kalamata and in cases of emergency can act as shelter spaces. Moreover, the gradual pedestrianizing of several roads created cohesion in the urban system. As a result, the city of Kalamata has preserved a well dispersed network of organized open spaces and green areas that improve the quality of everyday life and moreover act as shelter spaces in times of emergency. The following figure presents an updated map of the shelter spaces registered by EPPO for the city of Kalamata.

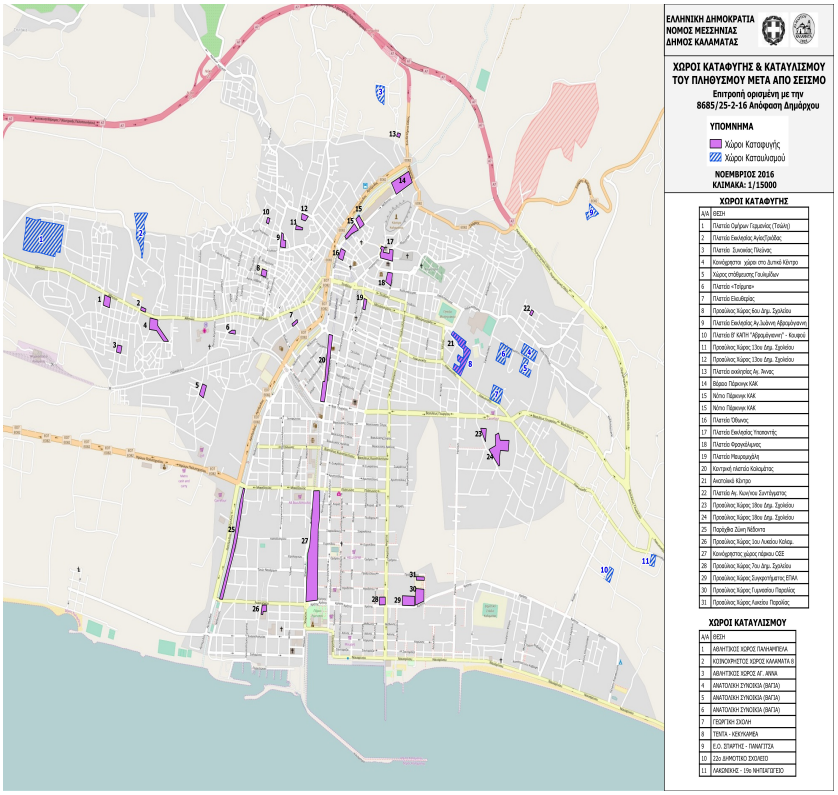

Figure 6.22: Shelter space in Kalamata (source: EPPO)

Natural Environment

A second important element of physical and urban environment resilience is the state of the natural environment within and around the city. The city of Kalamata is surrounded by a complex and rich natural environment. It is located in the Messenian gulf alongside the Nedon river that traverses the city. Kalamata is mostly flat, facilitating bicycling and walking around the city and with rich soils that extend from the western part of the city. However, the eastern side of the city is characterized by steep slopes on the foot of Mt. Taygetus range. Moreover, the city is largely characterized by its seafront where a beautiful coastline is preserved even within the city. Thus, these elements of its natural environment are central to the character of the city and their preservation is key to its long-term resilience.

Prior to the 1986 earthquake many of these elements were at risk. The preservation of the river Nedon and the seafront were not granted but where choices made in that time that impact the city up to today. In many other cases, urban rivers were covered since they were perceived as easy solutions to accommodate the growing needs in transport. Such an example is Athens whose major river Kifissos, is today covered by major highways while it flows underground. Thus, in Kalamata the preservation of the river in its natural environment and the landscaping of its riverbend has today multiple advantages. An important impact is that it regulates the microclimate of the city by mitigating humidity in the coldest months and refreshing in the warmest months. Moreover, it channels the rainwaters and functions as a first buffer zone when heavy rainfalls create flooding probabilities. Lastly, it is a pleasant recreation zone that extends linearly and runs through a large part of the city.

Another central element is the preservation of the beach in the city's seafront. Likewise, the preservation of the natural environment of the river, the preservation of the actual beach front was not granted. Most coastal cities in Greece built up their seafront creating built waterfronts while abolishing the beach. The local government preserved the beachfront and in combination with the wastewater treatment facility that was constructed at the time of the earthquake they ensured the preservation of the use of a unique urban beach as shown in the following picture.

Figure 6.23: (left) The beachfront of Kalamata (source: www.kalamata.in) (right) Nedon river (source: www.pna.gr)

Another interesting element that enhances the preservation of the natural environment of the city are the municipal community gardens situated in the western and eastern centers of the city. Through this municipal program, the agricultural character of the city is enhanced while urban agriculture is promoted as a vehicle for environmental education. Thus, the city's community gardens have the dual role of preservation and education while at the same time promoting urban sustainability.

In conclusion, through the described actions the city succeeds to preserve its natural environment. In this way, it ensures the long-term resilience of its natural environment. The protection of the biodiversity and the microclimate of the area further enhances the characteristics of resilience. The preservation of the natural environment within a city creates greater diversity, redundancy, strength, adaptability, autonomy, interdependence and efficiency. Therefore, it is evident that today a combination of short term and long term strategic decisions, the natural environment of the city of Kalamata is much more protected and reserved and thus, more resilient.

Built heritage

The physical and urban environment component of resilience includes not only the morphological characteristics of the city but moreover the cultural elements that are engraved on its buildings. These elements constitute the history of the city and thus its cultural heritage. Urban morphology and the natural environment are constitutional elements of this component but the built heritage is what shapes the character of the city. Therefore, being a part of the city's identity the preservation of this built heritage is critical in resilience.

Before the 1986 earthquake the built heritage of Kalamata was slowly degrading since many of the historic buildings were in bad condition or abandoned. These buildings that needed great restoration works would most probably end up being demolished and replaced by apartment buildings as it happened in many similar cases in Greece. In addition, the 1986 earthquake caused further damaged to many of these historic buildings including monuments and traditional buildings and was an additional threat to their survival. The preservation of the historic buildings of the city was a priority of the local government even before the earthquake. Therefore, acknowledging the threat that these buildings were facing post-disaster, the local government took on a series of actions to protect, restore and preserve the built heritage of the city.

In an effort to protect the historic buildings from being demolished and to encourage the owners to restore and reconstruct them the local government bought several of these buildings and created a reconstruction plan designed especially for the built heritage of the city. The acquired properties were gradually restored and housed different municipal programs. As a result, the city succeeded to protect its built heritage which is today cherished. In terms of resilience the restoration of the historic buildings improved the city's resilience by protecting its culture and identity.

Overall Physical and Urban morphology resilience

The analysis of the physical and urban morphology component of resilience results to the conclusion that it has been largely improved in the last 30 years. Physical and Urban environment resilience is important on the long term since it shows how the city evolves and adapts on its environment. At the same time, it fosters the sustainable development of the city. This long-term dynamic has three dimensions, the optimal function of the urban morphology, the preservation of the natural environment and the preservation of the built heritage.

In terms of urban morphology, the post-earthquake reconstruction policies frameworked a more balanced urban development that lead in the long-term to a more sustainable city. Such examples were the regulation of open and green spaces and the circulatory system. The natural environment of the city was also protected through a series of policies such as the landscaping of the riverbeds and the protection of the beachfront. Lastly the built heritage of the city was restored and protected through a specific and multi awarded program. Therefore, through a series of actions and decisions the physical and urban morphology resilience of Kalamata was improved on the long term.

However, these elements need regular updates so that they can continue to be sustainable in the future. This component includes elements that develop on the long term. Thus, in a rapidly changing environment the positive impact of past decisions must be regularly updated so that it remains positive in the future.

Table 6.14: Physical and urban resilience indicators in context. (source: author)

Indicators	**Increases/Decreases (+ /-)**	**Resilience Characteristics**
Urban morphology	**1986**: Many problems from unplanned areas and not an optimal circulatory system. A great percentage of open spaces exists that needs to be preserved	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: A well preserved network of open and green spaces and an improved circulatory system.	
Natural environment	**1986:** No preservation projects were implemented at the time	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: The preservation of the city's natural elements result to a more diverse and adaptable environment	
Built heritage	**1986:** The historic buildings of the city were in bad shape before the earthquake and no regulation existed for their preservation	**Diversity** **Redundancy** **Strength** **Adaptability** **Autonomy** **Interdependence** **Efficiency**
	2017: The preservation of the built heritage is successful	

6.3 30 years after the earthquake: Resilience and the heritage of the 1986 reconstruction.

The preceding per component analysis of resilience with different temporalities concludes that the resilience of the city of Kalamata 30 years after the 1986 earthquake is increased in overall. More explicitly, the longitudinal analysis of the resilience components with the help of the Census data and the several policy documents concludes that the resilience of Kalamata in terms of the Infrastructure on the short term, Economy on the mid-term and Social as well as Physical and Urban Environment on the long term has increased in the years that followed the 1986 earthquake. Even though the city is facing different challenges today, thirty years after the devastating earthquake the impact of the reconstruction plan in Kalamata is still apparent. The results of the reconstruction in terms of resilience are illustrated in the following figure.

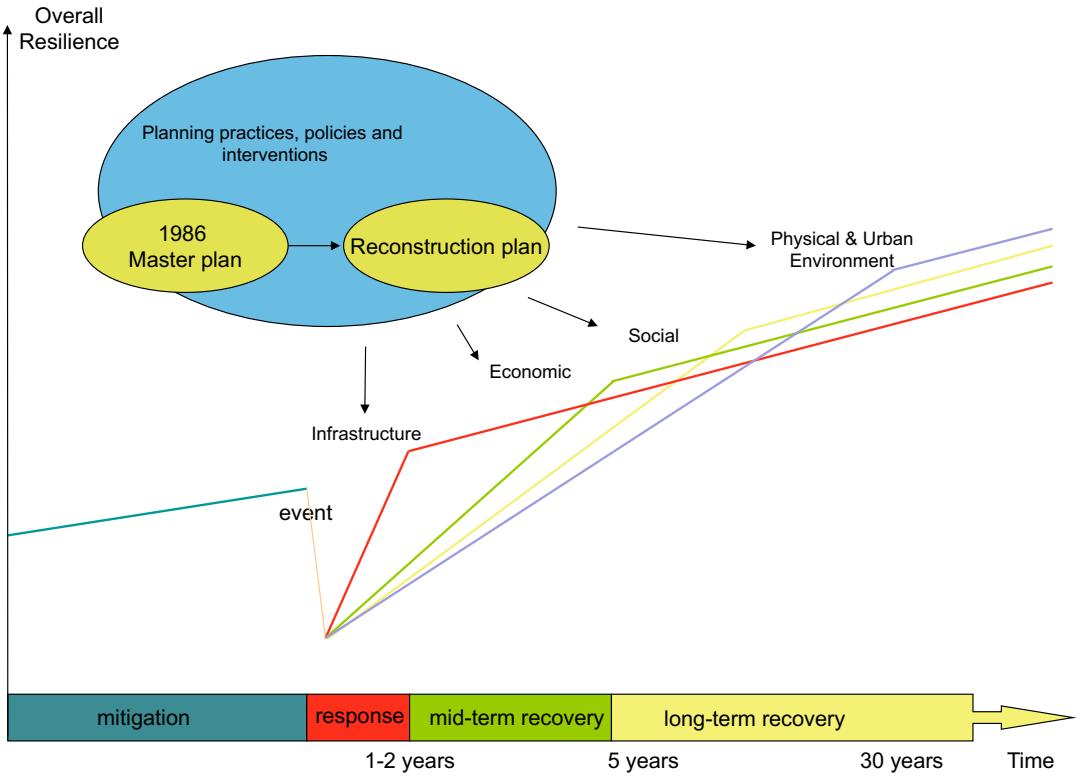

Figure 6.24: The evolution of Kalamata's resilience on the aftermath of the 1986 earthquake (source: author)

According to the analysis the resilient characteristics appear and matter differently for each component. Therefore diversity, redundancy, strength, adaptability, autonomy, interdependence and efficiency are not equally important for every component. Each component depends on different characteristics to increase its resilience. The results from the resilience analysis per component show through a qualitative correlation for each component that the urban system of Kalamata is today more resilient than in 1986. However, even if resilience is increased little insight there is on the process.

The question that arises from the previous analysis is how was resilience increased and how planning was involved. The preceding analysis evaluates the improvement of resilience through different planning and policy decisions but it gives little insight on the processes around the reconstruction. This is another dimension of the reconstruction that concerns elements that cannot be assessed with statistical indicators. The issues of governance and preparedness, of education and culture, involve factors that cannot be assessed in the same way as the previous components. These are thematics that need to be approached from a different perspective.

Thus, the need for further exploration of the recovery and resilience of Kalamata in the form of interviews is evident. The next chapter presents the results of the interviews concerning the process of reconstruction. More explicitly, the interviews with carefully selected interviewees offered different insights on the way that the reconstruction process altered the resilience of the city. Thus, the goal is to scrutinize the ways that planning influenced the reconstruction process and how it affected the resilience.

7. Planning for resilience and the window of opportunity.

The intention of the present section is to explore the process that guided the planning decisions and mechanisms that influenced the evolution of resilience in the aftermath of the 1986 earthquakes. In Chapter 6 different kinds of data were used to assess the resilience of the city of Kalamata. According to the proposed model resilience was conceptually divided in Infrastructure, Economic, Social and Physical an Urban Environment components. The assessment of these components was realized with different kinds of data, from Census data where these were available to data derived from policy documents and research.

This chapter attempts to shed the light on the process and mechanisms that influence the trajectory of Kalamata's resilience and that could not be explored through the previous analysis. For this reason, the insight of the interviews has been imperative to provide the depth needed to understand what influenced the evolution of resilience throughout the reconstruction process and today. Why was Kalamata rebuilt in a more resilient way when most reconstruction narratives recreate pre-existing vulnerabilities, or rebuilt with great injustices? The reconstruction of Kalamata is unique and precious as an example not only for what happened to its own reconstruction but moreover for the knowledge and experience that it can transfer to other cities, with similar or different vulnerabilities. This insight answers to the research's problematic on how resilience can be influenced through planning.

The interviews were conducted in the form of semi-structured interviews with purposefully selected interviewees with the criteria of their knowledge or/and experience from the reconstruction of Kalamata. Thus, a combination of municipal officers, practitioners and research specialists were interviewed. The use of semi-structured interviews had the advantage of pointing out the interests of this research while leaving space for additional subjects to emerge. The questionnaires used for the interviews were structured around the following subjects: the central characteristics of the city of Kalamata over time, the challenges of the city at the time of the earthquake and today, the role of the local government and governance, the role of urban planning in general and more specifically the role of the 1986 Master plan in the reconstruction of Kalamata after the 1986 earthquake.

During the interviews the discussion developed towards additional dimensions and as a result new subjects emerged through them: preexisting dynamics that are often magnified post-disaster, the importance of the cultural identity and its preservation, etc. In a combination of the pre-selected subjects together with the ones that emerged from the interviews, the results are organized, grouped and presented in the following chapters. This structure benefits the purpose of this research which is to identify the role of planning in the resilient reconstruction of the city of Kalamata while attempting to incorporate a big part of the acquired information and data. Thus, the following chapters are structured as follows:

- Preexisting dynamics and basic features
- Plan preparedness and anticipation
- Governance
- Long term adaptation

7.1 Pre-existing dynamics and basic features.

The basic features that a city is composed of are important elements that influence its resilience. These are elements with long term dynamics which can only be partially influenced. The structural elements as well as long term challenges of an urban system are such examples. Together with the basic features, the pre-existing dynamic of a system is critical at times of a shock. During emergencies, chronic stresses can result to disasters while a well-balanced system can use a shock as an opportunity for improvement, or in other words, resilience. Thus, the basic features of an urban system combined with the preexisting dynamic can forecast the reconstruction process.

In the reconstruction of Kalamata both elements were significant. Except for the central elements and the challenges of the city at the time, the interviews highlighted several times the impact of this pre-existing dynamic in the reconstruction of the city of Kalamata after the 1986 earthquake. The beginning of the 1980's was an era of change in Greece. The recent re-democratization after the country's military dictatorship (1967-1974) and later the integration of the country in the European Economic Community (EEC) created an atmosphere of change and optimism. Thus, at a national level, the gradual democratization of the Greek society, and at the European level where it was a time of creativity and optimism for the European Union, together created an atmosphere of innovation. At the same time, in the local level, the local governments were for the first time acquiring powers and introducing new institutions. In overall, a dynamic wave of change, optimism and involvement were present in the society and the institutions.

Together with this optimistic perspective, many challenges were present in most Greek cities. Among them, the consequences of the rapid and many times unplanned urbanization had resulted to the existence of many urban areas without basic infrastructure such as sewage systems, public spaces, etc. This element was repeatedly highlighted by the interviewees:

> *"Back then the greatest challenge as it was in most Greek cities was the urban planning degradation of the city due to the illegal buildings. More than 50 % of the city's buildings were illegal. (..) the city was divided between the rich urban culture part of the*

center that was well taken care of and the unplanned surroundings of the rest. Thus, this was a divided city in terms of urban planning but also, socially, economically and politically. A city of two speeds. Today this division is alleviated." (CO_E_1, 2014)

Moreover, the city was developing without a strategic plan, not preserving its rich urban culture and without a vision for the future. Thus, this unique identity was in risk. The local government was aware of the problems but prior to the earthquake could not address them adequately.

"It is a city with very old historic roots, with a continuity that developed into a dynamic city and because of its port, with a dynamic urban culture since the 19th century which is rare in Greece and which is depicted in its built heritage." (CO_E_1, 2014)

"an earthquake creates opportunities for good and bad. Preexisting challenges emerge and become central. Thus there are preexisting challenges that in the aftermath of the disaster are magnified and new stakeholders with different powers take part. Thus old challenges with new data" (RS_1, 2015)

"The historic center, around the landmark of the city the church of Agioi Apostoloi, around it there were (before the earthquake) 5-storey apartment buildings. The city would lose its history. This was the more difficult battle from 5 storey to limit the building coefficient to 2 storey. It happened after the earthquakes because before it was impossible for something like this to be approved. This was the benefaction of the earthquake." (CO_E_1, 2014)

"The crises give to the political authorities great powers that can be used both for the good and for the bad (..) The problems had emerged before the earthquakes but the political circumstances did not allow their confrontation." (CO_E_1, 2014)

"In the beginning of the 1980's the challenge for the city was to find an identity. (..) Then a drastic change happened in the everyday life as well as in the cultural life of the city. The municipality broke the cultural exclusion of the city and opened new pages in local governance." (CO_E_2, 2014)

"In 1995 , even though the first reconstructions were completed, many challenges remained, there were the historic buildings that needed reconstruction, the problem of schools, the historic center that was deserted as well as the Marina.." (CO_E_2, 2014)

In this way the city managed to protect and to enrich its identity during a critical time for its future. Except for the described temporal challenges, the city of Kalamata has a series of central characteristics that remain present over time. Since the 1986 earthquake the city of Kalamata has followed a long trajectory of reconstruction and recovery, with an increased resilience and a vision towards sustainability. Today, the challenges are slightly different. However, the main features of the city remain the same over time:

"The physical environment and the relation of the city with the sea and the mountain, the position of Kalamata in the southernmost part of the Peloponnese, that is rather secluded in relation to the main country, with a long history that is engraved in the urban grid and therefore one can identify historic and morphological characteristics. Also, a close relationship with the agricultural sector, everyone seems to have some relation with agriculture" (RS_E_1, 2015)

> *"(…) the fact that it is flat, its seafront, the closeness to the Mt. Taygetus, the fact that it is close to the country's capital, Athens and its history."* (CO_E_2, 2014)

> *"In my opinion the challenges remain in the city. Due to the history of the city and its anthropography the identity of the city should translate to the city of culture in all levels, from everyday life to urban planning, to its surroundings and its people."* (CO_E_1, 2014)

Thus, the insight from the interviews concerning preexisting dynamics is straightforward. Pre-existing dynamics matter. They can significantly influence the reconstruction process. Preexisting conditions and trends are magnified by the disrupting events. Thus, adaptation, autonomy and efficiency are critical to allow better adjustments to changing conditions. While the basic feature of the city remain the same over time, the process of reconstruction unfolds differently depending on the previous dynamics. For this reason, being prepared for possible disruptions is critical. The next section focuses on the importance of preparedness and how it was perceived by the interviewees.

> *The same plan without a vision about it could also be left forgotten in some drawer. We can imagine the situation. A city on the road, continuously emergent needs, little ressources, different goals. (..) What mattered here is the preexistence of a dynamic of people that could support the plan. Planners, engineers, municipal officers. It was the plan and the people that could implement it."* (RS_E_1, 2015)

7.2 Plan preparedness and anticipation: The role of the existence of the 1986 Master Plan.

The reconstruction process is also influenced by the degree of anticipation. A large part of resilience is the acknowledgement of the probability of a catastrophic event and the preparation for it. In other words, risk communication and awareness is a critical part for resilience programming (OECD, 2012). Thus, an element that emerged multiple times during the interviews was the importance of the 1986 Master Plan in the overall reconstruction plan. The existence of the 1986 Master Plan had multiple dimensions. The pre-disaster 1986 Master plan served not only as a base upon which to quickly assess the reconstruction needs but also as an organization plan for the spatial distribution of the multiple actions happening in the city, whether it was the removal of debris or the placement of tents. The adjusted 1986 Master Plan served as the central guide for the reconstruction period.

> *"The existence of a plan was critical because it showed were everything should be situated, which were the priorities. (...) In my opinion the long procedures of urban planning that had preceded the earthquake matured in the public opinion after the earthquake and they understood the need for public spaces as well as the need for spaces for public building and above all the need for preservation of the historic center that was neglected before. And this legacy memory still exists".* (CO_E_2, 2014)

> *"The earthquake acted as a catalyst to the implementation and also to the amelioration of the 1986 Master Plan (...) it helped implement things that would not be implemented otherwise, there were great objections to the Master Plan before the earthquake, such as the building coefficients"* (CO_A, 2014)

> *"After the earthquake there were adjustments in the Master Plan concerning future seismic fortification such as an increase in open areas for emergency shelters.(..)* (CO_A, 2014)

However, it is not sufficient to have just any plan. What makes a difference in the reconstruction process and in recovery is to have a complete plan that takes into consideration the different dimensions of its implementation, from possible objections to windows of opportunity created in times of emergency. In other words, to have a plan that acknowledges the vulnerabilities of the city and has reflected on different ways to address them.

> *"However, the existence of the plan is not enough, one must consider what kind of plan is that, is it relevant?" (...) "After a disaster, the urgent seems to be the most important. In reality, it is not. The existence of whatever kind of plan creates a base to integrate long term goals. Thus, the existence of a plan and that this plan is part of the decision makers and that it exists in material, in print, it is very important in my opinion."* (RS_E_1, 2015)

In Kalamata, the involvement with the 1986 Master Plan had familiarized the planning team with the advantages and challenges of the city. At the same time the different objections were bended with a combination of reasoning from the local government and the planning team and the catalytic impact of the earthquake that projected the city's weaknesses.

> *"In other words, the precedent urban planning preparations, the culture of objection that forced the local government and the planners to further investigate the planning subjects, the fear that the earthquake created and the post-earthquake adjustment*

produced a well-rounded Master Plan that was even awarded in Europe." (CO_E_2, 2014)

"The earthquake and some actions of economic nature from the local government such as the buying of the historic buildings to restore and use as municipal buildings, bended the strong oppositions to the Master Plan.(..) The earthquake acted as a catalyst" (CO_E_2, 2014)

As Maret and Cadoul describe the window of opportunity through the example of the reconstruction of New Orleans after Hurricane Katrina, the memory of the catastrophe is still sufficiently vivid for the inhabitants to agree to changes that would never have accepted before." (p.121)

"Even back then and also today Kalamata has many open air areas throughout the city which is critical for the city's vulnerability and for the emergency management. This is an asset of the city and the city's plan. Also in terms of building stock there is lower vulnerability today in my opinion." (RS_1, 2015)

Concluding, after the occurrence of the 1986 earthquake the priorities switched and the city's survival became the top priority. The first period after the earthquake the city was empty, the people were gone, the activities were transferred in the outskirts of the city since the center was devastated. These patterns can easily remain for a long time if there is no prepared action plan to address them. Thus, the importance of preparedness to possible disruption is another critical element on the process of reconstruction and on the configuration of resilience. The general preexisting conditions affect the trajectory of reconstruction but preparedness and anticipation further improve the coping capacities and recovery strategies of the city. Thus, anticipation is critical to resilience.

7.3 Governance: Auto-organization, Communication, Cooperation and Leadership

Another element that emerged multiple times through the interviews and that also includes many different dimensions is the importance of governance through the reconstruction process. Good governance is critical post-disaster to regain a functional rhythm and to address and organize the emergency quickly to address relief and reconstruction activities. Auto-organization, communication, cooperation and leadership have been highlighted as elements of successful governance. The governance relates to the process of reconstruction as it depicts how different stakeholders succeed or not to cooperate and to implement solutions within a very pressured post-disaster environment. The element of governance is of special interest in the case study of Kalamata as it had a catalytic effect on the overall reconstruction period.

The difficulty of successful governance lies on the fact that a balanced combination of different characteristics is required. Among them, leadership has a central role. “Planning for reconstruction must make emerge a leadership, identified by all the actors, who assumes the decision-making and plays a role of pedagogue for the population while remaining sensitive to its claims.” (Maret et Cadoul, 2008, p.123) With this perspective and in a post disaster context, the local government has multiple, often conflicting roles.

In the reconstruction of Kalamata, the local government took over a leading role and communicated the vision of reconstruction with the public, the citizens and the different stakeholders so that they don’t work in silos. The central government offered institutional independence to the local government for the reconstruction of the city and even though there was no such an institutional role at the time, no one doubted the leadership of the local government during the reconstruction. This transfer of power was innovative. Moreover, the local government communicated constantly the problems and the trajectory of the reconstruction, making the reconstruction decisions public. In this way, despite the severeness of the destruction the different stakeholders remained interested, committed and engaged to the reconstruction plan. Thus, a series of characteristics of governance guided a successful reconstruction. Among them, leadership and cooperation but also redundancy and interdependence.

> *"Back then the role of local government in the management of emergency situations was non-existent. There was no such an institutional role. Thus, it would be expected that the prefecture would manage the situation. A second point is that institutionally the EPPO together with the ministry of planning and environment would manage the registration of damages, the funding of the reconstruction the loans etc. What happened in Kalamata is that the local government took over this role (without such an institutional backup). And this happens often in such situations. The one who can and wants finds the space to take over and cover the gaps of management. And in Greece this happens despite or in violation of the institutional framework"* (RS_E, 2015)

Thus, the leadership that the local government showed was combined with the institutional flexibility that allowed for it to guide and implement the reconstruction plan. This leadership was moreover backed up with cooperation with the team of planners and as a result a well-developed, balanced reconstruction plan was produced and implemented.

> *"If it weren't for a very structured local government with the help of very good scientific team, the planners, that helped very much with the beginning of the reconstruction plans the very next day of the earthquake. (..) the city was reconstructed in very little time if we consider the extent of the destruction."* (CO_A, 2014)

> *'(...) if there is no redundancy and cooperation between the planning team and the local government you cannot have a good result. What happened in Kalamata happened because the planning team was in direct cooperation, they had the back of each other, there was togetherness."* (CO_A, 2014)

The implementation of the reconstruction plan of Kalamata was the product of successful governance that was achieved through leadership from the local government, institutional flexibility provided by the central state and cooperation between the local government and the scientific team of planners. This dynamic is not easily feasible since often this the institutional organization does not allow for such redundancies.

> *"Today in Greece there is an ongoing effort to stop this situation. To describe in a strict way the specification of the institutional roles and to design strict limits in the management of emergency situations. (...) The guidelines from the General Secretary of Civil protection is to not to allow an overlap of competences out of the institutional provisions. This is a position towards planning with advantages and disadvantages. But what happened in Kalamata was completely successful. It was an example of total auto organization, spontaneity and flexibility."* (RS_E, 2015)

Successful governance moreover depends on citizens. The role of the citizens is equally importance with local leadership. From participating in the decision process to being informed on the reconstruction process and even to not objecting to decisions the role of citizens can foster or object plans. During the reconstruction of Kalamata the citizens accepted and supported the local government's initiatives.

> *"The shock was great. Out of a sudden 50000 people were on the street not knowing where to go, even the ones that their homes were not affected. The given order was to stay away from the buildings. You understand that on one side the people had to find out what to do with their families and on the other side the local government had to take immediate decisions to start the reconstruction the next day. Thus, the local government decided but the citizens responded in the reconstruction of the city. (...)*

They responded in big numbers, only few hesitated. The next day everyone followed the guidelines from the municipality concerning how and what to rebuild, even the ones that did not have the means, they took loans to reconstruct their houses. There was a collective dynamic." (CO_A, 2014)

"After a big catastrophic event, you see splendor and you see tragic scenes. You could see people that you knew that had no such needs to beg for material help, for money, and at the same time others that offered their houses and their plots and they said take it and use it as you have for the city to be saved. These things were happening in parallel the same day. In general, the people accepted what was asked by the local government. They cooperated. But they did not decide together. The local government decided and the citizens followed." (CO_E_2, 2014)

Figure 7.1 The Mayor of Kalamata discusses the changes on the post-disaster 1986 Master Plan with the citizens. (source: Diamantopoulos, 1995)

Thus, the citizens participated in the reconstruction projects by not objecting them and by having the reflects to follow the guidelines. Any problems created during the distribution of supplies as described in the following quote were bent in large by auto organization initiatives by the responsible actors.

> *"With economic criteria, someone with large income could not take food supplies, and likewise for the distribution of the tents and later for the cruise ship 'Marina' that served as hotel/shelter for the earthquake strike for about a year. (...) how the tents would be distributed, we formed committees and decided: the ones with less than X income could apply for tents. Also we distributed money from the Ministry of Health and Welfare for micro-constructions, for the first needs. Again, with economic criteria of income and also with criteria of permanent residency in the city because there were cases of people living in Athens and having holiday houses in the city that came to take advantage of the money even though they were not allowed to. This was also our job to find out the real residents.*
> *The people were very tempered and we even found out later tents hidden in warehouses. Our role was very hard because many were filing up applications with false data." (R1, 2014)*

Concluding, good governance is a major element for the success of the reconstruction process. It involves a series of different and often conflicting characteristics. Strength and efficiency, autonomy and adaptability, redundancy and interdependence are all critical during reconstruction. Also, transparency is critical for good governance. Strong political power must be combined with interest, cooperation and auto-organization from the social capital. In this way, improved forms of governance can be produced that lead to successful reconstruction processes.

7.4 Long term adaptation: Prioritizing culture and education

The process of reconstruction needs a series of characteristics in order to be resilient and among them, adaptation is critical for the long-term evolution. With a long-term perspective adaptation is fostered by culture and education and therefore sustaining such an environment is critical for resilience. In the city of Kalamata culture and education were major priorities for the local government even before the earthquake. An attempt to infuse the city with cultural and educational activities was set in place. The problematic was to develop a permanent and inclusive cultural agenda for the city of Kalamata. The goal was to create a network of cultural activities that would be diffused through the city.

> *"Then a program was developed in Kalamata under the instructions of Hadjidakis[6] that created three circles. The first one included all of the city and had as a goal that the city would host quality shows. The second circle included the more engaged citizens and organized seminars such as art history, which had great attendance within the premises of DEPAK. The third circle were the art laboratories, the culture education in other words that did not exist in the school curriculums back then and it was organized in this way in Kalamata"* (CO_E_1, 2014)

Within this perspective, new institutions were introduced in Kalamata. Among them the Municipal and Regional Theater of Kalamata (1982) and the Municipal Organization of Cultural Development (DEPAK) (1985) that included Dance, Arts and Music. The municipal organization of DEPAK diffused cultural activities through the city and was the causation for the development of multiple private institutions (music, dance and arts schools) that did not exist beforehand. Another aftereffect of the development of these cultural activities was the creation of a renown internationally dance festival.

[6] Manos Hadjidakis (1925-1994) was a great Greek Composer and famous arts personality.

The Kalamata International Dance Festival, was established in 1995 and is an important international event that every summer attracts participants and public from all over the world, offering an important dynamic to the city in terms of culture and tourism. Thus, the DEPAK created a network of cultural activities and education that is still dynamic, today under the name FARIS.

Meanwhile, a discussion to prepare and implement a plan to reclaim and preserve the architectural heritage of the city was taking place. With the occurrence of the 1986 earthquake the emergence of this subject was revealed. The large number of destructed historical buildings and monuments threatened the built heritage of the city. Thus, with the mobilization of the local government and the involvement of the Ministry of Culture a series of actions took place for the salvation of the built heritage. The actions included an extended survey, listing and characterization of the heritage buildings. Further on the restoration work started that lasted for a long time.

> *'There was a big battle for the rescue of the historic built heritage. A big part was rescued, not all of it. This battle preexisted the earthquake. The paradox was that the earthquake instead of cancelling these efforts, gave them a new dynamic both in quantity and quality"* (CO_E_1, 2014)

In 1996, ten years after the catastrophic earthquake, Kalamata won the European Heritage awards (EU Prize for Cultural Heritage / Europa Nostra Awards) for the Restoration of historic buildings after the 1986 earthquake

> *"After the earthquake the municipality bought a large number of the destroyed historic buildings, it repaired them and used them for the different municipal services in a logic of diffusion of the municipality throughout the city for the citizen to meet the local government in multiple spots in the city"* (CO_E_2, 2014)

> *"The historic center was the darkest part of the city, (...) since it was scattered with ruins. The first steps were the pedestrianizing*

> *of some parts and the concession of the old municipal market building to Ministry of Culture to create there the archeological museum of the city. (..) Thus, the historic center gradually changed and is today a livable neighbourhood.:"* (CO_E_2, 2014)

Another project that distincted, the Kalamata Municipal Railway Park was awarded as a pilot project for the preservation of the European architectural heritage. The Railway Park is a unique open air museum of its kind. It was inaugurated only two weeks before the earthquake of 1986 but was only completed in 1990 due to the emergency phase that the city was into. However, the vast area of the Railway museum of 54,000 m2 in one of the most central locations of the city served as a shelter.

In conclusion prioritizing culture and education creates the prerequisites for awareness and the development of capacities that lead to improved degrees of adaptation on the long term. The reconstruction of Kalamata led by example by prioritizing these sectors even in times of emergency. In this way, it created the heritage of a long-term vision while addressing short term needs, a perspective that fosters future resilience.

7.5 The heritage of the 1986 reconstruction: more than a plan.

In the previous sections the most important aspects that facilitated a resilient reconstruction as they resulted from the semi-structured interviews were presented and discussed. Among them, pre-existing dynamics, awareness of risk and plan preparedness, good practices of governance and long term adaptation. Those elements worked for the reconstruction of Kalamata and the question that is raised is whether there was any transfer of this experience and knowledge to the responsible institutions or to similar cases.

In terms of local government leadership, the institutional framework has empowered its role in emergency management. However, in terms of auto-organization and institutional flexibility a reverse trend is witnessed. The ways that each institution is allowed to act is described in detail and there can be no flexibility from then on.

> *"It is a general trend not only in Greece but in many countries, especially after 9/11 to return to the old hierarchical model of management. Even though disaster events strike us and surprise us with an increasing pace. (..) We go back in old models and especially in Greece with the crises we go back in my opinion towards an hierarchical model."* (RS_1, 2015)

> *"Today the focus is who does what. What is needed though is the development of capacities. Not to describe what should be done but to make the institutions and its people capable of doing it. Therefore, we go from the development of capacities to the description of duties and this is a big problem in my opinion. We don't go towards resilience it is the exact opposite. Resilience is complementary to planning, it is the development of capacities."* ((RS_1, 2015)

In terms of lessons learned and heritage of the experience it is interesting to research if they were transferred to disaster management in general but moreover in a lower level, whether these experiences resulted in risk awareness and capacity development:

> *"The municipality later asked for an increase of the buildings coefficient, and the Ministry responded what will you do in the case of a new earthquake? And this was the legacy of the earthquake."* (CO_E_2, 2014)

> *"Another dimension is whether there was a development of capacities in the local government. Even if there was no institutional role of emergency management the previous effort of the local government concerning the development of infrastructure, the municipal companies of water and sewage, the municipal company of culture, the preparation of the Master plan, all these developed capacities. It has to do with the dynamic of the local government in general."* (RS_1, 2015)

> "*Concerning seismic protection I believe that Kalamata has been registered and has changed the whole perspective. Because back then OASP was new, it gained his experience through this procedure. Therefore, things that happened after were based in Kalamata. The most obvious is the system of transition housing, that is since used and that now is used for the refugees, the container stock etc."* (RS_1, 2015)

> *"Concerning nonstructural vulnerability as well as the acceptance and awareness of risk I believe there is an improvement. This is evident by several activities that happened since. For example, an evacuation exercise of Municipal Offices of Kalamata that happened some years ago. Also I think that the*

plan is still followed at some point. And some earthquakes that happened since the response was good. (RS_1, 2015)

"I am convinced, today the citizens of Kalamata understand the value of urban planning which was not the case back then.(...) the culture towards urban planning changed drastically" (CO_E_2, 2014)

Thus, it results that the reconstruction plan of Kalamata created a heritage in many dimensions. This heritage in mainly diffused in the specialists that worked in the reconstruction and in the awareness of the citizens that experienced the process. What would be very valuable is the communication of this tools to similar case studies. According to Delladetsimas (2009) even though the Greek experience has a concentrated knowledge and experience from past events it is apparent that it has not translated this knowledge into a more holistic reconstruction planning program. Such an example was the earthquake of Athens in 1999 where the local government was supplanted and the central government had the exclusive supervision of the reconstruction. Thus, the past experience from the importance of the local government in the reconstruction procedure was not successfully transferred to future disasters.

What hasn't happened and would be important is the transfer of this experience and this knowledge to other municipalities. Because for now it is only recycled and it will be lost because what is not improved is lost." (RS_1, 2015)

7.6 Discussion on findings

For a reconstruction to be resilient it must generate a more sustainable system and environment. Thus, the importance lies on the mechanisms and the ways that the reconstruction process is guided towards an improved system. Assessing resilience in Chapter 6 was critical to identify in which components and in what ways resilience was altered in the aftermath of a disaster and in different time-frames. The present chapter aimed at focusing even more closely on the process to identify the elements that made a resilient reconstruction possible or not. In both chapters the characteristics of resilient systems and processes were researched.

In the city level the reconstruction of Kalamata resulted not only to a recovery but to a more resilient city with a vision towards sustainability. The city managed to improve its infrastructure, to regain its economic dynamic, to retain its population structure and dynamic and to improve on the long-term the elements of its physical and urban environment. More precisely, in terms of tangible results, the reconstruction program improved the city's built environment, its infrastructure and its planning layout. Also, it preserved the natural environment as well as the built heritage of the city, it revived the historic center and it created a pedestrian network that transverses the city. At the same time, many intangible results were produced. The earthquake created a sense of unity among the citizens. Despite the great destruction of the earthquake in the built environment the cultural identity of the city was preserved. Thus, the reconstruction of Kalamata made a choice between what to recover and what to improve.

Even though the 1986 Master Plan was successful on its implementation and although it still influences the structural development of the city, some of the central elements of the plan were importantly delayed or failed to accomplish their role. Among them most of the central circulatory interventions such as the pedestrian network and the ring road that were realized only recently. The ring road was a central axis of the 1986 plan as it would offer multiple entry points to the city and that would decongest the city center. Even though the ring road was a central element of the 1986 Master Plan it was only completed in 2016, 30 years after the. Moreover, the pedestrianizing of Aristomenous street was only completed in 2014 and the pedestrian network is still an

ongoing work in progress. Thus, the circulatory system of the city, whose optimal operation was a central priority of the 1986 Master Plan, even though improved since the pre-earthquake era is not up to date with the current trends and challenges of the city.

Another pending element of the Master Plan is the pedestrianizing of the seafront road (Navarinou street) that was included in the 1986 Master Plan and is a project that is still uncertain. Except for the pending pedestrianizing of the eastern part of the seafront, neither the western part, where the Marina is situated didn't fulfill the dynamic role that was projected for it. Thus, the development of the seafront has not yet unfold according to the expectations of the 1986 Master Plan. Reflecting on this evolution the importance of plan implementation is highlighted. The resilience of the urban system and of the reconstruction process depends not only on the characteristics described on the previous chapters but moreover efficiency and feasibility are critical.

Concluding, planning is not enough, the present chapter resulted that for the reconstruction to be resilient a series of characteristics matter. Planning is important but moreover governance, education and culture matter. Building up resilience translates into building the capacities to be prepared in times of disaster to navigate a recovery and at the same time transition towards more resilient structures.

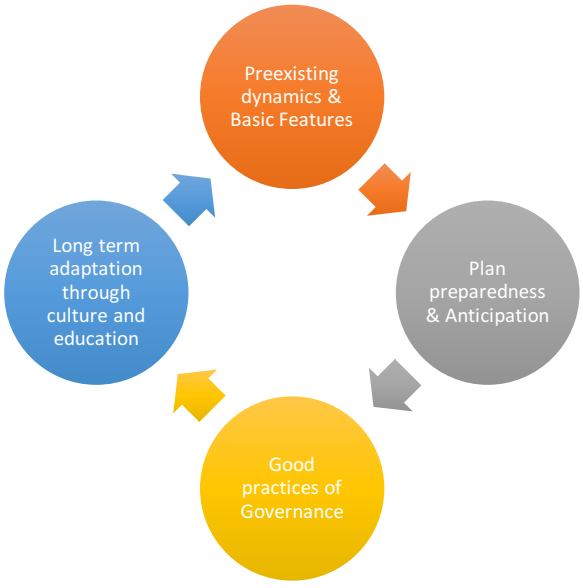

Figure 7.2: The characteristics of a resilient reconstruction, (source: author)

8. Conclusions

8.1 Overview

This research aimed at understanding the dynamic of resilience in a post-disaster context while highlighting the importance of long term projections and visions of reconstruction. The goal was to investigate planning as an essential tool for promoting resilience and sustainability goals. The importance of a posteriori evaluations was highlighted through the in-depth analysis of the reconstruction of Kalamata and its long-term recovery. An assessment method was developed through which resilience was explored. The method includes a series of resilience dimensions that evolved and matter differently over time. Moreover, the importance of a process of resilient reconstruction emerged as a critical element. The reconstruction process highlighted the link between planning and resilience. The conclusion discusses and summarizes the outcomes while it positions the research in the present state of resilience research and practice. Moreover, highlights the contribution to knowledge and the limitations of the research. Lastly, further possibilities of research are outlined.

8.2 Summary of research findings

In order to ground itself this research included as a first step an extensive literature review that positioned itself theoretically. Creating a firm theoretical background is critical for the development and the direction of the project. Thus, the origins of resilience were extensively researched resulting to a summative table of resilience definitions that were found relevant to the present research. Then, the relationship between resilience and vulnerability was explored concluding to a perspective on two interlinked concepts. The emerging questions on the complex relationship between resilience and vulnerability led to the concept of sustainability and the ways that it interacts with resilience.

The conceptualization shift on the resilience paradigm is presented in this section, explaining how resilience perspectives have shifted from an absorbing quality to a more inclusive concept that promotes adaptation and improvement and consequently, sustainability with a sense of improvement. Further, the particular context of this research is delineated, an urban area during the long term recovery phase in the aftermath of a catastrophic earthquake and how resilience is perceived within it. Lastly, this section concludes with the synthesis of a resilience definition.

In an era of uncertainty, planning often seems out of context. How can a community make long term projections when things change so rapidly? While the mosaic of uncertainties is long, from climate change consequences to the threat of terrorism, this research focuses in disasters triggered by natural hazards. This kind of perturbations in an urban system have the advantage that although they are not predictable, estimations of inherent system vulnerabilities and knowledge of the physical environment and the history of an area can create awareness on the possibilities of occurrence. Thus planning for the unexpected is imperative.

In such an environment resilience is critical as it is witnessed by the emergence of the concept in planning research, policy making and practice. Planning for resilience translates into creating awareness, minimizing vulnerabilities and creating coping capacities for present stresses and future shocks. However, the multidimensional character and the continuous evolution of resilience creates confusion over the concept and the ways it can be used in planning. For this reason, this research developed an approach for applying resilience within the discipline of planning.

After a focused literature review on the approaches on resilience within the disciplines of planning the next section scrutinizes the challenges of operationalizing resilience. It reviews approaches on measuring resilience resulting to a set of resilience components and it also positions itself in the spatial and temporal dimensions of the concept. Thus resilience is revealed as a concept that changes in different spatial levels and that has different temporalities.

In an attempt to find some insight and to contribute to the resilience discussion, this research focuses on the importance of resilient-driven reconstruction. The innovative part of the approach used in this research is that it has a long-term perspective in exploring the resilient dynamics of reconstruction over time. In the aftermath of a disaster reconstruction and recovery alter the development trajectory of urban systems. During this time, a window of opportunity for resilient reconstruction appears. The question that is raised is how this window of opportunity can be used. Thus, assessing the different components of resilience in different time periods, brought forward the need to explore the characteristics that made the process of reconstruction resilient.

This section results to a detailed description of the components and characteristics of resilience, contributing with a new perspective to the resilience assessment frameworks. A detailed resilience assessment model is proposed and implemented on the case study of the reconstruction of Kalamata after the 1986 earthquake, inspired by a combination of previous scientific approaches with similar research interest on resilience assessment and adapted on the actual case study. Moreover, the innovative part of this research is that it focuses its interest on the long-term impacts that the reconstruction had to the city. However the model was adapted to the case study and the results were interesting. Assessing resilience through different components resulted to the conclusion that each component has different importance in different time periods. While critical infrastructure and lifelines are most important on the short term, the economic revival is significant on the mid-term and the social and physical and urban environment are characteristics that are important on long term dynamics. Through this approach it became apparent that the process of reconstruction had a series of characteristics that rendered it resilience. Thus, a series of interviews were realized in order to identify these elements that made the reconstruction of Kalamata a resilient one.

The case study of the reconstruction of Kalamata is a unique case that experienced not only a morphological change but moreover a reorientation towards an holistic, integrative and more balanced development. The goals of social justice, economic and cultural development and environmental sustainability were set by the 1986 Master Plan. Its successful implementation was the reason that Kalamata was

selected as an ideal case study to explore the development of the reconstruction in terms of resilience and with a long term perspective.

Today, 30 years after the earthquake, Kalamata stands as a successful example in terms of both short term and long term resilient reconstruction. The assessment of resilience in different time periods showed that even if the city faces different challenges today it is better equipped to face future disturbances. Today, in a period of great uncertainty for the country due to the ongoing economic crisis, the city of Kalamata stands out as a developing urban center that preserves its identity and welcomes new ideas. Since the occurrence of the 1986 earthquake the city has improved and updated its infrastructure as well as its morphology. The implementation of the 1986 Master Plan gave the city a new orientation and it protected it from non-reversible choices that would affect its identity. Such an example is the preservation of its built heritage. Despite of the severe economic crisis, tourism is a major force in the development of the area and is presently on the rise. Lastly in terms of it social resilience, the city experiences the same demographic problem as the rest of the country, however with a lower intensity. The above characteristics compose an improved overall resilience for the city of Kalamata in comparison with 1986.

The goal behind assessing the resilience of Kalamata is to understand how it can be influenced. Thus, the focus of this research is to understand how resilience was fostered in Kalamata. Researching the ways that resilience was generated through the reconstruction process of Kalamata the second part of the analysis identified a series of characteristics that are important in the process of reconstruction and that made the difference in Kalamata. Preexisting dynamics, plan preparedness, successful governance, and long-term adaptation emerged through a series of interviews as important prerequisites for a resilient reconstruction process.

On the contrary, one can identify the radical improvements that happened to the city as a result of the post-disaster planning interventions. Instead of losing its growth dynamic Kalamata followed an improved trajectory in terms of sustainable urban development and is today one of the most vibrant centers of the country. Moreover,

during the economic crisis that is affecting the cities of Greece, the city of Kalamata remains one of the most vibrant both economically and culturally centers of the country.

8.3 Contribution and limitations

Today the world is going through an era of uncertainty, where structural and non structural changes are taking place in every aspect of our lives. During this transitional period strong resilience is emerging as a top priority for easing this transition and moreover to attempt a positive outcome of it. Thus, resilience and the ways that it can influence the development trajectories of the city are central in this research. This thesis contributes to the research approaches over the ways that resilience can be assessed and most importantly on how it can be improved.

Thus, the contribution of the present research on the field is multi-dimensional. It explores the concept of resilience with a focus in the field of planning and proposes an assessment model. The development of the assessment model through a series of resilience components that develop differently over time is innovative. The exploration of the developmental trajectory of resilience over time, it gives further insight on the understanding of the concept of resilience. By shedding the light in this approach on resilience it contributes to the attempt to understand the concept and it creates a more comprehensive perspective for the theoretical dimension of resilience. Moreover, it contributes to its practical dimension by creating a bridge between planning and disaster risk reduction and highlighting the need for cooperation between the two fields and how this can be achieved through resilience.

However, the goal of this research is not restricted to the theoretical dimension of resilience. Aiming to render the concept utilizable for practitioners and to identify how improving resilience can be achieved, this research identified a series of characteristics that are important for resilience during the different time periods of the reconstruction process. Through in depth interviews it concluded that even though the preexisting dynamics are significant, the existence of a well-prepared plan and good governance are critical in the resilience of the reconstruction trajectory. Moreover, long-term adaptation

is fostered by culture and education that leave a heritage of belonging and attachment in the city. These remarks and conclusions contribute to the better understanding of the concept and moreover to the operationalization frameworks.

The case study of this research reveals why further a posteriori research is needed. The unique trajectory of this reconstruction process highlights the need to learn from past examples. As resulted from Chapter 7, plan preparedness and good governance are essential prerequisites for a successful reconstruction. Moreover, plan preparedness emerged as a critical factor. In Kalamata the reconstruction plan had as a priority the needs of the citizens and the choice was the preservation and revival of the historic center. It was proved through the example of Kalamata that "(…) the reconstruction after the earthquakes is not only a matter of civil engineers and of the good reconstruction of the buildings, but how to design an holistic program with epicenter the citizen and his needs. (..) the citizens don need just to return to their houses but they have economic, cultural, social needs and all of them have to be answered." (Benos, 2010)

Therefore, plan preparedness is essential although not just any plan would work. What is needed is a well-balanced plan that addresses the citizen's needs. Moreover, the importance of good governance practices is also projected. In the reconstruction of Kalamata, the central government offered institutional independence to the local government for the reconstruction of the city and even though there was no such an institutional role no one doubted the leadership of the local government during the reconstruction. Thus, the present research contributes not only the theoretical part of the resilience discussion by highlighting new facades of the concept but it also contributes to the importance of implementation of resilience in actual situations.

Apart from the different contributions that were produced the present research faced a series of limitations. Even though the great chronological distance from the event was ideal for the longitudinal analysis that was required, data was not always available. In the case of interviews even though the interviewees were selected for their experience and knowledge on the case study, there were details that were forgotten after such a long time. Moreover, since 1986 two large administrative reforms have happened to Greece, "Kapodistrias' in 1999 and 'Kallikratis' in 2007 that have changed the morphology of the municipalities. The new reformed municipalities are different both geographically and in

population and thus comparing the evolution of indicators over time was not always attainable.

Thus, the chronological distance from the event created a series of limitations that were nevertheless addressed were possible by different and overlapping data sources. A last limitation, the research was conducted in Montreal and even though the author was familiar with the city and visited it multiple times to acquire data (2009, 2013) and to conduct interviews (2014, 2015) the distance created a sense of urgency while visiting and it was impossible to reach out for an additional source once away.

8.4 Towards future research possibilities.

The goal of this research is twofold. On the one hand to further explore the theoretical concept of urban resilience by contributing to the development of the concept within the discipline of planning. On the other hand, to develop a method of assessment to identify ways and mechanisms that it can be improved within an urgent reconstruction context. Both dimensions are targeted for researchers, policy makers and practitioners that aim at incorporating resilience in their works. Supporting the link between planning, reconstruction and resilience opens the way for the development of integrated resilience planning that will include social, economic, environmental and disaster risk reduction concerns. The combination of these dimensions is critical for todays' world of uncertainty. Planning for resilience is emerging as a priority both in times of stability and in turbulent times. Having the tools to address urgent needs while generating a resilient future is critical.

Thus, the present research can act as an initiative to further explore ways that urban resilience can be fostered through planning. Planning and disaster risk reduction are two different fields that have been developing separately even though their objectives often coincide. This research identifies resilience as a merging point for the two disciplines. Moreover, it showed the importance of a posteriori research on case studies as a way of identifying good and bad practices of resilience. However, the present research presented only one approach that offered important insight in the mechanisms of

resilience but is not exhaustive. Further research for the operationalization ways of resilience, through past case studies and moreover present ones that face challenges and risks is needed.

Internationally, resilience is promoted as a necessary concept for the development in times of uncertainty. Thus, research on actual case studies with a long-term perspective on their evolution and their goals will offer further insight on what kind of mechanism work for the promotion and implementation of resilience. One such example presently developing in this direction is the 100 Resilient cities initiative that aims at evaluating the resilience of the cities and further on at promoting resilient practices. More often, programs and initiatives target big cities that have the means and the resources to address these subjects. Smaller cities are often overlooked. The contribution of this research is that it develops an approach suitable for medium sized cities that can help them evaluate and promote good resilience strategies. Thus, the incorporation of resilience in practice is a challenging goal that has many more dimensions to be explored.

8.5 Closing remarks

Concluding, this research aimed at highlighting the importance of resilience in times of disaster and in normalcy. Disaster triggers resilience reflects that influence the urban system for a long time. Thus, the reason that resilience is important is that it can significantly influence the future of the city. At the same time the choice of reconstruction and development influence future resilience and in this way a never-ending cycle is created. In disaster, the brief window of opportunity that opens offers a chance to improve structures and to implement resilient strategies of reconstruction that can reorientate the development trajectories of cities. To achieve this improvement of trajectory a series of characteristics are needed such as a well-prepared plan, good practices of governance and long term adaptation through culture and education. This thesis presents a new dimension of the concept of resilience that incorporates these dynamic elements. Further research on the understanding on how planning and resilience are linked is needed but the insights are indicative. In an environment of uncertainty,

resilience matters and is not exclusively dependent on crisis. Ultimately, resilience translates into the shared responsibility to improve under every circumstance.

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Appendix 1: Ethics certificate

Université de Montréal

Comité plurifacultaire d'éthique de la recherche

31 août 2016

Madame Garis Myrto-Kalliopi
Candidate au doctorat
Aménagement - Faculté d'aménagement

OBJET: Approbation éthique (renouvellement)

Mme Garis Myrto-Kalliopi,

Le *Comité plurifacultaire d'éthique de la recherche (CPER)* a étudié votre demande de renouvellement pour le projet de recherche intitulé « La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata. » et a délivré le certificat d'éthique demandé suite à la satisfaction des exigences qui prévalent. Vous trouverez ci-joint une copie numérisée de votre certificat; copie également envoyée à votre directeur/directrice de recherche et à la technicienne en gestion de dossiers étudiants (TGDE) de votre département.

Notez qu'il y apparaît une mention relative à un suivi annuel et que le certificat comporte une date de fin de validité. En effet, afin de répondre aux exigences éthiques en vigueur au Canada et à l'Université de Montréal, nous devons exercer un suivi annuel auprès des chercheurs et étudiants-chercheurs.

De manière à rendre ce processus le plus simple possible et afin d'en tirer pour tous le plus grand profit, nous avons élaboré un court questionnaire qui vous permettra à la fois de satisfaire aux exigences du suivi et de nous faire part de vos commentaires et de vos besoins en matière d'éthique en cours de recherche. Ce questionnaire de suivi devra être rempli annuellement jusqu'à la fin du projet et pourra nous être retourné par courriel. La validité de l'approbation éthique est conditionnelle à ce suivi. Sur réception du dernier rapport de suivi en fin de projet, votre dossier sera clos.

Il est entendu que cela ne modifie en rien l'obligation pour le chercheur, tel qu'indiqué sur le certificat d'éthique, de signaler au CPER tout incident grave dès qu'il survient ou de lui faire part de tout changement anticipé au protocole de recherche.

Nous vous prions d'agréer, Madame, l'expression de nos sentiments les meilleurs,

Raphaëlle Stenne, conseillère en éthique de la recherche
Comité plurifacultaire en éthique de la recherche (CPER)
Université de Montréal
JP/RS/rs
c.c. Gestion des certificats, BRDV, Isabelle Thomas, Professeure agrégée, Aménagement, Faculté d'aménagement, Simone Zriel
p.j. Certificat CPER-14-062-D(2)

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Université de Montréal

Comité plurifacultaire d'éthique de la recherche

N° de certificat
CPER-14-062-D(2)

CERTIFICAT D'APPROBATION ÉTHIQUE

- 2ième renouvellement -

Le Comité plurifacultaire d'éthique de la recherche (CPER), selon les procédures en vigueur et en vertu des documents relatifs au suivi qui lui a été fournis conclu qu'il respecte les règles d'éthique énoncées dans la Politique sur la recherche avec des êtres humains *de l'Université de Montréal*

Projet	
Titre du projet	**La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata.**
Étudiante requérant	**Garis Myrto-Kalliopi** (GARM15588406) Candidate au doctorat, Aménagement - Faculté d'aménagement Université de Montréal
Sous la direction de	Isabelle Thomas, Professeure agrégée, Aménagement, Faculté d'aménagement, Université de Montréal
Financement	
Organisme	Non financé
Programme	--
Titre de l'octroi si différent	--
Numéro d'octroi	--
Chercheur principal	--
No de compte	--

MODALITÉS D'APPLICATION

Tout changement anticipé au protocole de recherche doit être communiqué au CPER qui en évaluera l'impact au chapitre de l'éthique. Toute interruption prématurée du projet ou tout incident grave doit être immédiatement signalé au CPER.

Selon les règles universitaires en vigueur, un suivi annuel est minimalement exigé pour maintenir la validité de la présente approbation éthique, et ce, jusqu'à la fin du projet. Le questionnaire de suivi est disponible sur la page web du CPER.

Raphaëlle Stenné, conseillère en éthique de la recherche
Comité plurifacultaire d'éthique de la recherche
Université de Montréal

31 août 2016 — Date de délivrance du renouvellement ou de la réémission*
1er septembre 2017 — Date du prochain suivi
3 juin 2014 — Date du certificat initial
1er septembre 2017 — Date de fin de validité
*Le présent renouvellement est en continuité avec le précédent certificat

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Université de Montréal

Comité plurifacultaire d'éthique de la recherche

21 août 2015

Madame Garis Myrto-Kalliopi
Candidate au doctorat
Aménagement - Faculté d'aménagement

OBJET: Approbation éthique (renouvellement)

Mme Garis Myrto-Kalliopi,

Le *Comité plurifacultaire d'éthique de la recherche (CPER)* a étudié votre demande de renouvellement pour le projet de recherche intitulé « La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata. » et a délivré le certificat d'éthique demandé suite à la satisfaction des exigences qui prévalent. Vous trouverez ci-joint une copie numérisée de votre certificat; copie également envoyée à votre directeur/directrice de recherche et à la technicienne en gestion de dossiers étudiants (TGDE) de votre département.

Notez qu'il y apparaît une mention relative à un suivi annuel et que le certificat comporte une date de fin de validité. En effet, afin de répondre aux exigences éthiques en vigueur au Canada et à l'Université de Montréal, nous devons exercer un suivi annuel auprès des chercheurs et étudiants-chercheurs.

De manière à rendre ce processus le plus simple possible et afin d'en tirer pour tous le plus grand profit, nous avons élaboré un court questionnaire qui vous permettra à la fois de satisfaire aux exigences du suivi et de nous faire part de vos commentaires et de vos besoins en matière d'éthique en cours de recherche. Ce questionnaire de suivi devra être rempli annuellement jusqu'à la fin du projet et pourra nous être retourné par courriel. La validité de l'approbation éthique est conditionnelle à ce suivi. Sur réception du dernier rapport de suivi en fin de projet, votre dossier sera clos.

Il est entendu que cela ne modifie en rien l'obligation pour le chercheur, tel qu'indiqué sur le certificat d'éthique, de signaler au CPER tout incident grave dès qu'il survient ou de lui faire part de tout changement anticipé au protocole de recherche.

Nous vous prions d'agréer, Madame, l'expression de nos sentiments les meilleurs,

Olivier St-Laurent, Conseiller en éthique de la recherche
Comité plurifacultaire en éthique de la recherche (CPER)
Université de Montréal
TP/OS/os
c.c. Gestion des certificats, BRDV, Isabelle Thomas, Professeure agrégée, Aménagement, Faculté d'aménagement, , , Simone Zriel
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Université de Montréal

Comité plurifacultaire d'éthique de la recherche

N^O de certificat
CPER-14-062-D(1)

CERTIFICAT D'APPROBATION ÉTHIQUE

- 1er renouvellement -

Le Comité plurifacultaire d'éthique de la recherche (CPER), selon les procédures en vigueur et en vertu des documents relatifs au suivi qui lui a été fournis conclu qu'il respecte les règles d'éthique énoncées dans la Politique sur la recherche avec des êtres humains *de l'Université de Montréal*

Projet	
Titre du projet	**La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata.**
Étudiante requérant	**Garis Myrto-Kalliopi** (GARM15588406) Candidate au doctorat, Aménagement - Faculté d'aménagement Université de Montréal
Sous la direction de	Isabelle Thomas, Professeure agrégée, Aménagement, Faculté d'aménagement, Université de Montréal
Financement	
Organisme	Non financé
Programme	--
Titre de l'octroi si différent	--
Numéro d'octroi	--
Chercheur principal	--
No de compte	--

MODALITÉS D'APPLICATION

Tout changement anticipé au protocole de recherche doit être communiqué au CPER qui en évaluera l'impact au chapitre de l'éthique. Toute interruption prématurée du projet ou tout incident grave doit être immédiatement signalé au CPER.

Selon les règles universitaires en vigueur, un suivi annuel est minimalement exigé pour maintenir la validité de la présente approbation éthique, et ce, jusqu'à la fin du projet. Le questionnaire de suivi est disponible sur la page web du CPER.

Olivier St-Laurent, Conseiller en éthique de la recherche
Comité plurifacultaire d'éthique de la recherche
Université de Montréal

21 août 2015
Date de délivrance du renouvellement ou de la réémission*

1er septembre 2016
Date du prochain suivi

3 juin 2014
Date du certificat initial

1er septembre 2016
Date de fin de validité

*Le présent renouvellement est en continuité avec le précédent certificat

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Université de Montréal

Comité plurifacultaire d'éthique de la recherche

3 juin 2014

Madame Garis Myrto-Kalliopi
Candidate au doctorat
Aménagement - Faculté d'aménagement

OBJET: Reconnaissance d'une approbation éthique

Mme Garis Myrto-Kalliopi,

Le *Comité plurifacultaire d'éthique de la recherche (CPER)* a étudié le projet de recherche intitulé « La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata. » et a délivré le certificat d'éthique demandé suite à la satisfaction des exigences précédemment émises.

Notez qu'il y apparaît une mention relative à un suivi annuel et que le certificat comporte une date de fin de validité. En effet, afin de répondre aux exigences éthiques en vigueur au Canada et à l'Université de Montréal, nous devons exercer un suivi annuel auprès des chercheurs et étudiants-chercheurs.

De manière à rendre ce processus le plus simple possible et afin d'en tirer pour tous le plus grand profit, nous avons élaboré un court questionnaire qui vous permettra à la fois de satisfaire aux exigences du suivi et de nous faire part de vos commentaires et de vos besoins en matière d'éthique en cours de recherche. Ce questionnaire de suivi devra être rempli annuellement jusqu'à la fin du projet et pourra nous être retourné par courriel. La validité de l'approbation éthique est conditionnelle à ce suivi. Sur réception du dernier rapport de suivi en fin de projet, votre dossier sera clos.

Il est entendu que cela ne modifie en rien l'obligation pour le chercheur, tel qu'indiqué sur le certificat d'éthique, de signaler au CPER tout incident grave dès qu'il survient ou de lui faire part de tout changement anticipé au protocole de recherche.

Nous vous prions d'agréer, Madame, l'expression de nos sentiments les meilleurs,

Pierre Lapointe, Président
Comité plurifacultaire d'éthique de la recherche (CPER)
Université de Montréal

PL/RS/rs

c.c. Gestion des certificats, BRDV
Isabelle Thomas, Professeure agrégée, Aménagement, Faculté d'aménagement
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Comité plurifacultaire d'éthique de la recherche

CERTIFICAT D'APPROBATION ÉTHIQUE

Le Comité plurifacultaire d'éthique de la recherche (CPER), selon les procédures en vigueur, en vertu des documents qui lui ont été fournis, a examiné le projet de recherche suivant et conclu qu'il respecte les règles d'éthique énoncées dans la Politique sur la recherche avec des êtres humains *de l'Université de Montréal.*

Projet	
Titre du projet	**La résilience urbaine face aux catastrophes naturelles: le rôle de la planification dans la reconstruction de la ville de Kalamata.**
Étudiante requérant	**Garis Myrto-Kalliopi** (GARM15588406) Candidate au doctorat, Aménagement - Faculté d'aménagement Université de Montréal
Financement	
Organisme	Non financé
Programme	--
Titre de l'octroi si différent	--
Numéro d'octroi	--
Chercheur principal	--
No de compte	--

Approbation reconnue	
Approbation émise par	non
Certificat:	s.o.

MODALITÉS D'APPLICATION

Tout changement anticipé au protocole de recherche doit être communiqué au CPER qui en évaluera l'impact au chapitre de l'éthique.

Toute interruption prématurée du projet ou tout incident grave doit être immédiatement signalé au CPER.

Selon les règles universitaires en vigueur, un suivi annuel est minimalement exigé pour maintenir la validité de la présente approbation éthique, et ce, jusqu'à la fin du projet. Le questionnaire de suivi est disponible sur la page web du CPER.

Pierre Lapointe, Président
Comité plurifacultaire d'éthique de la recherche
Université de Montréal

3 juin 2014
Date de délivrance

1 juillet 2015
Date de fin de validité

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Appendix 2: Consent Form

CONSENT FORM

Université de Montréal

Faculty of Environmental Design

CONSENT FORM

Research Title: Exploring urban resilience to disasters. The role of planning in the recovery of Kalamata after the 1986 earthquake.

Researcher : Myrto Kalliopi Garis, Phd Candidate, Urban Planning Institute, Faculty of Environmental Design, University of Montreal

Research Director : Isabelle Thomas, Associate Professor, Urban Planning Institute, Faculty of Environmental Design, University of Montreal

A) INFORMATION FOR THE PARTICIPANTS

1. Research Goals : To explore and understand the role of planning in the post-disaster development of a cityès resilience on the long term.

2. Participation : Interviews will take place with persons involved directly or indirectly in the reconstruction process of the 1986 earthquakes of the city of Kalamata as well as with persons involved in the planning processes of the city in the last 30 years. If you decide to volunteer, you will be asked to participate in one or two interviews at a place you find convenient, in Kalamata or Athens. You will be asked several questions, some of them about your experience before/during/after the reconstruction process of the city of Kalamata. The interviews will be recorded only with your permission. The interview will take approximately 1 hour.

3. Confidentiality : The content of this interview will be used exclusively for the puropose of the present reseaearch.

4. Advantages and disadvantages : This interview will help in the understanding of the connections between the planning processes that take place before, during and after a disastrous event and the development of the resilience of a city on the long term.

5. Right to Withdraw: Your participation is on a voluntary basis, and you may withdraw from the study at any time without prejudice or having to explain your decision. You may do so by informing the supervising researcher that you no longer wish to participate (no questions will be asked). A phone number is supplied on this form. You may also omit any question during the interview, but continue to participate in the rest of the study. Any data collected before withdrawal will be deleted.

6. Compensation : No compensation will be provided for the participation at the interview

7. Research results diffusion : The data you provide will be used exclusively for this thesis.

Université de Montréal

Faculty of Environmental Design

B) CONSENT

By signing this consent form, I am indicating that I fully understand the above information and I agree, after reflection and due delay, to participate in this study. I declare having gotten answers to my questions, and fully understand the nature of this research and whatever pertaining risks, advantages and inconveniences. Also, I am aware that I can withdraw at any moment by verbally informing the interviewer.

Signature : _____ Date : _____

Name : _____ _____

By signing this form, I declare I have explained the goal, nature, benefits, risks and disadvantages of the study and I have answered the questions to the best of my knowledge and belief.

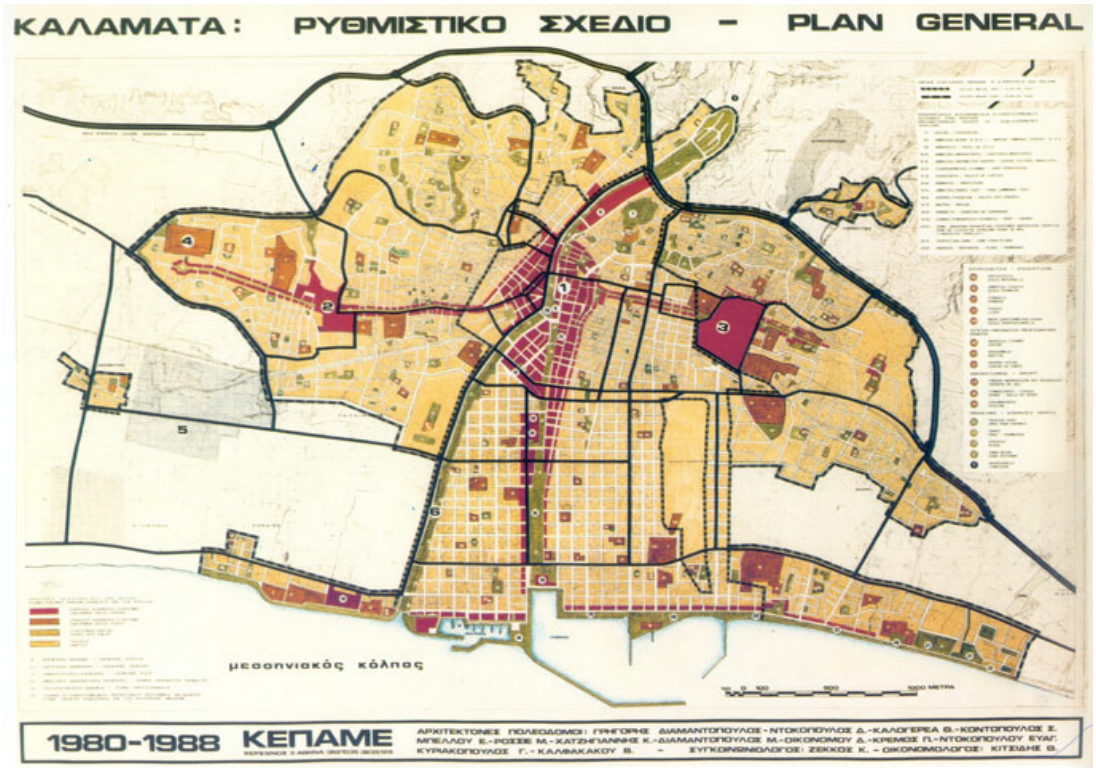
Researcher's signature : _____ Date : _____
Name : _____ _____

If you have any questions about this study, please contact Myrto Kalliopi Garis, PhD Candidate at Université de Montréal, phone (+30) 6942985349, (+1) 5146922139
Email : myrto.gari@umontreal.ca.

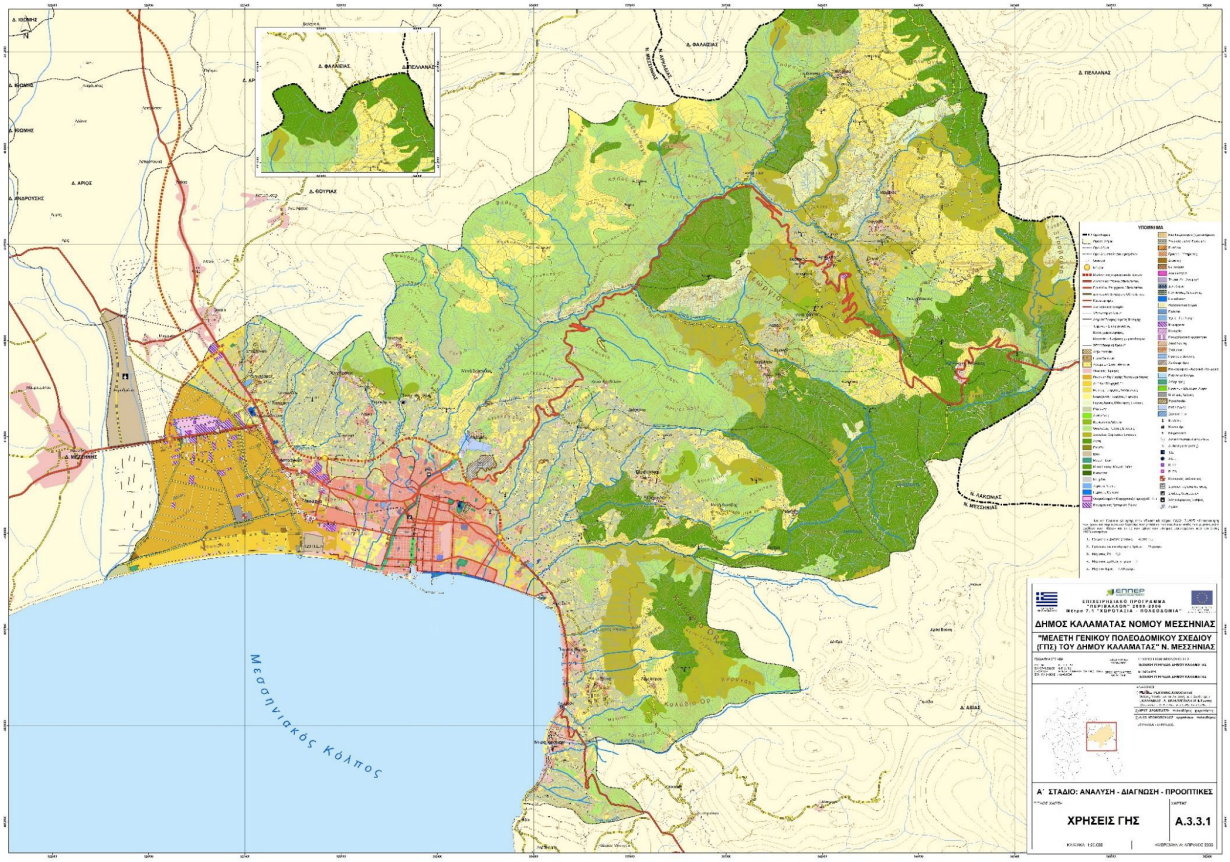
Any complaints about your participation in this research can be directed to the ombudsman at the Université de Montréal, phone (514) 343-2100 or email ombudsman@umontreal.ca
(the ombudsman accepts collect calls).

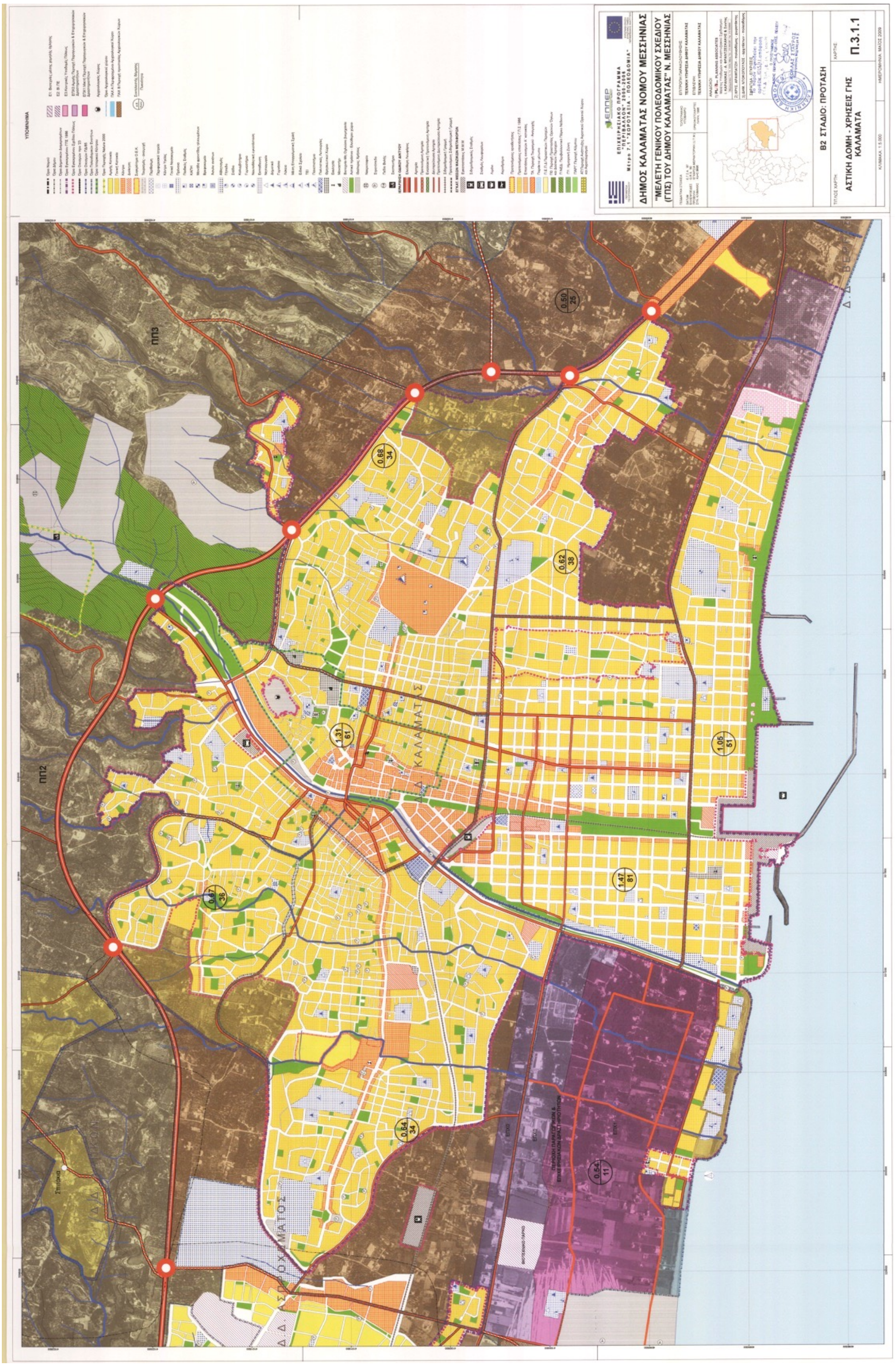
A copy of the consent form should be signed and handed over to the participant

Appendix 3: The 1986 Master Plan



Appendix 4: The 2011 Master Plan

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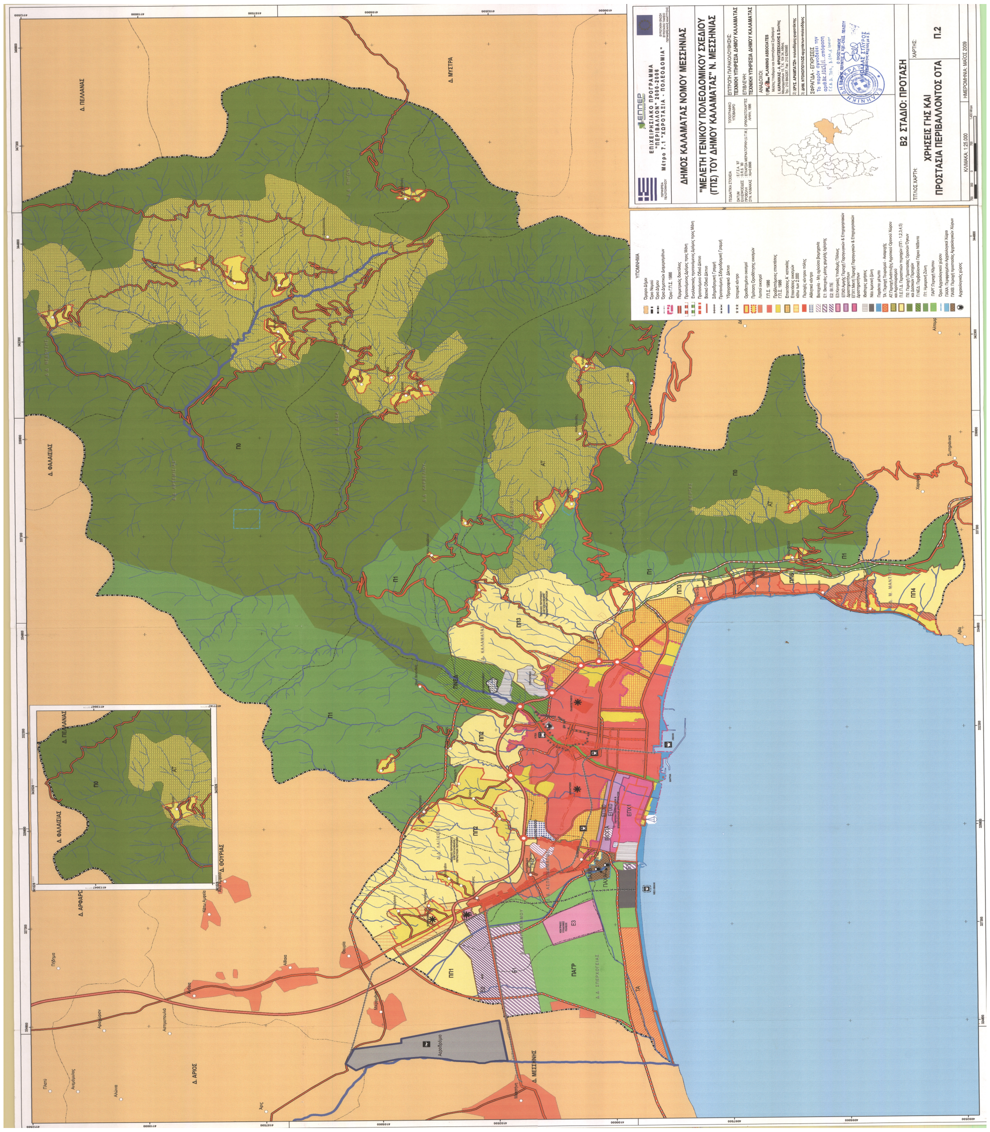
ΠΠ2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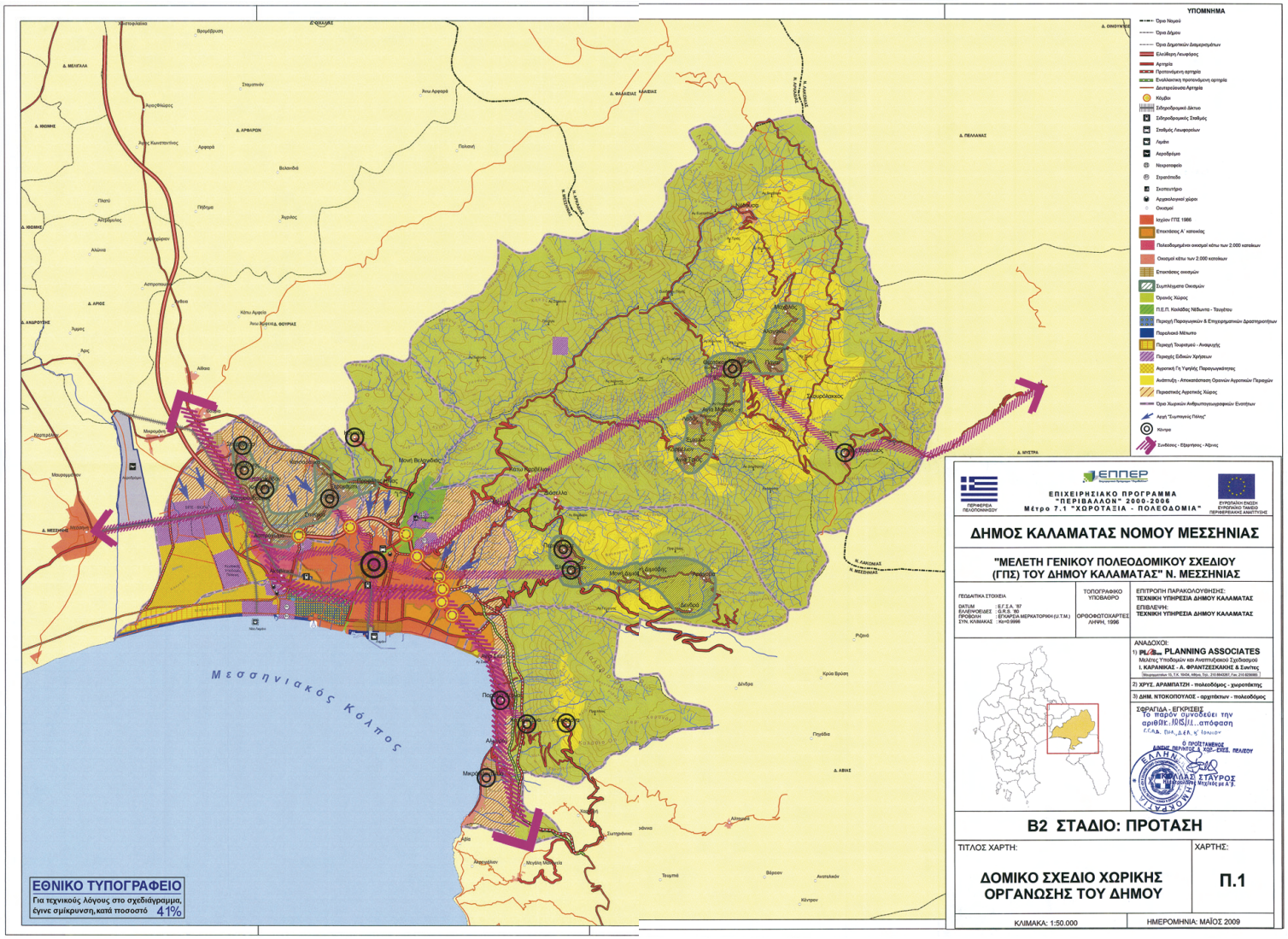
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1) PLANNING ASSOCIATES
Μελέτες Υποδομών και Αναπτυξιακού Σχεδιασμού
Ι. ΚΑΡΑΜΙΚΑΣ - Α. ΦΡΑΝΤΖΕΣΚΑΚΗΣ & Σια ΟΕ
2) ΧΡΥΣ. ΑΡΑΜΠΑΤΖΗ - πολεοδόμος - χωροτάκτης
3) ΔΗΜ. ΝΤΟΚΟΠΟΥΛΟΣ - αρχιτέκτων - πολεοδόμος
ΣΦΡΑΓΙΔΑ - ΕΓΚΡΙΣΕΙΣ
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ΣΤΑΥΡΟΣ
Β2 ΣΤΑΔΙΟ: ΠΡΟΤΑΣΗ
ΤΙΤΛΟΣ ΧΑΡΤΗ:
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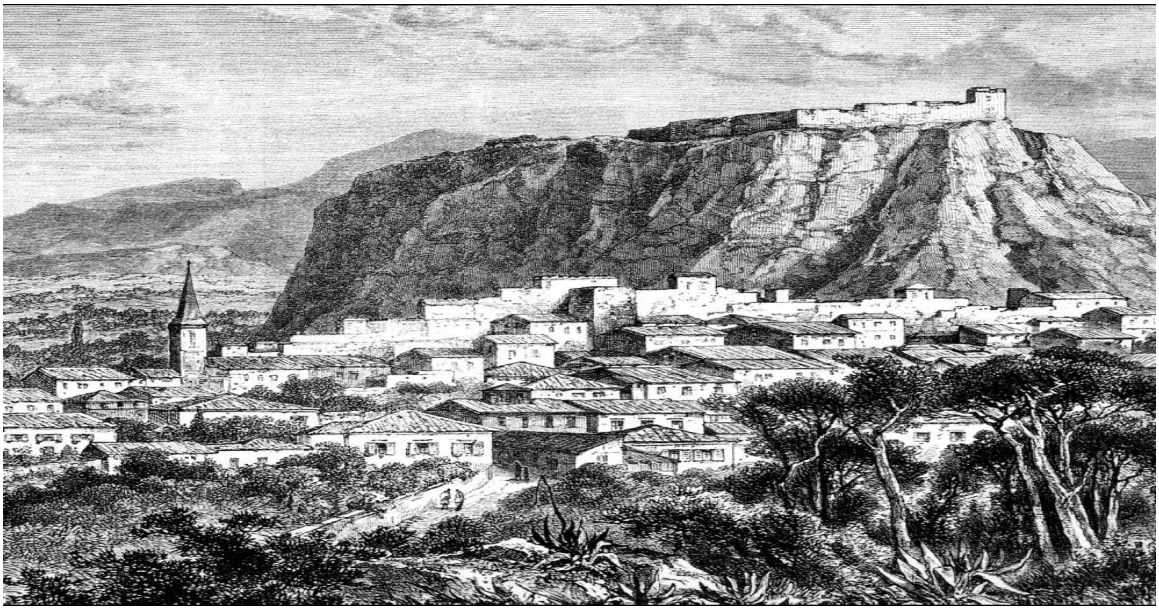
Appendix 5: Historic and current area pictures.

The city of Kalamata in 1688 (source: Municipality of Kalamata)



The city of Kalamata and the castle (1868) Th.Weber, (source: Municipality of Kalamata)

The port of Kalamata by Tassos (source: Municipality of Kalamata)

Aerial view of the city of Kalamata (source: ATHENSPLUS newspaper)