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ADAPTATION, ADAPTABILITY AND URBAN RESILIENCE: THE CASE OF KOBE AND THE GREAT HANSHIN EARTHQUAKE OF 1995

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ABSTRACT

In the past few years, the subject of resilience has captured the attention of academics, politicians and the public opinion and has been identified as the source of recovery policies of local, regional and national economies. As a result, the searching for the so called "resilient factor" has led governments to manage territories and resources combining sustainability and adaptation in an increasing risking world.

The purpose of this paper is to investigate the regional resilience in response to natural disasters through the analysis of the recovery process of the city of Kobe, completely destroyed by the Great Hanshin-Awaji Earthquake in 1995. Japanese regions have always coexisted with significant external pressures often leading to environmental disasters and consequent relevant economic and social damage. Kobe has been an emblematic case because of rapidity in urban reconstruction and speeding in economic recovery. Kobe and the Great Hanshin Earthquake of 1995 represent a successful case of resilient region able to adapt to changing circumstances and to foster local development proposing a renewed image of creative city.

Keywords: resilience; earthquake; Kobe; recovery; creative city

JEL classifications: R10, R11

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1. Introduction

An arising interest in the subject of resilience is due to the increasing of environmental, economics and social crisis: in an unstable world, the main objective for regions and territories becomes to manage disturbance and draw solutions for crisis.

The term resilience derives from the Latin verb *resilire, bounce back,* and refers to the ability of an organism or a system to recover elastic shape and position after a disturbance or an interruption. It was a research topic in several disciplines and it had different definitions: in Engineering, resilience is the ability of a structure to resist to a sudden shock and to not crack; in Emergency Management, it pertains to speed of recovery of critical systems after a natural disaster; in psychology, it is an indication of individual ability to overcome a traumatic event. There are two common features among different disciplines: resilience is linked to the ability to overcome the disturbance and the capacity to regain functionality (Zolli and Haely, 2012). In such context, the search for resilience's ingredients becomes essential in understanding why some regions are able to cope with external shocks, restoring existing structures and functions and creating new ones.

Alongside resilience, culture and creativity have also increased of importance in the new economic scenario. Culture was previously considered an asset to protect and preserve for its role in fostering economic development. Later, a part of the literature started to look at culture and creativity as an opportunity for solving problems related to employment, environment and social inclusion (Sasaki, 2010) and as sources of innovation (Amabile, 1996; Bakhshi *et al.,* 2008; Pratt and Jeffcutt, 2009).

Despite culture and creativity are recognized as an engine for regional growth, the relationship between resilience, culture and creativity is still a topic that has not been discussed enough (Lazzeretti and Cooke, 2015). In order to contribute to the topic, we want to study the regional resilience in the face of natural disasters through an analysis of the recovery process of the city of Kobe, completely destroyed by the Great Hanshin-Awaji Earthquake in 1995 and reborn as a new creative city. Japanese regions have always coexisted with significant external pressures often leading to environmental disasters and consequent relevant economic and social damage. The case of Kobe was an emblematic case because of rapidity in urban reconstruction and in economic recovery. Studying short and log-term recovery, we want to discuss resilience in a systemic and multidisciplinary vision in order to find origin of new trajectories in local development.

We questioned if Kobe was able to resiliently respond to the 1995 earthquake, creating new local development trajectories, and what was the role of the local actors and the cultural and creative resources in such resilient process.

The paper will be structured as follow. Firstly, we will provide a brief review of the literature related to resilience. This review is conducted to demonstrate that resilience is not the ability to absorb shocks and return to a previous balance, but it is the capacity of the system to react to shocks by adapting its structure and generating new pathways. Moreover, we will highlight three main gaps in the literature: the gap in linking economic

resilience to natural disasters; poor attention to the role of human agency in shaping resilience; a partial focus on which are the resources that foster resilience. Secondly, we will investigate the case of Kobe in order to find main stages in recovery process through primary and secondary data. The case of Kobe and the Great Hanshin Earthquake of 1995, particularly, represents a successful case of a resilient region able to quickly recover, changing economic structure and proposing a renewed image of a creative city. A long term analysis of disaster recovery in the city helps to investigate the influence of local actors in shaping new trajectories and to find features which contribute to resilience. Finally, the results will be discussed based on the case study and a general conclusion will be drawn starting from some key points of the literature review.

2. Defining resilience

The definition of "resilient systems" was first introduced by the Canadian ecologist Stanley Crawford Holling (1973). In his analysis of ecosystems, he inquired how different behaviour of natural ecosystems could lead to different management of resources. In its preliminary analysis, he identified two different components to define ecosystems behaviours: stability and resilience. While stability is the ability of a system to return to a state of equilibrium after a temporary disturbance, resilience is the ability to absorb such changes. Thus, while resilience measures capacity to absorb disturbances and still maintain the same relationships between system entities, stability emphasizes the conservation of the equilibrium within a predictable world with minimum fluctuation of the whole system (Bhamraa *et al.*, 2011).

Viewpoints of resilience and stability have been further extended (Holling, 1996; Holling, 2001; Walker *et al.*, 2004; Gunderson and Holling, 2000) to develop the ideas of "ecological resilience" and "engineering resilience". Engineering resilience is based on the ability of a system to endure shocks and is measured by the rapidity with which the system returns to its pre-existing equilibrium. Such definition emphasizes aspects such as efficiency, consistency and predictability, typical attributes of "fail-proof" engineering design (Martin and Sunley, 2015). Therefore, a system able to quickly restore a prior equilibrium after the occurrence of a shock is considered more resilient than one that takes longer. Ecological resilience, instead, emphasizes the ability of a system to adapt to shocks and move on to new schemes differing from previous equilibrium. Such kind of resilience can be measured from the amount of noise absorbed by the system before it changes its structure. Based on this definition, resilient systems will not remain trapped in sub-optimal equilibrium situations (Dawley *et al.*, 2010) but they will be able to generate new multiple equilibria.

A breakthrough in studying resilience comes from the theory of socio-ecological systems (SESs), systems including both human and biophysical subsystems (Gallopín, 1991). According to SESs shocks can be analysed through four variables: robustness, resilience, vulnerability and adaptive capacity (Gallopín, 2006; Young *et al.*, 2006). Such variables are strongly connected but their relationship is highly controversial. While robustness is the ability of a system to resist to disturbances without changing structure or dynamics, resilience is the ability of

competing with external disturbances. Vulnerability, instead, occurs when robustness and resilience are not able to allow the survival of the system without a structural change. Thus, resilience is related to the responsiveness of the vulnerability by adaptive capacity that is the ability of SESs both to cope with external shocks and to make better functions and structure of the system.

Adaptive capacity, therefore, becomes a requirement for regions in order to be less vulnerable and increase resilience. This evidence, coupled with the inability of engineering and ecological resilience to explain the dynamism of systems[3], suggests the theorization of a new definition of resilience in order to address both the evolution of long-term resilience in regions and effects of such evolution in the development of future pathways. As a result, the purpose will be to investigate trajectories of change rather than stability factors (Martin and Sunley, 2015).

Following such statement, Evolutionary Economic Geography, EEG, theorized a new *adaptive resilience*[4] (Martin, 2012) related to the ability of a system to reorganize and transform its shape and its functions in order to minimize the impact of disturbances. Adaptive resilience involves the possibility of a structural adjustment in response to shocks and has been defined by some scholars as "evolutionary resilience" in relation to its ability to conduct the systems to a bounce forward that involves an evolution rather than a simple recovery of previous functions (Simmie and Martin, 2010). Such adaptive resilience may explain the evolution of the system clarifying the attitude of some regions to renew, re-organize and develop, designing a sustainable future (Lazzeretti and Cooke, 2015).

Adaptive capacity becomes crucial in defining adaptive resilience as well as notions of adaptation and adaptability (Christopherson *et al.*, 2010; Pike *et al.*, 2010; Porter e*t al.*, 2013). Different characteristics of adaptation and adaptability can contribute to understand the integration between the components of a region and to explain the complexity of the resilient process. Adaptation, related to the phenomenon of path dependence and resilience, depends on the ability of economic regions to reconfigure and reorganize assets historically accumulated in a territory. It is defined as the ability of an economy to respond to a shock coming back to a path already conceived.

In view of adaptability, the success of an economy in the face of an external shock does not occur by getting back to an existing equilibrium but it depends on the ability to create a new pathway. Adaptability expresses the capacity of social-ecological systems of learning, combining experience and knowledge, in order to adjust its response to pressure (Folke *et al.*, 2010). It was defined as the capacity of actors in a system to influence

[3] Engineering approach emphasizing a return to a pre-existing equilibrium does not recognize a potential evolution of economic systems. Furthermore, despite ecological resilience identifies possibility of multiple equilibria, it sees the evolution of regional economies as a process resulting from a series of continues shocks rather than by the constant change and evolution of regional economies. All of this suggests that neither the ecological resilience nor engineering resilience would be able to explain the evolution of regional systems (Martin and Sunley, 2007).

[4] Martin (2012) finds four dimensions for regional resilience: resistance, the degree of reaction to the shock; recovery, the speed of recovery from the shock; re-orientation, the adaptability of the region in response to the shock; renewal, the degree of renew of pre-shock condition or change to new trajectories. A further review in defining resilience (Martin and Sunley, 2015) updates such dimensions involving vulnerability or risk of the system to be affected by the shock, resistance to the impact of the shock, adjustment and adaptability in order to restore base functions and, nature and degree of recovery from the disaster.

resilience (Walker *et al.*, 2004).

According to Pike *et al*. (2010), adaptation and adaptability can be divergent in order to identify resilient regions but these approaches assume complementarity when evolution and complexity in resilience is studied. To be more resilient a system needs a co-evolution in adaptation and adaptability (Hu and Hassink, 2015). As a result resilience is both the ability to absorb the shock and quickly recover and the ability to create new paths of development.

Despite advancements in studying and defining resilience, some points still remain unclear. We can highlight three main under-researched issues.

First, while studying economic shocks is common, there is less interest in studying relationship between resilience, natural disaster and economic change. Such lack may be attributed to a general poor attention to the long-term economic effects of natural disasters, preferring short-term analysis of decrease in physical capital and amount of financial damage. Moreover, identifying and isolating the long-term economic effects of natural shocks can be difficult[5] (Benson and Clay, 2004).

Second, the incidence of historical conditions and the role of human agency in the creation of new trajectories is still under-researched. Adaptability is often negatively associated with path dependence. However, history is not a constraint for new paths, on the contrary, past conditions[6] may be an opportunity to induce a re-orientation of technologies, capabilities and institutions (Boschma, 2015). Furthermore, understanding the role of human action in the process of adaptation can be extremely useful as it can provide a more complete picture of what behaviours contribute to resilience. The decisions of policy makers, companies or informal institution can influence the ability of a system to respond more or less quickly to a shock. Moreover, although agents react in similar ways to similar shocks, meaning and effects of such actions may be influenced by unique and "path dependent" features of system (Bristow and Healy, 2015).

Third, sources of resilience are still unclear. In one hand, scholars look at resilience as the ability to reorganize and renew but, on the other hand, innovative capacity can be itself a source of resilience. Some scholars sought relatedness between innovation and resilience. Studying Schumpeterian business cycles, Simmie (2014) highlights the role of specific features and capabilities of Regional Innovation Systems (RIS) in contributing to adaptation and resilience and in fostering economic growth and the creation of new pathways. Other scholars investigated resilience and innovation in the context of global change (Cooke and Eriksson, 2012).

Some interesting studies have focused on the relationship between culture, creativity and resilience. Vanolo (2015) proposed an analysis of the evolutionary process of Turin, in Italy, showing a transition to new forms of urban structure in a successful mix of industrialism and cultural/knowledge economy. Cooke (2015) emphasizes

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[5] According to Horwhich (2000), a measure of GDP can distort perceptions of disaster impact by capital invested in the reconstruction and debris removing activities. Also, effects on macro economic variables, often tend to be imperceptible because of resource substitutions, allowing positive forces to increase GDP.

[6] Kogler (2015) underlines the growing importance in EEG's studies of experience and skills accumulated in regions to determine the future trajectories.

the role of Arts & Crafts movement in warning against natural shocks such as climate change. Pasquinelli and Sjöholm (2015) look at resilience in creative careers faced with the uncertainty of the labour market discovering a strategy of visual artists in London to cope with a uncertain world. Combining local and global and physical and virtual dimensions, they created new forms of art consumption and new niche market. Finally, Pratt (2015) sought implication for resilience in cultural economy stressing the need for a resilience based on sociality and openness in order to foster local cultural economy.

Such theoretical reflections suggest that innovation, creativity and resilience may have a double relationship: the adaptive resilience of EEG become "creative adaptive capacity" (Lazzeretti and Capone, 2015), involving the ability to react to external pressure generating new ideas, innovations and change and creativity and culture may be both a source of innovation and a source of resilience.

To address such gaps a primary survey of recovery process after crisis can be used both to investigate the long-term adjustment of the system in face of a disturbance and to identify the immediate response of agents and aspects affecting resilience. Based on trade-off of adaptation and adaptability, short-term and long-term recoveries are a consequence of resilience of regions but at the same time may help in getting stronger the resilience in face of external pressures. Although recovery and resilience are well distinguished concepts, the analysis of recovery can contribute to point out new paths popped up after the shock and to identify the role of system's actors in an adaptive process. Moreover, it may enrich the search of assets which foster innovative capacity and resilience.

3. Data and methodology

Methodologies to study urban and regional resilience in evolutionary studies were different. Long-term evolution of regions and local systems through time series analysis has been proposed (Simmie and Martin, 2010). Indicators based on measuring economic variables, including GDP and employment have been created (Martin, 2012). Some studies have focused on the relationship between resilience and innovation analysing long-term performance in RIS in the North East and South East regions in the UK through a measurement of new knowledge production, learning through network, co-evolution of institutions and innovations (Simmie, 2014).

We use a qualitative approach to study resilience through the case study analysis (Yin, 1994). The case study proposed is the recovery of the city of Kobe, in Japan, destroyed by the Great Hanshin Earthquake in 1995. We have explored the empirical evidence from Kobe recovery process in order to analyse the long-term resilience, identify the trajectories of change, the role of local actors and the origins of resilience.

The study is part of a larger research project aimed at understanding connections between the adaptive resilience theorized in Evolutionary Economic Geography (EEG) and natural disasters. The analysis of reconstruction in Kobe after the Great Hanshin Earthquake comes from an analysis of primary and secondary data.

The field investigation in Kobe was realized from October 2015 to December 2015 through a number of

interviews with academics, professionals and the public administration. Such interviews allowed us to identify the most innovative changes perceived by the community and the trajectories of economic development in the long term.

A detailed survey of secondary data was then conducted in order to reconstruct the recovery process of the city after the quake. Data and information come from several sources. These include *Kobe City Statistics*, *The Great Hanshin-Awaji Earthquake: statistics and restoration progress* and *Pocketbook Statistical Data of Kobe* available in City of Kobe website; *Hyogo Prefectural Government Statistics* available in Hyogo Prefecture website; national and regional statistics.

Studying the recovery process in Kobe allows to analyse resilience through a systemic approach linked to different levels. Actions of short and long term recovery were the starting point for a change in the city's imagine and for the promotion of new trajectories of local development. Moreover, recovery in Kobe fostered mechanisms of institutional change in the whole of Japan

However, the analysis has some limitations. First, it was difficult to isolate the economic effect of disaster. According to Horwich (2000), a measure of the impact based on macro variables, such as GDP, may distort the economic effect of the disaster. This involves difficulties in choosing variables to evaluate the impact of natural disasters on the regional economy. Second, the availability of English data of Kobe recovery was partial. A lack of data means the impossibility to reconstruct historical trends and make comparisons between local and national scale.

4. Resilience and the Great Hanshin Earthquake: evidence from Kobe

4.1 Context analysis

At the time of the earthquake, the city of Kobe had a population of 1.5 million people, it was a coastal port city and one of the major cities in the Kansai region. Its territory covered an area of 553 square kilometres, with a hilly zone around Rokko Mountains and was divided in nine wards: Higashinada, Nada, Chuo, Hyogo, Kita, Nagata, Suma, Tarumi, Nishi.

The construction of the port, in 1868, contributed to the fortune of the city and helped to create a vital and multi-cultural environment. Before the earthquake, Kobe was the second largest port in Asia for container transit and was ranked the sixth around the world in terms of cargo throughput. Port activity accounted for about 39% of its gross industrial product (Chang, 2000). Moreover, urbanization increased concurrently with the economy of the port, making Kobe as a densely populated city.

In the inner town, the east coast was a residential area inhabited by high-income residents and white collar workers, along with universities and schools. A district for the production of sake was located in Nada ward. On

the west coast there was a low-income residential area hosting blue collar worker and the hybrid-rubber shoe industry in Nagata ward. Before the earthquake, such shoe industry counted 1,600 companies with 15,000 to 20,000 employees .

A unique characteristic of Kobe was its ancient tradition of community inclusion in the decision process for the economic development through *machizukuri kyogikai*, local associations for urban planning and local development. The city was the first in Japan to support such kind of associations in order to create a bridge between institutions and local community promoting a shared planning process (Edgington, 2010).

After the Second World War, a part of the city was completely rebuilt but modernization measures were partially absent in the coastal inner city. Buildings in those area were mostly old traditional wooden Japanese houses and only a minor part of constructions were built under the modern anti-seismic requirements. Furthermore, in the past, the city recorded floods and storms as major natural disasters. As a result, countermeasures were limited to the prevention of such kind of disturbances and there was a poor attention to earthquake. This scenario involved a general lack of preparation in order to cope with earthquakes.

4.2 Analysis of the damage

In the early morning of the 17th January 1995, at 5:46 am, an earthquake of magnitude 7.2 on the Richter scale shook violently the ground in the district of Hanshin, an area located in the south-western area of Japan, in Kansai region. The epicentre was about 200 km north of the Nankai Trough, along the Nojima fault a branch of the Japan Median Tectonic Line, an highly seismic area stricken in the past by other severe earthquakes (Zhao *et al.*, 1996).

The Great Hanshin Earthquake was one of the most destructive earthquakes recorded in the whole world in terms of economic damage, only preceded by the Tohoku Earthquake of 2011, recorded in the North of Japan (Table 1).

Tab. 1: Top 10 of the most damaging earthquakes in the world, 2015

Country	Date	Total damage ('000 US$)
Japan	11-03-2011	210000000
Japan	17-01-1995	100000000
China P Rep	12-05-2008	85000000
Chile	27-02-2010	30000000
United States	17-01-1994	30000000
Japan	23-10-2004	28000000
Turkey	17-08-1999	20000000
Italy	23-11-1980	20000000
Italy	20-05-2012	15800000
New Zealand	22-02-2011	15000000

Source: Guha-Sapir, D., Below, R., Hoyois, Ph., EM-DAT: The CRED/OFDA International Disaster Database, 2015.

The Great Hanshin Earthquake caused serious damage to several cities. Areas affected included towns and cities in the Hyogo prefecture, the north of the island of Awiji and some areas in the east of the prefecture of Osaka (Table 2) (UNCRD, 1995).

Tab. 2: An overlook on Great Hanshin Earthquake

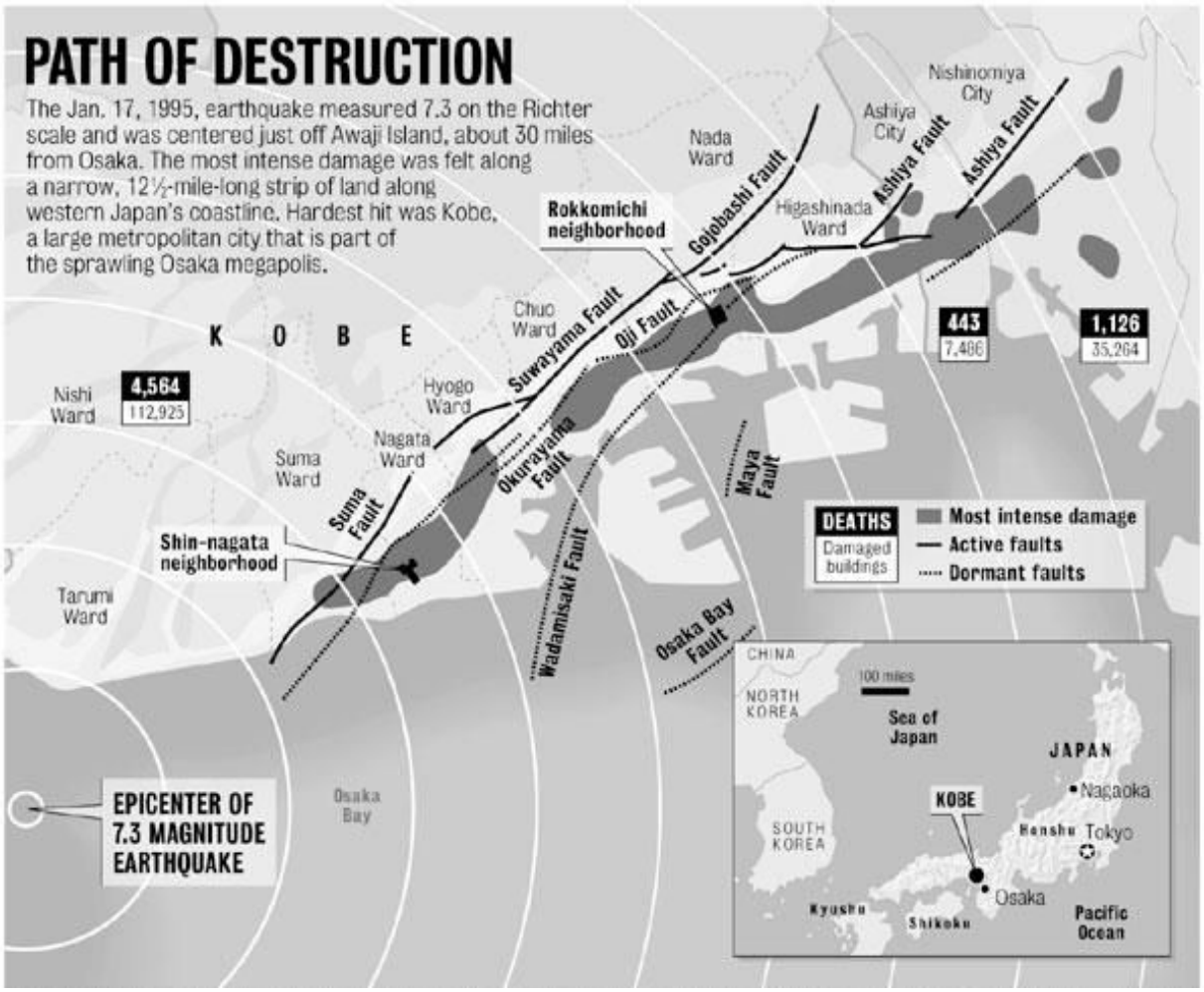
Date	Location	Disaster Type	Total deaths	Total affected	Total damage (‘000 US$)
17/01/1995	Kobe, Osaka, Hyogo, Kyoto	Ground movement	5297	541636	100000000

Source: Guha-Sapir, D., Below, R., Hoyois, Ph., EM-DAT: The CRED/OFDA International Disaster Database, 2015.

Major damages were recorded in the city of Kobe, largely destroyed by the earthquake. In Kobe, the total death figure amounted to 4,571 and the total injured to 14,678; 67,421 structures were fully destroyed and 55,145 structures were partially destroyed; the total amount of damage was estimated to account to 6,3 trillion of JPY.

The high damage was due to the proximity of the epicentre with the stricken city - the epicentre was only 32 km from the city of Kobe - and to the features of the earthquake itself. The earthquake of Kobe was an "inland", a highly destructive quake even at low magnitudes because it occurred near populated areas and had an epicentre near the land surface. The duration of ground shaking was ten seconds, but the time history had two or three pulse waves with a large amplitude. Such characteristic caused the collapse of several buildings, both modern houses and traditional wooden structures, even due to liquefaction of soil. A large part of the damage concentrated in the coastal area (Figure 1).

Fig. 1: Kobe areas stricken by earthquake

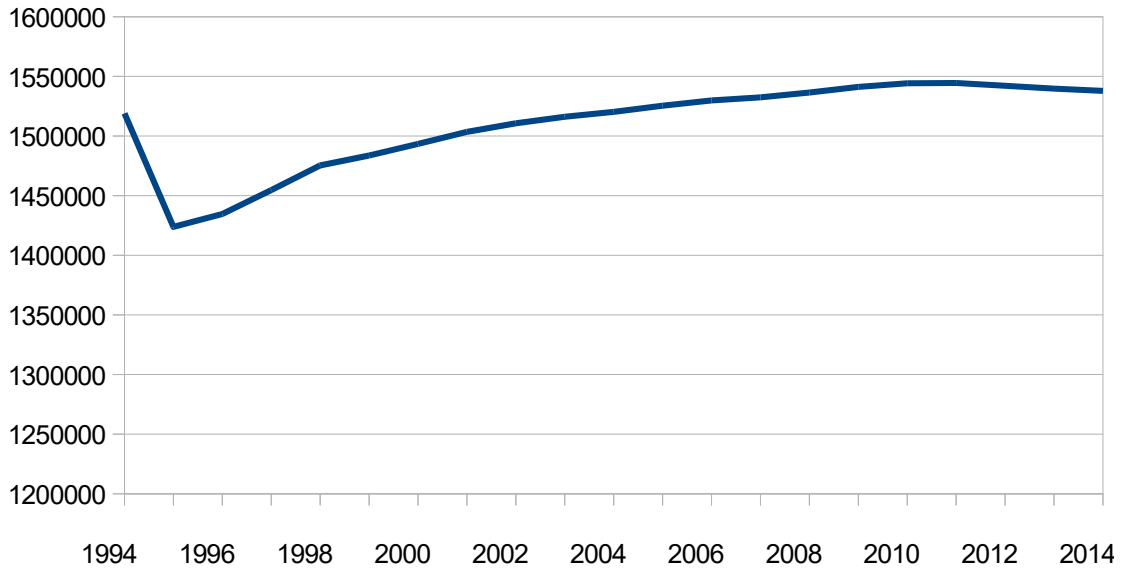


Source: Disaster Reduction and Human Renovation Institution, 2005.

In Higashinada, Nada, Hyogo, Nagata, and Suma wards about the 70% of housing collapsed, while around 90% suffered minor damage. Share of collapsed buildings increased in relation to their urban deterioration having such buildings survived to World War II (City of Kobe, 2010a). About 70% of people lost their lives due to the buildings collapsing.

Economic effects of the quake can be firstly analysed through macro variables as population and employment. First, as a result of the disaster the population decreased of approximately 95,000 people. Faced with 4,571 people dead, the remaining decreasing is due to a moving out of the area. In 2004, the population returned to 1994 levels (Figure 2).

Fig. 2: The evolution of population in Kobe (1994-2014)



Source: Authors' elaboration on Kobe City Statistics, City of Kobe, 2015.

The coastal wards (Higashinda, Nada, Chuo, Hyogo, and Nagata), extremely damaged by the quake, was affected more by migration effect than unaffected wards (Suma, Tarumi Nishi and Kita). In some case, population in unaffected wards increased, showing an internal moving of people as an important effect of earthquake. People decided to not move out from the city after the quake but they just moved within the urban borders. Moreover, data on population in 2014 show a high increasing of inhabitants in the stricken wards more than in some of the internal parts of the city (Table 3).

Tab. 3 : Kobe Wards population in 1994, 1995 and 2014

	Higashinada	Nada	Chuo	Hyogo	Kita	Nagata	Suma	Tarumi	Nishi
1994	191.540	124.891	111.536	117.918	216.036	130.466	188.863	237.781	199.951
1995	157.599	97.473	103.711	98.856	230.473	96.807	176.507	240.203	222.163
2014	213.358	135.888	130.187	106.453	222.695	98.391	164.189	219.384	247.319

Source: Authors elaboration on Kobe City Statistics, City of Kobe, 2015.

Second, trend in employment points out a considerable decrease in people engaged and in the number of firms between 1996 and 1999. Instead, the period between 1999 and 2001 is a growing period both for Kobe and for prefectural and national accounts (Table 4).

Tab. 4: Rate of change in Establishments and Employers in Kobe, Hyogo and Japan from 1996, 1999 and 2001 census

Country	Period	Establishments (%)	Employers (%)
Kobe	1996 - 1999	- 1,4	- 8,2
	1999 - 2001	2,7	10,2
Hyogo	1996 - 1999	- 4,1	- 7,3
	1999 - 2001	2,05	9,8
Japan	1996 - 1999	- 4,9	- 6,6
	1999 - 2001	2,37	11,8

Source: Statistic Bureau, Establishment and Enterprise Census of Japan, Official Statistic of Japan, 2001.

Economic effects of the quake can be secondly analysed through firms level. The largest economic damage was recorded by hybrid-rubber companies in Nagata, in the district of sake in Nada and by port companies. Approximately 80% of the plastics industries were destroyed and 50% of sake factories. In the port area, a whole area was devastated with considerable damage to ships and fishing boats and ways to access to port were cut off. Expeditions were routed to other ports and transits of raw materials between Japanese companies was stopped, causing damage to the entire Japanese industry.

The extent of such damage resulted in a slow recovery process that forced the local government to propose a long-term strategy to diversify the economic base of the city and stimulate adaptability to changed circumstance, in addition to a short-term strategy to quickly restore a normal state.

4.3 Crisis response: short-term recovery and adaptation

Despite the difficulties in the reconstruction planning, the recovery of Kobe and the actions taken by the local government assumed an important role, both in the city recovery and in the emergency management process for the whole of Japan.

On the 26th of January Kobe's mayor gave a statement on his vision for the future of the city: recovery process needed to contribute to "*build a disaster-safe model city where citizens can live and work in a safe and secure manner through the swift recovery of the urban infrastructure, civic life and urban development*" and to "*create a new Kobe that will become a civic-minded creative city interacting with the world*" (City of Kobe, 2010a, p. 11). Based on such declaration, the whole recovery process would be started under those principles in order to bring back the city to a normal state but also to bring the city forward, involving novelty and creating a better and stronger environment. The basic idea for the reconstruction in Kobe was to use a long-term recovery to build a creative and resilient city.

The Earthquake Recovery Headquarters headed by the mayor was created to formulate a 1*0-year Kobe City Recovery Plan*. Such Plan was based on three major recovery trajectories: a *physical* recovery by reconstructing infrastructures and planning operations of urban development; an *economic* one, through a revitalization of the economy and the support to small businesses; a *social* recovery with the construction of new houses and the restoration of livelihoods.

The local government was able to implement a number of immediate steps to handle the emergency. Immediate countermeasures included the organization of research and rescue groups, the supply of hot meals and drinking water, the provision of shelters and the construction of temporary housing. In April 1995, Hyogo Prefecture and the City of Kobe established "The Great Hanshin-Awaji Earthquake Public Reconstruction Fund" intended to favour the recovery of the damaged areas, to provide financial support to the victims and to pursue long-term reconstruction purposes. The fund had 100 million yen for the basic assets and 1.67 billion yen for assets management. Specific actions designated by the fund included the reconstruction of the earthquake victims houses, the assistance to small and medium-sized enterprises to resume their economic activities, the direct assistance to victims through health, welfare and culture in order to overcome the tragedy of earthquake, the reconstruction of private schools and other actions related to the promotion of disaster preparedness and public information.

A unique feature in Kobe recovery was the big attraction of volunteer movements in order to rebuild the city and support victims. The earthquake recovery process involved several NPOs organizations around the country: 1,3 million of volunteers participated to the reconstruction of the city of Kobe after the 1995 Great Hanshin earthquake (Kingston, 2012). In addition to the actions of formal and informal institutions, the local community was also engaged in the reconstruction process. In some cases, local community promotes projects

for restoring buildings and streets, demonstrating the power of social capital and the need of ties within communities. One example was the Mano neighbourhood in Nagata district which organized several projects dedicated to the reconstruction, activating public event and creating sixteen local organizations involved in the reconstruction. Compared to other areas, Mano has known a faster recovery, reasonably due to the power of social capital (Aldrich, 2012). Another neighbourhood directly involved in the reconstruction was Noda Kita, in Nagata ward, one of first neighbourhood to react and return to normal life after the earthquake. As a result of damages recorded after the earthquake, the community has set rules for common life in order to prevent future disasters. Such examples suggests that the presence of a strong community positively affect the speed in the reconstruction.

The recovery measures for Kobe local economy were based on three phases: relief, recovery and new development. Collaboration with local business was indispensable in order to make sure that the measures taken by the city would meet the needs of the industry.

Hyogo Prefecture offered 304.1 billion yen, and Kobe offered 118,1 billion yen through the *Emergency Disaster Relief Found*. A total of 422,2 billion yen was offered and the national government provided half of it. The fund aimed at restoring small and medium-sized companies certified as victims of the earthquake. Government assigned temporary buildings to firms to start up their operations. In 1996, Kobe municipality decided to promote the construction of permanent factories to rent in order to increase the development of the area and to help local small and medium size industries. This was the first large-scale factories-to-rent scheme sponsored by the public sector in Japan. As well as the construction of factories to rent, the government decided to build a number of facilities to support firms' business: an example is the Kobe Liaison Laboratory, a collaboration center for industry, academia, government and firms and the Kobe *Monozukuri* Cluster Support Center, a support center for consultation and exchange.

The Great Hanshin Earthquake damaged nearly 50% of the plastic factories, severely compromising industrial survival. In order to promote solutions to rebuild the hybrid-rubber shoe industry in a sustainable way, the Japan Hybrid-Rubber Shoe Industrial Association established a Study Group for Hybrid-Rubber Shoe Industrial Recovery in collaboration with representatives of the industry, government, and academic experts. Few months later, the group proposed the Recovery Plan for Nagata as a Town of Shoes a plan which combined the hybrid-rubber shoe industry recovery with the regeneration of Shin-Nagata as new town. Despite such efforts, the manufacturing sector was not able to completely restore to the pre-disaster level.

The port economy was not fully restored neither. Although the port was completely rebuilt in March 1997, in 2009 the number of cargo ships operated had not yet returned to the pre-earthquake values, reaching a peak of 87.7% in 2008 (duPont and Noy, 2015).

The case of the sake industry was different. The Japanese sake manufacturing industry was located along the coastal area of Kobe and it had been severely damaged by the earthquake. Even if more than 50% of Japanese sake breweries partially or totally collapsed, they were quickly refurbished or reconstructed combining

traditional method of production with modern technology.

4.4 Crisis response: long-term recovery and adaptability

Long-term adaptability in Kobe after the Great Hanshin Earthquake acted through economic, social and technological level.

Boost to local economic development involved the establishment of two new pathways: (1) revitalizing the handicraft and (2) creating new businesses in high-tech and bio-medical in order to diversify the city's industrial structure.

Handicraft revitalization took different directions. First a school for young designers opened: *Kobe Monozukuri Shokunin Daigaku* (College for Craftsmen) opened in 2000 to promote the transfer of skills and knowledge between old generation of craftsmen to the next generation.

Second, starting from the earthquake, a new urban strategy was promoted in order to improve attractiveness and vitalization of the city through the creative sector, particularly in design activities. Such strategy wanted to favour tourism, well being and sustainable development through three design perspectives: town design, life design, and *monozukuri* (manufacturing) design. Such strategy highlights the importance of the community for the local development: the idea to use creativity to promote the city aimed both at revitalizing the economy and creating a comfortable place for living. In October 2008, Kobe was certified UNESCO City of Design, as was Nagoya for the first time among Asian cities, and became member of the UNESCO's Creative Cities Network.

The establishment of new industries involved the creation of a medical industry and a robotic industry, namely, Project for Kobe Medical Industrial City and Kobe RT (Robot Technology) Project.

Th medical industry was a completely new sector in Kobe. It concerned biotechnology, drugs research and medical equipment. The aim of such project was to promote the research for advanced medical technology and to create a cluster of companies in the medical industry. Furthermore, such project was strictly linked to the idea of revitalizing the port area and as a result many industries were located in that area.

The Kobe RT (Robot Technology) Project came from existing resources in high tech industries in Kobe, such as machinery, metals and electrical equipment. The accumulation of knowledge and skills for industrial robots, mainly in large companies, as well as researchers in the field of robotics at universities and technical colleges was already established in Kobe. The goal for the industry was to develop and apply of robotic technology to several fields and to combine technologies between different areas to foster innovation.

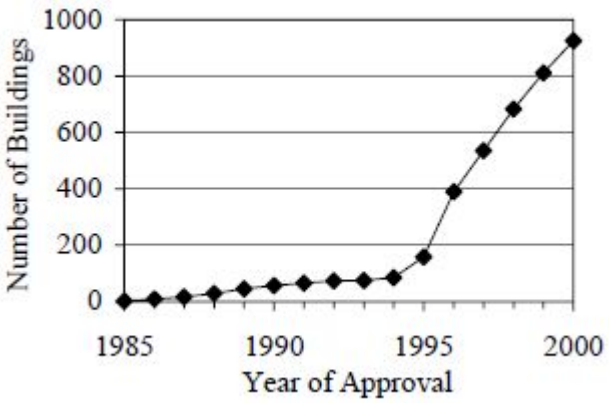
Alongside the economic level, long-term changes due to the earthquake involved social, technological and institutional levels in the whole Japan.

Firstly, due to the massive voluntary action and to the role of local communities in supporting projects for reconstruction, the national government recognized the importance of voluntary action in recovery in order to rebuilt communities both in physical and psychological way. As a consequence, a law to recognize legal

personality to Non-profit Organizations (NPOs) was passed by the Government of Japan in 1998.

Secondly, the Great Hanshin Earthquake pushed through the innovation in the technology of the constructive sector and triggered a social transformation in the management of disasters in Japan. From a technological standpoint, Kobe was the testing ground for anti-seismic technologies and initiated large-scale applications of innovative technologies of "based isolation", driving Japan towards a leadership position in such industry (Figure 4.2). Kobe as well as many Japanese cities is a densely populated area and consequently the greater amount of damage during the earthquake was caused by the collapse of buildings. Such reflection stressed connections between the loss of life in earthquake and the earthquake-resistant technology. As mentioned above, about 70% of people in Great Hanshin Earthquake lost their lives in the collapse of buildings. It is clear, therefore, that innovation in seismic technology related to earthquakes is crucial to reduce human losses. As a result, local government promoted the adoption of a new standard law for aseismic constructions under the belief that physical reconstruction is an essential phase in the reconstruction process: safety in homes and workplaces is a way to the regain psychological stability after the quake.

Fig. 3: Cumulative number of seismically isolated buildings approved until 2000



Source: A partial view of Japanese post-Kobe seismic design and construction practices, Nakashima, M., Chusilp, P. , Earthquake Engineering and Engineering Seismology, 2003, 3, 3–13, p. 9

Finally, before the Great Hanshin Earthquake, a national plan for long-term recovery did not exist. In this context, local government played a key role in promoting long-term development, both proposing a project approved by the national government and by creating a starting point for improving the national systems of emergency managemente.

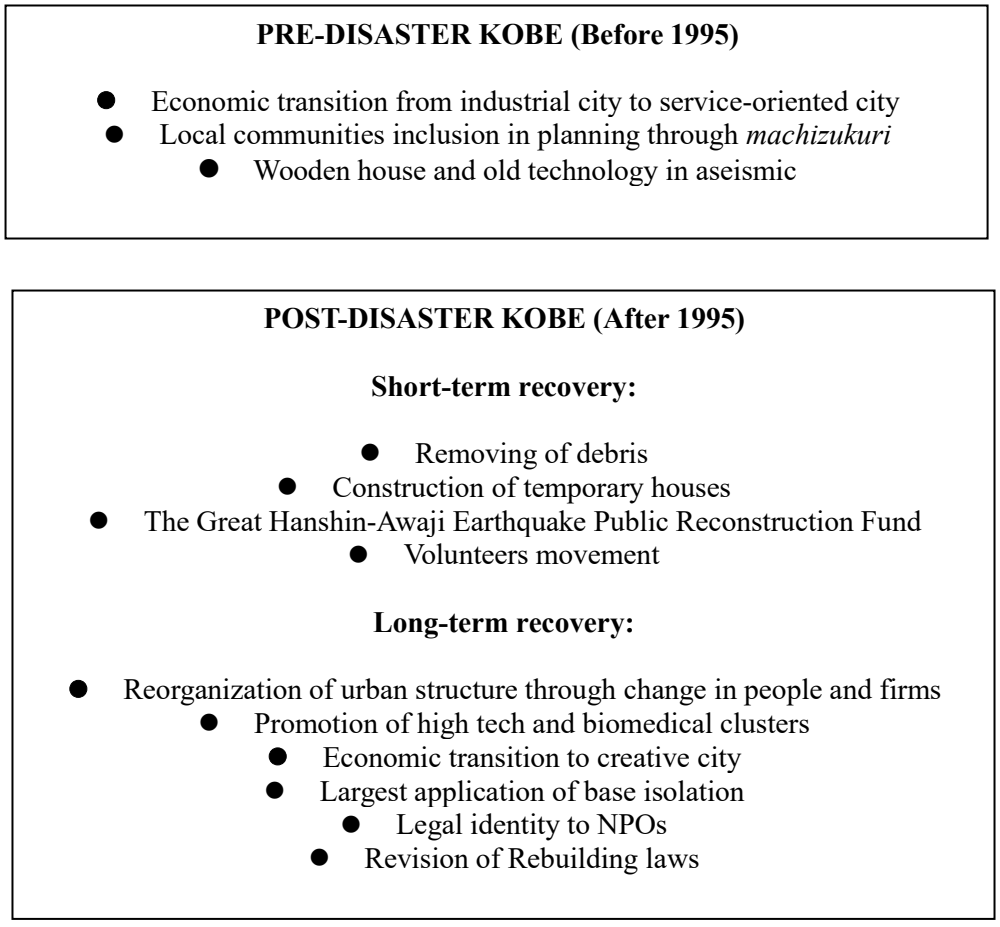
5. Results

The partial descriptive survey of the recovery process of the city of Kobe after the Great Hanshin Awaji Earthquake was aimed to determine whether Kobe resiliently responded to the shock. In order to achieve the goal, we proposed an analysis of the long-term and short-term recovery actions in order to identify new trajectories of local development. In Kobe, a combination of immediate actions and long term vision allowed the city to quickly bounce back to a normal pre-disaster condition and to foster trajectories for change.

Before the quake, the city was a thriving port city going through an economic transaction towards the service-oriented sector. Kobe was characterized by a long tradition of collaboration between institutions and communities through *machizukuri* associations. However, buildings and structures in the inner city were old: anti-seismic technology and modernization in urban planning had a slow implementation.

A summary of the main changes related to the earthquake is summarized in Figure 4.

Fig. 4: Short-term and long-term results of recovery process



Source: Author's elaboration

After the earthquake, immediate actions favoured the adaptation to new conditions allowing the city to return to an equilibrium state. Adaptation came from emergency management activities based on physical reconstruction and monetary aid. The intervention of a massive volunteer mobilization in operations of reconstruction was particular important.

In terms of long term adaptability, the local government was able to promote a successful strategy for the local development based on creativity and innovation. Through design activities, the manufacturing sector was rejuvenated, the local government activated a process of urban regeneration and an economy of events, with a positive impact both on tourism and on the liveability of the city. Through existing capabilities in robotics, robotic industries was converted to adapt to the needs of the new service economy. Finally, new skills were generated through the creation of an innovative bio medical cluster.

In addition, the long-term recovery had an impact on technological, social and institutional levels. Aseismic technology applied to buildings has grown exponentially and new technical standards were legislated. The role of associations and non-profit obtained legal recognition.

Was Kobe able to resiliently respond to earthquake, creating new trajectories for local development? In terms of the city's economic development, it is possible to emphasize a change in urban image. First, from a manufacturing city slowly turned into a service-oriented city. A survey in the employment composition by sectors shows a shift from manufacturing to service (Table 5).

Tab. 5: Employment rate by sector in Kobe[7]

Year	Primary sector	Secondary sector	Third Sector
1995	1,0	27,0	70,7
2000	0,8	23,6	73,0
2005	0,8	20,2	76,1
2010	0,7	18,7	73,4

Source: City of Kobe, Kobe City Statistics, 2010

However, such conversion is not entirely due to the earthquake. Already in the '80 years the local government had favoured a policy of economic restructuring, promoting the transformation of the industrial port in "urban resort" through the increase of tourism and a change in consumer and service oriented companies (Edgington, 2010). Although the switch towards a service-oriented economy is generally attributed to the whole of Japan, its acceleration in Kobe can be attributed to the earthquake (Chang, 2010).

Second, the strategy proposed by local government in order to resiliently respond to the crisis was to encourage the development of the creative and the high-tech sectors to build a stronger and diversified economic structure.

[7] Classification of industrial sectors for Kobe comes from Kobe City Hall Official Statistics survey.

As a consequence, the transition toward a new creative city definitely had a greater weight in relation to the earthquake. The Great Hanshin Earthquake was an opportunity for rethinking the image of the city and make it more competitive.

The main results drawn from the case study can be summarized in two key points.

First, studying the recovery process helps to understand both the direct and indirect economic effects of natural disasters and the countermeasures implemented. The Great Hanshin Earthquake had a negative impact on trends of population and employment in Kobe. The short-term actions allowed to quickly return to pre-disaster level of population in areas stricken by the quake. The long-term strategy proposed by the local government, aimed at creating a "resilient city", positively affected employment. However, increasing in population and employment can hardly be directly linked to the earthquake. In one hand, change in population shows an internal moving and an increase of people in the damaged wards but it can not be directly associated with the recovery process. It is reasonable to think that the trust in institutions and the ties with the local community can explain such movements. On the other hand, the trend in employment could not be a direct effect of the earthquake and a consequence of recovery policies. The negative trend of 1996-1999 concerns Kobe's economy but also Hyogo prefecture and the whole of Japan, as well as the positive period of 1999-2001. Despite macro fluctuations can not be considered directly related to environmental disasters, a focus on economic effects of natural disasters is important because it can highlight indirect losses that have a long-term effect on the development of the region causing economic stagnation period. Such damage can involve losses in productivity in sectors directly impacted by the shock or losses in investment or decreasing in population and employment (Noy and duPont, 2016). Long-terms effects of natural disasters can also involve a damage in the imagine of the region (Vale and Campanella, 2005) and have negative influence on economic trends, such as tourism. As a result, a short-term recovery to natural disasters is just a part of the process. A long-term action is required in order to promote both physical and psychological recovery. In order to to strengthen regional resilience can be useful to evaluate the long-term economic effect of a natural disaster and to establish a long-term policy in addition to the immediate action of emergency managing.

Second, an analysis of to long-term recovery allows to go beyond the shock and investigate the origins of the resilience. Shocks are rare events and change can not be pushed only by external pressures (Simmie, 2012). The case of Kobe shows that social capital, as resources and networks created by interaction in communities, can stimulate adaptability, adaptation and resilience. Strict cooperation between formal and informal institutions is an old tradition in Kobe. Such cooperation strengthens social capital and contribute to demonstrate that resilient communities can build resilient regions. The role of human agency is crucial in building the resilience: pro-activity of local government and a shared decision-making policy can make territories more stable, promoting processes of adaptation and adaptability.

Moreover, local resources may foster regional resilience. In Kobe, after the earthquake, the city confronted with declining population and employment and a huge damage in the port area, the old economic heart of the city.

Exploiting the creative industries such as the design sector was a way to react and reinvent the city promoting a new image of a creative city. Additionally, through high-tech industry policy makers decided to expand and diversify the economic base through robotics and bio-medical clusters. The case of Kobe shows that innovative and creative industries can be both sources for change and a way to increase the resilience in cities and regions.

6. Conclusions

This paper sought to enrich some under-researched topics of resilience, studying the recovery process after a natural disaster. It argued that resilience is the ability to reorganize, renew and evolve in face of an external pressure but literature gives poor answer in order to identify the long-term effects of environmental shocks, the role of human agency in the recovery process and the regional resources in fostering resilience.

In order to deep the process of building resilience we used the case of recovery in Kobe, a Japanese city extremely damage by the Great Hanshin Earthquake in 1995. The recovery in Kobe is an interesting case in searching the factors and the dynamics that foster resilience and can contribute to fill the gaps in the literature mentioned above.

What lessons from Kobe? The evidence from this case study suggests that a shock can be an opportunity for speeding change and renew in regional economy in order to build resilience. However, it is not the shock which shape trajectories for change. The occur of an external shock can not be the exclusive way to break with the past and create opportunities for new trajectories, as theorized by path dependence. Other sources need to be sought, such as local behaviours and embedded resources. As a consequence, adaptation, adaptability and resilience can be influenced by local agents and historical conditions.

Pro-activity of local institutions and collaboration between informal and formal institution played an important role in crisis response. In one hand, it is necessary to ensure to the regional and local institutions the possibility to act again crisis when the national government is not able to respond to localized disturbances. Moreover, such response can positively affect both the local and the national dimension. On the other hand, a dialogue between institutions and citizens must be ensured. Social participation is necessary in order to strengthen communities and increase social engagement. As demonstrated by the case of Kobe, strong relationships in the community positively influence the resilience and help to faster respond to crises.

Finally, to identify strategical local resources for building resilient region is a priority for local government. Resources such as culture and creativity can be fundamental in shaping the new paths. They can stimulate the innovation capacity and the economic change drawing on a rejuvenating of traditional exiting sectors or creating a new one. As a result, culture and creativity can be assets to react from a disturbance and find new ways to adapt to the new changed conditions.

The case of Kobe shows that proposing a long-term strategy of recovery demonstrates the ability of economic systems to cope with external pressure and confirms the resilience of the system. However, a long-term strategy

is also a way to identify agents and resources involved in the reconstruction process. A goal for policy makers is to acknowledge strategic relationship between actors and critical resource in the recovery process. After all, resilience is not just a natural features of regions and territories but it needs to be fed in order to create better and stronger environment.

In this scenario, future studies could focus on the role of communities to engrave regional resilience. It is still unclear what is the relationship between the capacity of response and the ties between members of communities in order to understand if stronger communities can better cope with external pressures. The study of social resilience presents complexities in defining and measuring but, at the same time, it is an extremely interesting and innovative topic.

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