



Vulnerability and resilience in the local systems: The case of Italian provinces



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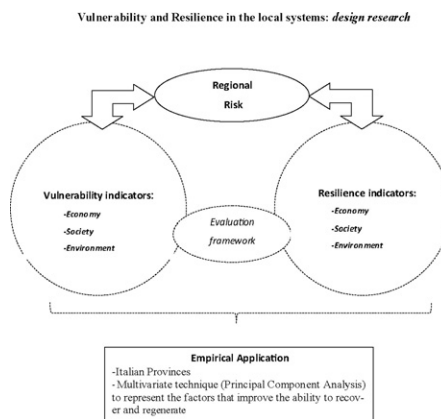
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HIGHLIGHTS

- The representation of regional risk needs a systemic approach.
- Two descriptive categories identify the regional risk: vulnerability and resilience.
- The local systems are represented in 3 dimensions: Economy, Society and Environment.
- Vulnerability and resilience are described with multivariate technique.
- Fragility of urbanized and industrialized areas emerges in environmental vulnerability.

GRAPHICAL ABSTRACT



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ABSTRACT

The aim of this work is to verify a theoretical representation of the multidimensional concept of territorial risk, through a study of Italian provinces. The concept is referred to the exposure of the territorial system to the risk of an exogenous event, as a combination of factors of fragility and resilience. In the proposed framework, elements of the organization of a territorial system had been identified, in its economic, social and environmental dimensions, mostly affecting his exposure to the adverse impact generated by a disturbing event and the ability to answer and to regenerate. According to this scheme of representation, the territorial risk is the result of the combination of these factors that influence the probability of a local system to undergo negative changes as a result of the occurrence of the event. The evaluation of vulnerability and resilience of a system, by adopting a holistic reading of the phenomenon, involves the identification of systemic components and attributes such as openness to the external environment, structural diversification, availability of resources, structural dependence/independence, functional redundancy, adaptability strategy. In the paper the authors propose the construction of an indicator system and composite indices for monitoring, through multivariate statistical techniques, the factors of fragility and ability to recovery. The proposed system is applied to a study of the economic, social and environmental vulnerability and resilience of the Italian provinces.

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1. Introduction

The objective of this work is to verify a theoretical framework describing the multidimensional concept of regional vulnerability through a study of the Italian provinces. In the proposed scheme the authors adopt a systemic approach to the study of the phenomenon (Holling, 2001; Resilience Alliance, 2007; Walker et al., 2004): risk is represented as a combination of vulnerability and resilience factors. The concept is described to give a representation in the three spheres of sustainability, the economic one, as well as the social and environmental ones. For a definition of the local system in three dimensions, it is used the theoretical background and the conceptual basis of ESA index (Dallara and Rizzi, 2012) to describe the competitive positioning of the local systems and their coevolution, with a view to balance the three subsystems.

For the application of the scheme concerning the study of Italian provinces, a system of indicators and composite indices is defined, according to the following steps: firstly a connection of some indicators with economic, social and environmental dimensions, then with the descriptive categories of vulnerability and resilience and finally, the macro-themes that define them; selection of elementary variables defined in the theoretical step; application of multivariate analysis, in particular principal components analysis, to get composite indices, at the level of macro-variables and, in a second moment, at the level of the *vulnerability* and *resilience* descriptors. The aim is to get a tool for regional analysis which can produce an assessment, as synthetic as comprehensive at the same time, of regional vulnerability in the three spheres of sustainability. It is intended to build a geographic information system, used to provide synthetic information or to focus on specific topics, in order to evaluate the positioning of a local system, according to a comparative approach.

2. The theoretical framework

Local and regional development is the focus of intense debate in recent decades: on the one hand the neoclassical models in the growth theory have been improved in terms of theoretical analysis (Huggins et al., 2013) and on the other hand endogenous growth models have had a great spread among scholars (Lucas, 1988; Garofoli, 1992; Vazquez-Barquero, 2002). Theoretical analysis and empirical research have been directed toward a gradual “widening” of the notion of capital. First emphasizing the role of R&D and human capital (Romer, 1990), then exploiting the concept of social capital (Putnam et al., 1993; Malecki, 2012) and finally making use of the notion of creativity and creative capital (Florida, 2002). Other researchers introduced the concept of “territorial capital” in order to catch the multidimensionality of tangible and intangible assets of regional and local systems (Camagni and Capello, 2013). Finally the neoinstitutional approach pointed out that the institutions represent an important factor in regional development (Rodríguez-Pose, 2013).

The dissatisfaction with strictly economic approaches has produced a radical revision of local development policies, techniques and models of analysis, with the transition to a new vision of regional competitiveness as the ability of a given territory to ensure its inhabitants sustainable development in economic, social and environmental terms (Dasgupta, 2004). This is a redefinition of target variables that more directly measure standard of living (Kitson et al., 2004), well-being (Huggins and Thompson, 2012), collective happiness (Layard, 2006) and quality of life (Rogerson, 1999). These holistic approaches are more oriented to the sustainability of development, with attention not only to increase the purchasing power or the income of citizens, but also to the aspects of social and environmental nature that promote the level of wellbeing of individuals at local scale (Dallara and Rizzi, 2012; Giaoutzi and Nijkamp, 1993; Rizzi et al., 2015). In this context the topic of risk mitigation is a crucial

factor for achieving the conditions for sustainable development of local systems (Walker et al., 2004). A sustainable urban planning necessarily takes into account two important goals, in order to face the uncertainty that characterizes the evolution of regions: on one hand, the improvement of the ability to recover to adverse shocks and, on the other hand, the reduction of impact of action and interventions which, leading to strong anthropogenic pressures, may affect this ability. In previous papers (Graziano, 2014; Rizzi et al., 2015) the authors proposed a theoretical framework useful for investigating the phenomenon of risk for every level of analysis, extending the interpretation to the three dimensions of sustainability.

It is a multidimensional approach¹ in which the design of the theoretical framework and its empirical translation followed a logical/operational sequence which is inspired by the one proposed by Lazarsfeld, 1953 for the quantitative determination of a concept designed for measuring. First, the theoretical framework has been designed identifying the elements of the concept description, its dimensions.

The research on fragility of small states (Briguglio et al., 2009) and territories (Blaikie et al., 2004; Cutter and Finch, 2007; Naudé et al., 2009) has suggested a model for the representation of territorial risk where it is positively related to fragility factors and negatively related to response capacity factors. The conceptual framework starts from these studies and from literature on complex adaptive systems in the context of both the socio-ecological sciences (Folke, 2006; Giaoutzi and Nijkamp, 1993; Holling, 2001) and regional sciences (Galderisi and Ceudech, 2003; Martin, 2012; Pendall et al., 2010; Rose and Liao, 2005; Simmie and Martin, 2010). It highlights the existence of two dimensions of territorial risk: vulnerability, concerning to the structural features of system, and resilience, concerning to the relationship among components. The vulnerability is the propensity of the system to undergo negative changes resulting from an adverse shock, as well as the inability to restore the structures that distinguish it. The vulnerability of a region depends on the fragility of its structure and increases the probability of the system to enter into functional crisis as a result of an exogenous shock (Galderisi and Ceudech, 2003). Resilience is the ability to cope with a negative event, tolerating the negative impact produced by the perturbing action (Carpenter et al., 1999; Holling, 1973). More recent studies (Martin, 2012; Martin and Sunley, 2015) emphasize more explicitly the resilience of regions as the ability to adapt, recover and regenerate. According to this systemic representation, regional risk is in general positively related to the factors of regional vulnerability and negatively to the resilience factors (Graziano, 2014). But the relationship between vulnerability and resilience appears more complex and not necessarily negative. For example, in the environmental dimension it is possible sometimes to observe high levels of ecological vulnerability associated with high values of resilience, especially explained by the policies of response to environmental problems (cycle paths, waste separation, etc.).

Subsequently, the design was filled, describing it in such a way as comprehensive as possible, to give a representation in all three spheres of sustainability. We have therefore identified the economic, social and environmental dimension and sub-dimensions that are relevant from the view of the phenomenon being investigated. In this step, we have used the contributions on the theme of the economic systems fragility and resilience (Briguglio et al., 2009; Liou and Ding, 2004; Naudé

¹ The territory is an open system, characterized by interconnected components and feedbacks that cause non-linear processes (Martin and Sunley, 2007). When the probability of specific events is unknown, a holistic approach is useful to provide an initial informative framework of systemic features that could determine fragility or could influence the paths of adaptation (Walker et al., 2004). This approach avoids underestimation of unexpected aspects, focusing on factors observed on long periods of time, rather than on resources needed to tackle a specific critical event (Paton, 2001).

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