

TeMA

Journal of
Land Use, Mobility and Environment

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THE TIMES THEY ARE A-CHANGIN'

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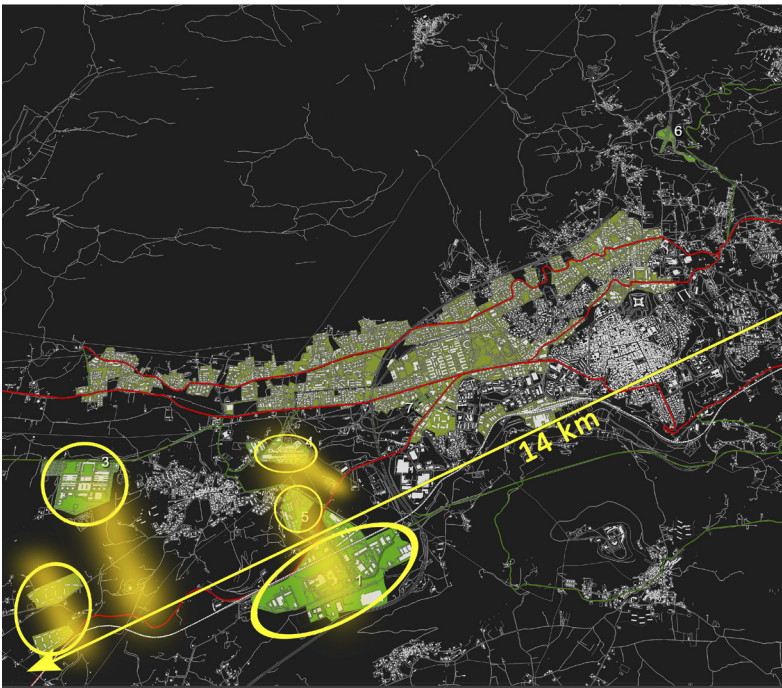
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GOOD PRACTICES FOR THE MANAGEMENT OF FRAGILE TERRITORIES RESILIENCE

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ABSTRACT

Italy is a territory frequently affected by natural disasters that have a huge impact on urban transformations. The physical and socio-economical reconstruction process of a territory damaged by a traumatic event at first pursues the path of emergency management and subsequently the rehabilitation of the damaged areas. These political and economic strategies are still unsystematic, so it is difficult to predict either long or short term effects. This paper presents an analysis carried out on the city of L'Aquila following the earthquake of 2009, in which indicators were defined to assess and monitor the reconstruction process. The method used to define the indicators is 'absolute', in such a way as to represent a replicable model that can be adapted to different territorial and emergency contexts. Furthermore, the set of indicators proposed can be used not only to monitor the reconstruction process, but also to guide public policies and to suggest shared strategic guidelines, not originated by the urgency of after-shock conditions. The proposed model is a tool to be used from the early stages of reconstruction, in order to predict the outcome of the reconstruction itself. In this way, it is possible to manage urban transformation in a coherent and organic way in all its phases by adopting a single tool. The use of the model shown in the research also makes it possible to enhance the resilience of a territory by exploiting its intrinsic characteristics.

KEYWORDS:

Reconstruction Indicators; Post-earthquake Reconstruction; City Resilience; Territorial Transformations; Fragile Territories Management; Guide-lines

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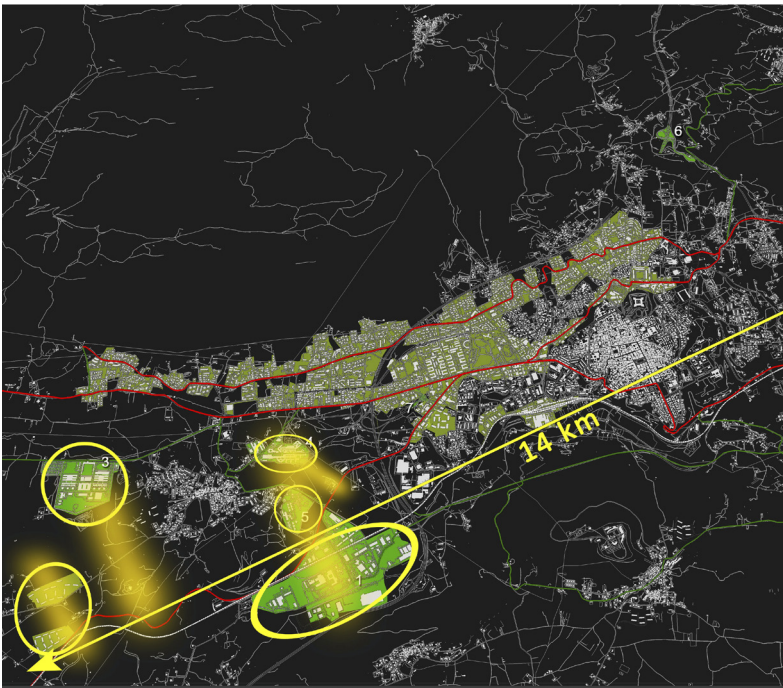
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管理脆弱区域恢复能力的有效措施

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摘要

意大利的国土频繁遭受自然灾害的影响，这对其城市转型造成了极大的影响。在对遭受破坏的区域进行物质和社会经济重建过程中，首要任务是应急管理建设，其次是对受损区域的复原。而重建过程的政治和经济举措仍处于无组织状态，因此难以预测其长期效果。本论文就2009年地震之后的拉奎拉市 (L' Aquila) 展开分析，制定指标以评估和监测重建过程。用于制定指标的方法为“绝对法”，以此呈现一个适用于不同区域和紧急情况的可复制模型。此外，文中提及的一系列指标不仅可用于监测重建过程，还可针对非灾后紧急情况为公共策略提供指引，以及提出共用的战略指导方针。该模型是一种可用于早期重建阶段的工具，旨在预测重建结果。这种方式能够通过单一的工具，对城市转型的所有阶段以连贯且有机的方式进行管理。对研究中所示模型的运用还可利用区域的内在特征以增强其恢复能力

关键词:

重建指标; 地震后重建; 城市恢复; 区域转型; 脆弱, 域的管理; 指导方针

1 INTRODUCTION

In recent decades, politics and research have confronted each other to reduce the impact of disasters on society: international agencies and national governments have begun to define clear objectives and commitments for disaster reduction. The Hyogo Framework for Action (HFA, 2005-2015) and the subsequent Sendai Framework for Disaster Risk Reduction (SFDRR, 2015-2030) represent fundamental steps in this sense. The policy and the global research area by which nations are trying to reduce the vulnerability is therefore "Disaster risk reduction" (Aitsi-Selmi, 2015). In the last years DRR has been strictly related to resilience, that assumes a key role in promulgating worldwide vulnerability reduction (Paton & Johnston 2017). The substantial effort among global agencies in trying to mitigate the disastrous effects was accompanied by abundant academic discussions and analyses on both "DRR" and "resilience". The current academic debate and discussion do not currently show clear signs of convergence towards a concerted series of concepts to be used in practice. However, the relation between the reduction of disaster impacts and resilience has been deeply argued by T. R. H. Davies and A. J. Davies (Davies & Davies, 2018). Italy is characterized by complex urban areas and territories, which derive from long processes of urban transformation determined not only by social and economic reasons but also substantially defined by natural calamities. The need to 'rehabilitate' the places devastated by traumatic events, immediately poses the problem of intervention modes, which widely depend on the political and strategic choices of the public administration. To this date, there is a lack of operational procedures that are able to conduct the reconstruction process in an organized and coherent way, from the first phases of emergency management to the completion of the reconstruction process – that is physical, social, economic and cultural. The strategic choices are determined by the outcomes of this process. These currently appear to be unpredictable because they are the result of a management lacking in the method. Governance actions, in the attempt to find a balance between eliminating dangers in the immediate after-shock and preserving the physical nature of places, should not be conditioned by the availability of resources. What really happens is that the economic issues begin, already from the first stages, to condition the future structure of a territory (Fiorani, 2018), also because of the fact that the strategic choices are mostly made only during full emergency rather than in anticipation of an event. With regard to the architectural scale, the intrinsic adaptability of Italian cities is evident in the numerous transformations, which followed the frequent traumatic natural events. These have been able to preserve the features of historic buildings and their contexts. In fact, the authentic preservation of historical architecture allows us to better understand and interpret various aspects of considerable importance, e.g. materially documenting both the previous vulnerabilities and the ability to adapt to traumatic events that have occurred in the past (Bartolomucci, 2018). Transferring this to a larger scale, it would be reasonable to state that the Italian territory, and the Italians themselves, have a 'natural predisposition' to resilience that has facilitated the adaptation of a huge cultural heritage - which includes buildings, historic centers and landscapes - to a more modern way of fruition and with renewed potential. Recognizing the quality of resilience to the Italian territory is also possible thanks to the weak definition that is attributed to this concept from both scientific literature and executive practice, with which the processes of transformation and enhancement of a territory are tackled. Indeed, Rizzi et al. highlight how over time the concepts of risk management and vulnerability assessment are evolving towards a direction that abandons the reduction of the city/territory fragility, to the benefit of its ability to adapt: in this adaptability resides the degree of resilience (Rizzi, 2017). Borsekova et al. state that resilience of cities can be perceived as a "roof" or "umbrella" of an urban system that is formed by four main pillars – economy, society, institutions and environment – and these pillars stand on the foundation stones of adaptability, robustness, flexibility, resources, inclusiveness, redundancy and integration (Borsekova, 2018). Therefore the DRR seems to be the best defined and understood term, perhaps due to its relationship with the consolidated discipline of Risk Management; clarity in the use and meaning of "resilience" is less obvious. The lack of clarity on the concept of resilience can be associated, in a first phase, with the impossibility of quantifying its dimensions, due to the

qualitative properties that are not measurable and which are usually attributed to them. If the resilience must be one of the standards for determining the ability of a territory to adapt in relation to its risks and fragility, it must necessarily be measurable, as all the others standards. For this reason, in recent years scientific literature has highlighted the need for the identification of a method and a multidisciplinary and interdisciplinary approach to planning, which the sole "Regulatory Plan" is not be able to guarantee. For this purpose, different IT platforms and models have been set up in an attempt to unify and manage knowledge through dynamic control tools. A study (Di Lodovico & Di Ludovico, 2017) reports the analysis of 8 platform models developed to allow and facilitate the interaction between different actors in the transformation project of an urban context, integrated with sensors for monitoring or supported by appropriate indicators. Furthermore, D'Ascanio et al. illustrate how resilience is becoming a necessary component for the achievement of sustainability standards set by E.U. for Smart Cities (D'Ascanio, 2016); the transition between Smart City and Smart Territory is possible thanks to the use of enhanced and at the same time simplified governance tools (Di Ludovico, 2014). In this paper a methodology for the definition of a set of indicators is presented. The method shown can represent a guide in post-disaster reconstruction processes. The need for the development of this methodology originates from the earthquake that hit the city of L'Aquila in 2009. On the basis of the data obtained from the analysis of the emergency and post-emergency phases, it was possible to identify a replicable model for assessing the reconstruction process and for disaster management. This method is based on the choice of indicators presented by the research, suitable for use for the definition of the strategic and operational lines of intervention also.

2. TOOLS AND METHODS

That natural disasters occur is undeniable. Preparing to cope and react in a best way is essential. According to Molavi (Molavi, 2018), a resilient city can survive after a devastating trauma. The concept of resilience was initially both associated and placed in opposition to the concept of vulnerability. The strategies adopted to reinforce the resilience of a territory were therefore aimed at reducing its vulnerability. Subsequently, within the scientific debate, resilience was associated to a broader vision and is thus no longer bound to the reduction of vulnerability only. For Colucci (Colucci, 2012) the capacity of a territory to be resilient depends mostly on the degree of organization in a territory at the stage prior to the event. In fact the better prepared the system, the quicker it will return to normality. The integrated use of appropriate management tools is necessary to achieve a resilient city vision. The indicators are qualitative and quantitative measures resulting from the facts systematically observed which describe the characteristics of certain phenomena analyzed in order to allow their evaluation (Martinez & Dopheide, 2016). In recent years, the management, monitoring and evaluation of a post-disaster reconstruction process are emerging topics in the field of scientific research. The main challenge presented to local governments is the effective management of both the emergency phase and the urban and territorial transformation process linked to the physical reconstruction of homes and infrastructures and to economic and social recovery. Until recently only few researchers have attempted to synthesize the entire reconstruction process. *Reconstruction following disaster* (Hass, 1977) is one of the few case studies that has analyzed a reconstruction process completely. Hass, Kates and Bowden in their research state that, as result of disaster, reconstruction actions are more effective and easy to achieve if there are existing intervention policies and action plans. Another significant contribution to literature on Reconstruction was a 1998 publication by the American Planning Association "*Planning for Post-disaster Recovery and Reconstruction*" (PAS Report, 1998). According to the researchers, the reconstruction process would have more chance of succeeding if the cities were already equipped with a reconstruction plan within the existing planning instrument, in order to reduce the possibility of decisions that could limit the future development of the territory affected by the disaster. There is an existing inherent trend in the search for a model that could be useful for public administrations to define in advance the priorities of a reconstruction process. It can be

said, however, that most of basic literature does not deal with the Process of Reconstruction in its entirety, but almost always focuses on certain aspects and is so lacking in many respects. The use of indicators in the monitoring of the urban transformation process can be considered a method of efficient management of city/territory fragility, as they are able to describe and evaluate multiple parameters and variables that exist, such as the different geographical scales and the different timing of the phases related to the event (emergency-reconstruction). "Furthermore, the use of indicators, in addition to encouraging the development of basic knowledge and hypothesis testing" (Chang, 2009), "guarantees objectivity in process analysis and allows comparison between different case" (Shohei, 2007). It must be noted that literature on these issues is very scarce. In a study Saporiti et al. (Saporiti, 2012) hypothesize a panel of indicators able to assess the degree of recovery of a territory by placing the problem at different levels, including the global and the local, the individual and social/community spheres. The contribution proposed takes into account the current debate within the urban planning discipline, which revolves around the refusal of the plan as a promoter of development. For this reason, "now the traditional paradigm of regulation seems obsolete" (Calafati, 2014). For these reasons, the management of the development trajectories is entrusted to the same Set of Indicators which is meant to monitor the reconstruction process. This paper suggests a planning model that helps to overcome the system provided for by Law 1150/42 and which provides definite principles and development guidelines. A simplification of the system which has in the 'Indicators' a flexible and adaptable instrument is thus predictable. The Set of Indicators will guarantee the future vision of the territorial and urban layouts, because it is, at the same time, both a frame for urban policies and a reference table for the evaluation of the urban transformations begun by the process itself. The proposed method uses the Indicators not only to monitor an ongoing transformation process, as described in the case study of L'Aquila, but also to guide the initial phase of definition of the Strategic Lines and actions of the reconstruction. The effectiveness of the method presented consists also in the possibility of considering all the dimensions of the system, physical, economic, social and not only the urbanistic dimension.

3. URBAN TRANSFORMATION IN POST-EMERGENCY CONTEXTS: THE CASE STUDY OF L'AQUILA

On the 6 April 2009, an earthquake of magnitude 6.3 Richter hit a large portion of the Abruzzo region in Italy. The greatest damage occurred in the city of L'Aquila and in the 20 neighboring towns, affecting an area in the Apennines with a significant industrial presence and a vast rural presence. The total population involved (1 January 2009) was 144,415 persons, equal to about 11% of the regional population and 0.2% of the national population (CRESA, 2011). The buildings damaged or destroyed, only in the municipality of L'Aquila, were between 10,000 and 15,000, thus causing the temporary evacuation of about 72,000 inhabitants and leaving about 67,500 homeless. More than 50% of the 'crater'¹ population resided in the Municipality of L'Aquila alone. This occurred together with the effects of the economic crisis that began in 2008 and continued in the following years.

3.1 THE SOCIO-ECONOMIC SYSTEM AND THE NEW URBAN SHAPE

For more than the last decade in L'Aquila, a very weak economic development has been taking place, made uncertain by the ongoing profound institutional and economic changes. Consequently, once the factors that had generated a development trajectory over the past decade had been exhausted, the city found itself in a phase of economic deadlock to which local institutions did not give much importance, trusting in the economic stability that the role of administrative and university city seemed to guarantee. During the decades preceding the earthquake, the economy of this territory was characterized by a poor integration between the

¹ "Cratere" and "Cratere Sismico" describes in Italian the list of municipality damaged by an earthquake.

manufacturing sector and the other sectors, including incomes deriving from Public Administrations and apartment rentals. The development of the University had helped to create the detachment between sectors. The local economy tended to exploit the position revenues. The result was a high degree of fragmentation, also due to the lack of coordinated strategies. The earthquake struck a city that was in a phase of economic stagnation, due also to the international economic crisis of 2008, and without a certain strategy of development. The earthquake accelerated the processes of transformation of the socio - economic structure. These are weakening the innovation and development capacity of the city and its territory. This is because the focus of decision-making processes has been addressed towards the reconstruction of the physical system, overshadowing the economic development issues. The infrastructures comprising both public and private building assets were damaged. It is particularly difficult to quantify the damage linked to production activities. In fact, in addition to the buildings, the damage suffered by equipment and machinery, or those resulting from the loss of stocks, must be considered. At the same time, the indirect damages deriving from the drop in demand due to the partial or total interruption of activities must be estimated. In addition, the loss of revenues resulting from the cancellation of orders and the damages related to the costs of relocating production and / or service activities have to be considered. More than 50% of the total active units present in the 57 Municipalities of the 'Cratere sismico'¹ are concentrated in the Municipality of L'Aquila. Before the earthquake, from a spatial point of view, L'Aquila was a city built in parts. A polycentric dimension held together the multitude of hamlets and inhabited centers - some large (Paganica: 5,000 inhabitants; Pianola: 1400 inhabitants) and others far from the main nucleus (Arischia: 8 Km; Assergi: 14 Km); a linear dimension, constituted by the settlement system located along the Aterno valley, extends for about 14 km. At the same time a diffuse and porous dimension coexist, and this is represented by urban voids, abandoned areas and important natural reserves. In this differentiated system, the identity recognized by all the citizens of Aquila who lived inside the ancient walls and in the hamlets, was the city's historical center. With respect to the historical center, in the years of the post-war construction expansion, the city was disposed to the east and to the west in an initially balanced manner and then, over the years, hierarchized and unbalanced towards the west. During the eight *LaurAq* workshops, held in L'Aquila in June 2010 following the analysis of the transformations that affected the city of L'Aquila after the earthquake, seven definitions of the city have emerged:

- '*città coerente*' (coherent city): that part of the city built within a system of shared rules, which has maintained a relationship of coherence in its different parts. It is the historical part of the city that extends its perimeter just outside the ancient walls;
- '*città consolidata*' (consolidated city): the city where the coherence has disappeared but within inside a homogeneity of the urban structure it is still recognizable, but that was deficient even before the earthquake. It extends its perimeters close to the highway that constitutes its invisible limit;
- '*città in formazione*' (city in progress): the residue of an unfinished plan. It is discontinuous within the urban structure that has different densities due to a significant presence of empty spaces, abandoned spaces and without a definite destination. It includes the outermost suburbs to the east and west;
- '*città delle frazioni*' (city of hamlets): plays an important role because the polycentrism of the hamlets, originally failing, has been strengthened as a result of the earthquake;
- '*città dell'emergenza*' (emergency city): born in opposition to the voids generated by the various 'Zone Rosse'², it was built in five months without a settlement rationality. It thus constitutes a difficult urban problem due mainly to its size (about 18,000 inhabitants), the consumption of soil and its social and economic issues (Fig. 1.a);

² The " Zone Rosse" are devastated areas forbidden to the general public.

- ‘*città lineare*’ (linear city): pre-existing to the earthquake and derived from the industrial locations of the '60s, today is emphasized by the new ‘C.A.S.E.’³ locations and from the relocation of urban and territorial equipment in industrial agglomerations. This Linear City has determined an erratic and ungovernable mobility, because of lack of a linear infrastructure of public transport (Fig. 1.b);
- ‘*città dello sprawl*’ (sprawl city): following the earthquake, there was ‘an explosion’ and a redistribution of population and facilities. This dispersion in the territory is underlined by the sprawl - 800 authorized buildings and as many unauthorized (data from L’Aquila Municipality 2011) emerged from the municipal deliberations that were liberalized. The construction of residences and productive activities in the municipal territory was carried out, in derogation of environmental landscape restrictions. The metabolization of these areas is still particularly difficult (Di Cristofaro & Pignatelli, 2011). This has happened because the phenomenon of urban sprawl has been recognized as one of the main anthropic threats with regard to natural landscapes. However, it is a theme only marginally addressed within the process of local development management (Zullo, 2015) (Fig. 2).

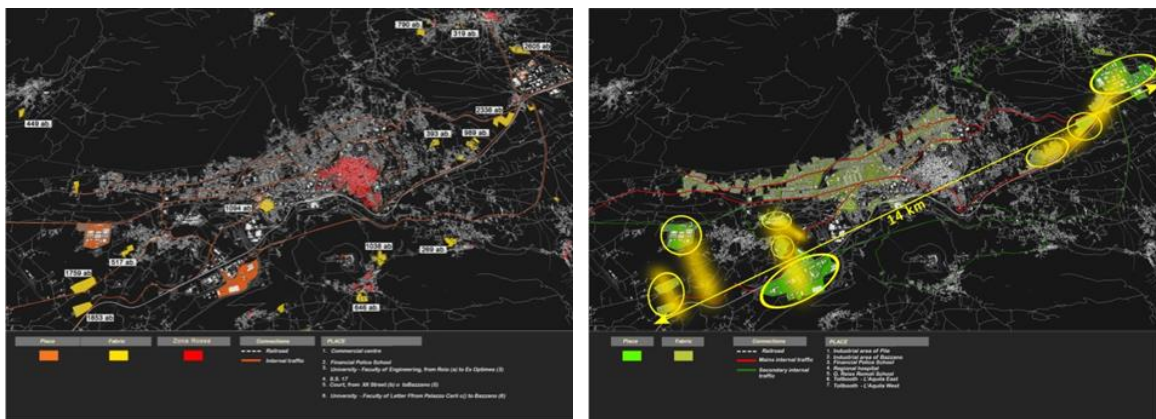


Fig. 1 (a) Emergency city (left); (b) Linear city (right)

The earthquake caused a weakening of stratified urban balances with long-lasting and difficult-to-contrast effects. Thus there was a break with the existing urban network and its morphogenetic role. The subdivision of the city in the seven cities listed above, has led to a distortion of the functional mix, a banalization of community living spaces and a loss both of proximity relations, which constitute the binding of community life, and urban relations between the different parts of the city, causing a weakening of the system of public spaces and an increase in the erratic mobility.

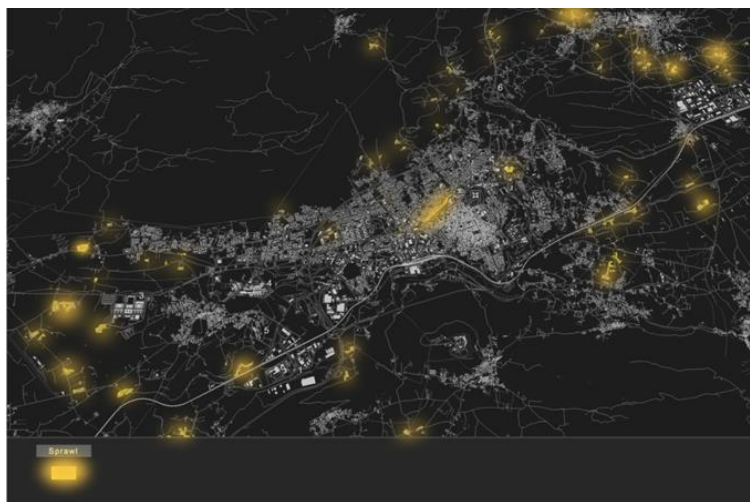


Fig. 2 Sprawl City: the sprawl is highlighted in yellow

³ ‘C.A.S.E.’ this is an acronym describing emergency temporary housing.

3.2 THE PROCESS OF RECONSTRUCTION, GOVERNANCE SYSTEM

The Reconstruction of L'Aquila was proposed in the aftermath of the earthquake of the 6 April 2009 as a particularly complex issue both for the uniqueness and the size of the phenomenon - the devastation of one of the most important and extensive historical cities of Central Italy – and the reconstruction itself. This is because the reconstruction is not reconnectable to the traditional disciplinary systems. This aspect especially has led to a reflection on the adequacy of the discipline in case of emergency processes and on the congruence of a traditional approach to the issue/problem (regulatory and forecasting) of reconstruction, which for its significant exemplarity and uniqueness misses in the experiences of strategic planning and in advocacy planning reference solutions. The themes of economic reconstruction of the affected communities (in L'Aquila this is an extremely complex matter and it is rooted in terms of identity and local characterizations) and the integration of the economies in crisis again due to the earthquake. The original economies must compete with new and aggressive economies of reconstruction. The management of these processes has tried to find its solution in Governance, defined by ordinances and decrees. (LAURAq, 2010). Within the process of reconstruction distinct phases emerge. In the early days following the disaster, the Central Government issued a comprehensive regulatory framework. This phase began with the enactment of Decree Law N° 39 of 28 April 2009 and Law 24 June 2009 N° 77. This was a primary legislation which envisaged General sectors of intervention and that gave impetus to two successive commissarial management models, until the application of Law 134/2012. This norm marks the third and final phase of reconstruction, which decreed the end of the State of Emergency by returning the management by a Commission (3 years) to an ordinary regime after a long time. This management has produced an acceleration of Private Reconstruction. Even so, notwithstanding the simplifications introduced, a sliding must be registered of the predictions made in the report presented Parliament by the STM⁴, which indicated the year 2022 as the year in which work would be concluded. This failure can be attributed to the interpretation of an exclusively programmatic nature of the reconstruction plan, introduced by the Law 77/2009. This erroneous interpretation has resulted in the inefficiency of the Law. The case of the city of L'Aquila may be read as a metaphor of urban disciplinary insufficiency that the scenario of the earthquake has sent into crisis (Properzi & Di Ludovico 2018).

4. THE RECONSTRUCTION OF L'AQUILA: LOOKING FOR A PERSPECTIVE

The process of reconstruction is an issue that spans various sectors, both public and private, and intangible assets, economic and social. In the city of L'Aquila the management of the territory did not have a guiding vision; the proposals and the instances were found to be inefficient when coping with the ever greater problems encountered within the city lifestyle. This inefficiency was found also in the Process of Reconstruction of both physical and intangible relations (Iagnemma & Pignatelli, 2013). It follows that the Reconstruction Process establishes a different perspective with which to view the city and his Government, referring to the various areas of planning and using what is called an integrated approach. The integrated approach implies the need to address the many aspects that affect the Urban Governance of the reconstruction simultaneously, in order to form a collective strategy within which to develop policies and management interventions. For this reason, the essential role is played by strategic planning, which must act on various aspects of the process. The words 'strategic planning' refer to a planning model that involves a project action where the boundaries between urban planning and management policies are weak and mostly do not have relevance to the goals that the reconstruction gives. In Italy the Regulatory Plan, intended as a land management tool, can gain form and content. Since the early '90s, in our country an evolution has been taking place that is making the Regulatory Plan more and more flexible by means of regulatory functions and also with strategic and address functions. The Regulatory Plan is now increasingly seen as a local development process which sees spatial

⁴ "STM" Struttura Tecnica di Missione constitutes in L'Aquila (Italy) the body at the base of the commissarial management models

planning interacting with economic development. Regardless of what is happening at the regulatory level, it is interesting to reflect on the opportunities that this transformation entails.

The complexity of contemporary Planning that embraces diverse areas inevitably refers to a participatory logic, of which the same building process is an integral part. This is not to speak about mere cooperation between institutions or coordination skills, but organic and mandatory participation by all the territorial Governments. There are all those actors that already provide their views on the choices of planning in separate locations, and that should instead assess the compatibility of the proposed spatial planning on the basis of shared cognitive frameworks (INU, 2009). Management models for emergency and reconstruction in the city of L'Aquila fluctuated between governance and government. The various forms of the plan also fluctuated among the conformative, normative and predictive traditions and the innovative and strategic ones. (Andreassi & Properzi 2012). This logic invokes other aspects, not at all obvious, as the awareness and political commitment from the Administration, institutional innovation in terms of governance, the creation of mechanisms for preparation, monitoring and evaluation necessary for the establishment and implementation of the process. A process, irrespective of the type of target, the size of the catchment area and the specific objectives, is based on the integration of different components, through a model, complex by nature and that must obtain, efficaciously and efficiently, the expected result, ensuring at the same time a suitable return in terms of costs/benefits. To ensure that this occurs the strategies must be detailed and the objectives well specified. A well-defined planning process involves having to work not only on the design choices, but also on building cognitive frameworks and indicators.

Following these directions, the process of reconstruction should be able to:

- construct an in-depth and details knowledge base for each sector set on the participations of the local actors through an integrated analysis (economic, social, urban, environmental, cultural, etc.);
- facilitate understanding of the local context;
- prepare objectives shared by all local actors;
- divide objectives in to obtainable and define programs and projects;
- submitting the results to a continuous process of follow up (periodic and scheduled inspections).

The specific objective of the research is the definition of a Set of Indicators that serves to develop guidance for post disaster reconstruction.

The research therefore presents a Set of Indicator useful for developing Guide-Lines for after-shock reconstruction. These Guide-Lines must apply to the strategic direction (objectives) that must be obtained through the reconstruction process. The Guide-Lines will therefore be used to start co-planning policies through acquiring of actions necessary for the termination of the reconstruction.

The approach chosen uses a replicable model for defining a set of indicators to monitor the process itself. This provides a tool to be used not only in progress during control, but also at the initial stage of defining the strategic lines and actions. In this way it will be easier to measure the efficiency of the processes because the information takes into account all the dimensions (physical, economic and social system) of the reconstruction (Pignatelli, 2016). "In analyzing the literature in this regard, it is important to clarify that the use of indicators in this sense implies an approach that does not include the analysis for parts of a complex system, but consider each part in its specific and particular context" (Vallega, 2008).

Another important concept related to this approach, is the circular logic within which the use of indicators is placed in order for the approach itself to become effective. The cycle is already at the base of the model of 'policy life cycle', developed by Winsemius in the '80s. "This model structures the decision-making process in 4 phases and involves the use of indicators both in the design phase and the evaluation of policies" (Caciotti, 2010). Within the process of reconstruction, the circularity is noticeable because the relationship between cause and effect (actions and policies) determines a continuous, circular path in the application of indicators and revision of policies.

For this reason the reference used for the definition of the set of indicators, able to guarantee the maximum of effectiveness of the Process of the Reconstruction as mentioned above, is the one called PSR (Pressures, States, Responses). This model, proposed for the first time by the OECD in the 1994 in the environmental field, allows not only to organize synthetically the information but more explicitly it is the expression of a way of understanding the relationships between society and the surrounding system, through a schematization of the complexities of the system analysed:

- Pressures: impact factors which have the general form of emission or removal of resources;
- State: state of the art of the different components of the process;
- Responses: objectives/policies that individuals responsible for the territorial Government should achieve.

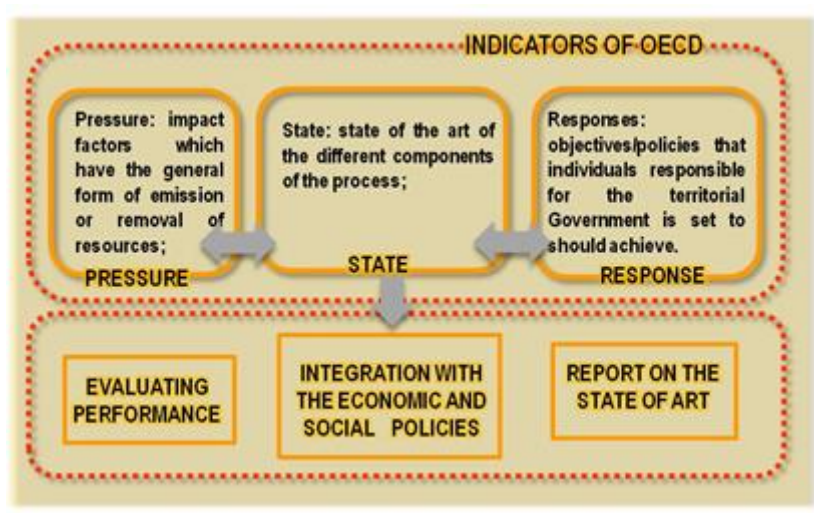


Fig. 3 OECD model: relationships between Pressures, States and Responses

The components, and related indicators, of the PSR model are connected by a circular logical relationship according to which the pressure acting on the system influences the state of the system itself which, in turn, determines the responses to be put into action to achieve the desired standard by reducing pressure on it. The model PSR evolved in the DPSIR model (Determinants, Pressure, State, Impacts, Responses), proposed by the EEA in 1995. This highlights two phases (Determinants and Impacts), already implicitly present in the previous model, but providing a more articulated scheme. In the present research, however, it was thought to use the previous PSR model, because it is simpler and it is considered more effective in describing the complex mechanisms of the Reconstruction Process. It is therefore worthy of note that there is a causal relation in the sequence of the model PSR Pressure-State-Response. The feedback loop, that is the ability of a system to take account of the results in order to change the characteristics of the system itself, develops on a scheme whereby the answers (the policies) can act independently on other elements without affecting the circularity of the process, but rather allowing the Administration to act promptly within it (scheme in Fig. 4). The purpose of this model is therefore to optimize the learning phase with those of processing and evaluating or monitoring the process of reconstruction.

4.1 THE INDICATORS FOR THE PROCESS OF RECONSTRUCTION

Within the process of reconstruction, 3 basic elements are highlighted:

- Inputs - the information entered in the process of undergoing a transformation;
- Constraints, rules and controls - the procedures and measures required to carry out activities that make up the process itself;
- Outputs - the resulting information.

Schematically, the reconstruction can be represented as a 'box' where input, constraints, rules and controls enter and return as output. Unlike inputs, constraints, rules and controls enter into the 'box' but do not undergo any change. We can affirm that the outputs are the object of transformation while resources, constraints, rules and controls are the entities that enable the development of transformation in an optimal manner.

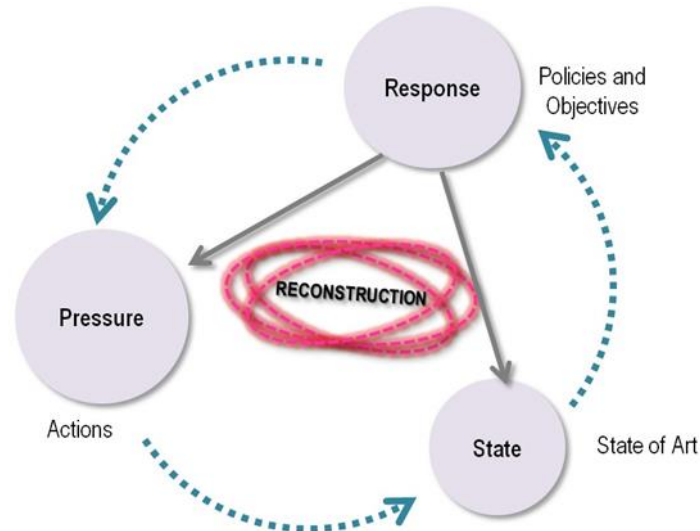


Fig. 4 Process circularity in the sequence of the PSR model

The research focuses on generating a replicable model for defining a set of indicators, which can be understood as a guide on one hand and as a check on the other. The Set of Indicators thus generated can be used to guide the implementation of the process itself, to monitor whether there are deviations from the objectives set in progress, or retrospectively (once it has been implemented completely) for verification purposes.

The Set of Indicators should cover essentially all aspects of the process, since it serves to generate and/or measure the achievement or non-achievement of a standard. For this reason it is a means of documenting and investigating, through the use of physical and structural data, certain classes of phenomena. It is an organized collection of information retrieval that occurs through the systematic study of the development of a particular phenomenon, in order to observe the evolution of variables over time. Indeed, it takes place in the form of periodic detection and on a regular basis. We can say, then, that the ultimate goal of defining the Set of Indicators is to understand what the positives and negatives outcomes are by comparing them with the analyses carried out during the previous period.

From this point of view the extent of the phenomenon is the focus of the management of a process. It allows to locate the data to be collected and analysed, to document the development of current activities, identify strengths and weaknesses and therefore guide the phases of improvement.

It is known that with the growth of the amount of data, it is increasingly difficult to manage the system. The indicators, then, must fulfil three basic functions:

- Control - the indicators are used to evaluate and monitor the performance of the process itself;
- Communication - the indicators allow you to disclose the performance of a process to all actors by providing quantitative information not otherwise available. Indicators that are little representative of a process can determine conflicts and confusion;
- Improvement - the indicators identify performance gaps between expectations and results. The magnitude and direction of the gap provides guidance for the development of strategies to optimize the process.

The basic functions of the indicators revolve around a standard; their aim is an expected outcome that is the measure of the goal itself. The expected outcome, in the specific case of the process of reconstruction, is what

Public Administrations expect to reach once their policies have been implemented. The indicators are used to measure the actions and the results that ensue; therefore, if used without the right precautions, they can lead to a distorted analysis of the processes and can encourage incorrect procedures. In the proposed model, each sub category of reconstruction is represented by a number of indicators, which have specific connections among them in compliance with the circular logic of the process (Fig. 5).

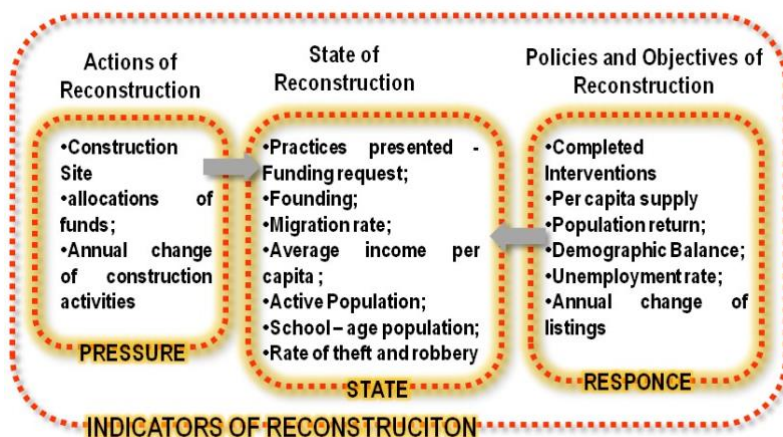


Fig. 5 The model proposed in order to obtain reconstruction indicators following the PSR process

Definition of the indicator set

If wishing to create knowledge that will serve as a base of the process of reconstruction, concern is generated by the existence of a multitude of aspects involved within the process itself and from which to begin. It is this plurality of facets which is reflected in the construction of the Indicator Set. It is clear that we must avoid focus on individual points of view and that we should, instead, find a common matrix.

Of course the process of reconstruction is defined through an idea of complex relationships, having as scenario the territory devastated by an earthquake. It is important to emphasize that in this context the object Process of Reconstruction is described by parts that are both tangible and intangible: flow of people, energy and matter -both internal and from the surrounding territory- in their intermingling define the quality. "It follows that the system to be proposed cannot limit its end exclusively to issues of physical reconstruction, but should also cover the issues of socio-economic development and welfare" (Vallega, 2008). The Set of Indicators must then be able to lead the Reconstruction, described according to its two qualitative and quantitative characteristics and according to predetermined objectives, by analyzing all the factors that affect the performance. With this tool you can also favour a system of public policies that can spread the knowledge of the process of reconstruction in such a way as to involve the citizens through direct participation. The fields of application of the indicators can be identified and grouped into two categories: 'Material Category' and 'Intangible Category'. 'Material Category' serves to define the capacity of physical reconstruction, by investigating the State of the Art of the buildings (private and public), the progress of expenditure and the socio-economic system; 'Intangible Category' considers and assesses the requirements and performance of the territory by analysing factors such as the economic demographic attractiveness, the economic dynamism and the social welfare. Within the 'Material Category', indicators represent the process of reconstruction in a structuralist form. The individual and the community are left out: the social perception of the process is considered only if it ensures that the process itself can be represented as a machine. We limit ourselves to tangible elements, material realities, that can be separable. The 'Intangible Category' both joins and is opposed to the material category. In this case the process of reconstruction is considered mainly in relation to the perception of local communities. It does not refer to an object but to a socio-economic subject representative of the development.

Considering this perspective, the process of reconstruction is no longer seen as a machine but as a set of values that should be considered in their entirety.

The relationship between the two categories of indicators and the PSR model, that underlies the proposed method, can be better summarized through the following table:

PSR Model and Categories for Reconstruction	
Material Category	Immaterial Category
The Reconstruction Process is represented as a disaggregable reality (Pressure indicators)	The Reconstruction Process is represented as a non-disaggregable reality (Pressure indicators)
The Reconstruction Process is represented as a machine, in which the relationship that links the inputs to the outputs is clearly evident (Response indicators)	The Reconstruction Process is represented as a set of values considered in their entirety (Response indicators)
The Reconstruction Process is summarised through indicators that describe and explain it in its entirety (Status indicators)	The Reconstruction Process is summarized through indicators that help to understand the progress of socio-economic development (Status indicators)

Tab. 1. PSR Model and Categories for Reconstruction

For both main areas the definition of the Set of Indicators is obtained through the same process.

In the first instance themes representing the two categories have been identified:

- Material Category (CRFE): Architectural Heritage (private and public); Progress of Expenditure; Socio-Economic System;
- Intangible Category (CRPE): Demographic Attractiveness; Economic Dynamism; Social Welfare.

Subsequently the strategic objectives of the reconstruction were defined to match as many indicators:

- responsiveness;
- transparency;
- timeliness;
- certificates (internal consistency);
- resilience;
- reliability.

Set goals can affect the choice and definition of indicators. For this reason it has been useful to build a 'matrix of relations' between targets and indicators so that it is possible to understand how a single indicator could represent one or more targets simultaneously.

In order to understand which of the proposed indicators better describe a phenomenon, the matrix alone was not enough. It was decided to proceed using the Pareto Method: the Pareto analysis is a statistical technique that can be used to support decision making necessary to identify the significant subset of causes or actions that produces the highest percentage of effects.

The most significant passages of the Pareto analysis are:

- constructing a table that associates each because its frequency of occurrence as a percentage;
- arranging table rows in descending order of importance;
- adding a column with percent cumulated;
- developing a line plot with causes on x-axis and cumulative percentages on the y-axis and interpolating the points (diagram of percent cumulated);

- developing the same template a histogram with the x axis and the y axis causes associated to the corresponding percentages;
- locating the intersection point with the curve traced by a line parallel to the x-axis and the aggregate value of 80% on the y axis. (Project Manager Center, [www.http://www.humanwareonline.com/project-management/center/analisi-di-pareto](http://www.humanwareonline.com/project-management/center/analisi-di-pareto)).

The matrix initially proposed was, therefore, complemented by adding values that indicated the importance of each goal. This importance has been associated with a numerical value on a scale from 1 to 5 (1 = very low, 2 = low, 3 = average, 4 = high, 5 = very high). In addition it was decided to define how each indicator was pursuing the objectives, in relation to the topic under consideration, through symbols. Therefore the indicators can represent a strong (●), moderate (□) or weak (◇) objective. The coding of these three symbols is:

- ◇ = 1;
- □ = 3;
- ● = 5.

An array is obtained where along the x axis is the set of indicators taken into consideration and the objectives to be pursued along the y-axis. Through the mathematical operations you will arrive at the definition of absolute weight for each indicator, whose maximum is 130, and the relative weighting, calculated in relation to the sum of the Absolute values of the weights of the individual indicators (Fig. 6).

Using the information in the matrix it was possible, starting with the importance attributed to the objectives, to determine a scale of priority indicators. The absolute weight of the indicators was obtained by the sum of the products between the degree of importance of each objective and the value to which the indicator represents the goal itself.

$$K_j = \sum_{i=1}^m d_i * v_{ij}$$

Where K_j is the absolute weight of the indicator j-th (j ranges from 1 to n); n is the number of indicators; d_i is the degree of importance of the objective i-th, 3 =, 4.5; v_{ij} is the value that describes how the indicator aims, $v_{ij} = 1, 3.5$; m is the number of goals.

The relative weight with which to construct the cumulative curve can also be obtained by calculating the formula:

$$K_j^* = \frac{K_j}{\sum_{j=1}^n K_j}$$

Where K_j^* is the relative weight of the j-th marker; K_j is the absolute weight of the indicator j-th; n is the number of indicators;

Looking at the chart below it may happen that, for example, the indicators that may help to describe 80% of the targets are numerous. Since it is known that the fewer indicators used in monitoring the greater the reliability, it has been decided to further reduce that number by choosing those indicators that turn out to have greater absolute weight, identified either by the height of the bars that make up the histogram, both from the increased slope of the line that represents the trend of cumulative percentages (Fig. 7).

The choice of indicators in the Material and Physical Category (CRFE), inherent to the themes of Building Heritage (both private and public) and Advancement of Expenditure, derives from the analysis of the data used for the Reconstruction monitoring proposed both by the Civil Protection and by the Special Offices for Reconstruction. As far as the thematic of the Socio-Economic System is concerned, the selection was carried out starting from both the analysis of the data used for monitoring the Reconstruction proposed by the Civil

Protection and the Special Reconstruction Offices, and the use of the Istat databases for the analysis and interpretation of economic and social phenomena.

SOCIO – ECONOMIC SYSTEM										
OBJECTIVES	IMPORTANCE	INDICATORS								
		Practices presented Funding request	Construction Site	Completed Interventions	Per capita allocations of funds	Per capita funding	Per capita supply	Population return	Annual change of construction activities	Migration rate
Responsiveness	5	◇	◇	□	◇	◇	◇	●	●	●
Trasparency	5	◇	◇	◇	◇	◇	□	●	□	□
Timeliness	5	◇	◇	□	◇	◇	◇	●	□	●
Certificate(internal consistency)	4	□	◇	□	◇	◇	◇	●	●	●
Resillience	4	◇	◇	◇	◇	◇	◇	●	●	●
Realiability	3	◇	◇	◇	□	□	□	●	●	●
ABSOLUTE WEIGHT		34	26	60	32	32	42	130	110	120
RELATIVE WEIGHT % respect to the sum of the maximum absolute values		9%	4%	4%	20%	18%	20%	4%	11%	10%

Fig. 6 'Matrix of relations' relating to socio – economic system

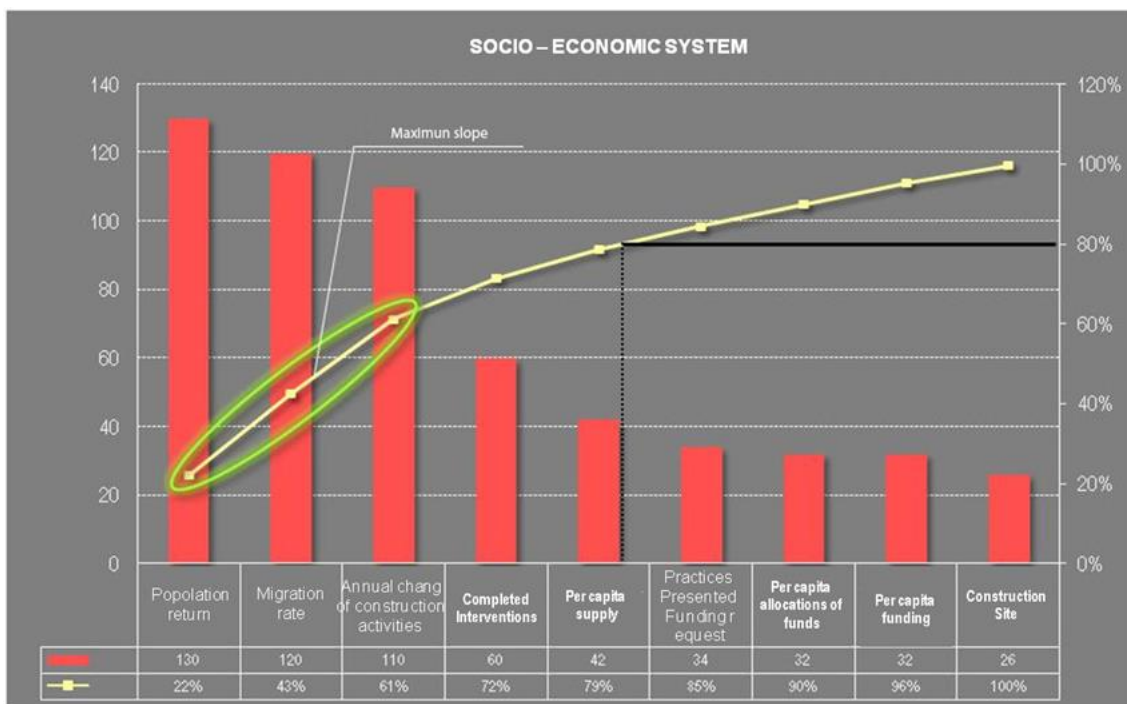


Fig. 7 Pareto histogram relating to socio-economic system

However, in the case of the Immaterial Category, in order to define the indicators, on the one hand an analysis of the Istat databases was carried out for the interpretation of demographic, economic and social phenomena, and on the other hand a study on the Bes Report proposed by Istat (which illustrates the 12 domains relevant to the measurement of social well-being) was used.

The indicators have the following characteristics:

- relevance, i.e. they are the most appropriate to describe the phenomenon;
- practicality, i.e. they are easy to set up and easy to use. They Must constitute a good basis of communication that is accessible to all;
- economicity, i.e. they are not expensive to recover.

Moreover, as regards their units, they will be:

- numerical (eg. Number of practices presented, working population);
- percentage or rate;
- report.

This leads to define the following set of indicators, described in Tabl. 2-7.

Code	Name	Type	Description	Value
(1.1. FE)	Practices presented or funding requests	STATE	The indicator describes the State of the Art by identifying the number or percentage of the practices presented (Private Reconstruction) and tenders financed (Public Reconstruction).	Number and/or %
(1.2. FE)	Construction sites	PRESSURE	The indicator identifies the number or percentage of open sites (public and private Reconstruction).	Number and/or %
(1.3. FE)	Interventions Completed	RESPONSES	The indicator identifies the response of the process by the number or percentage of operations concluded (private and public Reconstruction).	Number and/or %

Tab. 2 Material category, indicators relating to heritage buildings (Private and public) - CRFE

Code	Name	Type	Description	Value
(2.1.FE)	Allocation of funds per inhabitant	PRESSURE	The indicator describes the advancement of day-to-day expenditure (funding)	€/inhabitant
(2.2 FE.)	Per capita financing	STATE	The indicator describes the State of the Art through the relationship euro/inhabitant (Euro financing)	€/inhabitant
(2.3 FE.)	Per capita supply	RESPONSES	The indicator identifies the response of the process by the value of the money spent.	€/inhabitant

Tab. 3 Material category, indicators relating to shopping feed – CRFE

Code	Name	Type	Description	Value
(3.1.FE)	Population return	RESPONSES	The indicator identifies the response of the process by the number or percentage of the population that has returned to home.	Number and/or %
(3.2.FE.)	Annual change of construction activities	STATE	The indicator describes the State of the Art by locating the building contractors.	%
(3.3.FE.)	Migration rate	STATE	This indicator describes the level of migratory changes per year. It is obtained from the ratio of annual migrations recorded and the resident population.	%

Tab. 4 Material category, indicators relating to socio-economic system - CRFE

Code	Name	Type	Description	Value
(1.1. PE)	Demographic Balance	RESPONSES	The indicator serves to represent the natural balance and net migration rate.	Number and/or %
(1.2. PE)	Active Population	STATE	The part of the population, aged between 15 and 64 years, capable of performing an occupation.	Number and/or %
(1.3. PE)	School-age population	STATE	Population subject to compulsory education.	Number and/or %

Tab. 5 Intangible category, indicators relating to demographic attractiveness – CRPE

Code	Name	Type	Description	Value
(2.1. PE)	Unemployment rate	RESPONSES	Measures the percentage of the workforce who cannot find work	%
(2.2. PE)	Average income per capita	STATE	This is the amount of gross domestic product on average possessed, over a period of time by a single person.	€/year
(2.3. PE)	Annual change of listings	STATE	The indicator describes the State of the art by locating the annual percentage variation of the activities	%

Tab. 6 Intangible category, indicators relating to economic dynamism - CRPE

Code	Name	Type	Description	Value
(3.1. PE)	Rate of theft and robbery	RESPONSES	The indicator locates the number or percentage of burglaries in homes and the robberies.	Number and/or %
(3.2. PE)	Level Associations	PRESSURE	Per capita public expenditure allocated to the indicator describes the management of cultural heritage	%
(3.3. PE)	Psychological rate	STATE	Percentage of the population suffering from psychological disorders after an earthquake.	Number and/or %

Tab. 7 Intangible category, indicators relating to social welfare - CRPE

4.2 THE APPLICATION OF THE MODEL TO THE CASE STUDY: A LESSON TO REMEMBER

By monitoring and analyzing the State of affairs it was possible to observe what worked and what did not work in the process of rebuilding, a process that is still underway in the city studied.

Measuring the level of recreating a generic territory hit by a disaster is a complex. The main difficulty lies in the multidimensional character of the phenomenon, the measurement of which requests, initially, the overcoming of obstacles of a conceptual nature related to the peculiarities of the phenomenon. In this case it is oriented towards the construction of a synthetic measure that, through an appropriate aggregation function, is able to capture the many facets of the phenomenon under study, as described by the Set of Indicators identified. It is believed that the primary indicator system, nonetheless provides comprehensive and complete information can not be read easily because of the multidimensionality of the phenomenon under observation. The Set of Indicators needs to provide a unique quantification (one-dimensional) which collects all the information, so that it is readily visible and interpretable. This quantification is called Synthetic Index (Fig. 8 and 9). This is why the observation of the phenomenon is simplified. It was decided to associate to the Synthetic Index a tool that would allow a visual comprehension of the progress of reconstruction. This tool is the Radar Chart, which can display multiple series of data simultaneously, allowing an immediate comparison among them (Fig. 10). Therefore, the method illustrated is able to provide a measure of resilience directly related to the values expressed by each individual indicator and even more clearly by the Synthetic Index.

The data obtained in 2015 from monitoring carried out shows a slow but still favorable enabling of the Physical Reconstruction (index CRFE 60% for the city of L'Aquila, including reconstruction data both private and public), proving that the improvements and simplifications introduced with the new Governance were necessary. We see that the Reconstruction of the Building Heritage, both private and public, is now proceeding at a sufficient rate and that for almost all the buildings for which an application for contribution has been made, the practicability permits have been reconfirmed or the site is in operation. This trend is confirmed by observing the progress of the expenditure. It should be noted, however, that private reconstruction has a faster trend than public reconstruction. The thematism of the socio-economic system, always linked to the Category of Physical Reconstruction, is what indicates an unsatisfactory trend. First of all, we observe that it is not possible to have the data concerning the "Returned Population". This is because the Municipality does not carry out monitoring in this sense. This lack is to be considered serious in a catastrophe like this that hit a city populated by 73,203 people in 2009 (source CRESA), all of whom were considered as evacuees in the emergency phase. We can say that strategic co-planning of the territory affected by the earthquake is still lacking. In terms of institutional issues there has been a lack of coordination between the various levels of public administration. The proliferation of actors involved in the "earthquake issue" was the cause of incomplete and partial decisions,

making the process of reconstructing fragmented and not organic. The political fragmentation gave rise to the inability to locate and manage coherently the challenges posed by the earthquake. This fragmentation of the standard made the rehabilitation processes complex and difficult to understand. This has therefore not led to a shared strategy for long-term recovery. All this resulted in the substantial failure of the local administration, especially with respect to its chief town, in assuming the decision-making and coordination role that is proper to it. These considerations are confirmed in the values of Intangible Reconstruction (index CRPE 42,2% for the city of L'Aquila).

OBJECTIVES	IMPORTANCE	HERITAGE BUILDING			SHOPPING FEED			SOCIO – ECONOMIC SYSTEM		
		Practices presented	Construction Site	Completed Interventions	Allocations of funds per capita	Per capita funding	Per capita supply	Population return	Annual change of construction activities	Migration rate
Responsiveness	5	□	●	□	□	●	□	◇	□	◇
Transparency	5	□	●	□	□	●	□	◇	□	◇
Timeliness	5	□	●	□	□	●	□	◇	□	◇
Certificate (internal consistency)	4	□	●	□	□	●	□	◇	□	◇
Resilience	4	□	●	□	□	●	□	◇	□	◇
Reliability	3	□	●	□	□	●	□	◇	□	◇
ABSOLUTE WEIGHT		78	130	78	78	130	78	26	78	26
RELATIVE WEIGHT % compared to the maximum reachable		60,0%	100,0%	60,0%	60,0%	100,0%	60,0%	20,0%	60,0%	20,0%
RELATIVE WEIGHT % respect to the sum of the maximum absolute values		6,7%	11,1%	6,7%	6,7%	11,1%	6,7%	2,2%	6,7%	2,2%
PHYSICAL RECONSTRUCTIVE CAPACITY EXPRESSED CRFE - SYNTHETIC INDEX								60,0%		

Fig. 8 Synthetic Index relating to Physical Reconstruction

OBJECTIVES	IMPORTANCE	DEMOGRAPHIC ATTRACTIVENESS			ECONOMIC DYNAMISM			SOCIAL WELFARE		
		Demographic Balance	Active Population	School – age population	Unemployment rate	Average income per capita	Annual change of listings	Rate of theft and robbery	Level/Associations	Psychologic rate
Responsiveness	5	◇	□	◇	□	●	◇	◇	□	□
Transparency	5	◇	□	◇	□	●	◇	◇	□	□
Timeliness	5	◇	□	◇	□	●	◇	◇	□	□
Certificate (internal consistency)	4	◇	□	◇	□	●	◇	◇	□	□
Resilience	4	◇	□	◇	□	●	◇	◇	□	□
Reliability	3	◇	□	◇	□	●	◇	◇	□	□
ABSOLUTE WEIGHT		26	78	26	78	130	26	26	78	78
RELATIVE WEIGHT % compared to the maximum reachable		20,0%	60,0%	20,0%	60,0%	100,0%	20,0%	20,0%	60,0%	60,0%
RELATIVE WEIGHT % respect to the sum of the maximum absolute values		2,2%	6,7%	2,2%	6,7%	11,1%	2,2%	2,2%	2,2%	6,7%
EXPERT PERFORMANCE RECONSTRUCTIVE CAPACITY CRPE - SYNTHETIC INDEX								42,2%		

Fig. 9 Synthetic Index relating to Intangible Reconstruction

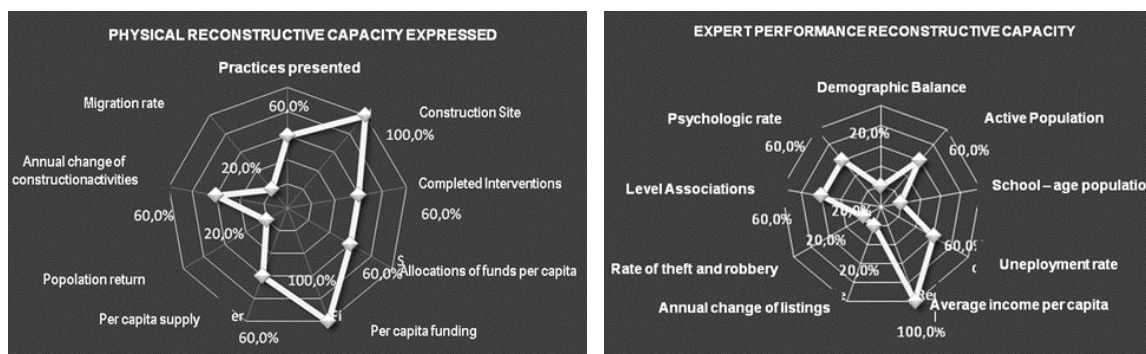


Fig. 10 Radar Chart: (a) Material Category – CRFE (left) ; (b) Intangible Category – CRPE (right)

5. TOPICS OF DISCUSSION

The strengthening of the resilience of the territories frequently affected by natural disasters is essential for a sustainable development strategy; this strengthening would achieve increasingly high performance standards through the rapid urban and landscape transformations associated with these special contexts. The resilience of an area depends to a large extent on the responsiveness of individuals, who must be able to conceive and implement adaptation measures (OECD, 2013). At the same time, the role of public administrations in the socio-economic recovery of a territory affected is crucial due to the choices that are applied and the objectives pursued with development policies. For this reason, following a consistent and organized methodology through forecasting models of the strategic objectives that can lead the territories to recovery is especially important in areas exposed to natural disasters. At the same time, irrespective of the occurrence of the disaster, equipping the administrations with a tool that can manage and overcome any future shocks, means improving the endurance and adaptability of a territory. "International experiences indicate a good metric of expected results from a development strategy (...will serve not only to monitor progress towards these results, but to allow changes, increase accountability and motivate citizens and policies" (OECD, 2013). The natural disaster impacts the disaster area, by destroying the physical capital and the social fabric. Improving the response to risk of the area affected, means to create precisely place-based policies (local development). Place-based policy aimed at implementing development strategies and respondents meet local objectives and needs identified, discussed and implemented in cooperation with the actors of the place. It is a cohesion policy and is associated with the recognition of the added value from the analysis of endogenous potentials and needs. In practice this results in the formulation of local development strategies. For this reason, the choice of indicators cannot be separated from the territory affected, as demonstrated by the case study presented in this work. In the experience of the city of L'Aquila, the diagnostic method of reconstruction process applied, can be seen as a prototype for future cases of reconstruction after disasters. In fact, thanks to the set of indicators, it was possible to understand what the Reconstruction Process involves in both positive and negative terms. What emerged was that the Italian government's policy regarding the immediate response to the disaster was to guarantee an indiscriminate convergence of large amounts of human and financial resources. The Achilles' heel of the post-disaster emergency management in Italy, and therefore also in L'Aquila, is the inability to complete the system by fully articulating the planning resources for emergencies and their management. The national guidelines for these processes are excessively complex, out of date and not in step with the times. One year after the earthquake the historic centers of the affected towns were still off limits. Another two years passed in "Gestione Commissariale" (L.77/2009), which lengthened the times and slowed down the Reconstruction itself, so much so that we talk about the end of the emergency phase only in 2012 (L.134/2012), with the takeover of ordinary management and the establishment of two Reconstruction Offices (USRA and USRC). It is thanks to this bureaucratic reduction that the reconstruction has finally gained

momentum. From a demographic and settlement point of view, however, all this has resulted in a demographic decline due to changes of residence with the consequent decrease in the school-age population. Furthermore, the slow recovery of reconstruction has generated the difficulties for small and medium enterprises and an increase in unemployment. The efficiency of the model lies in the evaluation of all dimensions of the system - physical, economic and social - at the moment of choosing the means of intervention for the recovery of the territory. There are various lessons that we can learn, as results from the application of the case study; the most significant is that of having to predict a system of strategic planning which from the very beginning will guide and shape the process of reconstruction, looking at both the physical reconstruction and the socio-economic development of local realities. For this reason it was decided to integrate the indicators of Socio-Economic System (CRFE) and social welfare (CRPE) used for the monitoring of L'Aquila with those updated by Istat for BES ⁵(Istat,2018), as shown in Tab. 8-11. The indicators of the BES (Fair and Sustainable Wellness) have been developed by ISTAT and CNEL, to assess the progress of a society not only from an economic but also from a social and environmental point of view, taking into account measures of inequality and sustainability also.

Code	Name	Type	Description	Value
(3.1.FE.)	Population return	RESPONSES	The indicator identifies the response of the process by the number or percentage of the population that has returned to home.	Number and/or%
(3.2, FE.)	Mobility of Graduates	PRESSURE	This indicator describes the response of the system according to the attractiveness of graduates.	%
(3.3. FE.)	Migration rate	STATE	This indicator describes the level of migratory changes per year. Is obtained from the ratio of annual migrations recorded and the resident population.	%

Tab. 8 Material category, indicators relating to socio-economic system a) - CRFE

Code	Name	Type	Description	Value
(3.4.FE.)	Investments in intellectual property	PRESSURE	The indicator describes the per capita public expenditure on research and development, software and databases, entertainment, literary or artistic works and other intellectual property products	€/inhabitant
(3.5, FE.)	Annual change of construction activities	STATE	The indicator describes the State of the Art by locating the building contractors.	%
(3.6. FE.)	Spending on cultural heritage management	PRESSURE	Per capita public expenditure allocated to the indicator describes the management of cultural heritage.	€/inhabitant

Tab. 9 Material category, indicators relating to socio-economic system b) - CRFE

⁵ BES (Fair and sustainable welfare) is an index develops, by Istat and CNEL, to evaluate the progress of a society not only from an economic but also social and environmental point of view.

Code	Name	Type	Description	Value
(3.1. PE)	Rate of theft and robbery	RESPONSES	Indicator locates the number or percentage of burglaries in homes and the robberies.	Number and/or %
(3.2. PE)	Physical and sexual violence	STATE	Indicator locates the number or percentage of acts of physical and sexual violence	Number and/or %
(3.3. PE)	Dissatisfaction with the landscape and the city	STATE	Percentage of the population unhappy with the place where they live	Number and/or %

Tab. 10 Intangible category, indicators relating to social welfare a) - CRPE

Code	Name	Type	Description	Value
(3.4. PE)	Air quality	STATE	Indicator locates of air quality.	Number and/or %
(3.5. PE)	Difficult access to certain services	STATE	The indicator describes the State of the Art by identifying the difficulty of access to certain services	%
(3.6. PE)	Time dedicated to mobility	RESPONSES	Percentage of time that the population uses in moving.	%

Tab. 11 Intangible category, indicators relating to social welfare b) - CRPE

Although the proposed method has various strengths, there are also weaknesses. It is, in fact, a non-autonomous process with regard to the schematization of the data. It is possible to link the indicators, and therefore the open data associated, with a GIS environment. In this way, thanks to the use of plugins, not native but designed ad-hoc, it would be possible to view, store and extrapolate the results directly from the software. This would allow to manage the entire process through ICT dynamic control tools.

5.1 FUTURE RESEARCH DEVELOPMENTS

The Reconstruction Process is a theme that embraces various sectors, public and private, material and immaterial, economic and social. It constitutes a different perspective with which to look at the city and its government, referring to the various areas of planning and using what is called an integrated approach. The integrated approach implies the need to simultaneously face all the multiple aspects that concern the Urban Governance of the Reconstruction, in a sort of overall strategy within which to develop policies and management interventions coherently and integrally. For this reason, the fundamental role is played by the strategic planning activities, which must intervene on the multiple aspects of the Reconstruction itself, by working not only on the design choices, but also on the construction of cognitive frameworks and indicators. Consequently we can say that monitoring becomes an integral part of the Reconstruction Process, making it acquire the character of circularity: from the framework of shared knowledge, decisions are determined whose consistency and compatibility is established through evaluation (ex ante evaluation) and through the monitoring of the implementation of decisions. In this way the two phases (evaluation and monitoring) are never really considered completed, being in constant revision. Beginning with the method suggested, this paper proposes the drafting of guidelines that can address the strategic lines of public administration so as to

guide urban transformations according to the optimization models resilience of an area. The general structure of the guidelines will follow the circular pattern proposed in Fig. 11: response and pressure indicators serve both to the definition for the control and, if necessary, for a subsequent redefinition of the strategic guidelines and proposed actions, while those of State are used only to monitor the situation at the time t. It should be noted that one policy does not exclude another, but are complementary and integrated. The reconstruction process can be governed by the Guide-Lines, taking in to the consideration the necessities for a socio-economic development, such as the environmental and the social and economic emancipation. Actions and interventions studied with the above Strategic Lines in mind, could be revealed as tools for overcoming administrative obstacles and to allow missing connections to converge. In this way will become more transparent and participatory. The Public Administrations will thus be able to obtain a wider range of objective elements and input before taking their respective decisions.

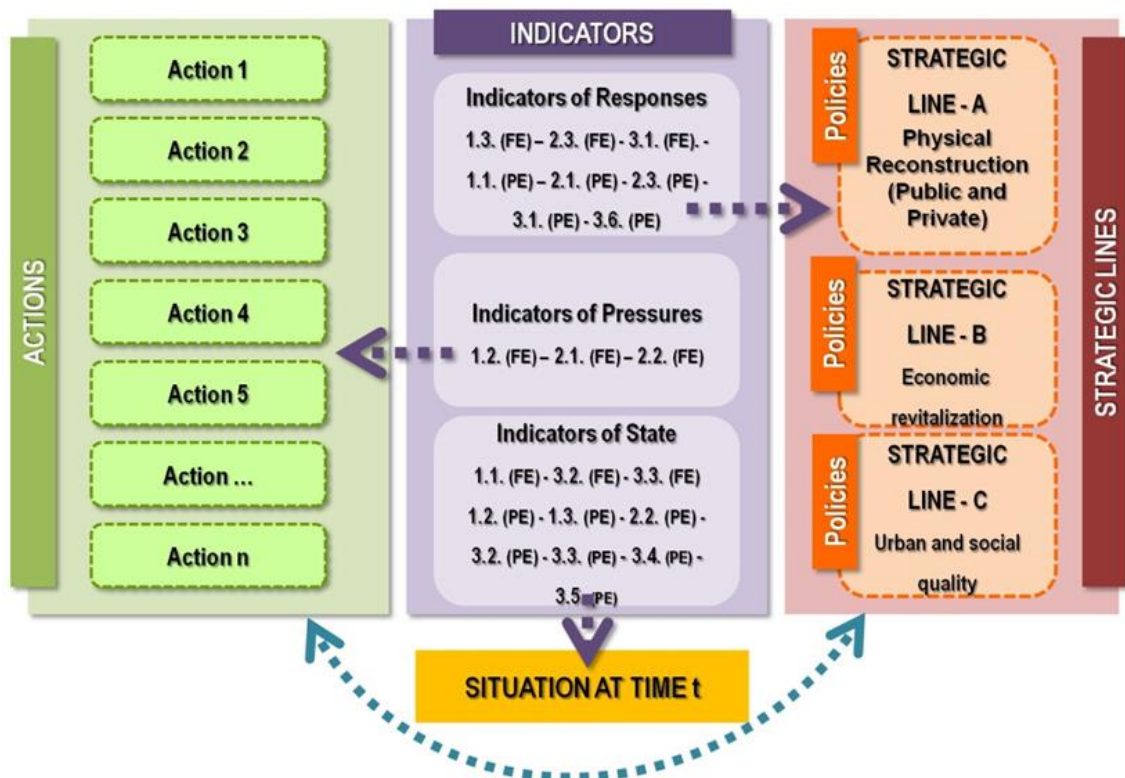


Fig. 11 Schematization of the guidelines structure proposed

6. CONCLUSION

The work aims at proposing a replicable method to define a set of indicators able to guide and monitor the transformation process of a territory affected by a natural disaster. The issues dealt with regard the extent to which an affected territory manages to use the traumatic event as a starting point for recovering from the critical issues by relying on the existing local potential. The L'Aquila earthquake was a medium-power seismic event which, however, caused a great deal of damage. The management of the Reconstruction process has been tackled by Italian government policy in a way that is not always optimal. The earthquake has accelerated the economic stagnation phases producing greater uncertainty about the future. It is on events of this magnitude that the research must concentrate, because they are more and more frequent and without certain and defined guidelines regarding their management in the post-emergence phase. The resilience of a territory, following a disaster, lies in the ability to withstand and respond to shock, through processes that are able to use the urban and territorial framework, the system of share knowledge and adaptive governance processes. These must ensure retrieval of performance level needed to begin now development processes. The essential

sustaining element for the Reconstruction Process is the Set of Indicators. This is necessary, as has been seen, for guiding a serious Public Policy and for quantifying the level of response of areas exposed to natural disasters, whose unexpected occurrence may require a new set of development management models. The possibility of using resilience through indicators that provide reliable results would equip public administrations with tools able to guide the strategic choices for local development, reaching the desired level of territory and urban resilience with the aim of guaranteeing their long-term wellbeing. It can therefore be affirmed that the strategic lines, the policies and the actions that are proposed are able to express as a whole a strategic order and a will to transform reality in a participated and shared way.

Author Contributions: F.P. designed the research, wrote Sections 3 and 4, performed the analyses, produced tables, schemes and results, wrote Section 5 and 6 with M.D.V.; M.D.V. designed the paper and wrote section 1 and 2; P.P. supervised the research and the paper.

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AUTHOR'S PROFILE

Federica Pignatelli is an engineering, she graduated with a special mention "Thesis worthy of publication" from the University of L'Aquila, where she also obtained a PhD in April 2016. Her thesis discussed the "Performance diagnostics of the process of reconstruction". In the months of May and June 2009 she carried out voluntary work at the Civil Protection following the 2009 earthquake. She was a member of the LAURAQ as operative secretary - L'Aquila Urban Planning Laboratory. From 2011 to 2016 she carried out activities of teaching support in the Course of Urban Planning Technique I and in the Course of Urban Planning at the University of L'Aquila. She became treasurer of the Abruzzo-Molise division of the National Institute of Urban Planning (INU) in 2013. She became Territorial Representative within the division council in 2016. She is the author of several publications and participations as a speaker in seminars. Currently she is a freelancer working in urban and architectural reconstruction. As from the 2009 earthquake she has carried out assignments and collaborations with several institutions both in the field of building design and in urban planning.

Mariangela De Vita is an engineering, she graduated with full marks and honours from the University of L'Aquila where she also obtained a PhD in July 2017 with a thesis on the performance evaluation of technical textiles applied to architecture. From 2016 she has collaborated with the Construction Technologies Institute (ITC), a scientific facility of the National Research Council of Italy (CNR), and since May 2018 has held a post doc research fellow at the same institute. She is the winner of numerous research grants, including funding received from the Abruzzo Region for AI.fo. and ERBOR_AQ projects. She has taken part in numerous design workshops on the theme of lightweight, parametric and sustainable architecture. From 2014 to 2015 she collaborated with the Dunamis design studio. Her research activity is oriented towards analysis and design retrofit interventions on Cultural Heritage with the aim of evaluating and optimizing compatible and more efficient solutions both in terms of energy performance and environmental comfort. The aspects related to the preservation and enhancement of the natural resilience of landscapes, places and buildings of the protected heritage plays a fundamental role in her studies.

Pierluigi Properzi is an Architect, he was full professor of Urban Planning Technique at the University of L'Aquila and general secretary of the INU - National Urban Planning Institute. He has coordinated research groups on the evolution of the national planning system (Quater) and of the regional legislative frameworks; he edited the first Report on the state of Planning on behalf of the Ministry of Public Works and participated in the ANPA research on guidelines for national ecological networks. He has been a member of the Governing Council of the Italian Association of Regional Sciences AISRE (1997-2000) and a member of the Scientific Committee of the Regional Center of Economic Studies and Social Research CRESA since 1999. He directs the AnTeA Laboratory (Territorial and Environmental Analysis) of the Architecture and Urban Planning Department and is the Scientific Director of the INU / ANCSA Laboratory for the Reconstruction of the city of L'Aquila. He has worked as a consultant for the National Public Authority (Min. LLPP - ANAS) and Regional Public Authority (Abruzzo Region - Basilicata - Molise - Friuli VG - Umbria - Autonomous Province of Trento) and has coordinated Working Groups for the formation of Framework Plans and Regional Laws. He has also drafted numerous regulatory plans for medium-sized cities and various urban strategic plans and interregional strategic platforms. He is author of over 150 publications and intervenes in the disciplinary debate on the main journals. He is also a member of the Scientific Committee (Urban Planning – Urban Information) of some of these journals. He edited the first Report on the state of planning on behalf of the Ministry of Public Works / 2001.