Academic perspectives on the specific challenges of urban resilience management

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Abstract

*Based on **preliminary studies** on critical infrastructure security management developed by authors, interested in the field, individually or in a team, the article brings to attention, as possible **results**, several lines of development of research, on a topical issue. The perspective is an academic one but it takes into account the **approaches** of practitioners in practical fields, trends and opportunities to achieve useful results to society as a whole but also to public and private institutions, especially considered in a dual capacity, by subject of the managerial approach but also as an object to be operationalized from the point of view of managerial action. The general **objective** proposed is to demonstrate the usefulness and how the academic environment can be involved for solving some problems of interest. The **implications** and implicitly the **value** of the paper have as a desideratum the minimization of the distance between different categories of stakeholders and especially, between the theory and the practice. The research method used is descriptive, with emphasis on the systematic observation of the object of study (resilience in the urban environment) and the cataloging of the specific data identified. The topicality of article is also given by the national and European context in which resilience plans are proposed, corroborated with the pandemic*

situation generated by Covid, especially at urban level. It is also emphasized that the functionality of some critical urban infrastructure systems (medical, transport, energy, etc.) fundamentally influences the level of resilience, their preparation in time of "peace" (lack of threat or a low level of it) based on robust project influencing decisively macro-behavior in crisis situations.

Keywords**:** *resilience, management, urban*.

1. Brief presentation of the current state of scientific research

From the analysis of existing knowledge resources (many articles especially the ones accessible online), although the last five years have seen an intensification of efforts and concerns to address specific topics or complementary to the proposed topic, there is a fragmented operationalization (example – resilience of water supply systems; resilience of medical services, etc.) or poorly integrative, which objectifies the need for integrative conceptualizations, with paradigmatic theoretical valences and practical-applicative potential. In other cases, given the topicality of the subject, it is tried through project management and related funding to solve specific issues, national or regional, related to the practical part of resilience management or an educational component, assumed by various public or private institutions. Even at the conceptual level, resilience involves many ways of defining (example (Ardebili, Padoano, 2020 [1])), more or less correlated with the standards officially recognized by socio-professional communities (ISO 22316 / organizational resilience, ISO 22301 / business continuity management, ISO 31000 / risk management).

Subsequently, a complex issue of interest, which requires a high degree of scalability and interoperability at the level of design requirement in the future, is that of achieving resilience measurement indexes, useful for benchmarking analyzes or decisions for civil emergency management, necessary in different sectors of activity, some examples of achievements so far being:

- The Resilience Index Measurement and Analysis (RIMA), developed in Jordan [5];
- City Resilience Index [6];
- disaster resilience index, developed in Australia [7];
- Coastal Resilience Index/Climate Toolkit, developed in the USA [8];
- Critical infrastructure resilience index, developed at EU level [9].

Also, in the spirit of creating a minimum public culture of resilience management (figure 1), subsequent to a recognized need to increase the proactive capacity of society in general to deal with events triggering malfunctions in the essential assets of an administrative unit, there are concerns setting up laboratories to simulate resilience levels and disseminate results through training offers, as part of recent initiatives, with relevant good practice existing even within the European space (Critical Infrastructures Preparedness and Resilience Research Network).

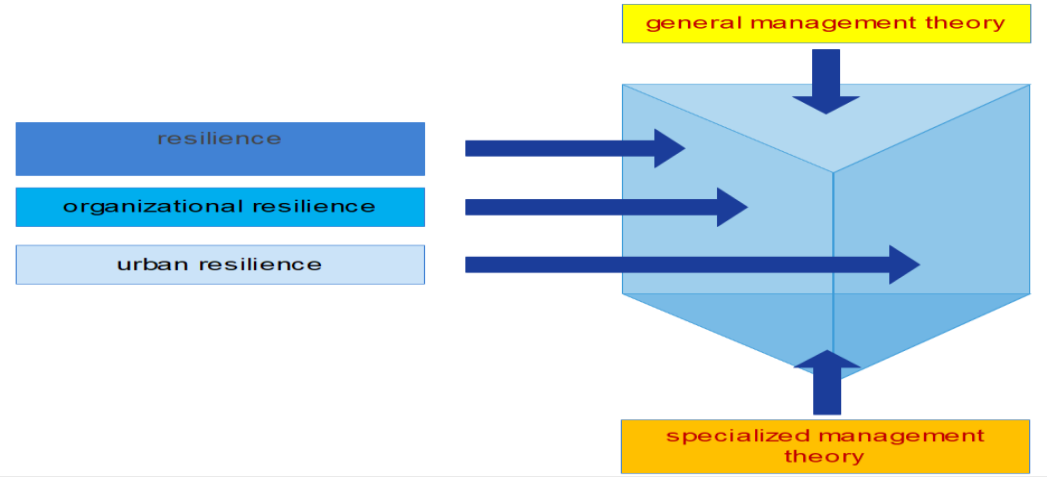

Fig. 1. Relation between resilience and management theory
Source: own elaboration

Under the impact of sustainable development goal (Agenda 2030) and implementation of the (in fact irreversible) Smart City initiative through the six verticals (citizen, mobility, life, environment, economy, government), as recognized by the European Commission, an additional pressure on the operationalization of resilience in urban areas occurs, which led, in conjunction with the dynamics of development in the field of disruptive and emerging technologies, academically nationally and internationally, to an intensification of assessments such as *what happens if*.

The interdependence of the theme is also used in some works considered of reference, published mainly in the last five years, some examples in this regard being highlighted in table 1.

Table 1. Examples of approaches in specialized papers of the proposed topic

Crt. no.	The title and author of the paper
1	Komninos, N. (2015). *The Age of Intelligent Cities. Smart Environments and Innovation-for-all Strategies.* Routledge
2	Heinrichs, H., Michelsen, P.M.G., Wiek, A. (eds.). (2016). *Sustainability Science An Introduction*. Dordrecht: Springer
3	Kolodko, G.W. (2015). *Încotro se îndreaptă lumea: economia politică a viitorului*. Iaşi: Polirom
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5	Lugo Santiago, J.A. (2021). *Leadership and Strategic Foresight in Smart Cities.* Springer Nature Switzerland AG
6	Setola, R., Rosato, V., Kyriakides, E., Rome, E. (eds.). (2016). *Managing the Complexity of Critical Infrastructures. A Modelling and Simulation Approach*, Cham: Springer
7	Vrabie, C., Dumitraşcu, E. (2018). *Smart Cities - de la idee la implementare sau despre cum tehnologia poate da strălucire mediului urban*, Bucureşti: Universul Academic

Source: Made by author

2. Critical analysis of the current state and identification of research niches

Beyond definitions and terminology, resilience is a dynamic concept that drives and impacts most areas of society, in an environment characterized increasingly by volatility, uncertainty, complexity and ambiguity (VUCA). Starting from the individual level, to the organizational level, the critical infrastructures (energy, water, transport, health, financial-banking, communications, etc.) are ubiquitous assets in the urban environment, through the characteristic of the need to ensure the normal development of day-to-day activities. Most of the approaches focus more on quantitative aspects specific to the functionality of these resources in the urban environment, a more intense connection to other topical concerns of the public agenda (sustainability, public innovation, security culture, etc.) being necessary.

An identified research niche is based on the following (presumptive) framework: efficient management of resilience in the urban environment leads to the creation of favorable conditions for a high organizational capacity, which determines favorable conditions for strengthening the public security culture, the latter component being in turn, in a circular approach, an input element for resilience management. We opted for this succession and not in the opposite direction having as argumentative framework the Maslow's needs pyramid, in the sense of placing at the higher level the *soft* elements (security culture) compared to the *hard* elements (organizational ability to accomplish the assumed mission, regardless of the organization's type).

Considering imperative and inclusive from the point of view of the issue of a resources-actors-rules workbook, in order to be able to solve the scientific desideratum proposed by the title, we considered it would be necessary to bring clarifications on the following general questions which alternatively aim at a response of efficient management of situations of dysfunction specific to these special types of assets (CI) present in the urban environment:

1. What are the evolving trends of critical infrastructure systems in the urban environment and what implications are there, subsequently, in the field of risks (in general) and resilience (in particular)?

2. What is the appropriate integrative managerial framework model to be applied in the urban environment for resilience governance in a wide range of situations affecting functionality?

3. How can the current education system be improved, as the main vector of knowledge and augmentation of the security culture, so as to ensure the reduction of vulnerabilities and the continuity of processes?

An "exclusive niche" in terms of topicality and relevance for resilience management in the urban environment, to be considered in the near future, is related to the implications (political, economic, social and technological) of establishing the NATO Command at corps level, in terms of the challenges and opportunities that result in the field of urban resilience. The subject is one of both military and civil interest (university-academic environment, local public administration, business environment), a side that can be investigated in research specific to resilience in urban space and in terms of particularities (content components, ways of achievement, intensity) on strengthening the public security

culture. Aspects subsumed to this idea are part of what is recognized as military-civilian relations (CIMIC) and were preliminarily discussed in the workshop on NATO URBAN. SIBIU - The first NATO city since November 14, 2019, with the participation of representatives from the "Lucian Blaga" University of Sibiu and other local public or private organizations involved in the implementation of this project proposal.

A central objective to be operationalized considering the current state of research and approaches at a practical level is to determine the way in which an efficient management of resilience in the urban environment contributes to the consolidation of the security culture in public and private institutions in Romania. A non-exhaustive list of specific objectives should of course consider:

1. Establishing a multicriteria framework for analyzing the concept of resilience and reviewing the existing literature in the field;
2. Investigating the interdependencies between risk, resilience and continuity;
3. Identifying the defining characteristics of the current urban environment;
4. Determining the influencing factors of the resilience of urban critical infrastructures with the particularization of the conditions imposed by the implementation of the SMART concept;
5. Analysis of the way in which resilience management is currently performed in the urban environment and identification of good practices;
6. Development of a conceptual model for analysis (actors, rules, resources) of resilience in the urban environment;
7. Identifying the peculiarities of resilience management in Sibiu;
8. Investigating the opinions regarding the perception of some specific aspects of urban resilience at the level of Sibiu city;
9. Identifying factors specific to the urban resilience of influence of the public security culture;
10. Substantiation and design of *a table top exercise* application, using the expertise of US specific good practices, for creating convergence with and for public-private partnerships, for the management of resilience in the urban environment, in a cluster approach;
11. Designing a database to collect and process data specific to urban resilience, good practices and lessons learned in the field;
12. Studying the relationship between organizational culture and security culture and proposing a set of competencies specific to the security culture necessary for the manager;
13. Appreciating the extent to which studies in the field of resilience management determine a trend in management science and have an influence on the reconfiguration of an integrative management model.

3. Highlights of a feasible methodological framework for such a topic

Generically, the macro framework of research specific to such a topic is preferable to follow a staged, systematic approach, from theory to practice, but given the specificity in the actual, applied field of the proposed topic, there will

certainly be questions to verify or validate ideas from practice to theory, in case of observations or results obtained.

Specifically, the research methods considered necessary in substantiating the approach may be:

- documentary analysis to identify the main directions and study trends of resilience management or even schools of thought insofar as they have emerged;
- modeling and simulation, for the conceptualization of representations of phenomena, processes and systems specific to resilience management, for the materialization of models to simulate human behavior and decision-making mechanisms in risk scenarios;
- the method of the interview and the questionnaire for carrying out the comparative analysis in public-private and civilian-military profile regarding the perception (role, importance, ways of accomplishment, contribution to the formation of the security culture, etc.) of urban resilience;
- Analysis of Competing Hypotheses (ACH), within a scenario for the management of urban resilience in Sibiu, in which, by confronting some hypotheses with the evidence found and trying to refute them, the validity of several competing hypotheses is assessed, which represent alternative explanations for the same phenomenon / situation.
- The use of software products needed especially for the practical part of research certainly facilitates and gives robustness to studies, some landmarks in this regard being the following:
- IBM SPSS Statistics, for processing data specific to the research based on the questionnaire, identifying correlations between variables (example - age, studies, environment of the respondent versus statements), validation of working hypotheses;
- EdrawMax for the generation of schemes and the implementation of specific IDEF modeling methodologies, based on graphical representations of the analyzed systems and subsystems;
- ArcGis, for modeling and simulating some essential aspects (risk areas, magnitude of risk, affected population, etc.) specific to the manifestation of events with an impact on the resilience of some in the Sibiu area;
- VBS 3.0Virtual Battle Space, for modeling and simulation in the virtual environment, of disruptive events, to identify, using the artificial intelligence module of the product, trend elements specific to human behavior, for predefined cases.

4. Conclusions

When we characterize a city in terms of the resources involved for the proper functioning of the daily life of the community, the most sensitive aspects are related to controlled resources at private or public level, essential for the operation of the economy and government at a minimum, critical infrastructures, presented by the

European Commission as an element, a system or a component thereof, located in the territory of the Member States, which is essential for the maintenance of vital societal functions, health, safety, security, social or economic well-being of persons, and whose disruption or destruction would have a significant impact in a Member State as a result of the inability to maintain those functions. Many works so far have focused on explaining the interdependencies, the cascading effects specific to the operation of essential infrastructures. Katina [3] was concerned with describing the defensive properties of a system that increase the resilience of that infrastructure - measures of protection, detection, adaptability, deterrence, robustness, slowing down the crisis, redundancy, warning and reliability - and proposes measures to increase resilience that go beyond conventional reactive and preparatory policies and also focus on measures to deter aggression and defuse threats before they occur. An idea with effects in terms of adapting managerial models to these realities is reiterated by Johnson [2] who draws attention to the usefulness of common mental models that promote communication and collaboration between different systems and different organizations. They are crucial in managing incidents of deviation from normal functioning and return to normalcy, as well as in preventing accidents and assimilating the lessons they offer.

Beyond the general scientific benefit of such research (increasing the scientific heritage of specialized knowledge on a current topic) a practical utility for several categories of beneficiaries is aimed at and appreciated: local public administration institutions (providing relevant recommendations for facilitating a diagnostic analysis of the current state of approach to urban resilience which will support the operational efficiency of decisions in the field), the academic environment (noticing the opportunity to renew the educational offer by including resilience management programs), the private environment (awareness of the need to adopt standards and adapt activities in this regard). The connection between the three types of institutions can be made, an ideal situation, within a regional center dedicated to the management of urban resilience. Last but not least, the results of the study can contribute to the substantiation of development strategies that currently consider only to a small extent the operationalization of the main concepts, with all their connections and implications, presented and developed in the proposed research.

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