

A multi-level method to measure museum resilience in the inland areas of the Marche Region's "seismic crater" (Italy)

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1. Introduction

Over the last twenty years there has been a rise and spread of the "resilience talk" in social sciences. Scholars have labelled "resilience" as a buzzword (Martin, Sunley, 2015), wondering if it could be considered a boundary object (Brand, Jax, 2007), a bridging concept or just a dead end (Davoudi, 2012).

Trying to cope with a still blurred and tangled theoretical framework, the present paper first discusses the main definitions of resilience provided by social sciences. Then, the key features and concepts of the evolutionary approach are identified, such as adaptability and transformability, reconfiguration and reorganisation. Adopting this perspective, the research also explores the way towards a normative resilience, in order to understand how to implement, manage and improve organisational resilience, with a focus on the cultural resources after natural shocks.

The second part of the paper presents a case study focusing on the so-called Marche Region's "seismic crater", a wide hilly and mountain area affected by the devastating earthquakes that stroke Central Italy between August 2016 and January 2017. Previous research has highlighted a huge concentration of cultural and natural resources in this area, particularly of small local museums beside the so-called "diffuse museum", meant as cultural heritage spread in villages, abbeys and parish churches (NSSAM, 2017). The wealth of bottom-up experiences launched after the earthquake and their high degree of inclusiveness have also emerged as signs of the social capital and self-organising capacity of the territory and of its resilience (Pezzi, Punziano, 2017; Cerquetti, Cutrini, 2018). As argued by the National Strategy for Inner Areas, these resources are an essential requisite for promoting sustainable tourism development in inland areas and could have a key role in counteracting the demographic decline and relaunching local economy (UVAL, 2014). However, in order to be effective, they need to be supported by public policy and actions (Bellandi, Santini, 2017; Bellini *et al.*, 2017). Moreover, any intervention should be preceded by an accurate analysis of initiatives carried out in the past, their impact, strengths and weaknesses, trying to avoid to repeat the same errors.

Sharing these assumptions, we investigated the resilience of the museum system of the "seismic crater" through the analysis of the evaluation forms of the local museums of the 87 municipalities of the area. The research starts from the hypothesis that the availability of adequate physical structures and qualified personnel are crucial factors for the resilience of the museum system, and, consequently, for a tourism-based recovery.

Drawing on information included in the evaluation forms of 122 local museums, the resistance and recoverability of the system were assessed, by examining museum equipment and performances. The analysis focused on the following dimensions: (1) security, storage, and management of collections; (2) staff and its qualification; (3) participation in networks and relationship with the territory.

For each dimension, a specific set of quantitative indicators was first introduced. Then, on the basis of a cluster analysis, four categories of museums were identified according to their degree/level of resilience, together with suitable interventions to manage and improve their capacity to face future shocks. Further attention should be given to museum networks as tools that could help museums in achieving more effective results not attainable by each single organisation (Pencarelli, Splendiani, 2011; Cerquetti, 2019).

2. Theoretical framework

Even though there is no universally agreed definition of regional economic resilience, three main types or definitions can be identified in scientific literature: (1) resilience as “bounce back” from shocks, referred to the speed and extent of recovery; (2) resilience as a system’s “ability to absorb” shocks or the size of shock that can be tolerated before moving to a new state/form; (3) resilience as “positive adaptability” in anticipation of, or response to, shocks, that is the capacity of a system to “bounce forward” or maintain core performances despite shocks by adapting its structure, functions and organisation (Martin, Sunley, 2015). Joining these different definitions, Martin and Sunley (2015) defined regional economic resilience as “the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterised by a fuller and more productive use of its physical, human and environmental resources” (pp. 14-15). This definition classifies resilience as a dynamic and continuous process, combining resistance and recoverability (Martin *et al.*, 2016). In the evolutionary approach, there is a clear tendency to refute the engineering, equilibrium concept of resilience, defined as the ability of a region to move back to a steady state. Instead, the attention is devoted to the long-term ability of regions to reconfigure their socio-economic and institutional structures in order to define and sustain new growth paths. Resilient regions are capable of overcoming the trade-off between adaptation and adaptability through a loosely coherent institutional structure (Boschma, 2015). Reconfiguration and reorganisation are central in the definition of resilience as a relational concept where context matters (Pratt, 2017).

Sharing this evolutionary perspective, resilience could be linked to adaptability and transformability (Folke *et al.*, 2010; Oliva, Lazzeretti, 2017). In addition, a normative resilience could be studied as the whole of strategies, actions and procedures able to sustain regional economic resilience. From this point of view, resilience can be implemented, managed and improved. Notably, it is important to deeply understand the historical dynamics that shape the current system and its structure so as to properly support public planning. On the one hand, public authorities have to support not just non-resilient communities, but also resilient ones, by managing problems and providing resources and adequate solutions (Shaw, 2012); on the other hand, given that social-ecological systems are dynamic, “having a broad overview of system change through time can reveal system drivers, the effects of interventions, past disturbances and responses” (Resilience Alliance, 2007, p. 22).

When focusing on cultural resources (Cooke, Lazzeretti, 2018), their capability to contribute to local development and recovery depends on the resilience of their systemic organisation. In that regard, recent studies have highlighted some specific weaknesses of the cultural sector that may hinder resilience. Resilience is often “outsourced to flexible or freelance workers who bear the costs

and risk of uncertainty” (Pratt, 2017, p. 136). Particularly, smaller institutions are disproportionately affected by the public sector funding cuts and the practice of lowering labour costs by the employment of volunteers and interns (Pratt, 2017). This kind of problem strongly affects the heritage sector.

If cultural heritage is considered a resource, the capability of the cultural heritage system to contribute to local resilience depends on the resilience of the cultural heritage system. Following the approach here adopted, the resilience of the museum system relies on its resistance, recoverability, and the capacity to reorganise itself.

3. Data and methodology

3.1 Data

Information was drawn from the Museum Information System, a permanent and dynamic tool set up by the Marche Region in 2011 according to the Regional Law 4/2010 (article 20). By means of a special self-assessment form, the database monitors museums’ conditions and performances gathering information about the eight areas identified by the Ministerial Decree of 10 May 2001: (1) legal status; (2) financial status; (3) structures; (4) staff; (5) safety and security; (6) management and care of collections; (7) relationships with the public and visitor services; (8) relationships with the territory. The architecture of the information system and the structure of the self-assessment form have been defined through the study of other experiences carried out by the Marche Region and already set up by other Regions (Lombardy, Emilia Romagna, Tuscany, etc.), referring to the application form designed by Umbria Region and adopting a specific software to manage the system. The first on-line self-assessment campaign was carried out in 2007, in cooperation with the University of Macerata, and updated every two years – in 2009, 2011, 2013, 2015, 2017 and 2018. In 2017, the form was updated to register information about damages caused by the earthquake¹.

On the whole, in 2017, 245 museums in the Marche Region participated in the self-assessment evaluation process: 38 museums filled the new form, 186 the old one and 21 both of them². Our analysis spanned all the 122 museums located in the Marche Region’s “seismic crater”, even though some of them did not update the form in 2017 (tab. 1, fig. 1).

Table 1. Museums of the Marche Region’s “seismic crater” participating in the self-assessment evaluation process (last update) (our elaboration)

Last update	Number	Percentage
2007	13	10,7%
2008	1	0,8%
2009	5	4,1%
2011	2	1,6%
2013	11	9%
2015	25	20,5%
2016	1	0,8%
2017	64	52,5%
Total	122	100%

¹ <http://www.regione.marche.it/Regione-Utile/Cultura/Musei#Autovalutazione>, last access 09.10.2019.

² http://www.regione.marche.it/Portals/0/Users/043/43/43/Report_Autovalutazione_2017.pdf?ver=2018-09-04-151417-153, last access 09.10.2019.

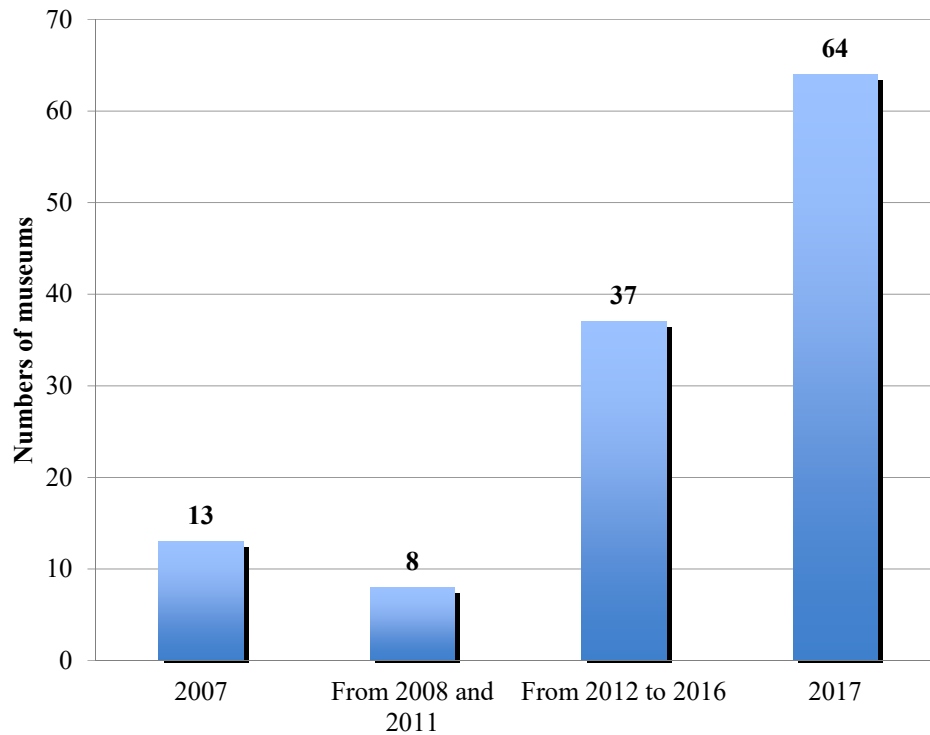


Figure 1. Update of the evaluation form (our elaboration)

The research focused on the following dimensions:

- 1) security, storage, and management of collections (e.g., inventory, security system, risk assessment, etc.);
- 2) staff and its qualification (i.e., employees and volunteers, education, position);
- 3) participation in networks and relationship with the territory (local context and its organisations).

For each dimension, a specific set of quantitative indicators was selected (fig. 2).

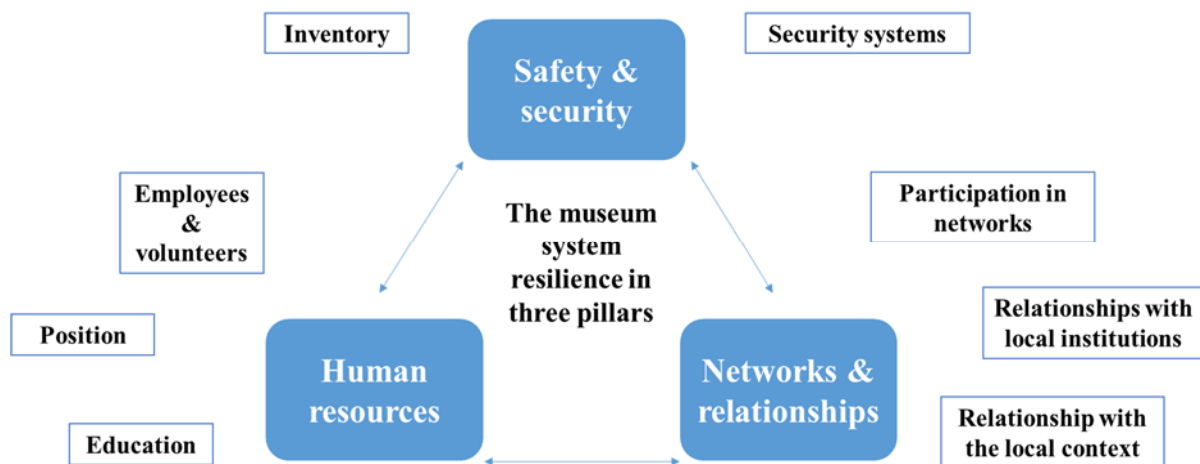


Figure 2. Research dimensions and indicators (our elaboration)

3.2 Encoding of questionnaire and cluster analysis

Cluster analysis or clustering attempts to determine the natural grouping (or clusters) of individual observations (objects). The classification of objects into different groups, or more

precisely, the partitioning of a data set into subsets (clusters), so that the data in each subset are similar according to some defined distance measure. Central to all of the goals of cluster analysis is the notion of degree of similarity (or dissimilarity) between the individual patterns being clustered.

In the present study the objective is to classify museums into four groups, based on relevant attributes, so that they can receive the mix of suitable interventions that will best help them improve their capacity to face future shocks.

We performed data transformation and variables' selection before clustering.

Table 2 reports the list of variables considered in our cluster analysis and the encoding utilised.

The individual observations are given in the form of variables (V1...V23) containing elements that describe in numeric form objects or events. The feature vector (V) for each museum is constructed by encoding numerically the answers to the questionnaire. Beside we explain our encoding technique used to transform the answers into numeric variables. Table 1 illustrates the techniques used to this purpose.

Table 2. List of variables and encoding of questionnaire for the cluster analysis

Variables	Questions (Yes, No)
Year (V1)	Year of compilation of the form
Insurance (V2)	Are the museum collections insured? (1; 0)
Deposits (V3)	Does the museum have deposits (1; 0)
Materials (V4)	1) Ability to preserve materials from possible damage (1; 0) 2) Functional lighting for storage and reading (1; 0) 3) Exhibition halls equipped with instruments for T, U Lux (1; 0) 4) Heating systems (1; 0) 5) Moisture installations / dehumidification (1; 0) 6) Air conditioning systems (1; 0)
Security (V5)	1) Is the museum adequate to the requirements of Legislative Decree 81/08 and subsequent amendments and additions? (1; 0) 2) Has the person responsible for the museum's prevention and protection service been appointed? (1; 0) 3) Is the museum equipped with all the certifications (homologation, testing, etc.) related to the installations (D.M. 37/08)? (1,0) 4) Does the museum have certifications relating to fire regulations? (1; 0)
Risk assessment (V6)	1) Environmental risk assessment (1; 0) 2) Structural risk assessment (1; 0) 3) Assessment of safety in use (large inflows or catastrophic events) (1; 0)
Inventory register (V7)	Is the museum equipped with an inventory register? (1; 0)
Inventory of materials (V8)	Inventory of materials (1, 2, 3) (1: <80%; 2: >= 80%; 3 = Totally)
Computerised archive (V9)	Is the museum endowed with a computerised archive? (1; 0)
Conservation form (V10)	1) Compilation of the material conservation sheet (1; 0) 2) Periodic updating of conservative form (1; 0) 3) Planning of conservation and/or restoration interventions (1; 0) 4) Control procedures (1; 0)
Qualified personnel for conservation (V11)	Is the museum equipped with suitably qualified personnel for conservation operations? (1; 0)
Risk card (V12)	Does the museum draw up the "risk card" for materials and works that cannot be moved? (1; 0)
Networks (V13)	Is the museum part of museum poles, networks or systems? (1; 0)
Contextualisation (V14)	Do the museum's communication tools contextualise collections with the territory? (1; 0)
Territory (V15)	1) Tourist-cultural routes in the reference territory (1; 0) 2) Decentralised information systems in the territory (cartels, signs, etc.) (1; 0) 3) Relations with schools in the area (1; 0) 4) Relations with other cultural institutions in the area (1; 0) 5) The museum carries out cultural activities on the territory (1; 0) 6) Dissemination activities for the promotion of the territory (1; 0)
Communication (V16)	1) Is the museum included in tourist information circuits? (1; 0)

	2) Is it possible to find inside the museum information materials related to the other cultural offers of the territory? (1; 0) 3) Does the museum have brochures, information leaflets? (1; 0)
Shared personnel (V17)	Does the museum make use of shared personnel? (1; 0)
Staff (V18)	Is the staff adequate to: 1) perform the functions in relation to the size of the museum? (1; 0) 2) fulfil the duties in relation to the characteristics of the assets? (1; 0) 3) perform the functions in relation to the functions that the museum carries out? (1; 0)
Opening (V19)	Total number of opening days: (1, ..., 6) 1: <50; 2: 51-119; 3: 120-150; 4: 151-200; 5: 201-250; 6: >250
Service chart (V20)	Is the museum equipped with a service charter? (1;0)
Services (V21)	The museum is equipped with the following services: 1) Ticket office (1; 0) 2) Sales of information material (1; 0) 3) Educational services (1; 0) 4) Guided tours (1; 0)
Online services (V22)	Does the museum have online services? (1;0)
Museum visitors (V23)	Average number of visitors in the current year (at the time of the last survey) and in the two previous years. The value is standardised and reported on a 0-1 scale.

The simple questions with a “Yes/No” answers associated to dichotomic variables, namely V2, V3, V7, V9, V11, V12, V13, V14, V17, V20, V22 can take either value 1 (in case of answer “Yes”) or 0 (in case of answer “No”).

In multiple choice questions, where the answers could be several categories, such as questions associated to V4, V5, V6, V10, V15, V16, V18, V21, the total number of the selected categories was accumulated and normalised between 0-1.

In questions involving ordinal variables (V8 and V19), we also normalised the outcome, so that a real number between 0 and 1 represents the answer and it is used as an input variable in the cluster analysis.

The numeric variable related to the number of museum visitors (V23) was computed as follow. First, we computed the average value of visitors at time t (year on which the form was compiled) and the two years before for the whole sample of museums. Then we standardised this variable subtracting from the number of visitors of each museum the average value for the whole sample and dividing the result by the standard deviation. We then rescaled the value from 0 to 1.

Finally, we also standardised the year of compilation of the self-assessment form (V1) from 0 to 1, starting from a numerical variable (with values 1 for 2001, ..., 17 for 2017).

We performed a partition-clustering method for museums by the *k-means* command in Stata. *Kmeans* clustering is an iterative procedure that partitions the data into k groups or clusters. We specified the number of clusters, 4, to create. Thus, the procedure begins with 4 initial group centers. Observations are assigned to the group with the closest centre. The mean of the observations assigned to each of the groups is computed, and the process is repeated. These steps continue until no observations change groups from the previous iteration. As for the distance measure, we use the Euclidian distance of V1, V2, V3, ... V22 to create 4 groups.

4. Results

The cluster analysis allowed us to classify the sample of museums in four groups.

The first cluster consists of 24 museums, the second cluster is composed by 26 museums, the third cluster consists of 50 museums and the fourth club includes 10 museums.

The characteristics of the clusters suggest that they may be categorised according to their degree of resilience as “No resilience” (Cluster 1), “Emerging resilience” (Cluster 2), “Developing resilience” (Cluster 3), “Mature resilience” (Cluster 4).

An overview on some basic information and service availability presented in Table 2 allows understanding that our classification may in fact be seen as successive stages of a virtuous organisational development.

For example, museums belonging to Clusters 3 and 4 – that we called “Developing resilience” and “Mature resilience” – are usually endowed with a variety of services, self-evaluation forms are updated and they registered a higher number of visitors during the observation period.

Table 3. General information and services

	Number of museums	Self-evaluation form updating	Service charter	Services	Online services	Visitors - annual average
<i>No resilience</i>	24	0.74	0.00	0.35	0.25	476
<i>Emerging resilience</i>	26	0.89	0.00	0.40	0.35	1011
<i>Developing resilience</i>	50	0.93	0.08	0.77	0.78	1957
<i>Mature resilience</i>	10	0.99	0.10	0.85	0.80	22076
Average value for the whole sample	110	0.88	0.05	0.60	0.56	3239

To further characterise the clusters of museums we referred to the three domains: safety and security, human resources and networks and relationships.

We will see that moving from the first cluster to the fourth cluster generally entails a widening of services for visitors, higher degree of safety and security, a deepening of the relationships with other museums and cultural institutions, that can improve innovation and empowerment of the whole systems of museums.

Table 4. Safety and security, human resources, networks and relationships

Safety and security										
	Insurance	Deposits	Preservation of materials	Security (certifications)	Risk assessment	Inventory register	Inventory of materials (%)	Computerised archive	Conservation form	Risk charter
<i>No resilience</i>	0.21	0.21	0.38	0.46	0.22	0.08	0.65	0.17	0.06	0.00
<i>Emerging resilience</i>	0.23	0.19	0.47	0.63	0.29	0.73	0.90	0.15	0.08	0.00
<i>Developing resilience</i>	0.38	0.60	0.58	0.75	0.43	0.78	0.81	0.54	0.35	0.02
<i>Mature resilience</i>	0.30	0.90	0.63	0.90	0.67	0.80	0.80	0.60	0.58	0.30
Average value for the whole sample	0.30	0.45	0.52	0.67	0.38	0.62	0.80	0.37	0.24	0.04

	Human resources			Networks and relationships				
	Qualified personnel for conservation	Shared personnel	Staff adequacy	Networks	Contextualisation	Territory	Communication	Opening days
<i>No resilience</i>	0.04	0.04	0.24	0.38	0.29	0.19	0.51	0.57
<i>Emerging resilience</i>	0.12	0.58	0.65	0.81	0.35	0.37	0.81	0.36
<i>Developing resilience</i>	0.34	0.52	0.45	0.88	0.94	0.77	0.96	0.73
<i>Mature resilience</i>	0.50	0.90	0.53	0.60	0.90	0.72	1	0.97
Average value for the whole sample	0.24	0.46	0.46	0.73	0.65	0.54	0.830303	0.63

Usually the first two clusters are characterised by values below the average for almost all the variables. The third and fourth clusters, instead, are characterised by values above the average for almost all the variables.

We can summarise the main characteristics of the clusters as follow:

1) *No resilience*

The cluster is composed by small museums, usually located in small villages, both in mountain and rural areas. Significant weaknesses (average < 0.3) are in most of the dimensions, especially the field of services, human resources, included qualified conservation staff, and in the field of safety and security, namely collection insurance, deposits, risk assessment, inventory register (0.08), computerised archive, conservation form, risk card. It means that these institutions have difficulties in ensuring even the conservation of cultural heritage they preserve. As for networks and relationship, the capacity of contextualisation of collections and relationships with the surrounding territory is scant.

Notwithstanding, these main weaknesses, the analysis suggest that self-evaluation forms are usually updated, and the cluster is performing quite well in terms of opening days (0.57), Inventory (0.65) and External communication (0.51).

2) *Emerging resilience*

The cluster is composed by small museums, usually located in small towns or villages in mountain and rural areas. Compared to the previous cluster, these museums are in areas that have a greater tourism development (Loro Piceno, Monte San Martino, Sarnano, Visso). They register values below the average for almost all variables. Main weaknesses are evident in the security and safety area (deposits, computerised archive, conservative form), although they perform quite well as for the presence of inventory registers (0.73) and the practice of inventory of materials (90% on average). As for human resources: the staff is numerically adequate in most cases even in the presence of a high percentage of shared personnel, possibly due to the lowest average number of opening days compared to the other clusters, and the scarce availability of services. The external communication seems adequately developed while the linkages with the territory are very limited. Museums belonging to this group are also generally part of networks (See Table 1 and Table 2).

3) *Developing resilience*

This cluster is the most heterogeneous and includes small museums located in different areas of the crater. They register values above the average for almost variables. Their main strengths are in inventory of materials, on site and on line services, networks (0.88) and contextualisation of collections (0.94). However, they do not perform quite well as for conservation: conservative form

(0.35) and risk chart (0.02). They also register values below the average for human resources: shared personnel (0.52) and staff adequacy (0.45).

4) *Mature resilience*

The group “Mature resilience” is the smallest cluster and consists of the largest museums located in the major urban centres of the crater (Macerata, Tolentino, Ascoli Piceno and Fabriano). Values are above the average for almost all variables, in many case average > 0.8 such as for deposits, certifications, inventories, shared staff, services, communication, opening hours and contextualisation of collections. Weaknesses are registered for collection insurance, risk and service charter (< 0.3).

5. Concluding remarks

The analysis, which is still ongoing, is revealing some weaknesses of the museum system of the “seismic crater”. Particularly, the small number of museums belonging to the fourth cluster (“mature resilience”) emerges, beside a lack of adequate conservation systems and human resources in the majority of museums. The museum system as a whole proves to be an unstable system of short term, precarious contracting and wide employment of “free labour” (i.e. interns and volunteers). The research also suggests that emerging and developing resilience should be fostered and maintained by setting up effective networks.

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