

Exploring the resilience of inner areas: a cross-dimensional approach to bring out territorial potentials

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new opportunities of local development through territorial cohesion (<https://www.agenziacoesione.gov.it/strategia-nazionale-aree-interne>). In 2019, the SNAI selected 72 project areas (about one thousand municipalities, representing 2 million inhabitants) and funded them with a total amount of more than € 591 million, in addition to the allocations of ESI Funds from Operational Programme and other public/private funds. The impact of this policy is now being evaluated in order to measure the results of the public investments and to start again with the next funding cycle.

Considering that the opportunity of new economic activities and job creation is closely related to the supply of essential services (education, healthcare and mobility), which is therefore an absolute precondition for reversing the decline trend, in recent years many studies [2]–[7] have been undertaken for policies, development projects and widespread strategies for fragile areas. “B4R Branding4Resilience. Tourist infrastructure as a tool to enhance small villages by drawing resilient communities and new open habitats” is a research project of national interest (PRIN 2017 – Young Line) funded by the Ministry of Education, University and Research (MIUR), started in 2020 [8]. The project is coordinated by the Università Politecnica delle Marche and it involves as partners the Università degli Studi di Palermo, the Università degli Studi di Trento and the Politecnico di Torino. B4R investigates the potential of branding in Italian small villages, proposing the transformation of minimal tourist infrastructures as an engine for the development of more structural and resilient territories and local communities. (<https://www.branding4resilience.it/>).

In this framework of both research and tangible national strategies for the development of actions aimed at revitalizing fragile areas, it is important to be able to bring out the potentials of territories in a multi-dimensional perspective, characterized as far as possible by quantitative data and indicators that can allow comparisons between similar territories located in very different geographical areas.

In this research a study strongly based on a first quantitative exploration of already existing data was conducted, in contrast to the common approaches that reduced or neglected the quantitative approach to a more qualitative, faster, and more flexible evaluation, which allows a more dynamic and generic vision. The contribution proposes an analytical framework to be applied in the exploration of fragile areas, which allows a certain flexibility and adaptability to different contexts and not limited to the single area of observation. A methodological approach (based on a multidimensional diagram structured in different sub-dimensions of analysis) and tools (indicators and cross-dimensional indexes) are proposed to study the resilience of marginal territories.

All this, according to a new significant assumption, designed and applied in B4R project (of which the authors are part), requires a shift from a "vulnerability approach" to a "vibrancy approach": no longer focusing on the weaknesses of the areas, but exploring their dynamism, i.e., the presence of actions/initiatives that give rise, or can contribute to the areas revitalization.

After an in-depth examination of the most recent scientific literature, which highlights an important gap, the paper describes the proposed methodological approach (which should be interpreted in a scalar way) and the multidimensional evaluation approach which, through cross-dimensional indexes, overcomes "sector-specific" visions and provides a broad vision of the territorial potentials.

## 2 Background

With the aim of highlighting the methodological perspectives recently adopted by scholars to investigate the territorial resilience, vibrancy and vulnerability by means of indicators, a synthetic literature review is here presented. The research was focused only on scientific works indexed on the most common databases and published in the last years. Geographically, no limits have been set, even if, at different scales, mainly European and Italian works have been taken into consideration.

To capitalize the researches already conducted by other authors on the basis of their results, appropriate contributions were thus included in our analysis by inputting in Scopus database (<https://www.scopus.com>, last accessed on July 22nd 2021) three different search scripts such as: “ALL (inner areas AND resilience OR vibrancy OR vulnerability)” which reports 150 results; “ALL ( resilience AND vulnerability AND vibrancy ) that reports 22 results and “ALL (inner areas AND development index) that reports 11 results.

These initial results were then analysed and reduced, and some research gaps emerged. Many scholars tackled the vulnerability and vibrancy topic in urban areas while only few others faced the problem to bridging the gap between urban/central areas and inner territorial areas [9]–[16]. Generally, the analysed papers can be divided in two main groups in relation to the geographical scale that they consider in the research: a regional or supra-municipal scale and an urban or sub-urban scale. For the present research we considered indicators belonging to both levels but that can be adapted to a village, not-urban, and inner area scale. At regional or national level there are EU official reports and very interesting development and resilience indicators [11], [17]–[24] and composite indexes [25], [26], suitable also for vulnerability/vibrancy research but not very adaptable for analyses at municipal or sub-municipal scale. The biggest and more specific part of the literature is related to cities and urban areas, with resilience, development, vulnerability, and vibrancy indicators [16], [27]–[31], but, also in this case, due to the different nature of the territory, most of these indicators are not suitable for inner areas or villages. In fact, some indicators are designed to have variability in urban sub-areas and so, when calculated at the territorial scale, do not identify differences between neighboring municipalities (e.g. Difference between male and female employment rate at the age of 15-64). Furthermore, there are some indicators referring to issues that do not exist in non-urban areas (e.g. urban transformation index based on the approval / adoption / drafting of urban plans) and, on the contrary, other key themes are missing. For example, the farm density and their innovation level represent indicators not relevant in urban contexts, but fundamental in studying inner areas. Finally, it is commonly recognized the criticality of data availability: in urban contexts POIs data are often available, while in suburban areas data are usually aggregated at municipal level and therefore less precise (e.g. New residential buildings and related dwellings by period of construction).

In Italy there are two main initiatives that are building and applying indicators to study and monitor the national territory, including inner areas: the National Strategy for Inner Areas (SNAI), that is trying to assess the resilience of inner areas/ rural areas and villages [32], and the ICity Rank indicators built up to monitor and rank the Italian cities. The latter measures, every year, cities capacity to adaptation (smartness) on the way to get more dynamic cities, more functional, more ecological, more liveable, more

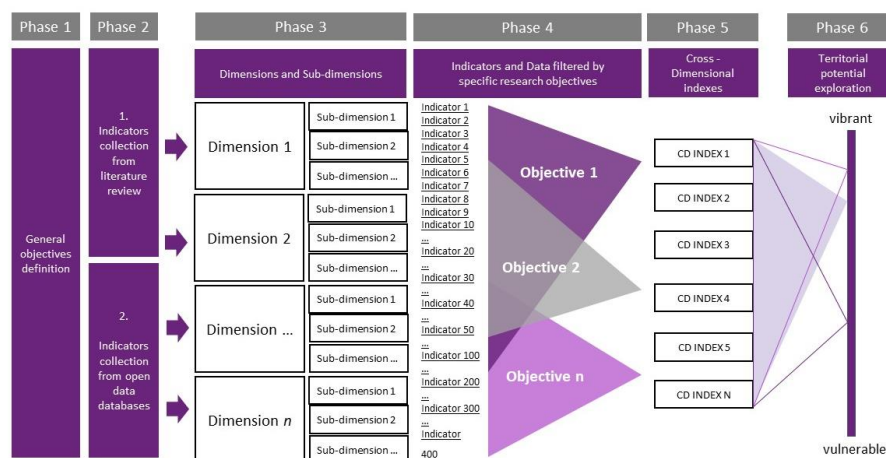
manageable, more innovative and more capable of promoting sustainable development by reacting to ongoing socio-economical changes through the use of new technologies [33]. It is worth mentioning also the Regional Digital Economy and Society Index (DESI), which tracks the progress of EU countries regarding their digital competitiveness, but it is also developed at urban level in the Piedmont Region in Italy to build indexes on sustainability and marginality. The Regional DESI Sustainability Index is an experimental multidimensional index, finalized to analyse local potentials for sustainable development. The assessment methodology was based on the work carried out by Forum PA "ICity Rank - 2019 annual report", partially borrowing its methodology and applying on all Piedmont municipalities, which were evaluated within groups of "similar" municipalities, based on the number of residents (small municipalities under 1000 inhabitants, medium-small 1000-5000, medium large 5000-25000 and large over 25000) and the area reference altimetric (plain, hill, mountain) [34].

By analysing this literature, some research gaps emerged. First, the concept of "territorial vibrancy" is very low investigated in the literature, while those of "territorial resilience" and "territorial vulnerability" are now almost developed. In general, the indicators presented in the literature refer to small scales (regions and territories) but with rather updated data, while if the scale is enlarged and therefore granular and not aggregated information is desired, the only multidimensional indicators found are related to urban areas. Fortunately, the lack of timely updated data in recent years is going to be reduced, thanks to the commitment of the various European nations to make as much data as possible available in open data format. In Italy, however, the situation is still very different from region to region, and the data availability mainly depends on the topics to be analysed: in fact, obtaining data that are even indirectly related to the national privacy law is still very difficult.

The abovementioned SNAI, given its purposes, is carrying out the analysis of the territories with a very effective series of indicators which, however, have the limit of being generally one-dimensional.

### 3 Methodological approach

In order to investigate the resilience of inner areas we developed a methodological approach based on the calculation of indicators and cross-dimensional indexes aimed at exploring vulnerability and vibrancy of fragile territories. Figure 1 shows its six phases.



**Fig. 1.** The six phases of the methodological approach (Source: Authors' elaboration)

Firstly, it is necessary to define the main objectives of the analysis, which can be almost general but specifically related to the territorial context that needs to be explored and evaluated (Phase 1). In fact, the analysed fragile area can be related to just a municipality or to a group of few or several municipalities.

Then, an extended selection of indicators has to be gathered on the basis of the objectives and the territorial scale of the analysis in order to create a suitable knowledge base, that is fundamental to set up the future development of the territory exploration (Phase 2). This phase must be supported by the literature, as well as by the analysis of the existing databases and data available for the areas to be explored.

The Phase 3 of the proposed approach is crucial to manage the numerous indicators previously identified. This important knowledge base has to be structured and organized by classifying each indicator in specific dimensions and sub-dimensions, which can change to represent the main issues of the analysis.

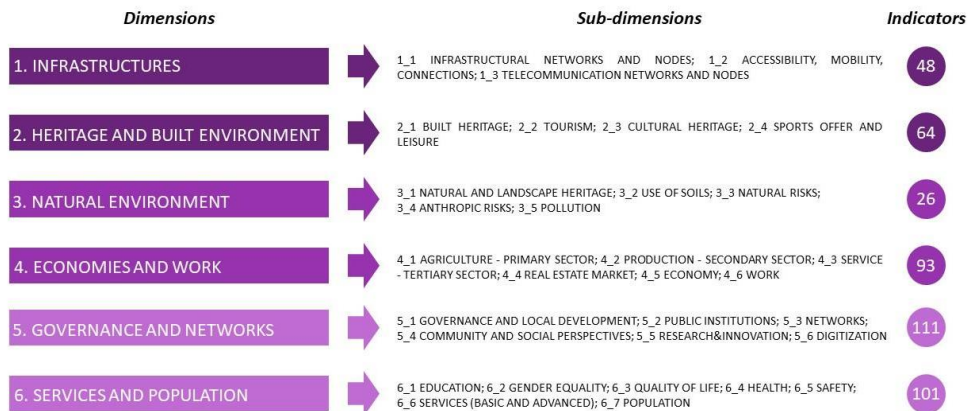
Therefore, more specific research objectives have to be outlined to more deeply analyse key aspects of the territory (Phase 4) and, according to them, a set of indicators can be selected to create cross-dimensional indexes (Phase 5). The previously identified dimensions and sub-dimensions can guide this selection even if it is highly suggested not to consider a single dimension/sub-dimension. It is important to highlight that the extended selection of indicators gathered during Phase 2 are not reduced, but just properly combined for the established purposes. The resulting cross-dimensional indexes can finally be used to further explore the territorial potentials (Phase 6). On this basis, different areas of the analysed territory can emerge as more or less vulnerable or vibrant, so that specific policies and actions can be strategically addressed.

## 4 Results

The proposed methodological approach was applied to explore the resilience of fragile territories. In particular, the general objective of the analysis (Phase 1) is to investigate the territorial potential of Italian small villages and inner areas in order to reactivate habitats and develop minimal tourist infrastructures as an engine for the development of more structural and resilient territories and local communities. Repopulation, local development and economic enhancement represent common challenges for several Italian territories: in this paper the four focus areas analysed in the context of the “Branding4Resilience” research project (<https://www.branding4resilience.it/>) were assumed as references. Although they are located in four Italian regions (Marche, Sicily, Trentino, Piedmont) and reflect different place identities, a common methodological approach can be applied to explore their potential and enhance their territories and communities.

To this aim a quantitative analysis based on specific indicators was set up: assuming the results achieved in other studies [9], [12], [15], [18], [21], [25], [26], [28], an extended selection of indicators was gathered in order to create a suitable knowledge base for the territory exploration (Phase 2). More than 400 indicators were identified and the main existing databases in the Italian context were analysed to check data availability for the considered areas. For example, the following data sources were examined: the Italian National Institute of Statistics (ISTAT), the National Strategy for Internal Areas (SNAI) Open Kit, the Open Coesione platform, Urban Index indicators, the Open Bilanci platform and different Geoportals at regional and municipal level.

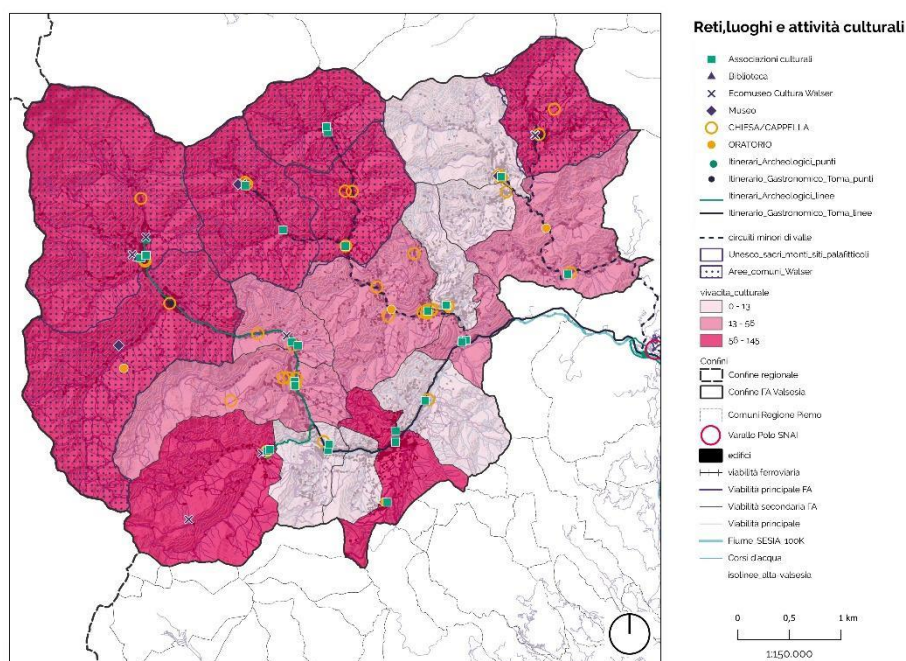
Therefore, all the indicators were structured and organized in specific dimensions (Phase 3). Each dimension was then detailed in several sub-dimensions, able to gather and classify specific indicators (Figure 2).



**Fig. 2.** Knowledge base dimensions, sub-dimensions and related indicators  
(Source: Authors' elaboration)

These dimensions and sub-dimensions supported not only the structuring and creation of a general knowledge base, but also the analysis of a series of specific issues of the territory able to highlight its vulnerability and vibrancy.

Therefore, it was necessary to outline more specific research objectives to address deeper analyses (Phase 4). For example, several key aspects were investigated such as the tourist offer, the commercial desertification, the presence of basic services, the capability of public administrations to attract funds, the presence of digital divide, the offer of sport and leisure activities, the presence of innovative companies. Figure 3 shows, for example, smooth and fast traffic networks, places of cultural or naturalistic interest and cultural and sports activities, to represent the entire cultural and leisure offer of the analysed area.



**Fig. 3.** Example of data and indicators representation: Cultural and leisure offer  
(Source: Authors' elaboration)

On this basis, a set of indicators from different sub-dimensions was selected and combined to create cross-dimensional indexes (Phase 5) and to further explore the territory vulnerability or vibrancy and bring out the territorial potentials (Phase 6). For example, according to the specific objective of creating infrastructures for cultural-tourist fruition, several indicators from different sub-dimensions - 1.1 (Infrastructural networks and nodes), 1.2 (Accessibility, mobility, connections), 1.3 (Telecommunication networks and nodes), 2.2 (Tourism), 2.3 (Cultural heritage) 2.4 (Sports offer and leisure), 3.1 (Natural and landscape heritage), 4.3 (Service - tertiary sector), 5.3 (Networks), 5.5 (Research&Innovation) - were aggregated as follows:



$$CDI = f(\text{Ind}_{h,d}; \text{Ind}_{k,d}; \text{Ind}_{j,d}; \dots; \text{Ind}_{z,d})$$

Where CDI is the cross-dimensional index expressed by the different indicators ( $\text{Ind}_{h,d}$ , etc.) belonging to the analysed different sub-dimensions.

## 5 Conclusion

The proposed methodological approach shows how quantitative analyses can support the territorial resilience exploration of fragile areas, to which the current literature has not yet provided an organic and comprehensive solution. The division into 6 subsequent phases allows to progressively build an important knowledge base scalable to the specific territorial level of the research. The structure, organized in dimensions and sub-dimensions, provides a more detailed overview context, enabling to select an appropriate set of dimensional indicators, depending on the survey specific objectives. The construction of cross-dimensional indexes gives a cross-sectional reading of the territories, useful for targeted development policies based on specific territorial vulnerability and vibrancy issues. Therefore, the proposed approach can effectively support the territory exploration and lay the ground for future evaluations based on a possible integrated use of data, simple indicators and cross-dimensional indexes.

Nevertheless, this study highlighted some limitations which have to be considered in applying the proposed methodological approach to specific case studies. For example, the problem of data availability at municipal scale is still to be addressed, in striking contrast to the current era of big data. Also other critical aspects must be taken into account, such as: scaling constraints; problems with updating information; lack of availability of (open) source data, both punctual and aggregated; the need to set up continuous series of data to describe trends over time.

Starting from this first exploration, the selected case study (B4R research project) is currently addressing the challenge of planning at municipal level, in order to define specific and/or widespread projects that - starting from existing networks - can be the trigger for virtuous local actions.

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