Bringing values at the center of policies for inner areas regeneration in the Covid-19 age

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The marginal territories require new tools to support the construction of policies capable of activating sustainable regeneration processes. This research, inspired by the ongoing political and scientific debate on Italian fragile areas, proposes the application of a hybrid methodological approach aimed at assessing territorial vulnerability, through an analysis that combines the potential of MCDA techniques with those of GIS. The research proposes the results of a first application of the proposed methodology, with a focus on the construction of value functions concerning the multiple dimensions of vulnerability. The analysis was carried out for the Italian provinces of Alessandria and Vercelli, both crossed by the VENTO project, one of the longest Italian cycle paths with a great potential for relaunching the territories it crosses.
Keywords: territorial vulnerability; value functions; inner areas

Portare al centro i valori nelle politiche di rigenerazione delle aree interne nell'epoca del Covid-19

I territori fragili richiedono nuovi strumenti di supporto alla costruzione di politiche in grado di attivare processi di rigenerazione sostenibile. Questa ricerca, ispirata dal dibattito politico e scientifico in corso sulle aree fragili del nostro paese, propone l'applicazione di un approccio metodologico ibrido volto a valutare la vulnerabilità territoriale, mediante un'analisi che combina le potenzialità delle tecniche MCDA con quelle dei GIS. La ricerca propone i risultati di una prima applicazione della metodologia proposta, con un focus sulla costruzione delle funzioni di valore riguardanti molteplici dimensioni di vulnerabilità. L'analisi è stata condotta per le province italiane di Alessandria e Vercelli, entrambe attraversate dal progetto VENTO, una delle più lunghe ciclovie italiane con un grande potenziale di rilancio dei territori attraversati.
Parole chiave: vulnerabilità territoriale; funzioni di valore; aree interne

According to the National Strategy of Inner Areas, established by the national government in 2013, today more than 60% of Italy is occupied by those territories, defined as «areas significantly distant from the centers that offer essential services, but rich in important environmental and cultural resources and highly diversified by nature» (SNAI, 2013).

The uneven economic development between city and countryside, mountains and plains, coast and hinterland have led to territorial disparities, which led to rampant fragilities (i.e., depopulation, lack of essential services, social and productive scarcity, etc.).

In a context of progressive deterioration of quality of life conditions, Covid-19 arrived to accelerate the decay process, with the rarefaction and congestion of health services, the difficulties of work and distance learning, the difficulties of accessing the internet and the weak digital connections (Balducci, 2020), with a consequent general slowdown of local micro-economies, over which local institutions had already previous management difficulties (Dezio, in press).

Despite this situation of crisis, a debate on the opportunities for marginal territories to attract permanent and temporary populations has increased. However, the risk of a misinterpretation of this opportunity can lead to increasing imbalances and missing the occasion to turn the crisis into a place-based regeneration process (Marchigiani *et al.*, 2020).

To return to live the marginal territories, it is necessary to take a look that brings them back to the center of new processes (De Rossi 2018; Carrosio 2019). That means recognizing limits, load capacity and local resources and values (Dezio, 2020), as well as to provide the conditions for local governance to take the right path of recovery. In this sense, there is an urgent need for strategies and tools for local institutions, capable of enhancing local territorial capital, through an effective ad impacting use of the available financial resources. Under this perspective, our research deals with the definition of an evaluation tool to support the recovery policies of inner areas with a special attention to the emerging needs exacerbated by the pandemic.

Therefore, purpose of this contribution is to propose a hybrid methodological approach that is able to analyze and evaluate both vulnerability and attractiveness of fragile territories, with a view to support the best resources allocation choices towards new social and economic regeneration processes. To do this an Italian marginal territory crossed by a long-distance slow tourism project (VENTO) has been selected as pilot case study to test the evaluation approach.

The proposed methodology is based on the use of Multicriteria Decision Analysis (mcda) techniques within the Geographic Information Systems (gis) domain (Dell'Ovo *et al.*, 2020a). By the definition of a set of spatial criteria and value functions, the evaluation process is open to various stakeholders directly as well as indirectly involved into valorization processes (Oppio, Dell'Ovo, 2020), in order to co-design strategies for a balanced and plural enhancement of territorial resources.

This work proposes an original as well as replicable contribution, both from a theoretical and an operational point of view, and it shows the first steps of an integrated model able to support a regeneration process of the most fragile territories. The paper is divided into several sections: a first focus on the notion of value-driven policies (§2); the description of the methodological approach (§3); a first application of the model on the pilot case study (§4) to generate value functions aimed at evaluating the territorial vulnerability (§5, §6). The paper concludes with a critical discussion of the results and some reflections on future research lines (§7).

From evidence based policy making towards value-driven policies

In recent times, the notion of 'smart land' has emerged as a reaction to the polarization of cities in terms of production and distribution of both tangible and intangible resources (Bonomi, Masiero, 2014; Rosés, Wolf, 2018). This idea, focused on the achievement of a new balance between urban and extra-urban dimensions, requires the assumption of a new paradigm for policy design, based on the combined use of data and values. Choices regarding the future of inner areas involve issues such as individual and social values, cultural identity, and the participation of local communities throughout the entire policy cycle (Tsoukias *et al.*, 2013).

When dealing with the social dimension of the development, the decision-making process becomes a more complex process, and it cannot entirely be supported by an approach exclusively based on data.

Measuring the impacts of policies is essential to understand if they work and whether they need to be readjusted, as well as to update our knowledge on the relationship between economic policy objectives and their related means (Pammolli *et al.*, 2021). Introduced by the uk government in the 1990s, the Evidence Based Policy Approach stresses the importance of data to reveal the factual truth and to use evidence to legitimate public policies (Blair, 1994; Tsoukias et al. 2013; Head 2013). Despite it can be considered as a 'practice oriented' effort to support policy making processes, its criticalities in legitimating public policies have been pointed out by Almquist *et al.* (2012) and De Marchi *et al.* (2016). This aspect has been furthermore discussed by Tsoukias (2013), who has focused on the special features that make a policymaking process different from any other decision process. In addition to the recognition of policy making process as a policy cycle, composed by subsequent and interrelated steps, he sheds a light on the public issues that these steps have in common: use of public resources; coexistence of multiple stakeholders; long-horizon time; legitimation and accountability; deliberation. On this basis policy analytics (Tsoukias, 2013; Daniell *et al.*, 2016) has been introduced as a value-driven approach aimed at considering both data information from the context and the stakeholders' preferences as well as at legitimating public

choices not only by the use of evidence but by the involvement of stakeholders (Dell'Ovo *et al.*, 2020b).

In order to enhance the responsiveness of smart land, especially of inner areas, and to boost local regenerative processes, value-driven policy making processes are crucial as they allow to overcome the limits of Evidence Based Policy Approach, by including the preferences of many stakeholders, providing spaces for interaction (Ostanello, Tsoukiàs, 1993) aimed at generating collective learning, assuming a long-term perspective and improving choices' transparency and legitimacy. According to this change of paradigm, data should be combined with values, and values should be the starting point of problem structuring, since from this crucial phase (setting objectives and criteria) policies have to be designed and include in-depth analysis of criticalities and potentials spatial distribution, as well as the composite system of public, private and general interest expectations (Crosta, 2010; Stanghellini, 2019).

The consequent implications are relevant to the extent that they require evaluation to play a guiding role within the entire policy cycle, not limiting its field of investigation to data but extending its heuristic power to investigation of, not always converging scenarios based on the values.

From an operational point of view, value functions (Beinat, 1997), are essential for including preferences into valuation. In order to point out their contribution, after a description of the hybrid methodological approach proposed to assess territorial attractiveness and vulnerability of inner areas, a special attention has been paid to the process for defining value curves.
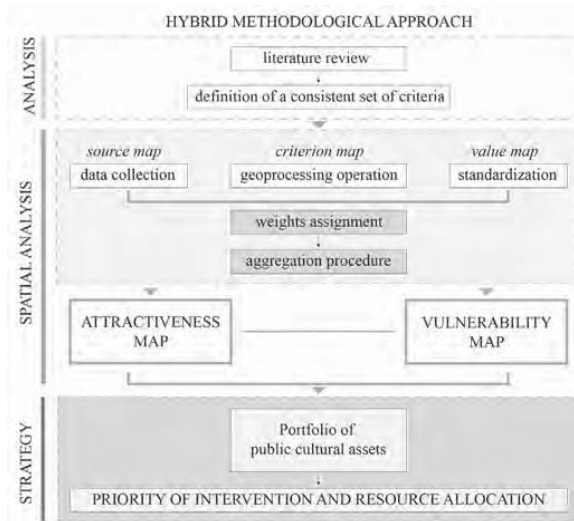
The hybrid methodological approach

Given the objective of the research and the selected approach, this section is aimed at explaining the phases in which the study has been structured.

In detail the method combines the strengths of the mcda within the gis domain (Borrough, 1998). The mcda improves the quality of the decision process by supporting the decision maker in structuring, analyzing, and solving the problem (Roy, 1985; 2005), while gis software allows the collection and elaboration of a huge amount of spatial data by giving the opportunity to visualize the results on thematic and value maps (Goodchild, 2009; Densham, Goodchild; 1989; Malczewski, 1997, 2000; Malczewski, Rinner, 2015). As described by figure 1, the hybrid methodological approach has been divided into three main phases. Within this context, even if the whole process is presented, it will be detailed the first steps which concern the definition of the territorial vulnerability paying attention on the generation of the value functions which allows the passage from Criterion map to Value map.

Analysis. The aim of this phase is the definition of two consistent set of criteria: one for the evaluation of the attractiveness of the territory and one for its vulnerability. The robustness of the framework has been based on a detailed literature review aimed at understanding limits and main characteristics of the studies already developed (Oppio, Dell'Ovo, 2021; Dezio *et al.*, 2021).

Spatial Analysis. The second phase concerns the collection, elaboration and aggregation of the criteria previously defined within the gis domain. The data collection consists of defining and developing the best indicators able to measure the territorial performances against the selected criteria. The results of this phase are the Source maps which allow to preliminary understand the

HYBRID METHODOLOGICAL APPROACH

ANALYSIS
- literature review
- definition of a consistent set of criteria

SPATIAL ANALYSIS

| source map | criterion map | value map |
| data collection | geoprocessing operation | standardization |

- weights assignment
- aggregation procedure

ATTRACTIVENESS MAP — VULNERABILITY MAP

STRATEGY
- Portfolio of public cultural assets
- PRIORITY OF INTERVENTION AND RESOURCE ALLOCATION

1. The Hybrid methodological approach.
Source: elaboration by the authors.

spatial distribution of the data under analysis. At this point it is possible to proceed with the elaboration of the collected data according to the functions which better represent the criteria by the support of geoprocessing operations (e.g., distance, the density, the slope, reclassification, etc.). The output of this phase is the Criterion map. Once these first steps have been concluded, it is possible to carry on the standardization process, in order to make the criteria comparable and to go on with their aggregation by the mean of value functions. Value functions permit to approximately represent human judgments (Beinat, 1997). Since each criterion can be represented by several units of measurement, in order to be compared, criteria should be made homogeneous through the use of value functions which transform the performance in a-dimensional value (0-1; 0-10). This phase also includes the weights elicitation which consists of assigning a different importance to the criteria previously defined (Riabacke *et al.*, 2012) according to the final objective of the research. Once criteria have been standardized and weighted it is possible to aggregate all the elaborations to visualize the Value maps, which suggest the most attractive and the most vulnerable territorial contexts according to the defined value trees (Hwang, Yoon, 1981).

Strategy. The last step of the methodological framework, which has not been developed yet, will allow to investigate the intrinsic characteristics of the cultural assets located within the territorial context under analysis and to integrate this information with the extrinsic characteristics resulted by reading the maps resulted from the previous phase. By combining both intrinsic and extrinsic characteristics it will be possible to define a priority matrix which will support the assignment of different levels of priority to interventions in order to aid decision makers to allocate resources and account its decisions.

The legitimacy of the overall evaluation process is promoted by a deep interaction with experts in the different phases of the approach, from the analysis of the context to the generation of the value trees until the validation of the overall evaluation framework. These values generated and carried on by the process allow to outline long-term regeneration scenarios.

Case study

In order to test its effectiveness, the hybrid methodological approach has been applied to the case study of the VENTO cycle route, given its fragile conditions and attractive potential.

VENTO is a territorial project conceived and developed by a group of researchers from the Department of Architecture and Urban Studies of the Polytechnic of Milan, which consists of a cycle route that follows rural landscape of the river Po and connects Venice to Turin (Pileri, 2018). In 2010, VENTO was born to regenerate rural areas in depopulation through cycle tourism, with innovation and tradition: to activate economies starting from local identities, avoiding freezing, trivialization, or exploitation. It experiences the paradigm for a different way of territorial design: a test for sustainable alternatives, shaped for helping inner and fragile areas, able to generate new jobs, slow down depopulation, create new economies with very low impact, save the beauty that still exists there (Pileri *et al.*, 2015).
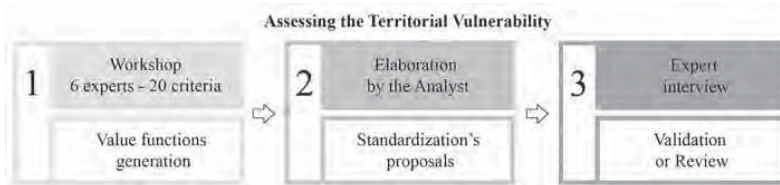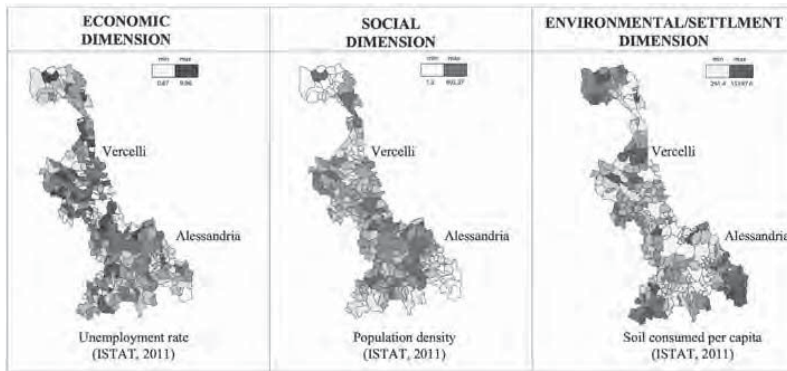
The approach proposed has been tested on a section of the VENTO cycle route, in particular two provinces crossed by VENTO, Alessandria and Vercelli. These two provinces are chosen because at their intersection VENTO crosses an interesting and complex landscape: depopulated villages, the 'Po Park Vercellese Alessandrino', historic rice fields linked to a known intangible heritage, numerous abandoned and disused cascinas (farmhouses of Northern Italy).

Measuring the territorial vulnerability

Within this section, the methodological approach presented in figure 1 will be applied to the Provinces of Alessandria and Vercelli, and in detail the first two phases (Analysis and Spatial Analysis) aimed at identifying the overall vulnerability of the territory, with a deep explanation of the process and the interviewing phases for value functions development. To do this, the work is based on the selection of those criteria useful to define the multidimensional notion of vulnerability. In particular, the concept of Economic, Social and Environmental vulnerability has been increasingly considered, as it reveals the degree to

Table 1

Dimension	Criteria	U.M.	Description	Source
Economic	Per capita income	€/freq	Per capita income is defined as the amount of gross domestic product that is hypothetically produced over a certain period of time by a person. It is calculated by dividing the amount in euros by the frequency, in this case annual.	Mundetia N., Sharma D., Dubey S., Priya M., 2018
	Unemployment rate	%	Unemployment rate refers to the percentage of the workforce that cannot find work. It is calculated by dividing the unemployed by the workforce, where "workforce" means the sum of the unemployed and the employed.	Graziano P., Rizzi P., 2016
	Local units of the manufacturing sector	%	Local units of the manufacturing sector C means the percentage of companies in the manufacturing sector per single municipality on the total of units (mineral extraction, manufacturing activities, construction, trade, transport, education, health, etc.).	Mundetia N., Sharma D., Dubey S., Priya M., 2018
	Industrial concentration in the manufacturing sector	%	The manufacturing sector industrial concentration refers to the percentage of employees in the manufacturing sector divided by the total of all sectors by single municipality. What is obtained is the share of the manufacturing sector in a municipality, compared to the total of all sectors present.	Salvati L., Zitti M., 2009
	Percentage of Utilized Agricultural Area (UAA) out of the total	%	The percentage of utilized agricultural area (UAA) allows you to get a picture of agricultural activity and the unused sector.	Graziano P., Rizzi P., 2016
	Digital divides from fixed and mobile networks	%	Fixed and mobile digital divide refers to the percentage of the population excluded from fixed and mobile broadband.	Urban index
	Economic dynamism index	Composite index	The Economic Dynamism Index refers to dynamism in terms of the increased presence of jobs in private sector companies. It returns the image of the local business fabric: the economic activities - primary, secondary, tertiary and quaternary - on which the composite and articulated structure of the local economic system depends.	Urban index
Social	1st Grade school failure rate	%	The 1st grade school failure rate means the percentage of the population between the ages of 15 and 62 that has not completed the first cycle of education.	Paul A., Deka J., Gujre N., Rangan L., Mitra S., 2019
	Old age index	% Ratio	The old-age index means the percentage ratio of the population aged 65 and over, to the 0–14-year-old.	Paul A., Deka J., Gujre N., Rangan L., Mitra S., 2019
	Population density	inhab/km^2	By population density we mean the number of people measured on square kilometers living in a area.	Kabir R., Akter M., Karim D. S., Haque A., Rahman M., Sakib M. 2019
	Foreign population	%	By foreign population we mean the percentage of foreign people with habitual residence in Italy.	Reckien D., 2018
	Average ten-year rate of resident population's change	%	The ten-year average rate of change of the resident population means the average of the inter-census percentage changes of the resident population between 1991 and 2001; 2001 and 2011.	Krishnamurthy P.K., Lewis K., Choularton R.J., 2014
	Accessibility index to urban centers (road)	(1-5)	The Index of accessibility to urban centers (road) means a synthetic indicator that classifies each municipality according to its greater or lesser ability to access urban centers, through the road network. The indicator is calculated using a sampling function of the isochrones in which the centroid of the municipality falls.	Urban index
Environmental/ Settlement	Average annual PM$_{10}$ concentration	µg/m^3	Annual average PM10 concentration means the annual average PM10 concentrations per municipality of residence. The annual legal limit for the protection of human health corresponds to an annual average of 40 µg/m^3.	Paul A., Deka J., Gujre N., Rangan L., Mitra S., 2019
	Drinking water per capita, fed into the municipal network	m^3/inhab/yr	Drinking water per capita, fed into the municipal network, means the drinking water supply service in relation to the population (Mc/inhabitant/year).	Paul A., Deka J., Gujre N., Rangan L., Mitra S., 2019
	Estimated building density	m^3/km^2	Estimated building density means the building load on a given area (in this case the municipality). The indicator is expressed in cubic meters/sq km and is calculated through the use of a metric coefficient (estimated height of houses) and a volumetric coefficient (estimated average volume of non-residential buildings).	Oliveira S., Felix F., Nunes A., Lourenço L., Laneve G., Lopez A., 2018
	Non-use rate of buildings	%	The rate of non-use of buildings is the percentage ratio of unused buildings to the total of buildings.	Urban index
	Per capita waste production	kg	Per capita waste production means the total quantity of urban waste produced in relation to the resident population.	Graziano P., Rizzi P., 2016
	Soil consumed per capita	m^2/inhab	Soil consumed per capita means the soil variation from a non-artificial to an artificial cover, in relation to the resident population.	Urban index
	Seismic hazard	Ag	Seismic hazard means a probabilistic indicator that indicates the expected ground shaking in a given site, with a certain probability of excess in a given time interval, or the probability that a certain shaking value occurs in a given interval of time.	Paul A., Deka J., Gujre N., Rangan L., Mitra S., 2019

ECONOMIC DIMENSION	SOCIAL DIMENSION	ENVIRONMENTAL/SETTLMENT DIMENSION
Vercelli	Vercelli	Vercelli
Alessandria	Alessandria	Alessandria
Unemployment rate (ISTAT, 2011)	Population density (ISTAT, 2011)	Soil consumed per capita (ISTAT, 2011)

Assessing the Territorial Vulnerability

1	Workshop 6 experts – 20 criteria	2	Elaboration by the Analyst	3	Expert interview
	Value functions generation		Standardization's proposals		Validation or Review

2. Examples of Criterion Maps.
3. Process developed for the generation of the value functions.

which a territorial system is likely to experience harm due to different types of threats, and the goal has been to provide reliable information for policy and decision making (Golobič, Breskvar Žăucery, 2010; Oppio *et al.*, 2015).

Description. The first step concerns the definition of a value tree. The vulnerability value tree was divided into the three territorial dimensions and some criteria for each dimension. The criteria were chosen on the basis of a literature review, in particular of Scopus scientific articles, selected with the keywords 'composite index' and 'vulnerability' and excluding the disciplinary sectors of Medicine and Energy. The final choice of criteria has been guided by the availability of data at a national scale, and according to the requirements of frequency, relevance and redundancy avoiding (table 1).

Spatial Analysis. This phase is the core of the elaboration and development of the whole process and it is aimed at supporting the strategy definition. The contribution is focused on explaining how the performances detected from the territory can be transformed into values and how a value-based approach can support the analysis of the territory and the definition of strategies and policies to support fragile territories in crisis.

Data have been collected by consulting official geoportals and websites. In order to be able to replicate the model in other territorial contexts, it has been judged strategic to select indicators available for all the Italian municipalities, which forces sometimes to involve some assumptions and simplifications. Most of the indicators have been defined and collected by browsing on the dataset developed by the funded project Urban Index – Indicatori per le Politiche Urbane born from the collaboration between the Italian Department for Planning and Coordination of Economic Policy (Dipartimento per la Programmazione e il Coordinamento della Politica Economica) and the Department of

Architecture and Urban Studies of Politecnico di Milano with the aim of providing useful tools for the definition and evaluation of public policies in urban areas. In addition to this source also ISTAT (National Institute of Statistics) and the Copernicus Atmosphere Monitoring Service (CAMS), provided by the European Union's Earth observation programme for the environmental criteria. The different dataset has been collected in the form of excel spreadsheet and in order to be spatialized and visualized on the map the table joins operations has to be performed on GIS software.

Figure 2 shows an example of the representation that is possible to obtain which convert the Source Maps (in this case excel spreadsheet) in Criterion Maps. Moreover, the visualization of data in graduated classes (minimum value and maximum value) allows to perceive the performance of each municipality.

Value functions for territorial vulnerability. In order to make the criteria comparable and to proceed with the aggregation to obtain the Value maps, the standardization has been developed and the value functions have been created. On the basis of Beinat (1997), value functions allow to analyze the criteria involved based on their meaning and not on their measures and since people are not used to elicit their preferences in this way, a specific interviewing process has to be organized in order to obtain analytical judgments. The generation of the value functions followed a threefold process which can be graphically appreciated in figure 3.

The first phase has been carried on within a workshop where experts, with very different skills ranging from mobility to cultural heritage, part of the Territorial Fragilities project – Department of Excellence program at DAstU, Politecnico di Milano, which are working on the territorial vulnerability, have been invited. The methodology selected to conduct the interview is the Evalue technique proposed by Demetriou *et al.* (2012). The workshop took
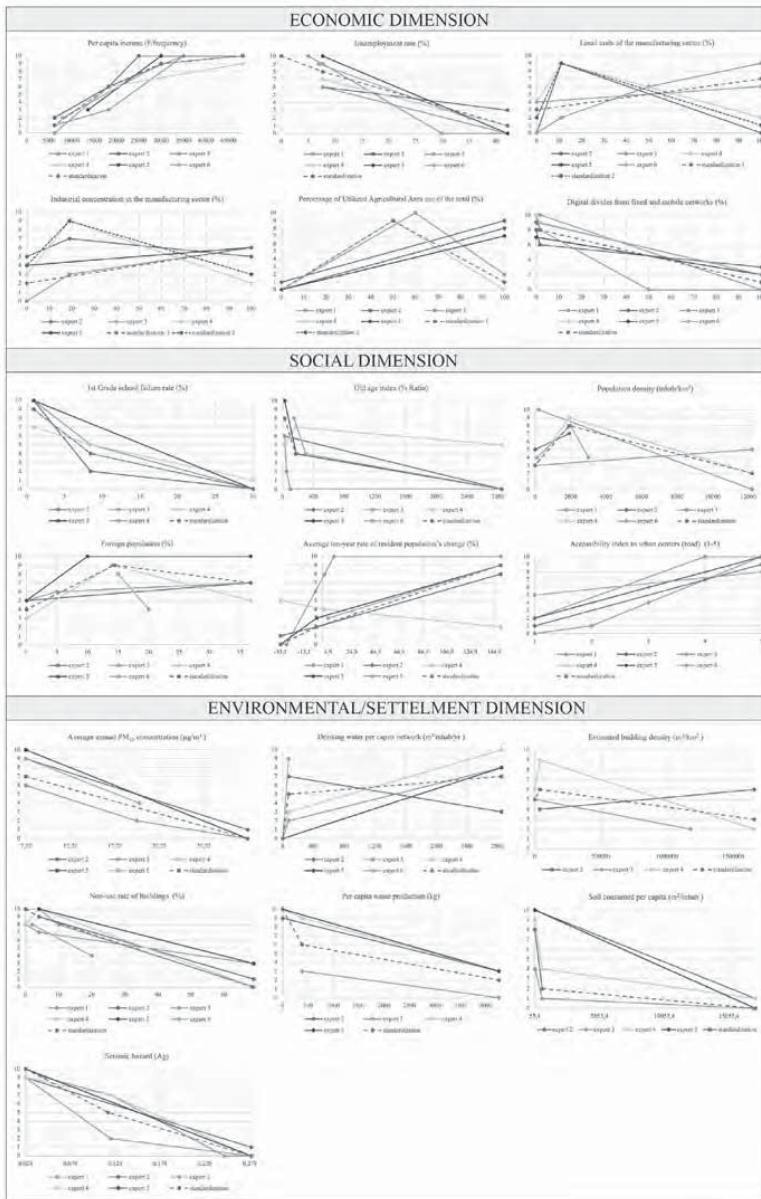
4. Results of the first two phases
of standardization.
Source: elaboration by the authors.

place on remote mode, given the pandemic situation, and experts have been asked to answer individually to the questions aimed at generating the value functions for each criterion. Moreover, it has been composed of different phases. After a general introduction where the objective of the research has been explained, paying attention on the process developed for the definition of the criteria set and its detailed description, the questionnaire has been presented. It is divided in several sections, namely Decision context, Objective of the interview, Dimensions and criteria, Method applied and a practical example where the steps required

for the generation of the value functions have been detailed:
1. *selection of a range and type of curve*: which performance score will you assign the highest value? which is the lowest?
2. *values assignment*: how does the curve behave for values beyond the established range? how does it behave for values in between?
3. *revision of the curve*: are you satisfied with the curve generated?
4. *consistency control*: is the curve coherent with your opinion about the criterion under evaluation?
After the explanation of the questionnaire which has been guided
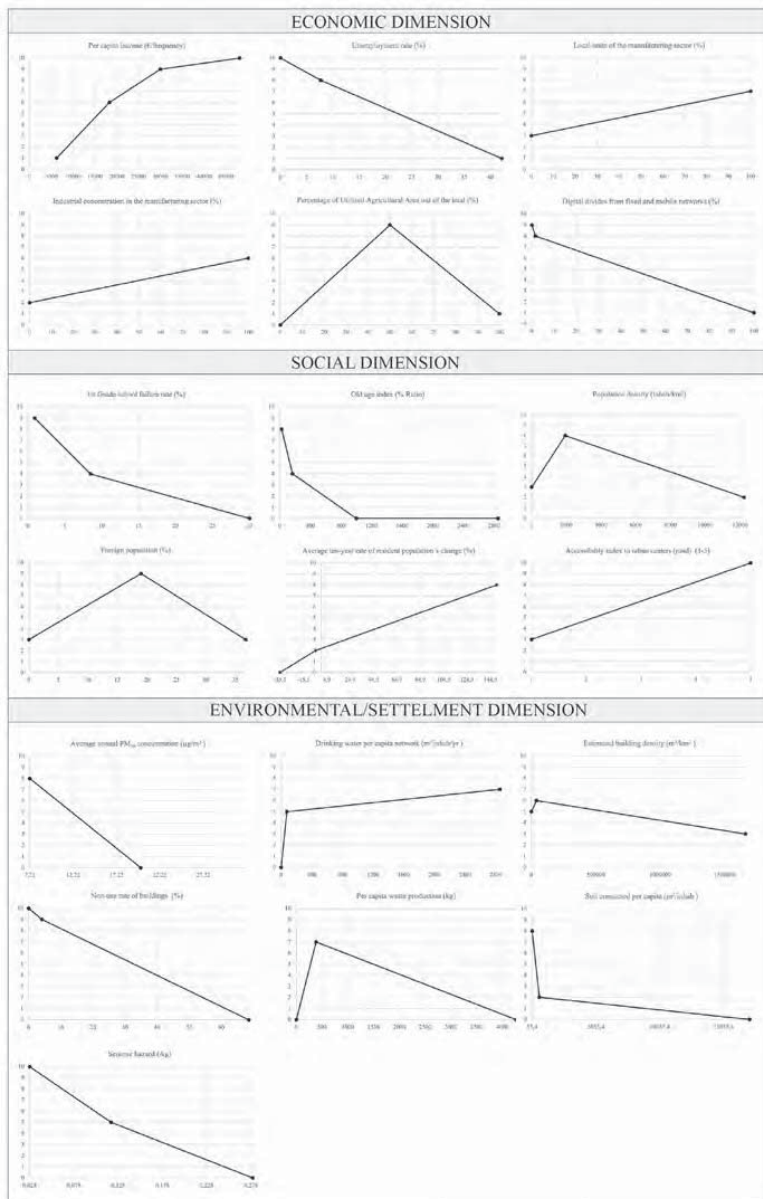
5. Validated Value functions.
Source: elaboration by the authors.

by three analysts, the experts could start to answer and create 20 value functions as the number of criteria included into the value tree. For each of the criteria, information has been provided regarding the minimum and maximum performance score obtained by Italian municipalities. At the end of the workshop, the answers of one expert have been shared with all the participants and discussed together.

The elaboration has been developed by the analysts which have combined the value functions generated during the workshop and the experts' opinion in order to obtain a final one for each criterion. For some criteria the process has been almost automatic, by considering the general trend of the answers, in other cases, given the high level of uncertainty two scenario have been proposed. Figure 4 presents the results of the first two phases aimed at generating the value functions, where the dashed line represents the elaboration of the analysts. When a common solution (compromise) could not be found, two standardizations are proposed. In agreement with the experts, the criterion Economic dynamism index has been delated since considered redundant.

Results

With the aim of validating the standardization proposed and elaborated by the analysts, a third phase has been developed consisting in asking to one specific expert for each criterion to review the value functions. At this stage, experts have been selected by considering their skills and knowledge on the fields under evaluation from academic professors and public agencies, namely economics, project appraisal, geography, urban planning, regional planning, risk assessment and hygiene and public health.

Interviews have been carried on individually and experts have been asked to validate only a precise number of criteria previously agreed according to their field of expertise. Most of the experts agreed with the function proposed and selected one of the scenarios generated (when a compromise has not been found) or slightly modified them. Figure 5 presents the final value functions resulted from the third phase and based on the opinion of experts.

Conclusions

The contribution presents the application of a hybrid methodological approach, aimed at supporting governance decisions regarding the allocation of resources, composed by a spatial analysis which combine the potentials of the MCDA within the GIS domain. The research proposes the partial results of the methods with a focus on the definition of value functions for Vulnerability evaluation.

One of the objectives of the approach proposed is the enhancement of the quality and the transparency of the decision-making process, especially when intangible and social values are part of the evaluation. The purpose persuade by the present contribution goes in the direction of the 'policy analytics' line of research which is based on the concept of constructive approach to support the decision process and not as a tool or a methodology (Tsoukias *et al.*, 2013; Meinard, Tsoukias, 2019; Meinard *et al.*, 2021). The first test of the hybrid methodological approach on the pilot case study has shown that the main requirements of policy analytics paradigm (Meinard *et al.*, 2021) have been achieved.

Furthermore, the MCDA combined with GIS allows to improve the transparency of each phase of the methodological process proposed by legitimating decisions in the public domain.

A future development could regard to reinforce participation for the value functions definition since at this stage of experimenting the effectiveness of the evaluation approach, both for the initial phases and for their validation, only experts have been interviewed. In the perspective, the involvement of multiple stakeholders and local communities could shed light on how people perceive territorial values and opportunities

Starting from marginal places to reconstruct their meaning through the activation of local resources is an opportunity opened by the shock of the pandemic from Covid-19, which has questioned the polarization of cities in favor of a rethinking of the local and peripheral dimension. So that this reflection is not limited to a theoretical exercise, forced by the suspension of concentration of activities and flows in urban areas, but becomes the new perspective for a more balanced territorial development, where it is essential to focus on values.

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