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A Multidimensional Evaluation Approach for the Natural Parks Design

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Abstract: The design of a natural park is generated by the need to protect and organize, for conservation and/or for balanced growth, parts of the territory that are of particular interest for the quality of the natural and historical–cultural heritage. The necessary tool to support the decision-making process in the design of a natural park are the financial and economic evaluations, which intervene in three successive steps: in the definition of protection and enhancement levels of the park areas; in the choice of the interventions to be implemented for the realization of these levels of protection and enhancement; in determining and verifying the economic and financial results obtainable from the project execution. This contribution deals with aspects and issues relating to the economic and financial evaluation of natural park projects. In particular, an application of the "Complex Social Value" to a concrete case of environmental design is developed on the basis of the elements that can be deduced from a feasibility study of a natural park: the levels of protection and enhancement of the homogeneous areas of the natural park are preliminarily defined, and the choice of the design alternative to be implemented is, therefore, rationalized with multicriteria analysis.

Keywords: complex social value; natural park design; environmental design; multicriteria analysis

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1. Introduction

The design of a natural park consists in the conception of a territorial system (park system) whose compositional and structural characteristics derive from a careful territory examination and its subdivision into homogeneous areas that constitute the park "subsystems". Within the individual areas, the activities are established on the basis of a summary judgment between the vulnerability degree and the social utility degree of the existing resources and emergencies.

The determination of the vulnerability degree involves multidisciplinary skills, which obviously depend on the nature and characteristics of the resources under study. The determination of the social utility degree is a specifically evaluative problem and can be summed up in the value that the community attributes to resources.

Since these are goods of a purely qualitative nature, not reproducible, belonging to the community and, therefore, by definition not exchangeable and capable of presenting values independent of use, the criterion of "complex social value" can be used for their valuation, corresponding to the "total economic value", grouping in its composition the preferences of all the subjects directly and indirectly involved in the formulation of the value judgment [1].

The complex social value synthesizes both economic needs and those that cannot be connected with objectives of pure efficiency. Therefore, it carries out a cognitive function aimed at revealing the multiple social expectations regarding increasingly scarce natural resources, whose use program, in the processes of territorial redevelopment or development, is aimed at a balanced qualitative–quantitative growth of the socio-economic and ecological–environmental components [2,3].

The search for the optimal degree of integration between various modes of growth cannot be separated from a composite evaluation set that can be formulated with a view to subjecting each sub-system to types of growth selected on "merit values" attributed by the community to existing resources.

Generally, it can be accepted that activities compatible with the objectives of exclusive protection must be localized in the subsystems that have a "high" complex social value. Any exceptions regarding the possibility of providing moderate forms of transformation of the environmental components can only be considered following a judgment of compatibility between the impacts originating from the transformation and the qualitative characteristics of the resources. Similarly, mixed objectives of protection and enhancement and objectives of mere enhancement may be pursued in areas that have a complex social value, respectively, "medium" and "low".

However, the classification of differentiated levels of value can only be carried out after having explained the various aspects of the complex social value of the resources and emergencies present in the park areas. This value, as is known, is given by the sum of two components: the "use value" and the "use-independent value". The use value is connected to the use of a certain resource and arises from the flow of collective utility consequent to the use, even indirect and current (vicarious value) or future (option value, bequest value), of the resource itself. The value independent of use, in turn, is represented by the so-called existence value, which depends solely on the fact that the resource "exists", regardless of its use/enjoyment of a direct and indirect type [1–4].

To express in economic terms the use value and the use-independent value of a resource, it is possible to consider various valuation methods.

In particular, the value associated with the direct use of a natural resource can be derived from a demand curve constructed through measures of willingness to pay or accept (direct methods), or by using "proxy" variables of value (indirect methods). The "willingness to pay" can also be used to express in economic terms the indirect use value and the rate of the complex social value independent by resource use. The valuation procedure generally applied is the Contingent Valuation (CV), which makes it possible to prefigure a hypothetical market for the asset, from which the value is deducted. The evaluation is thus carried out directly, without resorting to parameters that act as a proxy for the unknown value [5].

However, with economic evaluations only, it is not possible to express the various aspects of the complex social value of a resource. This is because some qualitative environmental components (i.e. the landscape, aesthetic, cultural or ecological) generally escape a monetary representation. It, therefore, becomes necessary, in order to correctly estimate the complex social value, to develop a disaggregated qualitative–quantitative evaluation with respect to a certain number of criteria.

The significance of the complex social value will obviously depend on the congruity of the individual assessments and the ability to compose them according to a multidimensional profile.

In order to define the protection levels and enhancement to be achieved in the park areas, it will then be necessary to identify a priority ranking among the sub-systems that takes into account the complex social value of each one. In this way, it will be possible to compare the different values attributed to the resources and emergencies present in the individual sub-systems, and subsequently to establish the methods of environmental protection to be implemented [2–4].

In the framework outlined, it must be said that among the major weaknesses of sustainable development is that it is not always possible to adequately measure the level of sustainability achieved by a particular activity or government/institution. There is a lack of knowledge on which environmental issues should be incorporated into the economic calculation and on how sustainability can be measured.

Sustainability is a multidimensional concept: the economic, social and environmental aspects must be considered simultaneously. This can be adequately considered through the complex social value, which is expressed through a set of multidimensional indicators. For this reason, the research question of the study consists of an attempt to combine the aspects of sustainability with assessments from the point of view of the community (economic, social, environmental), putting them in relation to each other.

2. Literature Review

With reference to decision-making processes, valuation systems can assume different meanings especially if they are related to spatial planning.

The issues with value in planning were examined by Campbell [6], who analyzed how planners can make ethical or qualitative judgements based on a critical understanding of the decision context considered.

Planning issues require evaluation methods based on complex value-focused thinking: this helps to articulate values, identify decision opportunities and create alternatives [7].

The ”complex social value” of a context and its resources was considered by Fusco Girard [8]. Further, this value expresses a system of immaterial relations, its specific character and identity [9].

Another concept of value complex was formulated by Zeleny [10], conceiving it as a metacriterion: an expression of a cognitive equilibrium integrated and rooted in specific contexts [11].

Complex systems can reflect only a specific subset of possible representations [12,13]; thus, the public-decision problems must be used to choose a definition of ”value” under an operational profile, although different policy goals may specify different aspects or definitions of value. Additionally, multiple values correspond to as many multiple forms of knowledge [14,15].

With regard to the importance of "social" decision making, the ways in which values, preferences and alternative knowledge are derived from interactions with the social environment, Larner and Le Heron highlighted the context of the decision-making environment, both in spatial and scalar terms [16].

Decisions based on complex values enable a better focus on the decision problem structure [17], where complex issues can also be complicated, not structured, difficult to manage or ambiguous [18–21].

Again, complex values are connected to the context and the decision framework, and they take shape through physical, environmental, social and economic environments [22].

With regard to the evaluation in planning, Alexander [23] focuses on the concept of planning-evaluation proposed by Lichfield [24]: evaluation is conceived as closely embedded in planning, evolving with it. Then, evaluation method evolution reflects the planning process interaction with the diversity and complexity of knowledge, favoring new approaches and methods focused on complex multimethod evaluation systems [23,25,26].

Among the applications of complex social value for the enhancement of ecosystems, the most representative studies are those of Sherrouse et Al. [27], Fulgencio [28] and Fagerholm et Al. [29]. In particular, Sherrouse et Al. [27] developed a tool to assess, map and quantify nonmarket values perceived by various groups of ecosystem stakeholders; this has two main objectives: evaluate how effectively the value index developed reproduces results from more common statistical methods of social-survey data analysis; examine how the spatial results provide additional information that could be used by stakeholders to better understand more complex relationships among stakeholder values, attitudes and preferences. Fulgencio [28] tries to clarify the understanding of social value in an innovation ecosystem, as a tool to aid science park orchestrators or managers to manage the expectations of social and nonsocial actors. Fagerholm et al. [29] synthesized the existing analysis methods applied to the data collected through participatory mapping approaches, with the aim to guide both novice and experienced practitioners in the field of participatory mapping.

However, in the examined studies, high attention should be paid to the fact that an assessment based solely on economic or social impacts does not always guarantee a fair integration of multidimensional values in the decision-making process, because it does not it take into account the many temporal phases of spatial context transformation.

3. Materials and Methods

The process of determining and evaluating strategic choices stimulates the search for increasingly objective systems and/or selection criteria that are not influenced by endogenous factors. This problem is particularly relevant if investment projects need to have public funding.

The constraints deriving from economic, social and environmental issues often contrast with the design needs, making choices influenced by value judgments indispensable. It is precisely in the need to make choices and in the opportunity to support them, even scientifically, that statistical tools are inserted, including multicriteria analysis.

Despite the great variety of multidimensional evaluation methods, they all have two elements in common: the existence of multiple evaluation criteria, often conflicting, for which there are different units of measurement; the possibility of a multidisciplinary approach [3,4].

A classification of multidimensional methods enables their subdivision into discrete multicriteria methods and continuous multiobjective methods.

Continuous methods can include an infinite number of choice possibilities (they concern the identification of the best choice within an infinite set of alternatives, given the pre-established constraints), while discrete methods take into consideration a finite and explicit number of feasible decision alternatives (actions, plans, interventions or projects that are alternative to each other). The latter, therefore, is better suited to be used downstream of evaluations when it is a question of comparing a finite number of opposing "alternatives".

The variety of tools offered by Multicrier Analysis includes techniques regulated by simple algorithms (dominance analysis, for example) and techniques that use more complex algorithms, among which the most frequently used are the Concordance Analysis and the Analytical Hierarchy Process (AHP). Other methods are the Electre method, the Evamix method and the Topsis method [30–39].

Giaoutzi and Nijkamp [35] gave, through an equilateral triangle diagram, a definition of sustainable development in which three dimensions are combined: economic, environmental and social. According to this triangle, sustainable development can be seen as a combination of the position of the economist, the opinion of the sociologist and the attitude of the environmentalist. Making choices will, therefore, mean recognizing and accepting priorities and through them favoring one position over another (establishing criteria).

In application practice, among the most used multicriteria evaluation procedures is the qualitative multicriteria analysis developed by Nijkamp [36–39], which is very useful, especially in the presence of little information on the effects of projects. This procedure consists in identifying classes of importance and effectiveness, then assigning preference scores and calculating how many times a given design alternative falls into a certain importance/effectiveness class. On the basis of the index found, a table of combined frequencies is constructed, in which each element indicates how many times a design alternative proves to be more or less effective and important. Although considered particularly easy to use, the Nijkamp method has the limit of establishing whether one project is better than another, but not to what extent, like any other method of qualitative evaluation.

4. Application of the Complex Social Value: Research Steps

After a preliminary overview of the territorial context of interest, the research phases can be summarized as follows:

1. Subdivision of the park area into homogeneous territorial zones (sub-systems) for morphological, utilization and anthropization characteristics;
2. Classification of homogeneous areas according to their complex social value;
3. Definition of the activities to be started for the constitution of the natural park on the basis of the classification referred to in point 1;
4. Identification of design alternatives;
5. Determination of the preferability order for the design alternatives.

4.1. Territorial Context

The system of the Picentini Mountains extends from the province of Avellino to that of Salerno, in Campania. It is bordered to the west by the Irno river valley, to the east by the Alto Sele valley, to the south by the plain of Battipaglia and to the north by the Ofanto river and the route of the ancient Via Appia. It is, therefore, placed between the "Neapolitan conurbation"—which is a dense urban and semi-urban agglomeration that extends continuously on the coastal strip between Cuma and the west of Naples, and Eboli and the south of Salerno—and the inland areas of Alta Irpinia. The Picentini Mountains include, in a landscape continuum of particular environmental interest, a set of reliefs and valley bottoms with evident and accentuated characteristics of morphological and landscape unity. The peaks of Monte Mai, Polveracchio, Calvello and Accelica are crowned by the higher reliefs, Mount Terminio (1783 m) and Mount Cervialto (1809 m). The system is rich in tall forests and spring waters, which give rise to the Sele, Ofanto, Calore, Sabato, Picentino and Tusciano rivers. The waters are partly used by hydroelectric plants and partly destined for drinking purposes in the Campania and Puglia regions. Of the entire system, the park area extends over approximately 14,000 hectares and is roughly delimited: to the east, by the administrative border of the "Valle dell'Irno" mountain community, coinciding with the ridge limit that determines the natural division and structural of the territory on two sides (western and eastern); to the north, west and partly to the south by the Salerno-Avellino highway and railway, which mark the border strip characterized by strong anthropization; to the south, for the portion not delimited by the highway, by the line of the road connecting the smaller towns. The land surrounding the inhabited centers is covered by vineyards, chestnut groves and mostly tree-lined arable land, managed in the direct economy by the farmers. The zootechnical activity, made up of sheep, goat and cattle breeding, is fragmented into small family farms and is constantly shrinking. The industrial initiatives are mainly located along the southern and western axes of the area, with tanneries in Solofra, spinning mills and small foundries in the valley areas. A good source of income is given by the production of wood and the small industries connected to it.

4.2. Homogeneous Territorial Zones

For the case study, the information relating to a feasibility study prepared for the enhancement of the park was used as a reference. In this reference, the park area is already divided into homogeneous zones. The subdivision was made on the elements collected with the specialist investigations carried out on the main environmental components of the park area:

- physical environment;
- Flora–vegetational–forest environment;
- Wildlife environment;
- Historical–cultural and anthropic environment.

The homogeneous areas identified have the following denominations and characteristics:

- Zone A—Area of natural environment. It includes the cacuminal belt of the mountains above the chestnut area and the areas of difficult access between mounts, where environmental resources are in almost optimal conditions.
- Zone B—Area of semi-natural environment. It includes the influence the area of a water basin. This area constitutes a defined and limited ecosystem, and it is characterized by an environmental balance determined by careful resource use. It falls within

the belt of the mainly western mountain slope, of pre-eminent landscape interest due to the scenery effect it produces on the inhabited centers located along the foothills.

- Zone C—Area of agro-forestry and agricultural environment. It includes the flat areas that extend around the inhabited centers, as well as the foothills and the valley floors, which, due to orographic characteristics, allow agricultural land use.
- Zone D—Area of urban environment. It includes the inhabited centers falling within the natural park perimeter.

The definition of these zones is consistent with the indications provided by European Community for the harmonization, at European level, of the zoning system for protected areas.

The percentage distribution of the 14,000 hectares that make up the park area among the homogeneous areas is identified as follows:

- Zone A: 12.70%;
- Zone B: 32.40%
- Zone C: 33.60%;
- Zone D: 21.30%.

Tables 1–4 show the summary data relating to the environmental heritage and production activities present in the study area.

Table 1. Naturalistic and anthropic emergencies.

Zone	Location	Naturalistic Emergencies	Monumental–Artistic Emergencies
A	Calvanico	Presence of fossils	Church of San Michele
	Pizzo San Michele		-
	Serre of Torrione		
	Mount Monna		
	Faggeto Valley	Beech forest, limestone ridges of Pizzo San Michele (1576 mt.) and Mount Mai (1607 mt.)	
B	Candelito Valley	-	Paleolithic finds 40,000 A.C.
	Fisciano		
	Prepezzano	Eastern edge of tectonic faults	Convent of San Michele
	Angel Cave	Natural caves	-
	Bad Cave		
C	Macchione	-	Villa Rustica II sec. A.C., San Cipriano Picentino Castle, Medieval settlements
	Mount Vetrano		
	Campo di Valle	Presence of fossils	-
	Castiglione dei Genovesi		Villa I sec. D.C.
	Mount Tubenna	-	Convent
	Pezzano		Mount Tubenna
D	Passatoia	-	Italic tombs V sec. A.C.
	Pozzillo		Imperial Villa II sec. D.C.
	Calvanico		Churh of San Salvatore XVII sec.
	Prepezzano		Cathedral with San Nigia Tower
	Fisciano		Convent of Capuchins
	Solofra		Collegiata of San Michele, Baroque cathedral XVII sec., Castle of Rota, Old tanneries of the early industrial period

Table 2. Flora and wildlife present in the park area.

Zone	Main Flora–Vegetational–Forest Presences	Main Wildlife			
		Mammals	Amphibians	Reptiles	Birds
A	Beech	Marten	-	-	Pregrine Falcon, Landrio
	Chestnut	Weasel			Buzzard
	Holm oak	Badger			Hoopoe
	Aquilina fern	Wolf			Cotressola
B	Oak	Surnottolo	-	Orbettina	Codirosso
	Cerro			Biacco	Frosone
	Chestnut	Flour			Sorpone
C	Orniello	-	Tree frog	Cervone	Taccola
	Hornbeam		Fire salamander	Grass snake of the collar	Zigolo
D	-	-	-	-	-

Table 3. Land use and productive activities.

Zone	Land Use	Productive Activities
A	Prevalence of woods, chestnut and beech woods, grazing and bushy pasture	Agriculture
B	Woods, chestnuts, hazelnuts and beeches, with the presence of specialized crops: citrus and olive groves; grazing and bushy pasture	
C	Prevalence of arable land and specialized crops: citrus and olive groves; grazing and bushy pasture	Agriculture and farming
D	Prevalence of arable land and specialized crops: citrus and olive groves	Agriculture and farming, industrial activities: light manufacturing and tanneries

Table 4. Land use and productive activities.

Zone	Location	Mining Activities	Landfills
A	Calvanico	Fossils	Illegal landfills
	Costa Grande	-	Landfill of municipal solid waste
B	-	-	-
C	Rocca dell'Aquila	Disused quarry	-
	Fisciano	-	Landfill of municipal solid waste
D	San Cipriano Picentino	Active quarry	-

4.3. Protection Levels: Classification of Homogeneous Areas

The complex social value enables the measure of the protection degree to be achieved in the individual park areas. It must, therefore, be determined for each homogeneous zone. The comparison of the results leads to the ranking and classification of the zones: zones with the highest complex social value are those in which it is preferable not to carry out any transformation; for areas with a lower complex social value, modifications of the use characters may be envisaged.

Multicriteria qualitative–quantitative analysis was applied to estimate the complex social value for the single homogeneous zones.

Based on the reference literature [30–45], the criteria considered are the following:

- C1. landscape/perceptual quality;
- C2. archaeological/cultural quality;
- C3. vegetation quality;
- C4. wildlife quality;
- C5. quality of production activities;
- C6. accessibility.

Criteria C1 to C4 reflect the "intrinsic" quality of the area (value independent of use); C5 and C6 reflect the "extrinsic" quality (use value). The indicators selected to express the chosen criteria are:

- I1. level of presence in the area of sites with particular aesthetic value;
- I.2. state of archaeological/cultural emergencies;
- I.3. level of presence of flora–vegetational species with particular interest and rarity;
- I.4. level of presence of rare wildlife species;
- I.5. average annual income produced in the area;
- I.6. average market price of land with the same destination than that prevailing in the area.

The assessments corresponding to indicators I1 to I4 are based on an ordinal scale. The assessments relating to I5 and I6, as they are of an economic type, are based on a cardinal scale.

The assessment summary, with respect to the selected criteria, is shown in Table 5, whose rows explain the complex social values for the four homogeneous areas between which the study area was divided.

Table 5. Summary of complex social value with respect to the selected criteria.

Zone	C1	C2	C3	C4	C5	C6
A	4	2	3	4	2	1
B	3	2	3	3	2	2
C	2	3	2	2	3	2
D	1	4	1	1	4	3

The value judgments contained in Table 5 are expressed through ordinal numbers ranging from 1 to 4, with 1 and 4 equal to the minimum and maximum values, respectively. The attribution of the values corresponding to the criteria from C2 to C6 did not cause difficulties, as it was possible to obtain the results of specialist surveys on the main environmental components of the park area. The definition of the value relating to criterion C1 was more complicated due to the scarce information available. However, this latest information has been integrated with data from a survey carried out through interviews.

Additionally, economic assessments are expressed in ordinal scale, since the multicriteria analysis purpose is to define an ordering of the areas, a ranking according to their complex social value. To define the priority order of the homogeneous zones, it is necessary to assign a "weight" to each of the considered evaluation criteria. Each combination of weights corresponds to a different sorting of the zones. It is, therefore, a question of identifying an overall ranking that takes into account all the possible weighting systems of the criteria.

The overall ordering of the park areas for the possible weight combinations was obtained with the regime analysis developed by Nijkamp and Hinloopen [36,37]. In fact, the regime analysis makes it possible to determine the overall priority of the park areas even if only ordinary information is available.

Table 6 shows the zones ordering according to the attributions (w_k) of different weights to the six evaluation criteria considered. The weights are expressed using ordinal numeric symbols.

Table 6. Zones ordered according to the weight attributions.

Weights						Zone			
w1	**w2**	**w3**	**w4**	**w5**	**w6**	**A**	**B**	**C**	**D**
1	2	3	4	5	6	4	3	1	2
6	1	2	3	4	5	4	3	1	2
5	6	1	2	3	4	4	3	1	2
4	5	6	1	2	3	4	2	1	3
3	4	5	6	1	2	4	3	1	2
2	3	4	5	6	1	3	2	1	4

Table 6 highlights that zone A was the one that presented, in almost all cases, the highest preferability and, therefore, the highest complex social value. The preference for zone B was slightly lower, then zone D followed and, finally, zone C, which in all cases had the lowest preference. This priority ranking did not change when we set (w1 = w2 = w3 = w4) > (w5 = w6), and when w1 = w2 = w3 = w4 = w5 = w6 also, assuming that the different criteria have the same weight for the purposes of the overall assessment of each area. The priority order of the park areas, on the other hand, varied substantially when the highest importance was attributed to criterion C5. In this last case, the area that presented the greatest preferability was D. This was also confirmed when we assumed (w5 = w6) > (w1 = w2 = w3 = w4), i.e., when greater importance was assigned to the criteria that expressed the "extrinsic" quality (use value) of the park areas.

The overall priority of the homogeneous zones identified in the park area is, therefore, the following:

- Zone A: 4;
- Zone B: 3;
- Zone C: 1;
- Zone D: 2.

The above classification represents the least “sensitive” ranking to variations in the weighting system of the evaluation criteria. In it, zone A, “natural environment”, was the one with the highest complex social value, in which it is appropriate to preserve or increase the naturalistic values, excluding any type of transformation. The complex social value of zone B, “semi-natural environmen”, was lower, for which a generalized protection must consequently be envisaged, which can result in the inhibition of activities that involve irreversible ecosystems modifications. In zones D, “urban environment”, and C, “agro-forestry and agrarian environment”, with a complex social value, medium and low transformations, respectively, can be introduced, whose impacts are not incompatible with the qualitative components of the area (natural, historical and cultural resources).

4.4. Activities Planned for the Natural Park Establishment

The knowledge of the protection degrees assigned to the homogeneous zones of the park area allows us to establish the types of activities that can be carried out in them.

These activities are indicated in Table 7 in the form of active and passive requirements for the individual zones.

Table 7. Activities that can be implemented for the establishment of the park and positive or negative prescriptions for the individual homogeneous areas (+ permitted activity, − prohibited activity).

Activities	Zone			
	A	B	C	D
Construction of buildings and products in general	−	−	+	+
Construction of new infrastructures	−	−	+	+
Installation of visual technological systems	−	−	+	+
Construction of systems for collective and/or tourist use	−	+	+	+
Use of synthetic fertilizers	−	−	+	+
Withdrawals from surface or underground water bodies	−	−	+	+
Traffic and vehicle parking	−	+	+	+
Collection of minerals for production purposes	−	+	+	+
Modification of water regulation, riverbeds, or reservoirs	−	−	+	+
Extension and adaptation of driveways	−	+	+	+
Crop transformations	−	−	+	+
Reforestation	−	+	+	+
Exploitation of hydrothermal and mineral springs	−	+	+	+
Agronomic practices	−	+	+	+
Farming	−	+	+	+
Industrial activities	−	−	+	+

4.5. Design Alternatives

The design alternatives for the study area were defined by taking into account indications contained in the Territorial Urban Plan of the Mountain Community "Valle dell'Irno", and proposals made by local public administrations and authorities, as well as by naturalistic associations.

The types of intervention hypothesized are compatible with the activity categories that can be implemented in the homogeneous areas.

Three design alternatives were considered.

Articulated into types of intervention that compose them, the design alternatives are indicated in Table 8.

Alternative 1 is the one that most closely matches the status quo. The planned interventions essentially refer to environmental protection (environmental control and restoration) and resource use. The interventions related to resource use are aimed mainly to satisfy a demand with naturalistic reasons.

Alternative 2 provides, in close connection with the protection measures necessary to safeguard the natural environments present in the park area, a set of resource enhancement interventions, aimed at encouraging the correct use of resources by visitors because they exercise demand segments with multiple motivations (naturalistic, cultural, sporting, recreational, etc.).

Alternative 3 differs from the previous ones because it aims to increase, to a greater measure than the others, the production capacity of the park area, enhancing its potential through support structures for existing economic activities and through the promotion of new productive activities.

Table 8. Summary of design alternatives: green cells represent the possibility of admitting the intervention in the area.

Type of Intervention	Alternative 1 (Zones)				Alternative 2 (Zones)				Alternative 3 (Zones)			
	A	B	C	D	A	B	C	D	A	B	C	D
Pollution control and monitoring	X	X			X	X			X	X		
Quarry restoration			X	X			X	X			X	X
Landfill remediation		X	X			X	X			X	X	
Faunistic farms											X	
Animal shelters					X	X				X		
Equipped green areas							X	X			X	X
Horse riding routes						X						
Nature trails		X	X		X	X	X			X	X	
Naturalistic observers		X			X	X				X		
Food points							X			X	X	X
Hilly lakes						X						
Support structures for zootechnics											X	
Areas equipped for grazing						X						
Harvesting center for agricultural products											X	
Chestnuts processing and marketing plant											X	
Social center for the elderly								X				
Visitor and information center				X			X	X			X	X
Museum of the territory							X					
Laboratory for scientific and didactic activities						X						
Parking lots							X				X	X
Signage	X	X			X	X						
Typical products promotion center						X						
Forest trails						X						
Camping							X					
Hotel											X	
Pension											X	
Horse riding facilities						X						
Oil mill												X

4.6. Order of Preferability for the Design Alternatives: Optimal Alternative Choice

A priority ranking among design alternatives must be constructed by first evaluating each alternative with respect to defined criteria and objectives. The alternative ordering is then determined with the application of specific multicriteria analysis, after assigning weights to the criteria/objectives considered.

The design alternatives defined for the park area under study were evaluated using the following criteria:

- Environmental protection criterion. This searches for the solution that minimizes the loss or compromise of resources and irreproducible emergencies. To make this criterion operational, an indicator of the consistency of environmental resources that will be destroyed or compromised with the project realization must be used.
- Ethical/social criterion. This is the result of searching for the solution that produces the highest increase in occupation degree in the gravitation area of the park. The increase in the number of employees produced by the activities in the park area with the project realization should be taken as an indicator of this.
- Criterion of economic valorization territory. This can be expressed through the solution searching which corresponds to the highest economic benefit for the community. The internal economic rate of return of the project can be used as an indicator of this.
- In other words, for the park area considered, the identification of the optimal alternative must be achieved with the search of the design solution capable of minimizing the environmental cost and, at the same time, maximizing the social and economic benefits.

In the application of the above criteria, both the environmental cost and the social and economic benefit were envisaged for each alternative outlined.

The evaluation result is shown in Table 9. The latter table is an ordinal impact matrix with indexes ranging from 1 to 3 (1 is the minimum preferability; 3 is the maximum preferability).

Table 9. Order of preferability for the design alternatives.

Alternatives	Minimum Environmental Costs	Maximum Social Benefits	Maximum Economic Benefits
1	3	1	1
2	2	2	2
3	1	3	3

Additionally, for the definition of the overall priority of the three design alternatives, the regime analysis developed by Nijkamp and Hinloopen was applied, already used in the analysis to define the ordering of the homogeneous areas identified in the park area.

Table 10 shows the preferability rankings of the alternatives according to the possible ordinal systems of weighting of the criteria.

Table 10. Preferability rankings of the design alternatives taking into account the possible ordinal systems of weighting of the criteria.

Weights			Alternatives		
w1	**w2**	**w3**	**1**	**2**	**3**
2	2	2	1	2	3
3	2	1	2	1	3
3	1	2	2	1	3
2	3	2	1	2	3
1	3	2	1	2	3
2	3	1	2	1	3
2	2	3	1	2	3
1	2	3	1	2	3
2	1	3	1	2	3
3	3	2	1	2	3
2	3	3	1	2	3
3	2	3	1	2	3

Alternative 3 expressed the highest preferability, and therefore, the highest complex social value, in correspondence with every possible combination of weights assigned to the three project objectives. In general, Alternative 2 was less preferable, followed by Alternative 1. The latter became preferable to Alternative 2 when the greatest importance was assigned to the objective of reducing the environmental cost, i.e., when the objective of greater importance was the maximization of social benefits. In all other cases, Alternative 1 was less preferable than Alternative 2. This was also confirmed when we set w1 = w2 = w3.

The ordering representing the overall priority of the project alternatives hypothesized for the park area is, therefore: Alternative 1 equal to overall priority 1; Alternative 2 equal to overall priority 2; Alternative 3 equal to overall priority 3.

The highest overall priority was expressed by Alternative 3, which consequently constitutes the design solution capable of optimally integrating environmental protection objectives with the objectives of social and economic enhancement of the territory. Alternatives 2 and 1 are less preferable, the reciprocal position of which in the system may nevertheless undergo changes in the event that environmental and ethical/social considerations require less importance to be attributed to the objective of economic development of the territory.

5. Concluding Remarks

The management of sustainable development is an open and current issue.

In the design of natural parks, the examination and definition of the compatibility between qualitative and quantitative growth profiles of the park system, as well as the intervention choice to be implemented to achieve the protection level and enhancement of resources, involve a necessary expansion of the evaluation framework and parameters.

A balanced and sustainable development strategy of the park area implies, in fact, the search for solutions capable of satisfying diversified needs, attributable to economic needs and to aspects more directly related to ecological and social quality. Consequently, the use of evaluation methodologies that lead above all to the identification of the different components of the value of the resources and then to the analysis of the interdependencies between components is indispensable in order to group them according to a multidimensional scheme. A scheme that adequately reconnects, in order to arrive at an overall result, economic, social and environmental valuations.

The complex social value collects the variables of different nature that form the value of the resources and emergencies present in the area delimited for the constitution of the park. It reflects the weight of the economic, ethical–social and ecological variables of the resources being evaluated. Therefore, it understands and expresses the multiple expectations of the community with regard to the use of natural and historical–cultural resources within the planning and implementation processes of the reorganization and growth projects of the territory.

However, the application of the complex social value cannot ignore the multicriteria analysis—the evaluation techniques belonging to this family—taking into account the plurality of quantitative and qualitative components that make up the value of environmental resources. These techniques also make it possible to recognize and explain at qualitative–quantitative scales the complex of direct and indirect impacts that can be generated by possible interventions in the economic, social and ecological contexts of reference. Unlike traditional evaluation techniques, they appear to be capable of translating, in a global judgment, the multidimensionality of the aspects and the interdependence of the variables on which the choice of the solutions to be implemented depends in optimal terms.

The prospects for the use of "complex" assessments—undoubtedly linked to the development of landscape planning but even more, in general, to the implementation of planning and requalification policies of the territory—are nevertheless still conditioned by the inadequacy of methodological tools. This concerns, in particular, the processing of data and the objectification of information of a qualitative nature, as well as, above all, the problem of assessing "environmental quality".

Some limitations of the approach used in this study are represented by the regulations in force in natural parks and protected areas. Each individual country can provide a legislation that has the defect of sometimes being confused with respect to the European Community legislation or directives from worldwide coordination authorities, although in recent years, there has been numerous legislative novelties on the subject. National regulations can in fact be based on a purely static–conservative conception of the wooded and natural heritage, rather than based on operations to safeguard and transform the soil, as well as to protect the environment. Furthermore, the regulation of protection and enhancement activities, within the individual areas to be protected, may or not enable the establishment of specific management authorities, which, among other things, have the task of harmonizing protection plans and actions with territorial planning guidelines. These are all issues that, very often, determine conflicting aspects between environmental protection and economic operators involved in the processes of territorial transformation and redevelopment.

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References

1. Forte, F.; Girard, L.F.; Nijkamp, P. Smart Policy, Creative Strategy and Urban Development. *Stud. Reg. Sci.* **2006**, *35*, 947–963. [CrossRef]
2. Forte, F.; Girard, L.F. Creativity and new architectural assets: The complex value of beaty. *Int. J. Sustain. Dev.* **2009**, *12*, 160–191. [CrossRef]
3. Del Giudice, V.; De Paola, P.; Forte, F. Valuation of historical, cultural and environmental resources, between traditional approaches and future perspectives. In *Green Energy and Technology*; Springer: Berlin/Heidelberg, Germany, 2018; pp. 177–186.
4. Forte, F.; Del Giudice, V.; De Paola, P.; Del Giudice, F.P. Cultural heritage and seismic disasters: Assessment methods and damage types. In *Green Energy and Technology*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 163–175.
5. Manganelli, B.; Vona, M.; De Paola, P. Evaluating the cost and benefits of earthquake protection of buildings. *J. Eur. Real Estate Res.* **2018**, *11*, 263–278. [CrossRef]
6. Campbell, H. Planning: An idea of value. *Town Plan. Rev.* **2002**, *73*, 271–288. [CrossRef]
7. Girard, L.F.; Cerreta, M.; De Toro, P.; Forte, F. The human sustainable city: Values, approaches and evaluative tools. In *Sustainable Urban Development. The Environmental and Assessment Methods*; Deakin, M., Mitchell, G., Nijkamp, P., Vreeker, R., Eds.; Routledge: London, UK, 2007; Volume 2, pp. 65–93.
8. Girard, L.F. *Risorse Architettoniche e Culturali: Valutazioni e Strategie di Conservazione*; FrancoAngeli: Milano, Italy, 1987.
9. Girard, L.F.; Nijkamp, P. *Energia, Bellezza e Partecipazione: La Sfida della Sostenibilità. Valutazioni Integrate tra Conservazione e Sviluppo*; FrancoAngeli: Milano, Italy, 2004.
10. Zeleny, M. Multiple criteria decision-making: Eight concepts of optimality. *Hum. Syst. Manag.* **1998**, *17*, 97–107.
11. Zeleny, M. *Human Systems Management: Integrating Knowledge, Management and Systrems*; World Scientific Publishers: Hackensack, NJ, USA, 2005.
12. Giampietro, M.; Allen, T.F.H.; Mayumi, K. Science for governance: The implications of the complexity revolution. In *Interfaces between Science and Society*; Gutmaraes-Pereira, A., Guedes-Yaz, S., Tognetti, S., Eds.; Greenleaf Publishing: Sheffield, UK, 2006; pp. 82–99.
13. Munda, G. *Social Multi-Crireria Evaluarion for a Sustainable Economy*; Springer: Berlin/Heidelberg, Germany, 2008.
14. Funtowicz, S.O.; Martinez-Alier, J.; Munda, G.; Ravetz, J. Multi-criteria-based environmental policy. In *Implementing Sustainable Development*; Abaza, H., Baranzini, A., Eds.; UNEP/Edward Elgar: Cheltenham, UK, 2002; pp. 53–77.
15. Munda, G. Social multi-criteria evaluation: Methodological foundations and operational consequences. *Eur. J. Oper. Res.* **2004**, *158*, 662–677. [CrossRef]
16. Larner, W.; Le Heron, R. The spaces and subjects of a globalising economy: A situated exploration of method. *Environ. Plan. D Soc. Space* **2002**, *20*, 753–774. [CrossRef]
17. Mingers, J.; Rosenhead, J. *Rational Analysis for a Problematic World Revisited: Problem Structuring Merhods for Complexity, Uncertainty and Conflict*; Wiley: Chichester, UK, 2001.
18. Cats-Baril, W.L.; Huber, G.P. Decision support systems for III-structured problems: An empirical study. *Decis. Sci.* **1987**, *18*, 350–372. [CrossRef]
19. Rittel, H.; Webber, M. Dilemmas in a general theory of planning. *Policy Sci.* **1973**, *4*, 155–169. [CrossRef]
20. Rosenhead, J. Controversy on the streets: Stakeholder workshops on a choice a carnival route. In *Planning under Pressure: The Strategic Choice Approach*; Friend, J., Hickling, A., Eds.; Butterworth-Heinemann: Oxford, UK, 2005; pp. 298–302.
21. Schon, D.; Rein, M. *Frame Reflection: Toward the Resolution of Intractable Controversies*; Basic Books: New York, NY, USA, 1994.
22. Strauss, K. Re-Engaging with rationality in economic geography: Behavioural approaches and the importance of context in decision-making. *J. Econ. Geogr.* **2008**, *8*, 137–156. [CrossRef]
23. Alexander, E.R. (Ed.) *Evaluation in Planning. Evolution and Prospects*; Ashgate: Aldershot, UK, 2006.
24. Lichfield, N. *Community Impact Evaluation*; UCL Press: London, UK, 1996.
25. Deakin, M.; Mitchell, G.; Nijkamp, P.; Vreeker, R. (Eds.) *Sustainable Urban Development. The Environmental Assessment Merhods*; Routledge: London, UK, 2007; Volume 2.
26. Miller, D.; Patassini, D. (Eds.) *Beyond Benefit Cost Analysis. Accounting for Non-Market Values in Planning Evaluation*; Ashgate: Aldershot, UK, 2005.
27. Sherrouse, B.C.; Semmens, D.J.; Clement, J.M. An application of Social Values for Ecosystem Services (SolVES) to three national forests in Colorado and Wyoming. *Ecol. Indic.* **2014**, *36*, 68–79. [CrossRef]
28. Fulgencio, H. Social value of an innovation ecosystem: The case of Leiden Bioscience Park, The Netherlands. *Int. J. Innov. Sci.* **2017**, *9*, 355–373. [CrossRef]

29. Fagerholm, N.; Raymond, C.M.; Olafsson, A.S.; Brown, G.; Rinne, T.; Hasanzadeh, K.; Broberg, A.; Kyttä, M. A methodological framework for analysis of participatory mapping data in research, planning, and management. *Int. J. Geogr. Inf. Sci.* **2021**, 1–28. [CrossRef]
30. Ribera, F.; Nesticò, A.; Cucco, P.; Maselli, G. A multicriteria approach to identify the highest and best use for historical buildings. *J. Cult. Herit.* **2020**, *41*, 166–177. [CrossRef]
31. Guarini, M.R.; Morano, P.; Sica, F. Historical school buildings. A multicriteria approach for urban sustainable projects. *Sustainability* **2020**, *12*, 1076. [CrossRef]
32. Guarini, M.R.; D'Addabbo, N.; Morano, P.; Tajani, F. Multi-criteria analysis in cmpound decision processes: The AHP and the architectural competition for the Chamber of Deputies in Rome (Italy). *Buildings* **2017**, *7*, 38. [CrossRef]
33. Morano, P.; Locurcio, M.; Tajani, F.; Guarini, M.R. Fuzzy logic and coherence control in multi-criteria evaluation of urban redevelopment projects. *Int. J. Bus. Intell. Data Min.* **2015**, *10*, 73–93. [CrossRef]
34. Saaty, T.L.; De Paola, P. Rethinking Design and Urban Planning for the Cities of the Future. *Buildings* **2017**, *7*, 76. [CrossRef]
35. Giaoutzi, M.; Nijkamp, P. *Decision Support Models for Regional Sustainable Development*; Avebury: London, UK, 1994.
36. Nijkamp, P.; Hinloopen, J. A sensitivity analysis of multicriteria choice methods. *Energy Econ.* **1989**, *11*, 293–300.
37. Nijkamp, P.; Hinloopen, J. Qualitative multiple criteria choice analysis. *Qual. Quant.* **1990**, *24*, 37–56.
38. Girard, L.F.; Nijkamp, P. *Le Valutazioni per lo Sviluppo Sostenibile Della Città e del Territorio*; Franco Angeli: Milano, Italy, 1997.
39. Nijkamp, P.; Rietveld, P.; Voogd, H. *Multicriteria Evaluation in Phisical Planning*; North Holland: Amsterdam, The Netherlands, 1990.
40. Del Giudice, V.; De Paola, P. Undivided real estate shares: Appraisal and interactions with capital markets. *Appl. Mech. Mater.* **2014**, *584–586*, 2522–2527. [CrossRef]
41. Del Giudice, V.; De Paola, P. The effects of noise pollution produced by road traffic of Naples Beltway on residential real estate values. *Appl. Mech. Mater.* **2014**, *587–589*, 2176–2182. [CrossRef]
42. Del Giudice, V.; De Paola, P.; Del Giudice, F.P. COVID-19 Infects Real Estate Markets: Short and Mid-Run Effects on Housing Prices in Campania Region (Italy). *Soc. Sci.* **2020**, *9*, 114. [CrossRef]
43. Del Giudice, V.; Massimo, D.E.; De Paola, P.; Del Giudice, F.P.; Musolino, M. Green buildings for post carbon city: Determining market premium using spline smoothing semiparametric method. In *Smart Innovation, System and Technologies*; 178 SIST; Springer Nature: Berlin, Germany, 2021; pp. 1227–1236.
44. De Paola, P.; Del Giudice, V.; Massimo, D.E.; Del Giudice, F.P.; Musolino, M.; Malerba, A. Green buildings market premium: Detection through spatial analysis of real estate values. A case study. In *Smart Innovation, System and Technologies*; 178 SIST; Springer Nature: Berlin, Germany, 2021; pp. 1413–1422.
45. Del Giudice, V.; De Paola, P.; Bevilacqua, P.; Pino, A.; Del Giudice, F.P. Abandoned Industrial Areas with Critical Environmental Pollution: Evaluation Model and Stigma Effect. *Sustainability* **2020**, *12*, 5267. [CrossRef]