

## Article

# Waste Landscape: Urban Regeneration Process for Shared Scenarios

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**Abstract:** The theme of urban redevelopment and regeneration has long been a priority in the international debate and current practices in the field of urban policies and strategic programs for sustainable development, implemented according to the circular economy model. In the contemporary city, there are fragments of unused, residual, abandoned landscapes, defined as “Waste LandScapes” which are the natural consequence of the metabolic process of growth and development of cities, both for the incompatibility of their original use and for the loss of their economic value. These waste landscapes, if inserted in virtuous processes of urban redevelopment, have a great intrinsic value and a considerable regenerative potential, capable of triggering virtuous development processes, not only on an urban scale but also on a territorial level. In this context, the research applied to a degraded area located on the edge of the historic center of Catanzaro (Italy) illustrates an adaptive and multi-methodological, inclusive and site-specific evaluation process, useful to support decision-makers in the selection of a shared scenario, evaluated both in multi-group and multi-criteria terms, capable of generating benefits in terms of cultural enhancement, social inclusion and economic development for a circular city.



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**Keywords:** waste landscape; urban regeneration; circular economy; shared scenarios; multi-criteria decision analysis; NAIADE; PROMETHEE

## 1. Introduction

In the contemporary city it is possible to find fragments of unused, residual, abandoned landscape, defined as “wastescape”. They can be recognized in abandoned areas, polluted territories, interstitial areas, waiting areas, terrain vague or drosscape [1]. These landscapes share the fact that they physically belong to the city, but cut off from the active life of the city, excluded or marginalized with respect to the completion of its metabolic cycles, due to the incompatibility of their use with the urban reality or for the loss of their economic value. “Waste LandScapes” (WLS) [2,3], if inserted in virtuous processes of urban redevelopment, have a great intrinsic value and a considerable regenerative potential, capable of triggering virtuous development processes. The WLS are hybrid urban areas on the border between urban centers and rural areas, which do not have a negative intrinsic value but a characteristic specificity, a natural consequence of the growth and development process of the city and its metabolism. The WLS, if properly valued, constitute the main potential places where it is possible to activate processes of economic, social, urban, and environmental regeneration not only on an urban scale but also on a territorial level.

In this context, public bodies, at different levels, have tried to develop and implement policies aimed at regenerating cities through the support and activation of new forms of production and social aggregation. The prerogative of these policies is the regeneration of places that have fallen into disuse and in a state of neglect and their transformation into new hubs of interactions and actions.

In line with the idea that cultural heritage constitutes “a strategic resource for the society of the future and for the economy, rather than a passive stock” [4], urban regeneration

policies have tried to combine the recovery architectural to the activation of relationships and activities around the spaces brought to a “second life”. This connection between the architectural/restorative dimension and the social/productive one represents a priority objective of the experiences that have developed both in large metropolitan areas, located in the center of territories in full economic development and in small ones located in marginal areas with greater difficulty. From this point of view, urban regeneration processes can be considered social innovation operations aimed at redefining the so-called “sense of place”, which is the relationship between people and the spaces in which they act, to respond to certain needs [5]. Physical spaces, in fact, respond to important needs such as the reconstruction (or maintenance) of the social cohesion of a community, the re-appropriation (or renewal) of the identity of a territory, or the greater democratization of urban governance [6–8]. In particular, in recent years there has been a proliferation of spaces dedicated to contamination and collaboration, which have represented a key tool in urban regeneration policies [8–10]. Often referred to as collaborative spaces, they refer to shared environments in which people with different professional profiles (self-employed and freelancers, micro-enterprises, project collaborators, employees who work through forms of remote and agile working, etc.) and coming from different sectors, carry out their work and professional activity side by side [9,10]. Also identified as “third places” [11], they offer a neutral environment in which to develop social interactions, supporting creative and productive processes [12,13]. They include a wide category of places ranging from coworking to fab labs, from social innovation hubs to cultural and incubation hubs.

In recent years experiences and studies on these issues have indeed multiplied [14–16], but the effectiveness of operations of this type is not always high, even if bottom-up approaches are adopted that provide for a strong co-participation of various subjects, such as the local community, universities, companies and the world of the third sector. On the other hand, regenerating a space that has become part of the urban and cultural heritage of a city is not an easy and immediate operation, as this also implies a reworking of the sense of place that such spaces, a once they have become marginal, consequently transmit or evoke and, consequently, a reconfiguration of the very identity of the community. How a community has experienced a place over time creates, in fact, an indissoluble bond that must be taken into consideration when implementing urban regeneration actions.

To identify intervention strategies and tactics for the regeneration of parts of abandoned cities, an empirical approach was chosen in this work, which consists in identifying a case study. The study is focused on the analysis of spaces, times, actors, tools, and processes of the recycling of WLS.

In the process of urban transformation, through the analysis of the case study and in order to build sustainable and ecological parts of cities, the general objective is to contribute to the increase of social and economic cohesion.

In pursuing this objective, the experience of an urban regeneration project of the city of Catanzaro (Italy) will be presented, which is implementing a path aimed at repositioning the urban area of intervention and the interests of the community, with the aim ultimately to generate benefits in terms of cultural enhancement, social inclusion, and economic development.

The challenge is that citizens, seeing their potential for co-participation in decisions recognized, become the actors of change and are not mere beneficiaries of public intervention.

In the context of sustainable urban regeneration programs and processes, according to the Sustainable Development Goals (SDGs) in the implementation of the Circular Economy (CE) models for urban policies of the 2030 Agenda, social inclusion and the involvement of the local community are considered essential for the resolution of urban problems [17]. In addition to participating in decision-making processes, communities of inhabitants should be the main beneficiaries of urban transformation actions, which must be addressed to improve their quality of life, promoting social cohesion, and a sense of belonging to a place [18].

Urban transformation interventions must be aimed at improving the quality of life of the communities of inhabitants, promoting social cohesion and a sense of belonging to

a place [18]. Their strategic involvement in the implementation of alternative scenarios and self-organized regeneration processes constitutes the main driver for activating urban regeneration processes, based on local culture [14,15] and the creative capacity of an urban community.

In this perspective, the research investigates the possibility of activating regenerative socio-spatial dynamics, in the context of peri-urban areas, through the commitment of the community in cooperative processes of transformation, which promote environmental integrity and socio-spatial diversity.

In this context, the research applied to a degraded area located on the edge of the historic centre of Catanzaro (Italy) illustrates an adaptive and multi-methodological, inclusive, and site-specific evaluation process, useful to support Decision Makers (DMs) in the selection of a shared scenario, assessed both in multi-group and multi-criteria terms, according to a set of Sustainability Indicators (SIs) linked to SDGs provided by the United Nations in the 2030 Agenda [19]. The operational steps will be described in detail in the following subsections.

## 2. Materials and Methods

The territory is a complex system [20,21] in which multiple material and immaterial components interact, over time the planning and design approaches have detached from linear models, which interpret the territory in a one-dimensional way, giving the aspects of post-normal science their own uncertainty and conflict of value [22]. Solving complex problems depends on the ability to be able to tackle them from different points of view, in order to manage uncertainty. Post-normal science, therefore, makes it possible to fill the void by resorting to a new type of practice that arises from dialogue, applying traditional methods together with the direct involvement of people. In this way, the evaluation becomes a dynamic, flexible, and adaptive “learning process” [23], in order to evolve based on possible changes.

In order to provide useful information in the real context, evaluations require more profound changes regarding approaches, against which adaptive and synergistic evaluative approaches can be considered.

Adaptive assessment approaches [22] are characterized by some distinctive characteristics: they address emerging problems, take into account the specificities of contexts, start from specific needs and contemplate possible conflicts. The solutions are therefore not predetermined, but are the result of the comparison between the multiple interests/opportunities/resources at stake. The combination of techniques allows structuring the evaluation as a learning process that aims to understand the local specificities and the points of view of the different categories of stakeholders involved, allowing to detect the issues relevant to a given decision-making problem. In this way, the development of intervention alternatives is based on an oriented knowledge that takes into account specialized and common knowledge, and at the same time contemplates the “complex values” recognized and shared by a community [20,21,23].

The methodological structure of the evaluation process is therefore designed on the context, integrating methods and tools (multi-methodological approach) or parts of them. These assessments support incremental decision-making processes [24] where continuous feedback loops are required, and people are empowered to make informed decisions about the dynamics at play.

This represents a significant shift in evaluative practice as it “moves to a new level, where the key dynamic is negotiation.” By supporting the interested parties in the process, local empowerment is implemented and guidelines are developed that can best affect the action by defining the path to follow step by step. The evaluation process is therefore a process of constant and mutual learning, which requires commitment and questioning, in which only a community truly interested in the operational implications participates. Adaptive assessments then unite the evaluator and stakeholders in an interaction that produces situated knowledge and strategies.

In this perspective, evaluations are increasingly configured as a system for learning and interpreting the changes taking place; the evaluation process itself is called into question, which is not defined a priori but is built in itinere, precisely because it is incorporated in the social learning process.

The study aimed to define an adaptive decision-making process, aimed at supporting the elaboration of an urban transformation/regeneration strategy and development of metropolitan cities according to the Circular City Model (CCM) [25–27].

In this perspective, the goal is to design a sustainable and circular development of the city of Catanzaro (Italy), starting from those areas known as the ‘Waste LandScape’, integrating skills and knowledge relating to different disciplinary fields, in order to trigger an evaluation process/dialogical/communicative, for improve the processes of territorial regeneration and requalification of the urban cultural landscape. The target area, located near the historic center, represents an unused, abandoned urban landscape, with abandoned areas inside, brownfield areas, and unused industrial archaeological buildings [21,24].

The objective of the multi-methodological approach [28–31] is to support DMs in the elaboration and selection of future scenarios, considering as drivers the: (i) observation and interpretation of the complex relationship of the target area with the surrounding urban context; (ii) evaluation of the characteristics of the identity places and the needs of local communities.

The evaluation process proposed for the case study applies a site-specific adaptive approach, divided into three operational steps: the Knowledge Process, the Alternative Scenario Development Process, and the Evaluation Process (Figure 1). In particular, the adaptive and multi-methodological decision-making process integrates into the various operational steps, soft and hard knowledge, selection of sustainability indicators, and decision support methodologies such as Multi-Criteria Decision Analysis (MCDA), to define and evaluate alternative scenarios, useful for transforming “waste landscape” in the regenerative landscape. The operational steps will be described in detail in the following subsections.

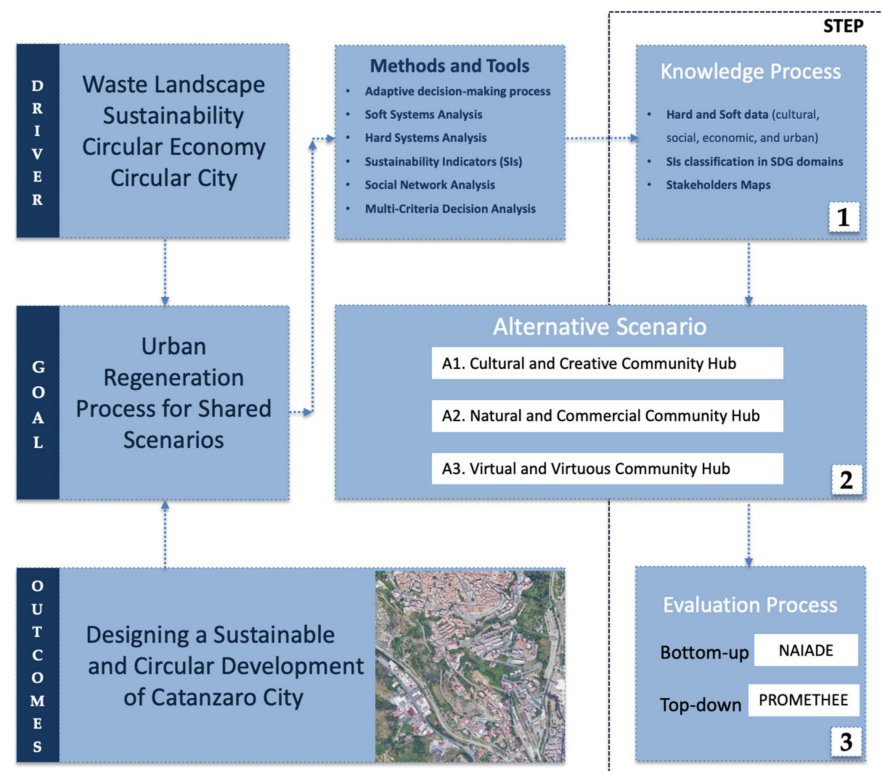


Figure 1. Methodological framework.

In the knowledge process (step 1), both hard and soft data were selected to investigate the field of study, through four areas of investigation: cultural, social, economic, and urban, analyzed through a core set of Sustainability Indicators (SIs) linked to the Sustainable Development Goals (SDGs) [19,28].

In step 2, a first summary of the information obtained from the analysis and processing of hard and soft data was useful to evaluate how the study area has changed over time. Subsequently, through a bottom-up and top-down approach, it's made possible to selected some potential actions from which were developed some alternative scenarios, to start a culture-led regeneration strategy.

Finally, in step 3, the three alternative scenarios identified in the previous step were evaluated using multi-criteria and multi-group methodologies [29–31].

### 2.1. Knowledge Process

Complex decision-making processes must require different skills and backgrounds to evaluate the different intervention scenarios according to the multi-dimensionality of the solution points of view involved in the evaluation process.

Therefore, it is of vital importance to structure well the information that emerges from the public debate, in order to elaborate, evaluate and define multidimensional solutions that take into due account all the interests at stake. To this end, the identification of the most significant stakeholders is of vital importance, to understand the institutional context and the different interests that arise within complex decision-making contexts. Furthermore, the set of knowledge deriving from Institutional Analysis [32] has been completed with the analysis of the “hard dimensions “ and the direct investigation of the so-called “soft dimensions”.

In this first preliminary phase of the study, through a multi-methodological approach, the study context was analyzed through both hard and soft data, relating to four significant areas and investigation criteria from a cultural, social, economic, and urban point of view.

In the context of the study, for the analysis of hard data, significant indicators were selected for the four criteria identified. For the soft data analysis, an Institutional Analysis was initially used [32] in order to identify a map of significant stakeholders [33]. Subsequently, the information collected and obtained from soft data—relating to online questionnaires, semi-structured interviews, and storytelling—were processed through tools such as Social Network Analysis [34–36].

In the decision-making process, starting from the objective of satisfying specific needs, it represents valid support for the experimentation of new models of regenerative landscape, favoring the interpretation of internal dynamics [32].

The combination of techniques such as Soft Systems Analysis and Hard Systems Analysis [34–36] allows structuring evaluation in a multi-stakeholder environment as a learning process that aims to understand local specificities and the points of view of different categories of stakeholders involved, making it possible to identify the issues relevant to a given decision-making problem. In this way, the development of intervention alternatives is based on an oriented knowledge that takes into account expert and common knowledge, and at the same time contemplates the “complex values” recognized and shared by a community, towards a vision of balanced development linked to the principles of the CE.

### 2.2. Alternative Scenario Development Process

In step 2, starting from the cognitive framework analysis, obtained from the processing of both hard and soft data, it was possible to proceed with the elaboration of alternative scenarios for the activation of an urban culture-led urban regeneration strategy.

In this phase, the analysis of the needs, criticalities, and potentialities of the urban area under study made it possible to identify and select some potential actions, capable of triggering a regeneration process useful for developing social and cultural cohesion for regeneration of urban poverty areas [37].



The potential actions that emerged were elaborated according to the thematic checklist (Table 1) considering categories of the selected criteria (cultural, social, economic, and urban).

**Table 1.** Thematic checklist for potential actions for culture-led and community-led regeneration strategy.

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<ul style="list-style-type: none"> <li>○ Promote the aggregation of people of all ages, social backgrounds, and cultures;</li> <li>○ Building community networks;</li> <li>○ Encourage and accompany creative ideas and projects;</li> <li>○ Promote multicultural integration and foster sociality and the building of meaningful relationships;</li> <li>○ Promote culture and facilitate its accessibility to all;</li> <li>○ Promote collaborative environments for mutual learning;</li> <li>○ Promote values and strategies through continuous interaction between/with local actors and decision-makers;</li> <li>○ Promote new jobs for social and economic growth;</li> <li>○ Promote the sustainable reuse of unused urban heritage, starting from the places and the recognition of local value.</li> </ul>
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The appropriate combination of the different actions identified, identified by considering the categories of criteria explained in the thematic checklist, made it possible to develop three different alternatives:

- Alternative 1. Cultural and Creative Community Hub;
- Alternative 2. Natural and Commercial Community Hub;
- Alternative 3. Virtual and Virtuous Community Hub

The development of development scenarios is based on oriented knowledge that takes into account expert and common knowledge, their main economic, cultural, social, and environmental interests and at the same time contemplates the “complex values” recognized and shared by a community. In the next phase of evaluating the alternatives, the selection of the most consensus and compromise alternative is determined taking into account the conflicting needs and interests of the different categories of stakeholders.

### 2.3. Evaluation Process

The structure of the decision problem required the use of multidimensional operational methodologies. Innovative approaches were tested to investigate the performance of public policies, programs, and services. Methods and tools for evaluation need to be increasingly inclusive and thus allow real collaboration and interaction throughout the development cycle of a program. The integrations between “top-down” and “bottom-up” approaches were used to investigate complex decision aid problems and to support DMs to initiate processes of integrated conservation and transformation of places, starting from specific needs and contemplating possible conflicts without compromising the identity values of a territory.

The decision-making structure required two evaluation flows, which lead to the elicitation of knowledge of hard and soft information, respectively, in order to respond to two main types of problems.

The first flow evaluates the opportunities and threats, both the needs and concerns of the citizens living in the area of influence of the study area that could arise from each of the three proposed alternatives. The NAIADE [37,38] was selected as the most useful multi-criteria method to dynamically and quickly collect citizens’ preferences. The NAIADE result shows the preferences of the participants concerning the proposed alternatives.

The second flow, on the other hand, concerned the evaluation of the performance of the design alternatives in a circular economy perspective and according to the SDGs considered. Furthermore, in this perspective, the preferences of the most influential stakeholders have been incorporated into the evaluation process. The multi-criteria method of Preference

Ranking Organization METHod advances in operations research for Enrichment Evaluation (PROMETHEE) [28,37–43] which was chosen as it allows to analyze different scenarios representative of the visions of the main stakeholders involved and to return the final ranking of alternatives, according to all stakeholder' points of view [44,45].

Leveraging on a cyclical and iterative process, some focus groups were organized, which saw the active involvement of some categories of stakeholders: institutions and local public administrations (Municipality of Catanzaro, Local authorities such as Urban planning, Tourism, Social policies, Labor policies, and Superintendence), economic operators (operators in the sector creative, leisure and tourism), local communities (residents and representatives of associations of citizens, tourists, and visitors) designers/operators (Professional Order of Geologists, Professional Order of Architects, Professional Order of Engineers, Order of Building Constructors of Catanzaro, and Union Industrial), experts in the fields of urban planning, history of architecture, cultural heritage and economic evaluation.

The evaluation process within focus groups supports incremental decision-making processes in which continuous feedback loops are required and people are enabled to make informed decisions regarding the dynamics at stake. The evaluation process is therefore a process of co-evaluation, constant and mutual learning, which requires commitment and questioning, in which only a community truly interested in the operational implications participates. Adaptive assessments, therefore, unite the evaluator and the interested parties in an interaction that produces knowledge and situated strategies, a regenerative model in which solutions are developed in a specific context thanks to the interaction between expert knowledge and common knowledge.

The urban landscape today, in fact, is understood as a relational resource whose value can be co-created thanks to interconnections and relationships that are not only monetary but also social, ethical, and political. The generation of value can in fact emerge through social and creative learning and represents an enabling factor for the planning of opportunities and synergies and the consequent fine-tuning of the respective attributions of value respective judgments.

### 2.3.1. The NAIADE Method: Bottom-Up Approach for Evaluating Stakeholder Preferences

According to the methodological approach illustrated in Section 2, the NAIADE method makes it possible to evaluate the social compromise solutions by eliciting the opinion of the stakeholders identified as relevant for the decision-making problem relating to three alternatives of urban regeneration. In decision-making processes, given the complexity of the decision-making problem and the conflicting nature of the decision, it is important to consider the opinion of all the actors involved in the process and of the experts with knowledge of specific skills. In order to make a more informed decision, the NAIADE method was applied to evaluate the solutions of greater social compromise, raising the opinion of the stakeholders identified as relevant for the decision-making problem relating to three alternatives of urban regeneration.

The Novel Approach to Imprecise Assessment and Decision Environments (NAIADE) is a discrete multi-criteria evaluation method capable of managing qualitative and quantitative data. It is a suitable tool for evaluating problems linked by great uncertainty and complexity to existing territorial, social, and economic structures and their interrelations [38]. The basic input of the NAIADE method consists of a series of alternative scenarios to be analyzed, different decision-making criteria for their evaluation, and different stakeholders who express opinions on the scenarios under examination. Based on this method, two types of analysis can be conducted:

- A multi-criteria analysis, which, on the basis of the impact matrix, leads to the definition of the priorities of an alternative scenario to certain decision-making criteria;
- An equity analysis, which, on the basis of the equity matrix, analyzes possible “alliances” or “conflicts” between different interests in relation to the scenarios in question. This information is essential for DMs to reach a higher level of consensus among stakeholders, thus ensuring more effective implementation of their plans.

### 2.3.2. The PROMETHEE Method: A Top-Down Approach to Evaluation

According to the described multi-methodological approach and in order to obtain a hierarchy of importance among the alternatives analyzed, was adopted the method of Preference Ranking Organization METHod advances in operations research for Enrichment Evaluation (PROMETHEE). The evolution of this algorithm in PROMETHEE II, through the implementation of the open-source software called Visual PROMETHEE [46], allows to create a ranking among the scenarios analyzed according to certain judgment criteria. PROMETHEE also establishes the thresholds of preference, indifference, and incomparability between the alternatives with respect to each criterion [47–51].

The core set of selected criteria and Sustainability Indicators (SIs) were used as a proxy to measure the values of sustainability and circular economy.

Furthermore, the application of PROMETHEE to real-world cases has made it possible to select a compromise solution and determine how much one alternative outclasses the others based on the degree of preference of the main institutional stakeholders.

In PROMETHEE, it is also possible to assign weight to the criteria, expressing their relative importance. To identify the different points of view and visions, focus groups and targeted meetings were organized with experts from different sectors (urban planning, economic evaluation, architecture, and environmental engineering) and local decision-makers, in order to define the vector of weights for each of the four domains and related indicators, through preference functions and the threshold values.

### 3. A Multidimensional Decision-Making Process for Urban Regeneration

The described multi-methodological approach of adaptive assessment was tested in a target area, selected as a case study. The area of interest is located within the Municipality of Catanzaro (Italy).

It is a large area located within the Catanzaro Sala district, including the former gasometer with some historic buildings of industrial archology, a historic station now in disuse, and the adjacent Valletta Park (Figure 2).



Figure 2. Case study.

In this context, a regenerative model of resources for the city of Catanzaro was tested, inspired by circular economic systems places and the recognition of local values, to then start a process of reorganization of the territory itself from an economic, social, and governance point of view [52]. Through regenerative processes of landscape resources, territorial surplus values (economic, social, and environmental) are therefore created thanks to the development of self-sustainable systems, which improve self-sufficiency. In this perspective, communities in appropriate conditions can therefore affect the way of living and feeling of a place, triggering self-regenerative models of knowledge, promotion, and enhancement of a territory.



First of all, the study context was thoroughly investigated through a quantity of hard data, structured according to Sustainability Indicators (SIs) [19,28,32], in combination with an appropriate set of indicators deriving from the Institutional Analysis.

Subsequently, three alternative development scenarios were subjected to multidimensional assessment, in order to choose the alternative of greater compromise, through the structuring of hard and soft data and the use of Multi-Criteria Decision Making (MCDM) methodologies, according to an approach methodology of the Decision Support System (DSS) methodology [28,30,31].

### 3.1. Sustainability Indicators as Tools for Evaluating the Alternatives

As part of the evaluation methodology, has been defined a core set of place-based Sustainability indicators (SIs), closely related to the SDGs (Table 2), in particular to Objectives 9, 11 and 12, was defined:

- Goal 9. “Industry, innovation, and infrastructure”: Building resilient infrastructures, promoting sustainable and inclusive industrialization, and fostering innovation and the creation of new jobs. Both infrastructures and especially the cultural industry are important to support the entire economic development and our well-being by becoming sustainable and reliable with technological development and research.
- Goal 11. “Sustainable cities and communities”: Make cities and communities safe, inclusive, resilient, and sustainable. The environment around us can drastically affect our habits and lifestyles. For this reason, the sustainable improvement of our living spaces is an essential goal by 2030.
- Goal 12. “Responsible consumption and production”: Guaranting sustainable consumption and production models, aimed at reducing the ecological footprint, through the management of natural resources, recycling and waste reduction and the creation of production and supply chains more efficient.

Based on site-specific issues, the core set of indicators were classified into five domains: Economic Growth and Development, Traffic Accessibility, Urban Metabolism, Society and Culture, and Quality of the Landscape, which were deemed relevant for the regeneration of cities. Table 2 shows the list of indicators, further explained in nineteen Sustainability Indicators (SIs) [19,28,32,36], whose is highlighted connection with the SDGs of the 2030 Agenda is highlighted.

It is important to point out that, the selection of the core set of indicators, derived from the main issues that emerged during the public debate with local stakeholders on the future development of the Catanzaro city, was developed based on sustainable development models, linked to the principles of the circular economy and community processes for the regeneration of cities [53–56]. Therefore, if from one hand, the indicators were used to easily quantify and communicate complex information on the survey area, on the other hand, they were used as evaluation parameters to produce scenarios with the stakeholders’ points of view.

**Table 2.** Sustainability Indicators (SIs) List.

Domain	Indicators	Description	Goal	Unit	SDGs
Urban Quality	Urban density	A built area on a total land area	max	%	11
	Functional mixité	N alternative functional destinations	max	1–5	11
	Distance from local attractors	Distance from primary public services: town hall, school, railway, etc.	min	minutes	11
	Accessibility and public transport	Pedestrian accessibility to public transport	min	minutes	11
	Parking areas availability	Parking area extension	max	sqm	11
Environment	Renewable energies	Energy production from renewable sources	max	%	12
	Environmental sustainability	Permeable surface area	max	sqm	12
	Green areas	Presence of public green areas	max	sqm	12
	Rehabilitation polluted areas	Areas to be reclaimed	max	%	12
Social	Creation social housing	Construction of residences for social use	max	n.	11
	Gentrification	Possible phenomena of gentrification	min	1–5	11
	Creation of attractive public functions	Attractiveness of public functions	max	1–5	11
	Sports and recreational activities	Recreational attraction	max	1–5	11

Table 2. Cont.

Domain	Indicators	Description	Goal	Unit	SDGs
Economics	Creation of new jobs	Creation of new jobs	max	n.	9
	Real estate market	Real estate market prices	max	%	9
	Potential of economic development	Interconnections and synergies with local economic activities	max	1–5	9
	Investment costs	Investment costs	min	€/sqm	9
	Management costs	Maintenance costs	min	1–5	9
	Financial appeal for private investors	Attractiveness of private investors	max	1–5	9

### 3.2. Involvement of Stakeholders within the Urban Transformation Process

In the context of the study, the involvement of local stakeholders and a broad base of key subjects is a determining factor in favoring the innovation of the regenerative model [57,58].

Participatory processes and multi-stakeholder contexts, through open and respectful dialogue, foster mutual responsibility and information sharing [59], triggering processes of mutual understanding and learning [60,61]. The specific objective was in fact to improve the involvement of professional activities promoted by local groups, experimenting with different methods of collecting information, functional to the interaction with different users, and to the return of data that can be analyzed. Therefore, through the involvement of local stakeholders, it was possible to structure an articulated cognitive framework oriented to an overall collaborative planning process.

The map of potential stakeholders was identified through a cyclical and iterative process [62].

In consideration of the economic, social, cultural, environmental, and urban activities, the local actors were subsequently grouped into the following categories [22]:

- Promoters—representatives of institutions operating in the area, those who, thanks to their representativeness, have an influence in the choices of the common good and on final decisions;
- Experts—scholars and researchers representing scientific knowledge, who with their knowledge, skills, and support institutions in making choices;
- Operators—dominant in the cultural and productive sectors, organized local groups and the influential world of associations, which have a strong influence in the choices regarding regenerative processes;
- Users—residents, workers and tourists, representatives of common knowledge, who have strong interest but a low influence, but who must be involved as recipients of final public policies.

According to a stakeholder engagement approach [63], some thematic focus groups were organized with the main institutional stakeholders, within local workshops, during which the various points of view on the effects of the programs were recorded.

Subsequently, in order to manage conflicting relationships, a dialogue with all the stakeholders was conducted to encourage interdisciplinary interaction between the various actors [64–68].

Citizen involvement in collaborative decision-making was implemented through the use and implementation of deliberative evaluation techniques. Thanks to social networks, a web platform was created for quick and horizontal public participation. At the same time, direct observation and documentation in the field, through the collection of qualitative and quantitative data, a survey on declared preferences relating to relations between citizens, their territorial context and the target area was supported (online questionnaires, semi-structured video interviews, and storytelling). The questionnaires were structured similarly to the interviews but left the possibility of suggesting possible re-uses of the area and alternative availability of collaboration in the use and management of spaces and functions.

In detail, the exploration of preferences was conducted through:

- an online questionnaire, through the social network Facebook, was structured in three parts: a first part, aimed at defining the sample structure of the interviewees;

- a second, dedicated to focusing on the strengths and weaknesses of the WLS under study, according to the perception of the stakeholders; a third, aimed at identifying some guidelines for the implementation of a shared development strategy;
- interviews with preferential actors, representative of each stakeholder group, conducted during some focuses and structured for the exploration of preferences based on a CATWOE approach a technique, developed in the context of Soft System Methodology [69–71] which allows to focus on the different aspects of a problem and to define design solutions that meet the expectations of the various stakeholders. It is a simple check-list, useful for understanding the various issues of interest to each stakeholder group and for identifying a shared and effective development strategy. The check-list was organized by targeted questions according to the different types of Stakeholder and different points of view. The model, typical of the CATWOE approach, was improved through the introduction of two further aspects, strengths and weaknesses, in order to directly define the problem and integrate the available information.

### 4. Results

#### 4.1. The NAIADE Results

The application of NAIADE’s equity analysis to the case study highlights possible “alliances” or “conflicts” between stakeholder groups. To this end, the equity matrix is constructed, whose elements show, in a qualitative way (linguistic expressions according to a semantic scale: perfect, very good, good, more or less good, moderate, more or less bad, bad, very bad, and very bad), the views of stakeholder groups with respect to alternative scenarios (i.e., different prioritization for each specific group based on their interests). This allows identifying the solution that collects the greater consensus or greater social compromise and the weaker alternative (Figure 3).

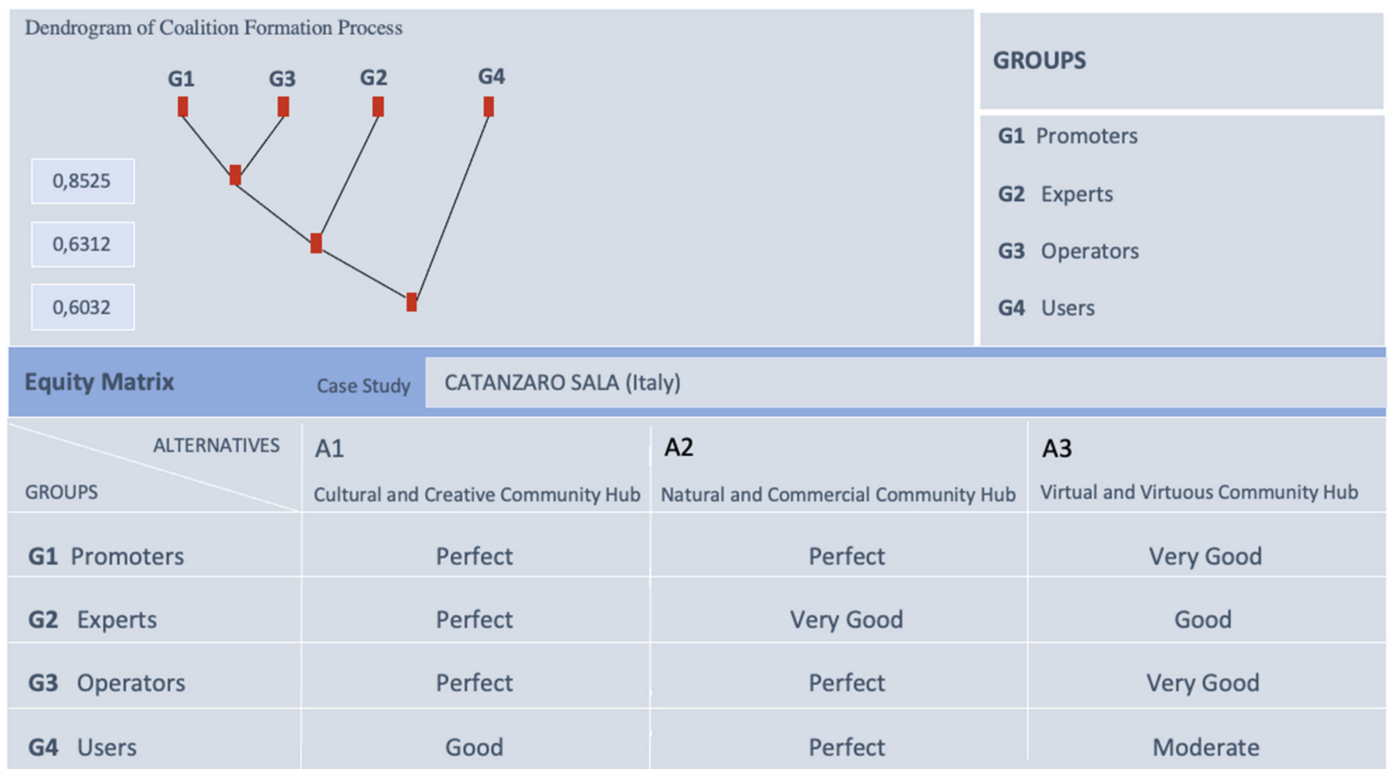


Figure 3. Results NAIADE method.

The processing of these data leads to the calculation of a similarity matrix, in which the degree of similarity of the opinions of each pair of stakeholder groups (i, j) is presented.

These calculations are based on the “semantic distance” between the opinions of every single pair of stakeholder groups for each alternative scenario. The phases followed are:

- structuring of the equity matrix, based on a participatory approach;
- calculation of the similarity matrix;
- construction of a dendrogram, representing graphically possible “alliances” or “conflicts” between stakeholder groups.

The interpretation of the dendrogram provides DMs with valuable information on the “resistance” or “consensus” reached in relation to the alternative scenarios evaluated. In addition, it can provide information on the level of divergence of stakeholders’ opinions in relation to the scenarios under consideration, in which a wide dispersion of opinions may lead to a restructuring of the scenarios or even of the purposes and objectives of the planning activity.

The dendrogram is an effective graphical representation that shows possible coalition formations for decreasing values of the similarity index and the degree of conflict between stakeholder groups. The final ranking expresses the result of the consensus between the alternatives reached among the stakeholders.

The application and the results of NAIADE highlight a preference towards the two Alternatives: 1. Cultural and Creative Community Hub and 2. Natural and Commercial Community Hub, which according to the participants can potentially trigger greater economic development, both in the neighborhood but also in the surrounding fabric, with the provision of greater public services.

Among the actors G1 (Promoters) and G3 (Operators) who reveal a high level of credibility (0.8525), Alternative 3 is the least appreciated from the point of view of the analysis of social conflict (Figure 2).

In the research, the application of the NAIADE method was very useful for involving all stakeholders in a collaborative process that allowed greater awareness of the problems in the urban study context and stimulate the entire community in promoting local cooperation for the regeneration of the target area.

#### 4.2. The PROMETHEE Results

Considering that with the application of the NAIADE method in the evaluation of alternatives emerged strongly conflicting values and interests among the stakeholders, it was necessary to apply PROMETHEE, a multi-criteria method of outclassing that allows the resolution of complex problems and the evaluation of alternatives according to multiple criteria.

The first step in applying the PROMETHEE method to the case study, is to define the preferences of decision-makers regarding the importance of the criteria. For this purpose, was used the cards method, proposed by J. Simos (1990), and revisited by Roy and Figueira, (1998) was used [50]. An interactive software was also used to define the ranking between the different criteria, which allows the decision-maker to express preferences and obtain the weights of the criteria [51].

Figure 4 shows the values of the weights attributed to the criteria by the experts involved in the evaluation. They agree in attributing greater importance to the aspects of Functional mixité, with respect to the criteria relating to gentrification and environmental sustainability.

The implementation of the open-source software Visual PROMETHEE 1.4 [46] shows the ranking of alternatives. Alternative 1 outperforms the other alternatives in all four scenarios, achieving positive scores in both the net overrun flows (Figure 5) and the aggregate flow view (Figure 6).

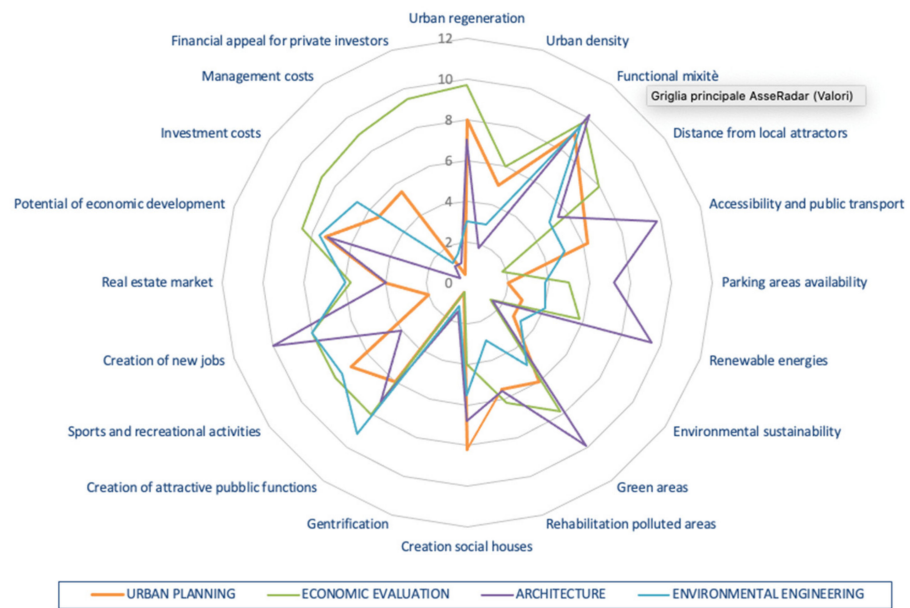


Figure 4. The values of the weights for the different experts.

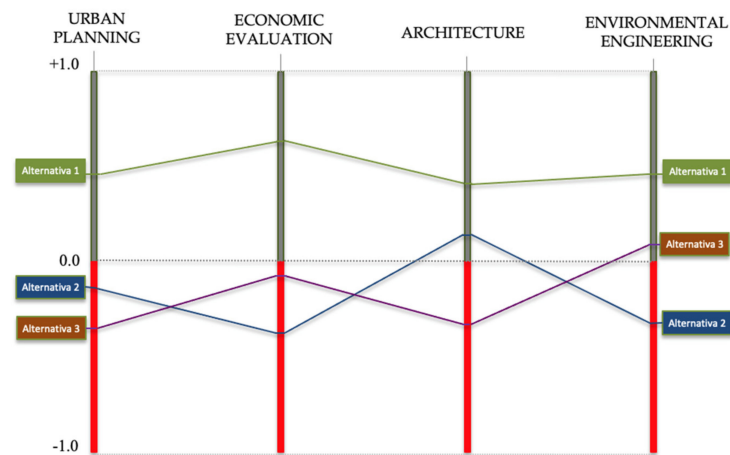


Figure 5. Net outranking flows diagram related to the scoring of three alternatives concerning the four scenarios.

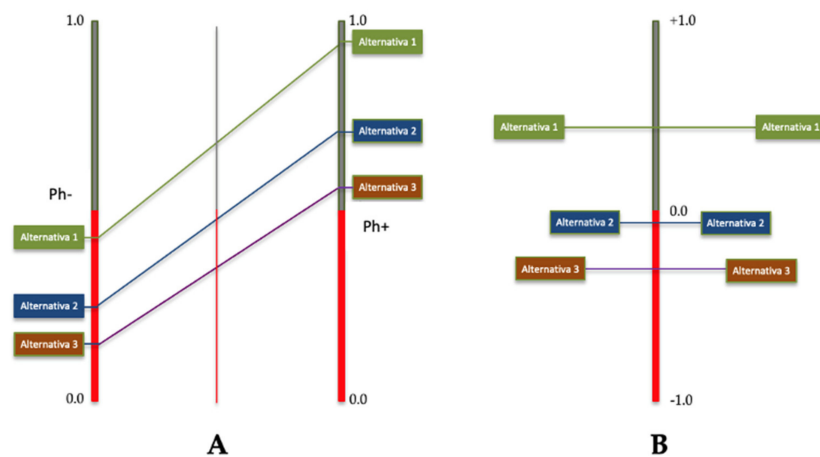


Figure 6. Preference Ranking Organization Method for Enriched Evaluation (PROMETHEE) II outranking flows. Uni-criterion positive flow (f+) and uni-criterion negative flow (f-) (A); net outranking complete flow as subtraction of negative flows from positive ones (B).



## 5. Discussion

The adaptive and multi-methodological decision-making process for the development of strategies for WLS and urban growth according to the CCM, has made it possible to identify the significant components that can influence the choices of place, with attention to the specific reality of the analyzed context [72]. The objective of the methodological path—to elaborate an integrated methodology to define and evaluate new solutions for waste-circular landscapes—was achieved by combining a multidimensional evaluation approach, the selection of SIs, and the development of a multi-stakeholder environment as a process learning that aims to understand the local specificities and the points of view of the different categories of stakeholders involved [28–31].

Among the three operational steps that characterize the process, the first, the structuring of the problem and the analysis of the cognitive framework, represents the most complex one, in which the premises of the decision-making process were built and the dynamics that have influenced the choices, combining hard and soft knowledge. In this phase, the existing problems in conflict were analyzed, the map of the Stakeholders and their internalization process was drawn up and the decision-making flows were identified [73–78].

The second operational phase made it possible to identify three main alternatives for the transformation and regeneration of the WLS in question, highlighting the different opportunities that each is able to generate and, at the same time, how to solve both urban and territorial criticalities. In this phase, the identification of the potential project actions, developed according to a thematic checklist, was particularly significant because it allowed the comparison and interaction of different forms of knowledge, identifying potential win-win alternatives, based on specialized and common knowledge, which contemplates the “complex values” recognized and shared by a community [73–78].

In the third phase, the evaluation of the alternatives required the use of multi-criteria methodologies and the need to integrate the bottom-up approach with the top-down one.

According to a sequential process, the alternatives were first evaluated from a social point of view—using the NAIADE method—to identify coalitions and alliances between stakeholders on a more shared scenario. The social evaluation made it possible to explain the key role of interaction with stakeholders and to verify the need to accompany the decision-making process with continuous opportunities for comparison and integration between interests and skills, possibly reaching a shared vision, capable of reflecting the needs of the actors involved, their ability to influence the decision-making process and to become an active and proactive part of territorial transformations.

Subsequently taking into account the feedback of the NAIADE method, the alternatives were evaluated from a technical point of view, using the PROMETHEE method. The evaluation was structured in order to evaluate the performance of the alternatives according to the selected criteria and SIs linked to the SDGs domains, but also to bring together the views of the main stakeholders, in an attempt to identify opportunities for coalitions and alliances. The comparison of preferences by analyzing the impacts of the alternatives with respect to the domains of the selected SDGs defines the scenario of the greatest compromise of the stakeholders in the decision-making process

In Table 3, the MCDA methods used are compared according to different evaluation criteria.

**Table 3.** The MCDA methods were used and compared according to different evaluation criteria.

Criteria MCDA	Degree of Compensation Allowed Among the Criteria	Modeling of DM Preferences	Ease of Use	Ability to Support a Large Number of Decision-Makers	Ability to Manage Many Criteria and Alternatives	Treatment of Inaccurate or Uncertain Criteria	Interpretation of Software Parameters
NAIADE	++	SI	++	++	+++	+++	--
PROMETHEE	++	NO	--	++	++	++	+

The scale “+++/--” is ordinal in nature (‘+’ is more desirable than ‘--’ ‘+++’ is more desirable than ‘+’ and ‘---’ is less desirable than ‘-’) and reflects the experience gained from our direct involvement in a number of real case studies.

The adaptive decision-making process thus structured lends itself to being replicated in other similar decision-making contexts. It is a process that certainly requires not short times, linked to the specific complexity of the decision-making context analyzed, as it requires a careful analysis of the study context—through the collection, selection, and processing of data useful for managing information—and structuring the indicators that they will be used to make the subsequent phases of the process operational. Added to this is the time necessary for continuous and in-depth interaction with stakeholders for the analysis of preferences and points of view, which are essential for carrying out a transparent assessment.

It is a non-linear process that takes into account the multidimensional complexity of decisions, which requires continuous monitoring, with selection and verification of the tools and methodologies used and of the objectives. Through this experimentation, the DMs can practically verify how the different intervention options behave, verify the consequent effects, and choose which strategies are most effective for long-term systemic development [74,79].

The adaptive and multi-methodological decision-making process thus outlined was useful for supporting DMs in facing complex decisions, reflecting on WLS' regenerative opportunities and on the effects of choices on an urban and territorial scale, in a circular and multidimensional perspective, useful for orienting the transition from WLS to regenerative landscapes, in a progressive and systemic logic.

The places of urban waste are the context in which it is possible to trigger regeneration processes and where it is possible to manage the circular transition, stimulating territorial productivity, economic development, and social cohesion.

In this perspective, future research directions are aimed at supporting public administrations in regenerative programs and in circular transformation operations involving the WLS, building dialogue and interaction processes between the various stakeholders, in order to govern the complex reconversion of the WLS urban to regenerative places, in a perspective of recomposition and integration with the city and the surrounding area.

## 6. Conclusions

The fight against land consumption and climate change are among the most ambitious challenges that the European Union has launched to the Member States and which have a direct impact on the way we plan our cities [80]. The European Union, in order to guarantee the ecological balance necessary for the subsistence of the European population, has set itself the goal of eliminating land consumption by 2050 [81–84].

In this perspective, the experiences of urban regeneration that have involved our cities in the last ten years tell of a paradigm shift in the urban planning process that has involved the transformation of previously unexplored places (fragments of unused, residual, abandoned landscape, and underused areas or areas awaiting transformation), new actors (small owners, creative industry, start-ups, and active citizenship), and a different time frame focused on the temporariness and flexibility of solutions, aimed first of all at activating processes and experimenting new urban structures by focusing on the construction of community-driven and cultural-led regeneration processes [85–89].

These are often activated “bottom-up” processes, also with laboratory methods, aimed at building new urban dynamics, which are more immediate, because they are aimed at finding a rapid convergence between supply and demand, ecology and economy, creativity and innovation, community, and territory.

At the urban level, in urban regeneration programs, the current trend is to reconvert and reuse the residual and/or no longer used urban spaces of the city, the so-called WLS, which follow dynamics of the divestment of productive activities and functions or of the residential settlements in situations of urban decay. The concept of urban regeneration is therefore understood as the ability of an urban area or neighborhood to self-regenerate, through techniques, technologies and behaviors in a circular city perspective.

A correct urban regeneration strategy for the WLS, according to the principles of the circular economy in urban regeneration processes, should be supported by specific clear, unambiguous objectives, possibly shared by the relevant community and measurable through physical and performance indicators.

It is therefore important to keep these basic concepts in mind, in order to overcome the generic notion of urban renewal and introduce circular economy functions and indicators that certify their effectiveness in terms of sustainability and circularity, identifying the beneficiaries of environmental improvement, the distribution of costs and benefits in relation to the public interest and investment returns for public and private actors.

In the perspective of a circular city, the research frames the relationship between the WLS and urban growth, and identifies in the recycling projects of abandoned and critical landscape a driving force for the redevelopment of the urban centres according to the CCM [31,89].

The research project illustrates a decision-making process that arises from the collaboration between universities, public administrations, operators and citizens. In this context, the involvement of several actors in the different phases of the process represents an opportunity to define new governance and management approaches of urban metabolic processes, oriented towards the principles of the circular economy.

Through the evaluation process described, it is possible to create new opportunities for the regeneration of “waste” spaces, which through the definition specific strategies and micro-actions are able to trigger circular urban processes capable of improving the functioning mechanisms of the urban and territorial system [90].

In this perspective, the study provides a methodological structure for a WLS redevelopment model, useful to support DMs in the process of “cultural” and “community” regeneration of unsolved territories, better known as “Wastescape LandScapes” [1–3].

From an environmental, economic, and social point of view, WLS are a potential resource, in terms of circularity and of recycling, useful to guide the transition from waste landscapes to regenerative landscapes, in a progressive and systemic logic [88].

In the incremental decision-making process elaborated, the evaluation assumes the role of a decision support system according to bottom-up and top-down approaches, a multi-stakeholder negotiation tool useful for identifying preferable scenarios of urban regeneration [30].

The adaptive path for the elaboration of regenerative scenarios was very useful for the team of university researchers to identify values, and priorities and build coalitions, between different fields of knowledge and conflicting points of view, to converge towards shared visions and scenarios [22,28,76,77,87–89].

Notable experimentation of collaborative processes has been promoted at the international level on impulse of the role widely recognized internationally and highlighted by the Faro Convention and in subsequent Council of Europe documents [91–93].

Compared to the common practices of participation, collaborative environments are configured as collaborative hubs of deeper involvement of the community, in which the communities dialogue together, activate a constructive comparison even on divergent positions, which stimulates and produces knowledge for all the participating subjects.

Several studies have investigated these processes, in which citizens are protagonists and “co-decision makers” in the implementation of processes of co-creation, co-production, and co-evaluation of new products and services through open innovation where ICT tools can facilitate community involvement in urban enhancement proposals and strategies [94].

The complexity of the problems faced in terms of urban regeneration of WLS requires a multidisciplinary approach. The issues at stake are many and varied and involve different spheres of scientific knowledge.

In recognizing the complexity of decision-making processes described, the discipline of evaluation plays a central role capable of putting knowledge into a system and providing communities with evaluation tools capable of supporting learning and decision-making processes increasingly characterized by a multidimensional and multi-actor vision.

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