Tailored Urban Regeneration Process: A Multi-method Evaluation for Waterfront Brownfield

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Abstract. The research aims to outline a tailor-made urban regeneration project for the urban brownfield area of Castellammare di Stabia waterfront, in southern Italy, structuring a multi-methodological and adaptive evaluation approach according to the Social Multi-Criteria Evaluation (SMCE) perspective.

The methodological process is elaborated in three main steps that integrate vertical and horizontal assessments to frame the multiplicity of aspects that characterise an urban regeneration decision-making process for a brownfield area. Starting from identifying environmental, economic and social issues, the proposed approach aims at defining a sustainable development strategy. The expected results consist of the selection of the preferred scenario among the outlined alternatives, spatialised in a multi-scale meta-project for the brownfield area of Castellammare di Stabia waterfront. Integrating quantitative and qualitative dimensions aims to build a decision-making process oriented towards developing an innovative model of well-being for the local community. In addition, the implementation of SMCE, combining the C.I.E. method and the NAIADE method, is an effective tool to support public policies in line with the impact assessment objectives set by the European Commission.

Keywords: Community Impact Evaluation · NAIADE · Urban regeneration · Waterfront · Scenario analysis

1 Introduction

The global crisis has highlighted the limits and criticality of a development model based solely on trade and pure economic return. The crisis is, however, an opportunity to launch a new model of urban development in which the economy is based on the exchange of knowledge and relationships between different actors. Furthermore, the waterfront could be read as part of a coastal zone system, considering the specific functional dimension that affects it, since in medium-sized cities in particular, the role of the waterfront directly influences the functions and image of the city [1]. In the context of small and medium-sized port cities, as in the case study presented below, a key element within the decision

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support system is the analysis of stakeholders and their needs to identify coalitions between stakeholder groups based on their perceptions [2] and synergies between local authorities belonging to the same coastal zone [3]. In this perspective, waterfront regeneration becomes a re-connection, in a circular perspective of integrated symbiosis that simultaneously involves all levels of relationships and capital, rebuilding and multiplying ties and making the system more resilient, making possible future development in this direction for port cities [4].

The use of integrated approaches can engage cooperation between academia and public authorities and promote integrated, spatially explicit, and strategic urban planning [5]. Through the creation of assessment maps, it is possible to trigger holistic regenerative and cyclical planning processes [6], solving the complexity of problems involving both spatial and environmental issues and social, cultural and economic ones. A significant aspect of the urban regeneration process is played by culture as an integrated and driving component, capable of renewing the synergic and symbiotic between business and territory, empowering citizens and guaranteeing efficiency, effectiveness, and equity [7]. This approach is able to enhance aware forms of a culture focused on people promoting the use of innovation and technology according to local conditions and citizens' needs, defining a complex space of social cohesion, creativity and quality of life, and synergies among natural, rural anche urban areas in which the landscape becomes an innovative action research field [8]. Issues related to environmental, social, and cultural values are assuming an increasing role in the evaluation of reuse projects related to urban regeneration from the perspective of the circular economy, where assessment tools are essential to understand the effectiveness and efficiency of this new model and to evaluate the multidimensional impacts it produces [9]. Investigating, mapping, and assessing the waterfront landscape is part of an approach that, through multidimensional geospatial data, allows us to address contemporary environmental issues and support decision-making related to sustainable management and planning [10], as an expression of a multidimensional interface about the meaning and the role of the different evaluation criteria, that contribute together to the definition of the scenarios, and the combined use of methods and techniques is crucial into tackling the complex decision process, making the evaluation process crucial both in planning and in identifying alternative solution in the spatial decision-making process [11].

Thanks to these processes, land assessment/action is an essential tool to identify possible development scenarios and becomes a method of integrated heritage enhancement for public administrations, according to the perspective of Social Multi-Criteria Evaluation (SMCE) [12]. The social multi-criteria evaluation method used is NAIADE (Novel Approach to Imprecise Assessment and Decision Environments) [13], explicitly designed for public policy, capable of providing appropriate responses to the objectives of efficiency, effectiveness, and consistency set by the European Commission on Impact Assessment [14]. Based on these assumptions, the research aims to identify a tailor-made urban regeneration process through the data spatialization in mapping scenario analysis and structuring an SMCE approach for the waterfront of Castellammare di Stabia, a city on the south coast of the province of Naples (Italy).

The paper is structured as follows: Sect. 2 presents the research methodological approach. Section 3 explores the cognitive framework of the territorial system. Section 4

is dedicated to building a tailor-made evaluation model. Finally, Sect. 5 relates to results, while Conclusions are presented in Sect. 6.

2 Materials and Methods

The methodological framework (Fig. 1) is fleshed out by analyzing hard and soft data, identifying and comparing social and economic transformations and issues with Sustainable Development Goals [15].

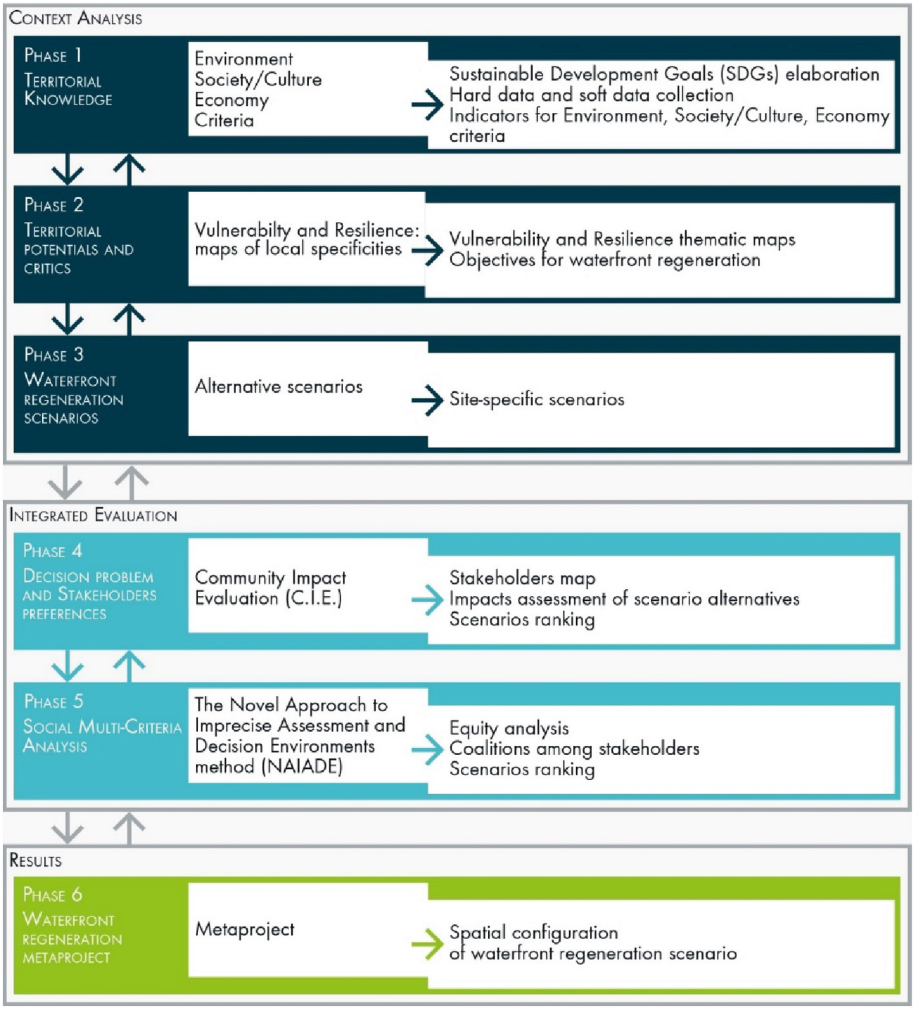


Fig. 1. Methodological framework, Authors' Elaboration

The interpretation of transformative processes and opportunities is made by analyzing the information collected and processed using specific indicators tailor made

for the local context to identify the area's potentialities and criticalities concerning environmental, economic, and social criteria.

The primary purpose is to build specific territorial vulnerability and resilience maps, essential for identifying possible regeneration scenarios and elaborating a multi-criteria and site-specific assessment. According to a multi-methodological approach [16], the research addresses a complex decision-making problem.

3 Context Analysis

3.1 Phase 1: Territorial Knowledge

Castellammare di Stabia belongs to the Southern coast of Naples province, a wide area consisting of municipalities, each with its characteristics and specificities, which can be read as a territorial cluster (Fig. 2).



Fig. 2. Location of Castellammare di Stabia, Authors' Elaboration

The city is a crucial hub for cultural, landscape and archaeological tourism and a territory of intense environmental, urban, and social contrasts. The urban fabric is characterized by social housing with high social fragility. The landscape of Castellammare di Stabia is rich in highly complex and heterogeneous aspects in which social, cultural, economic and ecological components act and interact dynamically. The multiplicity of these factors has led to the identification of a spatial reading, carried out both at the local level and at the level of the conurbation made up of the towns of the southern coast of the province of Naples.

3.2 Phase 2: Territorial Potentials and Critics

The complexity of the territory is explored through simple elements combined in more articulated processes to build a careful and respectful reading of the specificities of the context and its population, return a more homogeneous and cohesive general vision and being able to represent the multidimensional quality of the territory. The assessment of vulnerability in multidimensional terms requires the selection of indicators capable of describing the complexity of the context in line with three critical aspects of sustainable development: environment, economy, and society.

Due to the specificity of spatial and territorial dynamics indicators is possible to illustrate and represent the territorial diversity of the natural environment and to assess the related impacts of the urbanization process [17].

The approach is appropriately structured to effectively reflect a synthetic framework for measuring sustainable transformation of the territory, which aims to improve the level of well-being of the entire community. To profile the territory quantitatively and qualitatively in the process of mapping environmental, economic and social vulnerability and resilience, we made use of census data from the Italian National Institute of Statistics (ISTAT) [18] and ISTAT's 8milaCensus [19] indicators built to meet the SDGs, interpolating different quantitative data to give qualitative and more realistic answers about the dynamics of the territory's development.

Two levels of data analysis were carried out for each indicator: first, for the Municipality of Castellammare di Stabia at the census years 1991, 2001, 2011, to understand local development trends; and second on national, regional, and conurbation scale consisting of the Cities and Towns of Naples, Portici, Ercolano, Torre del Greco, Torre Annunziata, and Castellammare di Stabia. In addition, several aspects were investigated in the mapping process: population and household structure, integration of foreigners, land use for housing purposes, housing stock, education level, population activity, unemployment and employment, mobility, and material and social difficulties, which produced thematic maps of spatial dynamics.

Specifically, the ranking of potential material and social difficulties considered the Social and Material Vulnerability Index developed by 8milacensus, which holds together seven different indicators and determines the position of the municipality of Castellammare di Stabia within the ranking of municipalities, allowing the local situation to be compared with other Italian municipalities. The high part of the ranking, where municipalities with a low-rank value are placed, corresponds to a high social and material vulnerability index.

Indicators	Italia	Campania	Castellammare di Stabia	Napoli	Ercolano	Portici	Torre del Greco	Torre Annunziata
Social and material vulnerability index	99,30	102,41	103,50	104,90	107,00	102,30	103,80	104,90
Position in the municipalities vulnerability ranking	-	1,00	90,00	37,00	5,00	224,00	75,00	38,0
Improper housing incidence	0,22	0,35	0,20	0,70	0,30	0,20	0,30	0,50
Large families incidence	1,42	2,83	4,10	3,40	4,80	2,50	3,10	3,70
Families with potential economic hardship incidence	2,65	7,58	8,00	9,50	11,10	6,10	8,40	9,60
Population in overcrowed conditions incidence	1,48	3,53	5,60	7,10	10,80	4,40	6,80	8,00
Young people out of the labor and training market incidence	12,30	20,36	20,70	22,80	27,20	15,90	23,20	24,80
Families in need of assistance incidence	3,00	2,24	2,60	2,20	2,10	3,00	2,20	2,41



Fig. 3. Potential material and social difficulties: comparisons on a national, regional and coastal scale (Source: 8milaCensus, http://ottomilacensus.istat.it/, Authors' Elaboration)

For Castellammare di Stabia, the social and material vulnerability index has remained relatively constant over the observed years, ranging from 105.0 in 1991 to 103.5 in 2011, remaining within a score range corresponding to 15 per cent of the national corresponding. However, the position within the vulnerability ranking changed considerably during the same observation period: position 651 for 1991, 200 for 2001, and 90 for 2011. This increase in vulnerability can be attributed to a movement of other Italian municipalities, which have activated practices aimed at improving their condition over the years. In the comparison with the other municipalities of the coastal strip analysed, Castellammare

di Stabia is, in fact, the one with the lowest level of vulnerability after Portici and quite close to Torre del Greco, distancing itself from the others, which appears to be considerably higher, and therefore more vulnerable. Each indicator was then classified as an element of criticality/potentiality (Fig. 3.) and vulnerability/resilience, which structured the database to elaborate the territorial thematic mapping (Fig. 4).

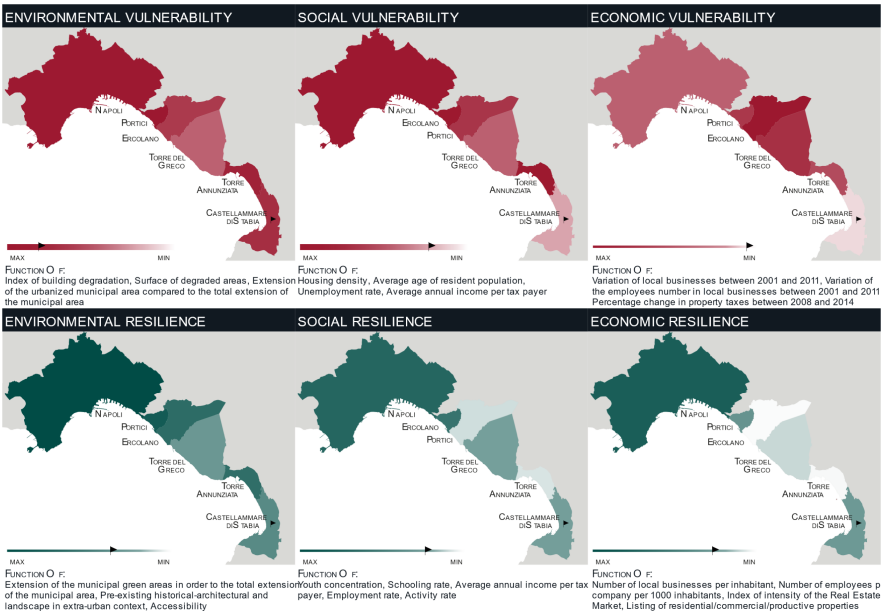


Fig. 4. Thematic maps, vulnerability and resilience (Source: 8milaCensus, http://ottomilacensus.istat.it/, Authors' Elaboration)

3.3 Phase 3: Waterfront Regeneration Scenarios

The exploration of the spatial context that flowed into the development of vulnerability and resilience maps led to the identification of a set of strategic urban regeneration goals for the Castellammare di Stabia's waterfront to 1) Promote a sustainable and innovative production process; 2) Realize a tourism system capable of enhancing environmental and archaeological potential; 3) Improve the quality of housing supply; 4) Implement a functional mix capable of responding to the heterogeneous needs of the social system. The four strategic goals become possible scenarios of sustainable development and regeneration of the waterfront and territorial poles with a specific vocation on which the scenario analysis and multi-criteria analysis focus on identifying the preferable alternative for the specific local context (Fig. 5).

Goal 1, promoting sustainable and innovative production processes, is embodied in the Productive Hub|S1 scenario, in which the implemented activities are commercial, corporate, and of the culture-education sphere, the majority private, with a small percentage public and social linked mainly to the involvement of universities.

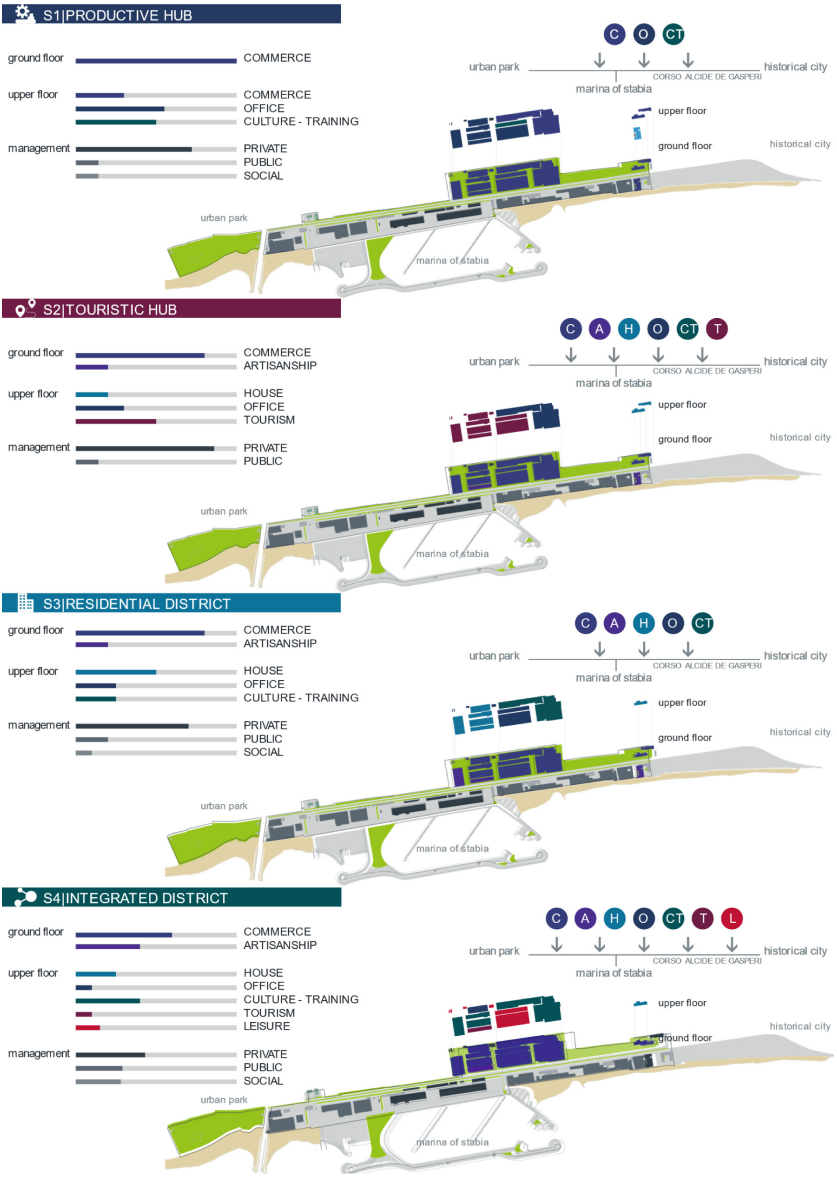


Fig. 5. Scenarios of urban regeneration, Authors' Elaboration

Goal 2, which is related to the tourist reception system, due to the proximity of the new marina, and protected archaeological and natural sites that are part of the World Heritage Sites (Archaeological Excavations of Pompeii and Herculaneum, Sorrento Peninsula, Islands of Capri and Ischia), is related to the Touristic Hub|S2 scenario, which sees an increase in commercial, craft and tertiary activities, increases the residential share, and

allocates about one-third of the total activities to tourist reception and hospitality. It is an almost exclusively privately managed scenario.

Goal 3, improvement in the quality of housing supply, results in the Residential District|S3 scenario, where the increase in commercial and craft activities, offices, and the culture and education sector are accompanied by a large proportion of area for residential use, responding to the growing demand for urban housing.

Finally, Goal 4 corresponds to the need for heterogeneous types of activities, which can hold together several distinct components related to different community needs and requirements. Implementing a heterogeneous functional mix generates the Integrated District|S4 scenario, in which the sectors of commerce, handicrafts, offices, culture and education, tourism, and residences are increased, adding a part intended for recreation and leisure activities. The scenario thus configured has more than half under public and social management, leaving the remainder to private management.

4 Integrated Evaluation

4.1 Phase 4: Decision Problem and Stakeholders Preferences

A heterogeneous and complex territorial context requires an assessment model that considers the plurality of elements involved and prioritises the prediction of impacts on the local community. The approach of the Community Impact Evaluation (C.I.E.) [20], which can integrate economic and not economic analysis, was initially used to assess the impacts of the four hypothesised scenarios, combining quantitative and qualitative aspects. It also allows for conducting financial, cultural, and social evaluations and managing coalitions and conflicts between different stakeholder groups.

After a phase of the description of the status quo, the entire regional and urban system, comparison of options, as well as explication of the design variables and the changes associated with them, the analysis phase brings the observed variables and data into the system, producing different matrices for each scenario, and for aggregating impacts. For each scenario, the impacts related to implementation and management (classified as direct financial, indirect financial, direct non-financial, indirect non-financial) were assessed about the objectives of the urban regeneration intervention, set in two macro-objectives: rehabilitation of disused industrial buildings; recovery of open spaces and green areas. The examined variables consist of the mix of activities, space allocation, and interventions on the urban and social fabric characterising the four scenarios for the sustainable regeneration of the waterfront of Castellammare di Stabia, of which the aggregation of these impacts (Fig. 6.) concerning the set objectives follows.

Next, the sector preference assessment was conducted, corresponding to the convenience and interest of each category being part of the producer-operator, and user groups for the four scenarios, resulting in a matrix of results aggregated by sectors (Fig. 7).

Systematizing the results of the aggregate impact matrix with that of sectoral preferences required an additional level of interpretation of the values obtained. Finally, the complexity of the environmental system, the heterogeneity of the needs, and the multiplicity of types of subjects constituting the community led to the elaboration of the information into a structure organized by macro-criteria (economic/financial, environmental,

socio-cultural) related to the common goal of the regeneration of the Castellammare di Stabia waterfront (Fig. 8).

AGGREGATE IMPACTS

Objectives	Variables	Scenarios				Realization				Management			
						DF	IF	DNF	INF	DF	IF	DNF	INF
RECOVERY OF DISUSED INDUSTRIAL BUILDINGS:	artisanship	1	2	3	4	X				X		X	
	healt care		2	3	4	X		X		X	X	X	X
	bed and breakfast		2		4	X				X		X	X
	libraries	1	2	3	4			X				X	X
	house of the music				4	X		X		X		X	X
	educational didactic center			3	4			X	X			X	X
	commerce	1	2	3	4	X				X		X	
	co-working	1	2	3	4	X		X		X		X	
	hotel		2			X				X			X
	infopoint		2					X				X	X
	environmental research institute			3	4		X	X			X	X	X
	laboratories	1	2	3	4	X				X		X	
	toy library		2	3	4			X				X	X
	sea museum				4	X		X		X	X	X	X
	hostels		2		4	X				X		X	X
	houses		2	3	4	X	X			X	X	X	X
	food activities	1	2	3	4	X	X			X	X	X	X
	work training school	1		3	4		X	X			X	X	X
	social housing		2	3	4	X	X	X	X	X	X	X	X
	offices	1	2	3	4	X				X	X		X
RECOVERY OF PUBLIC SPACES AND GREEN AREAS:	event areas	1	2	3	4	X		X		X		X	X
	play areas	1	2	3	4			X				X	X
	rest areas	1	2	3	4			X				X	X
	bike sharing	1	2	3	4			X				X	X
	thematic gardens	1	2	3	4			X	X			X	X
	green mobility	1	2	3	4			X	X			X	X
	urban gardens	1	2	3	4			X	X			X	X
	parks	1	2	3	4			X	X			X	X

LEGEND:
DF → DirecFinancial DNF → DirecNon-Financial
IF → IndirecFInancial INF → IndirecNon-Financial

Fig. 6. Community Impact Evaluation (C.I.E.): Aggregate Impacts, Authors' Elaboration

AGGREGATE RESULTS BY SECTORS

Sectors of the community	Comparison between the Scenarios S1| Productive Hub	S2| Touristic Hub	S3| Residential District	S4| Integrated District
Producers and Operators				
1 municipal administration	more or less good	good	more or less good	very good
2 organisation non-governmental	more or less good	good	good	very good
3 region, metropolitan city	more or less good	good	more or less good	very good
4 private subjects (companies, individuals)	very good	very good	good	good
5 university, research institutes	good	more or less good	more or less good	good
Users				
6 researchers	good	more or less good	more or less good	good
7 traders	good	very good	good	very good
8 self-employmed (company employees, professionals)	very good	more or less good	good	good
9 non-preschool and school-age residents	very good	more or less good	very good	very good
10 residents of the city of Castellammare di Stabia	good	good	very good	very good
11 tourists	more or less good	very good	good	good
12 users of collective equipment	good	very good	good	very good

Fig. 7. Community Impact Evaluation (C.I.E.): Aggregate Results by Sectors, Authors' Elaboration

ECONOMIC - FINANCIAL macro criteria

CRITERIAS	INDICATORS	DIRECTION (max, min)	IMPACT TYPE D/I - F/E/C/S	MEASUREMENT UNIT	CURRENT CONDITION |S0	PRODUCTIVE HUB |S1	TOURISTIC HUB |S2	RESIDENTIAL DISTRICT |S3	INTEGRATED DISTRICT |S4
PROMOTION OF TOURISTIC, CULTURAL ENVIRONMENTAL NETWORKS	Promotion of tourist flows	max	DF, IS, IC	qualitative judgment	-	-	+++	-	+
	Organization of major events and manifestations, exhibitions, shows	max	DF, DS, DC	yes / no	no	yes	yes	yes	yes
	Expansion of accommodation activities	max	DF, IS	qualitative judgment	-	-	+++	-	+
	Strengthening of tourist mobility services	max	DF, IF, IS, IC	yes / no	no	no	yes	no	yes
ENHANCEMENT OF PUBLIC MOBILITY	Improving local accessibility	max	IF, DS	yes / no	no	yes	yes	yes	yes
	Increasing collective public mobility	max	DF, IS	yes / no	no	yes	yes	yes	yes
PROMOTION OF PUBLIC-PRIVATE-SOCIAL PARTNERSHIP	Establishment of new collaborative relationships and partnerships	max	DF, IF	qualitative judgment	--	++	++	+++	+++
	Involvement of non-governmental associations	max	DF, IF, DS, IS	yes / no	-	yes	yes	yes	yes
PROMOTION OF JOB SECTOR	Reduction in the unemployment rate	min	DF, IF, DS, IS	qualitative judgment	+++	- --	- --	-	--
	Increased activities for the tourism sector	max	DF, IF, IS	m^2	-	0,00	21362 ,20	0,00	4272 ,44
	Increased activities for the culture - education - training sector	max	DF, IF, DS, DC, DE	m^2	- --	8408 ,66	2500 ,00	10681 ,10	25634 ,64
	Increase in activities for the craft sector	max	DF, IF, IS	m^2	- --	20137 ,43	8054 ,97	8054 ,97	12082 ,46
	Increased activities for the trade sector	max	DF, IF, IS	m^2	- --	20137 ,43	32219 ,89	32219 ,89	28192 ,41
	Increase in activities for the tertiary and production sector	max	DF, IF, IS, IE	m^2	--	34316 ,47	10318 ,05	10681 ,10	6409 ,39
PROMOTION OF HOUSING AND SERVICES SECTOR	Increase in residential activity	max	DF, IF, DS, IS	m^2	--	0,00	8544 ,88	21362 ,93	6408 ,66
DEVELOPMENT OF THE REAL ESTATE MARKET DYNAMICS	Increase in market value for premises for productive use	max	DF, IF, IS	yes / no	no	yes	yes	yes	yes
	Increase in market value for residential premises	max	DF, IF, IS	yes / no	no	no	yes	yes	yes
	Increase in market value for office and tertiary premises	max	DF, IF, IS	yes / no	no	yes	yes	yes	yes

ENVIRONMENTAL macro criteria

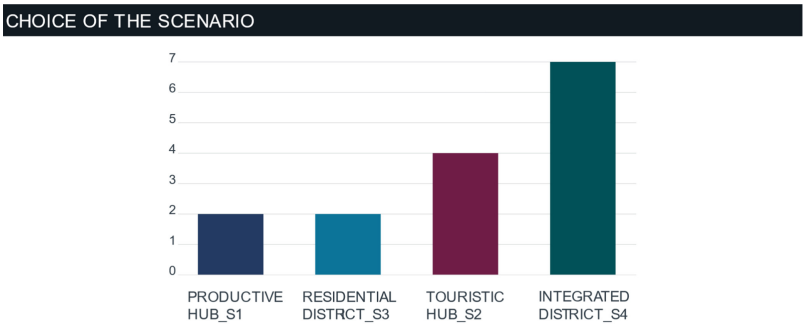
CRITERIAS	INDICATORS	DIRECTION (max, min)	IMPACT TYPE D/I - F/E/C/S	MEASUREMENT UNIT	CURRENT CONDITION |S0	PRODUCTIVE HUB |S1	TOURISTIC HUB |S2	RESIDENTIAL DISTRICT |S3	INTEGRATED DISTRICT |S4
ENVIRONMENTAL SUSTAINABILITY EDUCATION	Formation of environmental awarenessat pre-school age	max	DS, IS, DE, IE, IC	qualitative judgment	--	+	+	++	+++
	Training and education for the environment and sustainability	max	DS, IS, DE, IE, IC	qualitative judgment	--	+	+	++	+++
PROMOTION OF RESEARCH AND PROTECTION PROGRAMS	Activation of research and environmental protection programs	max	DS, IS, DE, IE, IC	yes / no	no	no	no	yes	yes
REDUCTION OF ENERGY CONSUMPTION	Containment of energy consumption in work activities	min	IF, DE, IE	qualitative judgment	nd	+++	+++	+++	+++
	Use of alternative and renewable energy sources	max	IF, DE, IE	yes / no	no	yes	yes	yes	yes
	Low energy buildings	max	IF, DE, IE	yes / no	no	yes	yes	yes	yes
	"Passive" residences	max	IF, DE, IE	yes / no	no	no	yes	yes	yes
CREATION OF A GREEN URBAN SYSTEM	Re-naturalisation of abandoned green areas	max	IS, DE, IE	m^2	0	116133 ,33	116133 ,33	116133 ,33	116133 ,33
	Creation of play areas	max	DS, IS, DE, IE	yes / no	no	yes	yes	yes	yes
	Construction of parking areas	max	DS, IS, DE, IE	yes / no	no	yes	yes	yes	yes
	Realization of thematic gardens and urban gardens	max	DS, IS, DE, IE, IC	yes / no	no	yes	yes	yes	yes
	Establishment of a public bike sharing service	max	IF, IS, DE, IE	yes / no	no	yes	yes	yes	yes

SOCIO - CULTURAL macro criteria

CRITERIAS	INDICATORS	DIRECTION (max, min)	IMPACT TYPE D/I - F/E/C/S	MEASUREMENT UNIT	CURRENT CONDITION |S0	PRODUCTIVE HUB |S1	TOURISTIC HUB |S2	RESIDENTIAL DISTRICT |S3	INTEGRATED DISTRICT |S4
PROMOTION OF CULTURAL EDUCATION ACTIVITIES	Activation of educational-educational projects for the school age	max	IF, DS, DE, IE, DC	qualitative judgment	--	+	+	++	+++
	Activation of educational projects for the resident population	max	DS, DE, IE, DC	qualitative judgment	--	+	+	++	+++
SOCIAL REGENERATION OF THE URBAN CONTEXT	Creation of a museum of the sea and industrial tradition	max	DF, IF, IS, DC, IC	yes / no	no	no	no	no	yes
	Creation of spaces of aggregation and relationship	max	DS, IS, IE, IC	yes / no	no	yes	yes	yes	yes
	Creation of common workspaces	max	DF, IF, IS, IE, IC	yes / no	no	yes	yes	yes	yes
	Creation of common craft workshops	max	DF, IF, IS, IE, IC	yes / no	no	yes	yes	yes	yes
	Activation of a public library and book sharing service	max	DS, IS, IE, DC, IC	yes / no	no	yes	yes	yes	yes
	Activation of a public playroom service	max	DS, IS, IE, DC, IC	yes / no	no	yes	yes	yes	yes
	Realization of social housing and cohousing	max	DF, IF, DS, IS	yes / no	no	no	yes	yes	yes

Fig. 8. Community Impact Evaluation (C.I.E.): Information Matrix, Authors' Elaboration

The comparison shows that the preferred alternative is Scenario 4 (Fig. 9), which generates positive community impacts in the short and long term in a holistic and sustainable development vision for the coastal zone.



IMPACTS AND PREFERENCES FOR THE CHOSEN SCENARIO

Community sectors	Preferences	Impacts DF	IF	DNF	INF
PRODUCERS AND OPERATORS					
1 municipal administration	● ●	X	X	X	X
2 organisation non-governmental	● ●			X	X
3 region, metropolitan city	● ●			X	X
4 private subjects (companies, individuals)	●	X		X	
5 university, research institutes	●		X		X
USERS					
6 researchers	●		X	X	
7 traders	● ●	X		X	
8 self-employmed (company employees, professionals)	●	X		X	
9 non-preschool and school-age residents	● ●			X	X
10 residents of the city of Castellammare di Stabia	● ●	X	X	X	X
11 tourists	●	X		X	
12 users of collective equipment	● ●			X	X

LEGEND:
DF → Direct Financial DNF → Direct Non-Financial
IF → Indirect Financial INF → Indirect Non-Financial

Fig. 9. Community Impact Evaluation (C.I.E.): Chosen Scenario, Authors' Elaboration

4.2 Phase 5: Social Multi-criteria Analysis

NAIADE [13], an acronym for Novel Approach to Imprecise Assessment and Decision Environments, is a multi-criteria assessment method in the fuzzy domain that enables an integrated approach by constructing outperformance relationships between alternatives concerning an assessment criterion with different types of measures, using conflict

analysis procedures to be integrated with multi-criteria results. A significant aspect consists in predicting coalitions and conflicts thanks to the different positions of the various groups of actors involved [21].

NAIADE makes it possible to arrive at a defensible and equitable decision, which reduces the level of conflict and achieves a certain degree of consensus. The procedure performs pairwise comparisons of alternatives under each criterion, resulting in aggregation of all criteria; ranks alternatives and analyses social conflicts.

The application of the NAIADE method allows for the ranking of solutions to compromise, sorting the alternatives according to a set of criteria, indicating the possibility of convergence of interests and coalition formation, and sorting the alternatives according to impacts on groups or preferences of actors.

For applying the NAIADE method to the case study, Scenario 0, related to Existing Conditions, was included among the possible alternatives. The Equity matrix (Fig. 10) was constructed by entering the groups of stakeholders involved in the regeneration process and indicating as alternatives all scenarios understood as areas of opportunity for the enhancement of the Castellammare di Stabia waterfront.

GROUPS \ ALTERNATIVES	Existing Conditions|S0	Productive Hub|S1	Touristic Hub|S2	Residential District|S3	Integrated District|S4
PRODUCERS | OPERATORS					
Local Municipality	PERFECT	VERY GOOD	GOOD	VERY GOOD	PERFECT
Regione Campania	MORE OR LESS GOOD	GOOD	VERY GOOD	MORE OR LESS GOOD	VERY GOOD
Metropolitan City of Napoli	MORE OR LESS GOOD	GOOD	VERY GOOD	MORE OR LESS GOOD	VERY GOOD
Real estate operators	PERFECT	VERY GOOD	VERY GOOD	GOOD	PERFECT
Touristic operators	MORE OR LESS GOOD	MODERATE	PERFECT	MODERATE	VERY GOOD
Nautical operators	GOOD	PERFECT	VERY GOOD	MORE OR LESS GOOD	VERY GOOD
ICT operators	MORE OR LESS GOOD	PERFECT	MORE OR LESS GOOD	MORE OR LESS GOOD	PERFECT
University and Research Institutions	MODERATE	PERFECT	GOOD	GOOD	VERY GOOD
USERS					
Cultural associations	MODERATE	MODERATE	VERY GOOD	VERY GOOD	PERFECT
Social associations	MODERATE	MODERATE	VERY GOOD	VERY GOOD	VERY GOOD
Traders	GOOD	GOOD	PERFECT	VERY GOOD	VERY GOOD
Professionals - corporate employees	GOOD	PERFECT	VERY GOOD	VERY GOOD	VERY GOOD
Resident citizens	GOOD	VERY GOOD	GOOD	VERY GOOD	PERFECT
Non resident citizens	GOOD	MODERATE	GOOD	MORE OR LESS GOOD	VERY GOOD
Young people	GOOD	VERY GOOD	GOOD	VERY GOOD	PERFECT
Tourists	MORE OR LESS GOOD	MODERATE	PERFECT	MORE OR LESS GOOD	VERY GOOD
Users of collective equipments	MORE OR LESS GOOD	GOOD	VERY GOOD	VERY GOOD	PERFECT

Fig. 10. NAIADE: Matrix of Equity, Authors' Elaboration

Each alternative/group intersection corresponds to qualitative output as an expression of judgments of interest to analyse the conflicts between the groups through a linguistic evaluation of the alternatives according to the following scale: perfect/very good/good/more or less good/moderate/more or less bad/bad/very bad/extremely bad.

Each scenario identified contributes to structuring a possible positive-sum regeneration strategy in which the triggered process activates social and economic growth. Consequently, within the NAIADE matrices, the alternatives/scenarios did not receive negative ratings.

The NAIADE software returns the Coalition Dendrogram (Fig. 11) through a fuzzy clustering algorithm, which makes the coalitions and the level of conflict between the groups visualizable, with the relative index for each partnership alternative. Through the dendrogram, it is possible to check the level of agreement of the preferred alternative and, consequently, improve the participation process in collective choices to make the Integrated District scenario for sustainable waterfront development.

The ranking of alternative Scenarios (Fig. 11) presents the Integrated District|S4 as the preferred scenario, which meets the demand for increased activities, services and housing and improved community welfare with a heterogeneous functional mix.

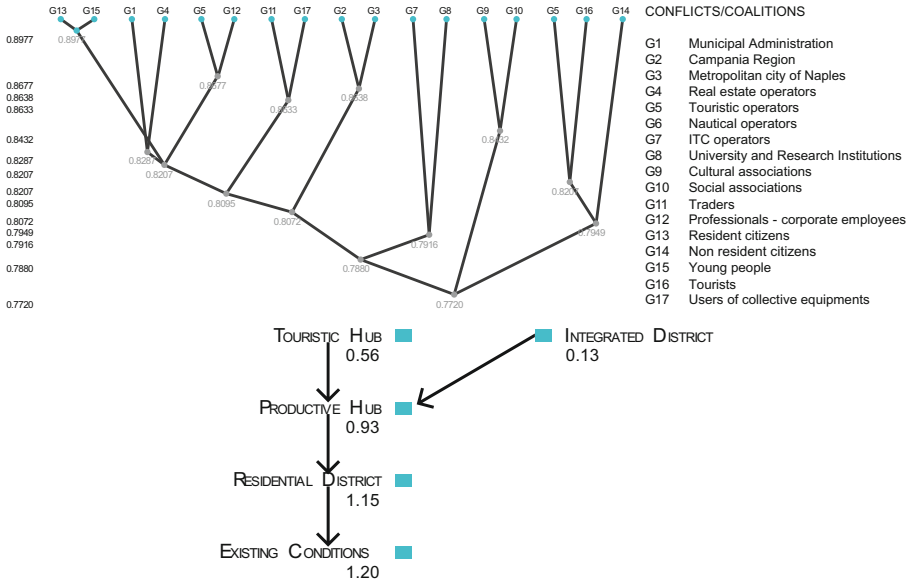


Fig. 11. NAIADE: Dendrogram of Coalitions and Ranking of Alternatives, Authors' Elaboration

5 Results

5.1 Phase 6: Waterfront Regeneration Metaproject

The outcome of the evaluation process for the tailor-made regeneration of the waterfront of Castellammare di Stabia provides an elaboration of Scenario 4, Integrated District concretized in a metaproject vision (Fig. 12), that includes new public and cultural areas obtained from the reconversion of disused industrial buildings; activities able to revitalise the supply of employment and livability thanks to open spaces and new housing;

renewed mobility system, configuring a green infrastructure for the local community. The buildings that accommodate the functional mix of the scenario create a new urban fabric, similar in layout to the already operational and functioning Marina di Stabia Tourist Port hub and draw a novel urban pattern: the built-up areas are punctuated by paved public spaces, connected to the road axis by a green infrastructure that changes continuously.

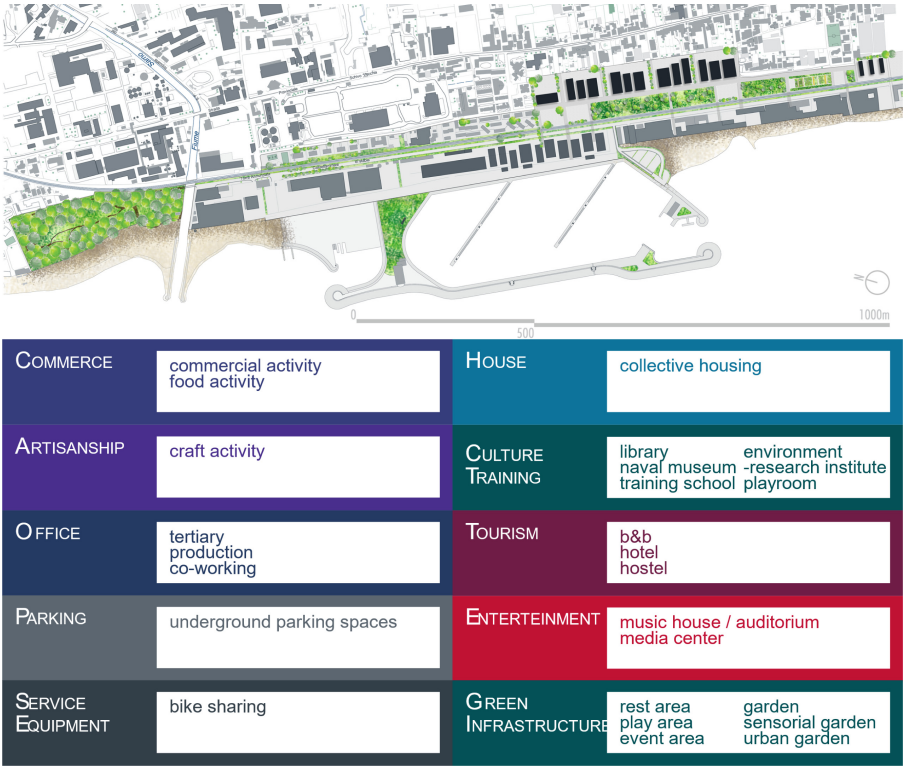


Fig. 12. Metaproject: Integrated DistrictlS4 and Functional mix, Authors' Elaboration

6 Conclusions

The research aimed to structure, through the study of the territory, the mapping operation of vulnerability and resilience, scenario analysis and a multi-criteria social assessment, a site-specific regeneration process for Castellammare di Stabia waterfront, attentive to the needs and requirements of the community and respectful of the local context. Applying the C.I.E. and NAIADE methods in such a complex and heterogeneous context made understanding the conflicts and coalitions that characterize the construction of the decision-making problem more accessible and proved to be an effective decision-making process in achieving consensus by the actors involved. Therefore, the research

dimension did not involve more detailed planning and design activities, left to later phases of investigation and work, focusing instead on structuring specific responses to the possibility of activating a process of urban regeneration in an integrated approach that created new connections, relationships and values between the community and the landscape.

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