

A Decision-Making Process for Circular Development of City-Port Ecosystem: The East Naples Case Study

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Abstract. The synergy between the city and the port area represents an essential component for the sustenance of the economic system of the European Union. In this perspective, ports have been recognised as critical strategic hubs in economic competitiveness, job opportunities and investments. Nowadays, ports as strategic hubs suggest an increase of spaces dedicated to logistics and a high economic, social and environmental impact on cities. The need to define a new process of circular development of the city-port ecosystem considers environmental and social challenges, proposing a circular urban model capable of renewing the relationship between city and port. Starting from the Sustainable Development Goals (SDGs) and Agenda 2030, and the instances of circular development, the research defines an adaptive and multidimensional decision-making process capable of integrating evaluation approaches and tools to deal with complex interactions and conflicts that characterise the city-port ecosystem. The outcomes were focused on evaluating alternative scenarios for the city-port ecosystem of East Naples, in Italy, towards a circular model implementation. The decision-making process supports an accurate reflection on the possibilities of regenerative transformation of a complex context, considering the specific needs of stakeholders and the local community.

Keywords: Circular city-port · Multi-criteria analysis · Community-driven process

1 Introduction

The synergy between the city and the port area represents an important issue for the economic system of the European Union as a trigger capable of relaunching its growth, improving its efficiency and stimulating innovation and long-term competitiveness [1].

In this perspective, ports have been recognised as critical strategic hubs for the transport system and economic competitiveness and their high potential for job opportunities and investments [2]. However, today speaking of ports as strategic hubs means considering an increase in spaces dedicated to logistics and consequently of a high impact on cities in economic, social and environmental terms [3].

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Pollution, noise and visual impact are some of the leading social and environmental effects stemming from port expansion [4]. The awareness of the negative impact of port expansion has led to a growing public demand for the transformation process of urban waterfront [5, 6]. It is evident the need to define a new growth process for a port-city that considers environmental and social challenges, proposing an urban model capable of overcoming the dichotomy between the two polarities. This model could allow proposing integrated and circular visions that, on the one hand, enhance the port as a strategic hub and, on the other, favour a mending of the urban fabric and a renewed relationship between city and sea.

The definition of a circular vision of the city [7] is strongly interconnected with the Sustainable Development Goals (SDGs) of the Agenda 2030, drawn up by the United Nations [8]. The approach of the SDGs is particularly significant to address the issue of a regenerative transformation process and to deduce a set of actions focused on the complex urban and maritime issues affecting the city-port ecosystem.

In this perspective, the circular models stimulate reflections on the architectural project moving toward the re-use of existing heritage [9], understood as a fundamental element for local identity and social cohesion [10]. The concept of reuse has been enriched over time with cultural, socio-economic and ecological objectives that underline its potential as a driver of new strategies for the regeneration of the context for the reduction of soil consumption [11–16].

In the specific context of the city-port, the landscapes are dotted with imposing architectures, now abandoned or underused, which have marked a glorious past in terms of production and transformation of raw materials. Starting from a circular perspective, it is central to rewrite the role of these great ghost architectures present in the coastal landscape and the relationships between the city and the port.

The research aims to define an adaptive and multidimensional decision-making process that integrates evaluation approaches and tools to deal with complex interactions and conflicts that characterise the city-port ecosystem. Specifically, the research finds its field of application in the context of the port city of Naples (Italy), in the district of San Giovanni a Teduccio.

The decision-making process was developed as part of the activities carried out during the Second level Master in “Sustainable planning and design of port areas”, at the Department of Architecture (DiARC) of the University of Naples Federico II, in support of the Metropolitan City of Naples and the Central Tyrrhenian Port System Authority (AdSP) in identifying alternative strategies for the redevelopment of the East Naples port area.

This contribution is organised as follows: the first Section indicates the materials and methods adopted to define a multidimensional and multi-methodological decision-making process for the city-port ecosystem of East Naples; the second Section describes the case study; the third one shows the application of the methodological approach to the case study and report the results. Finally, the last Section points out preliminary outcomes, highlighting potential and critical aspects.

2 Materials and Methods

The research aims to elaborate an evaluation framework for defining a decision-making process based on a multidisciplinary and integrated methodology [17], which can help a circular growth strategy for the city-port ecosystem.

The complexity of the city-port ecosystem necessarily requires the coexistence of specific and diversified skills and to structure the decision-making problem starting from the main issues that are the subject of public debate. Therefore, the research, from a sustainable and circular development perspective, considers the following transformation factors:

– the complex relationship between port and city;
– the economic issues of the port authority;
– the social issues of the local community.

The methodological process proposed by the research adopts a place-based approach [18–20]. This approach requires a decision-making process involving a plurality of local actors (governments, communities, businesses, universities, etc.) to support initiatives of territorial regeneration and cultural and social innovation [21].

The proposed methodology is based on mixed evaluation methods, eliciting soft and hard knowledge domains, which were then assessed to develop and define alternative, inclusive and sustainable solutions [22] (see Fig. 1).

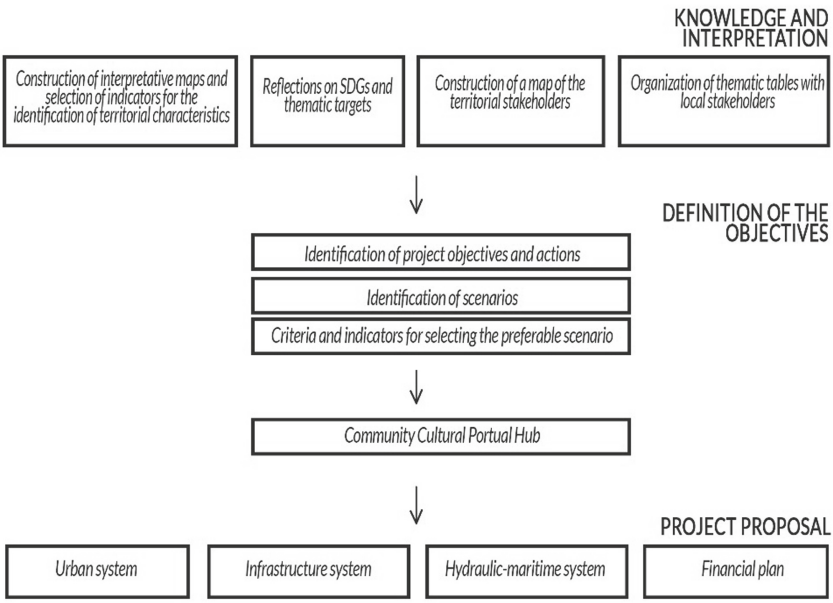


Fig. 1. The methodological framework.

The collection of hard data deriving from institutional sources was combined with a soft survey to bring out the needs and requirements of local communities. To this end, defining a map of the most significant stakeholders proved indispensable, orienting research towards a vision of balanced development and making it possible to assess compromise solutions (see Fig. 2).

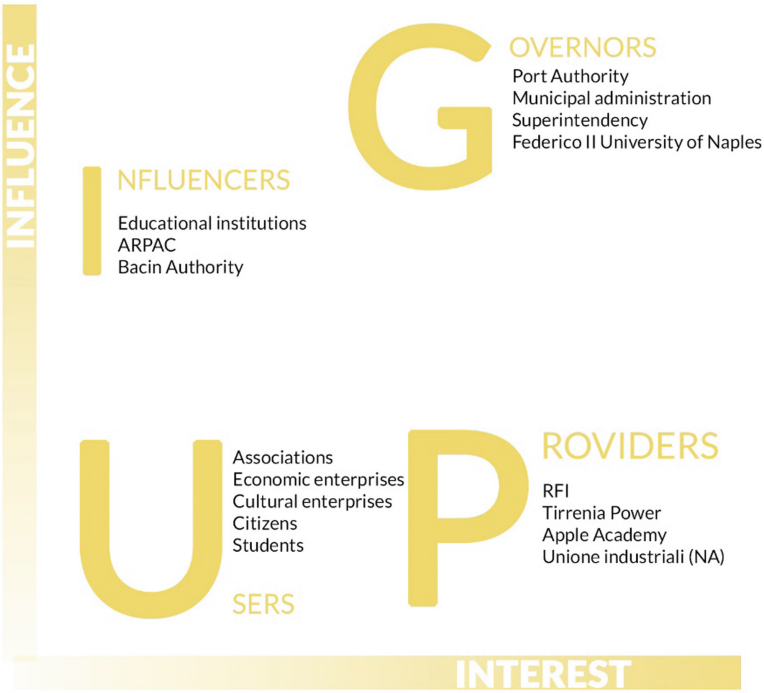


Fig. 2. The stakeholders' map.

By organising thematic tables of discussion, a workflow was built focused on defining sustainable and inclusive design alternatives starting from choosing the most suitable SDGs objectives [8].

Each round table was organised by submitting to the various participants some of the SDGs objectives of Agenda 2030 regarding the subject of the meeting. For the study of the San Giovanni a Teduccio area, ten objectives (Objective 4 - Quality education; 7 - Affordable and clean energy; 8 - Decent work and economic growth; 9 - Industry, innovation and infrastructure; 11 - Sustainable cities and communities; 12 - Responsible consumption and production; 13 - Climate action; 14 - Life below water; 16 - Peace, justice and strong institutions; 17 - Partnerships for the goals) were selected, translated into project criteria and brought to the attention of stakeholders during the seminars.

During the discussion table, each participant was asked to express a score according to the Likert scale from 1 to 5, where 1 represents "strongly disagree" and 5 means "strongly agree" for each proposed SDG object to build together a set of macro objectives to be

pursued. At the end of each seminar, sustainable goals and visions for the neighbourhood are extrapolated to help define project scenarios.

At the same time, a survey was submitted to associations and citizens of the neighbourhood to identify better moods regarding new transformation processes to be undertaken. The survey, constructed according to the CATWOE method [23], allows to highlight criticalities and potentialities of a possible transformation process and what are the advantages, disadvantages and traits of this transformation. The CATWOE method is structured as follows in Table 1.

Table 1. CATWOE method structure

Labels		Questions
C	Customers	Who could get advantages or disadvantages from the transformation?
A	Actors	Who could carry out the transformations? How could you help to build this vision?
T	Transformations	What objectives will be pursued to enhance San Giovanni a Teduccio district?
W	Weltanschauung	Which of these projects should occur in the area? What do you propose?
O	Owners	Who could oppose these transformations?
E	Environment	What environmental constraints could be conditioned?
+	Critical and potential	What are the significant criticalities and potentialities of the area?

Concerning the results of the discussion tables and the survey, the definition of several project alternatives made it possible to envisage different development scenarios. Thus, three design alternatives have been defined for a new spatial configuration of the city-port eco-system of the San Giovanni a Teduccio district which corresponds respectively to port-centred, community-centred and hybrid visions. Each scenario was evaluated using the Evamix method, implemented by the Definite 2.0 software [24]. A coalition dendrogram with the Naiade method [25] was also structured to highlight the conflicts and coalitions arising from each scenario. The preferable alternative is one capable of mediating more between the interests of the various stakeholders by proposing a new sustainable, circular and integrated configuration of the city-port eco-system of the San Giovanni a Teduccio district.

3 The Case Study: The East Naples City-Port

Located in Southern Italy, the district of San Giovanni a Teduccio lies on the east coastal zone of Naples city-port. With an original agricultural vocation, this area is nowadays squeezed between the administrative boundaries of the two systems: the Metropolitan City of Naples and the Central Tyrrhenian Port System Authority (AdSP). As in all

those territories located in city-port interaction, the dichotomy between city and port has generated places in between, spaces waiting for a definition [26, 27]. Furthermore, communities who live in these contexts are marked by the uncomfortable conditions of the places themselves: communities that need essential services, in places where there are problems of welfare, illegality, and security (see Fig. 3).



Fig. 3. The focus area: the city-port of Naples, the district of San Giovanni a Teduccio.

This area of city-port interaction has been selected as a case study within the Master's Degree Course Level II in "Sustainable planning and design of port areas" of the Department of Architecture (DiARC), University of Naples Federico II.

The study and the analysis of the main urban planning tools have made it possible to have a broader and more solid knowledge of the complexities of the urban processes affecting the San Giovanni a Teduccio district. This operation has highlighted how the mending between the coastal strip and the rest of the urban fabric is indispensable and central to the planning of the territory. Another evidence is the quantity of stakeholders that affect this portion of territory, each with their requests, thus highlighting the need to build a collaborative decision-making process capable of finding a compromise between the various visions [28–30].

4 Results

The proactive involvement of the main stakeholders ensures the definition of a methodological approach based on support systems for collaborative decisions. The organisation of thematic discussion tables makes explicit the relation between SDGs and the decision-making processes of transformation of the study area. Representatives of the local municipal administration, urban regeneration experts, scholars, representatives of local associations and representatives of the Port Authority were involved in the thematic tables held between the spring and the summer of 2020 on the themes of the

reuse of existing heritage, the right to the city and the sea, the opportunities related to SEZs the rearrangement of the road system and the water networks of East Naples.

During the first round table, entitled "The Ex-Corradini: industrial archaeology in East Naples", held on May 22, 2020, emerged the need to recover the existing architectural heritage, enhance the identity of the neighbourhood and its memory, to improve the quality of public space and create greater integration between port and city.

The second seminar is "The reconstruction of a shared vision for East Naples" on June 19, 2020. The emerging objectives concern the urgency of recovering the relationship between the community and the sea by stopping port expansion.

The third round table focused on the theme of "Special Economic Zones (SEZs): Opportunities and conflicts" on June 26, 2020, defined a new concept of cultural SEZs, tax-facilitated areas whose beneficiaries could be cultural and creative enterprises.

"Infrastructures and transport systems for East Naples" is the title of the fourth seminar held on 3 July 2020. This meeting made explicit the need to have a new port mobility system capable of respecting European standards and integrating with the urban context.

Finally, the last meeting entitled "Management of environmental resources and water networks in East Naples", held on 10 July 2020, focused on constructing a complete framework of knowledge about the situation of the district's water networks and the theme of reclamation of the coastal strip.

In parallel, a survey titled "Let's build together a new vision for East Naples" was submitted to associations and citizens of San Giovanni a Teduccio.

The main criticalities that emerged refer to the lack of direct access to the sea due to an almost total absence of overpasses or underpasses to overcome the physical barrier of the railway line. Another important criticality emerged is the urgency of reclamation works in the coastal area to allow its use for recreational purposes. In addition, there are inadequate housing conditions, the absence of job opportunities and a poor perception of safety. Instead, the proximity to the sea, the historic city, and the privileged view of the Gulf of Naples were considered the neighbourhood's potentialities to be enhanced and from which to start a new and more conscious city-port project.

These considerations confirm that the dichotomy between the two polarities of the city-port ecosystem has generated isolated and insecure places that urgently need structured and adaptive planning.

Furthermore, the survey shows the need to activate a process of regenerative transformation of the neighbourhood's city-port ecosystem that could aim to develop collaborative processes involving stakeholders and the local community and encourage greater physical and functional integration between the port and urban spaces.

The objectives and visions that emerged allowed the definition of three possible scenarios:

- "Portual International Hub" envisages the expansion of the Levante dock with consequent construction of the track bundle without any enhancement of the Ex-Corradini complex. In this scenario, the SEZs are intended as central retro-port areas to make San Giovanni a Teduccio an internationally competitive production hub.
- "Cultural Hub" gives voice to the community issues. The Ex-Corradini, the waterfront, the Pietrarsa railway museum, and the Apple Academy are configured as the neighbourhood's new centres of cultural and social development. In this proposal, the

SEZs are interpreted in the sense of cultural SEZs. Any expansion of the port spaces is renounced, allowing to think about a new urban waterfront configuration.

– "Community Cultural Portual Hub", is an equilibrium scenario. The expansion of the port is limited to the completion of the dock in its current configuration. This scenario favours a high development of the port towards the SEZs areas of the hinterland of East Naples. The neighbourhood would have the opportunity to reappropriate of the waterfront, recovering abandoned and degraded areas and converting some of the inland SEZs into SEZs with a cultural vocation. In this comprehensive system, the Ex-Corradini plant acts as a hinge between the issues addressed.

The three scenarios were compared using the software Definite 2.0 [24] and Evamix method to make a decision-making process operational and capable of combining the preferences of the various stakeholders and the hard data collected during the analysis and knowledge phase. The Evamix method, also pursuing the objective of tracing the preferable scenario, reasons by gradually attributing different weights to the various indicators, establishing an order of priority.

The three scenarios were assessed through the adoption of 7 criteria divided into further indicators, as showing in the following Table 2.

Table 2. Criteria and indicators used for the evaluation.

Criteria	Indicators
Capacity to accommodate maritime traffic	Goods handling
Commercial attractiveness of port activities	Surface of SEZs
Commercial attractiveness of cultural activities	Employment of shipping companies
	Construction/infrastructure companies
	Logistics companies
	Export companies
	Cultural companies
	Hi-tech companies
	Manufacturing companies
Alteration of the coastline	Size of the fill
City-port interaction	Presence of overpasses
	Presence of a promenade
	Beach reclamation
	Presence of public spaces along the coast
	Elimination of physical barriers
Enhancement of the archaeological and industrial heritage	Recovery of the Ex Corradini area
	Recovery of the area of the Ex Depuratore
	Enhancement of the "Forte di Vigliena" area

The criteria relating to the city-port interaction, the enhancement of the existing heritage and the alteration of the coastline are those to which greater weight has been attributed than the others because of their essentiality for a process of transformation of San Giovanni a Teduccio. The Evamix method highlights the preferability of the third scenario: Community Cultural Portual Hub (see Fig. 4).



Fig. 4. The results of the alternative scenarios assessment with Evamix method.

Implementing the Naiade software [25], a coalition dendrogram was created that highlights the relationships between the proposed scenarios and the needs of the territorial stakeholders involved. The coalition dendrogram also identifies the third scenario as preferable. In particular, the dendrogram underlines how the time component is decisive for defining a compromise scenario capable of responding to the needs of the various stakeholders (see Fig. 5).

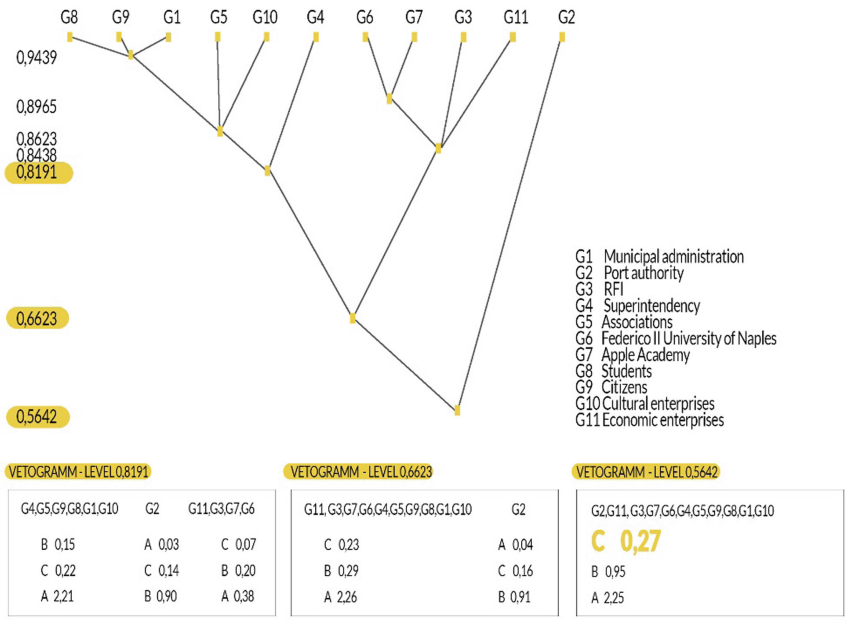


Fig. 5. The coalition dendrogram elaborated with Naiade method.

The Community Cultural Portual Hub scenario proposes an inclusive and participatory vision capable of explaining the needs of the various stakeholders involved and, therefore, defining possible mediation solutions. This scenario has been explored in this contribution by proposing a new coastline configuration through the design of a network of public spaces capable of reconnecting the environmental, urban and social resources that characterise the district of San Giovanni a Teduccio in an ecosystemic vision.

4.1 Community Cultural Portual Hub

The research defines a project proposal focused on recovering the relationship between the urban fabric of the neighborhood and its coastal strip (see Fig. 6).

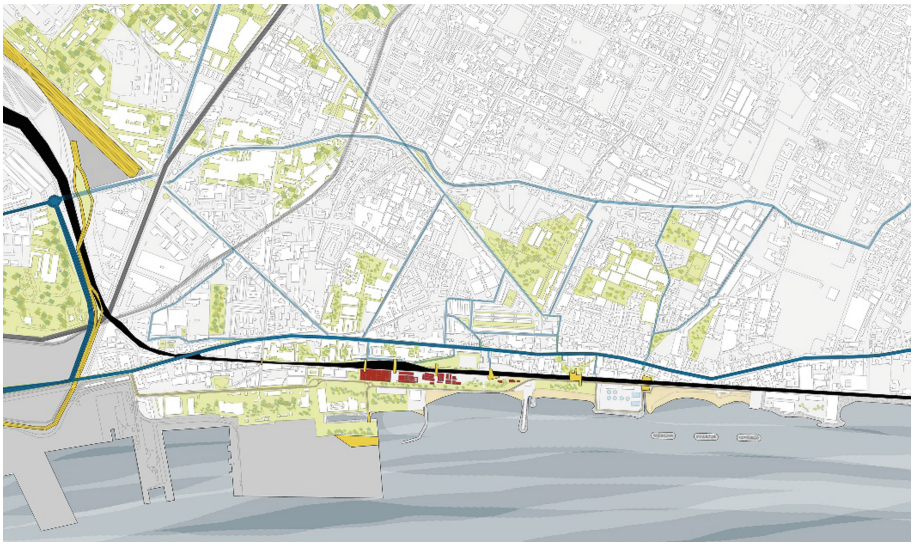


Fig. 6. A new spatial configuration of the city-port eco-system of the San Giovanni a Teduccio district.

The main purpose of the project proposal is to rethink the coastal strip in terms of a public space accessible from the city and capable of accommodating a new variety of activities and functions related to well-being, training and productivity [31].

The Ex-Corradini area acts as a hinge between the issues in this panorama of possible transformations. Parks, promenades, and beaches become the spaces of sociality.

The project concept focuses on the theme of public space as a connecting element in the city-port ecosystem and, therefore, capable of redefining the relationship between sea and neighborhood [32].

To foster this connection, it becomes necessary to think of a port infrastructure that is not expanding towards the coast but widespread inland, thanks to the presence of the SEZs. According to the concept project, SEZs are conceived as retro-port areas and areas dedicated to cultural productivity thanks to their economic potential. The proposal

focuses on enhancing and strengthening a direct connection between the port and the Napoli Traccia station and between the port and the SEZs. According to the project, new tracks for access to the hub area are provided to meet the needs of accessibility and enhancement of the port logistics chain. At the same time, the research proposes separating the flows of urban mobility and port mobility by creating separate traffic systems.

To verify the project's economic sustainability, a financial analysis was carried out considering a time frame of twenty years.

The NPV (Net Present Value), calculated considering the conventional rate of return of 5%, was positive. The IRR (Internal Rate of Return) was higher than the discount rate chosen to calculate the NPV. Therefore, the investment can be considered profitable taking into account a public-private partnership.

5 Discussions and Conclusions

The research proposes an adaptive and multi-methodological decision-making process able to grasp the complexities of East Naples' city-port ecosystem and develop sustainable and circular strategies for new regenerative transformations of the study context. Adopting a circular approach makes it possible to interpret the complexity of the urban and socio-economic processes that characterise the city-port ecosystems and trace the drivers capable of activating new scenarios of regenerative transformation.

The structured decision-making process was helpful to support an accurate reflection on the possibilities of regenerative transformation of a complex context, focusing on the specific needs of stakeholders and the community. The main limitations of the proposed approach are to be found in the fact that the application of the process requires a long time as it focuses on the involvement and willingness to collaborate of different subjects. Furthermore, integrating hard and soft knowledge requires a careful collection and selection of the most appropriate data and a deep interaction with the various stakeholders. The methodological process chosen was structured in such a way as to be flexible and continuously contaminated by the new information collected.

The research aims are oriented to highlight the validity of a strategy applicable in cases of urban regeneration of complex areas affected by the influence of various stakeholders. From this point of view, the city-port ecosystem represents an enabling context capable of activating integration processes at multiple levels and accompanying the entire territory towards a circular and sustainable transition by stimulating territorial productivity, economic development and social cohesion.

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