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*Article*

# Port Cities Creative Heritage Enhancement (PCCHE): culture and creativity for sustainable development of Naples port

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**Abstract:** Port cities' sustainable development can start from innovation in maritime culture to build new urban visions based on the goals of Agenda 2030 and oriented towards local and international cooperation. In the international debate innovative strategies on cultural heritage enhancement contaminate the research and production contexts of ports. In addition, numerous cities have implemented creative and cultural responses to climate change and environmental sustainability. Creativity and cultural heritage enhancement can guide the definition of new trajectories of sustainable urban development, particularly in port-city interaction areas. In Europe, port-city interaction areas have been transformed into laboratories of cultural and creative experimentation for the sustainable management of cultural heritage and the urban quality of public spaces. In this perspective, the paper, starting from the studies developed on the main measurement frameworks of creative cities and sustainable development policies, aims to investigate the possibility of developing a "Port-cities Creative Heritage Enhancement" approach to assess and plan possible cultural and creative transformations of historical-architectural buildings, industrial archaeologies and symbolic urban spaces in the port-city interaction areas of Naples.

**Keywords:** port-city sustainable development; culture and creativity; port heritage enhancement; evaluation and planning

## 1. Introduction

In the current global scenario, culture is increasingly being recognized as a key player in sustainable development policies, especially in building opportunities for city-based interventions that celebrate local cultural diversity and unleash the transformative power of creative action on climate change and environment resilience.

Culture has assumed a strategic role within the European political agenda (European Commission, 2007, 2018; KEA European Affairs, 2017) especially within sustainable development policies. In fact, cities can build links between their cultural strategies and climate change policies by drawing on a rich background of sustainability policy frameworks that filter down to national and regional policies [1].

Cultural approaches give data, information, models, integrated evaluation frameworks, and holistic solutions to decision-makers, academics, practitioners, and citizens to support climate change adaptation and mitigation actions aiming at sustainable urban development.

More culturally embedded contributions to the construction of sustainable urban development alternatives can enrich future-thinking processes beyond climate model outputs towards mitigation/adaption solutions tailor-made on local context. It can also put to the test and extend several well-established climate research and policy approaches for forecasting and planning futures. The fundamental features of cultural alternatives for sustainable urban development consist in providing spaces for collective, improvisational and reflexive modes of acting on and thinking about uncertain futures [2] such as those outlined by the new climate scenarios.

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Culture and climate definitions frequently use terms like "shared set of assumptions, beliefs, or attitudes" [3–10]. In their definitions, Hale (2000) [6] and Cooper and Phillips (1995) [10] both combine culture and climate. Cooper and Phillips (1995) define culture as the product of multiple goal-directed interactions between people, jobs, and organizational settings, whereas Hale (2000) defines safety culture as attitudes, perception and beliefs shared by natural groups as establishing norms and values. Fang et al. (2006) [4] describe culture as "a set of key indicators, ideas, and values that the organization owns in safety. According to Nayak and Waterson (2017) [11], culture refers to how individuals behave, whereas climate refers to how they feel" [12].

In this context, cultural and creative policies and practices are cross-disciplinary innovative approaches for sustainable development in cities [13–16]. New policy initiatives such as the New European Bauhaus strongly underline the role of art, culture, and creativity to foster experimentation and connection in public spaces to build a sustainable and inclusive future. In this regard, a cultural and creative approach to climate change can have a significant impact on policy, and cultural creative sectors are likely to play a key role in assisting the transition to a greener Europe especially in making easier for citizens to transfer and adopt sustainable actions and behaviours. These sectors may use the urban cultural scene as a platform to influence and inspire their communities and audiences, resulting in increased public participation within climate and environmental issues.

A city's cultural life provides opportunity for inhabitants to connect each other and influence locally based collective values, while also reflecting cultural diversity and environmental surroundings. Current economic and urbanization trends are stressing on local resources, systems, and infrastructures, necessitating new approaches to regulating, financing, and monitoring urban and environmental performance, with a focus on cultural and creative capital [17]. An increasing number of cities have developed creative and cultural-based approaches to climate change and environmental sustainability as vital sites for experimentation and innovation.

Recent examples can be grouped into the following categories [18]: (i) Actions to promote awareness: cities are using cultural movements, single cultural institution projects, or artists to create awareness and consciousness about more sustainable choices; (ii) Citizens' engagement and participation in policymaking: by raising citizens' understanding of environmental issues culture and creativity can improve citizens' participation in policymaking and governance in respect to the environment and climate change; (iii) Bottom-up participatory activities can also make it easier for citizens to transfer and adopt sustainable behaviors and actions; (iv) Greening the cultural creative sectors: as environmental knowledge and sensitivity have become more prevalent in recent years, the cultural creative sectors are experimenting with new environmentally friendly procedures while encouraging consumption habits that are less harmful to the environment.

Despite the fact that culture has a basic relationship with climate change mitigation and adaptation, these experts all agreed that culture is mainly absent from current climate change talks. The United Nations Framework Convention on Climate Change, the Paris Agreement, and the IPCC Assessment Reports do not include culture in a systematic way. Incorporation of all components of sustainable development, including the environmental dimension, into cultural policies is also critical. UNESCO is bringing together more experts and specialists on this topic, emphasizing the importance of culture in addressing climate change, as well as the necessity to guarantee that culture is included in decision-making processes connected to climate change [19].

Culture has key role in decision-making processes because of its ability of linking people to their surroundings and to one another, building cohesion, community and collective action. Artists and cultural voices help to raise public awareness and action on climate change, and their work may be a potent vehicle for mobilization. Cultural institutions such as museums and libraries provide platforms spaces [20] for listening to communities and also as hubs of multicultural and intergenerational interchange, capacity building, and knowledge-sharing through public accessibility and trust.

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Integrating natural and cultural values shows the connections between landscapes' ecological and social functions, promoting environmentally friendly lifestyles. In this perspective, the owners and users of landscapes and buildings are now investing in this historic environment. Cultural heritage preserves people's stories and local knowledge (what the Paris Agreement refers to as "endogenous technologies") and demonstrates the causes of historical changes as well as how people adapted to them [21].

An interesting testing ground for this integration among cultural and natural values, in terms of "endogenous technologies", are port cities [22–24]. In this urban context, especially ports, as nodes of the logistic system that supports international trade, are key realities in the local economic growth, having substantial effects on the city's well-being and quality of life, as well as causing spatial, social, and environmental issues in terms of pollution footprint and increasing sea level rise.

This implies the need to review the relationship between port heritage and urban functions by redefining spaces with creative, environmentally and socially sustainable uses by identifying new services able of increasing the port's performance and the city's development in an integrated way [25,26].

In this context, ports broaden their sphere of action by developing themselves as "cultural and creative infrastructures" capable of becoming city hinges by establishing a synergic relationship among the maritime cluster, the creative cultural sector, and the territory, thereby activating urban regeneration processes.

To measure how cultural creative sectors could enhance environmentally, economic and socially sustainability of port-city environment, different indicators frameworks can be considered.

First of all, we can analyze the "Sustainable Development Goals" of the United Nations 2030 Agenda [27]. In particular, Goals 8, 9, 11 and 14. Goal 8 "Decent work and economic growth", in which development-oriented policies that support productive activities, decent work creation, entrepreneurship, creativity and innovation and encourage the growth of micro, small and medium-sized enterprises, including through access to financial services, are promoted. Objective 9 "Industry, innovation and infrastracture", which aims to build resilient infrastructures, promote industrialization and innovation, improving the efficiency of resources to be used and the adoption of clean and environmentally friendly technologies. Objective 11, "Sustainable cities and communities", aims at the realization of urban transformations able to take into account the cultural and natural heritage, to minimize the impacts of urban agglomerations on the environment, through a participatory approach. Objective 14 "Life below water" aims to ensure sustainable management of marine and coastal ecosystems, minimizing marine pollution (in particular from land-based activities, including the reduction of marine waste and pollution).

Furthermore, the recent "Agenda 2030" of the "Association Internationale Villes Et Ports" (AIVP), adapts the United Nations Sustainable Development Goals to the specific context of city-port relations. Through the identification of 10 goals, linked to the SDGs, 46 action measures are specified with the aim of promoting sustainable development and relations between cities and ports. In particular, the goal 6 "Port culture & identity" aims to promote and capitalize on the culture and identity of port cities as a lever to develop a sense of belonging and build a "city port community of interest" [28], and goal 8 "Port city interface", which aims to provide, to inhabitants living near ports, recreational and cultural services in the areas of the port-city interface. Declining the goals of the 2030 Agenda in the context of port cities can help to «ensure support for city and port institutions in the development of projects and strategic plans that promotes sustainable development and city-port relations» [28].

Regarding the cultural-creative production monitoring systems, UNESCO has developed the "Culture for Development Indicators" (CDIS) project, which proposes a new methodology to demonstrate the role of culture as a driver of sustainable development processes based on empirical data [29]. This project, which stems from the "Convention on the Protection and Promotion of the Diversity of Cultural Expressions" [30], addresses

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"cultural expressions" in terms of values and norms that guide human action and not only as a productive or recreational sector.

At the European level, the ESSnet-Culture framework was developed [31] to help EU countries build their own specific statistical framework for the cultural sector. The update of ESSnet for European cultural statistics - previously defined in 2000 by the LEG-Culture framework - is the first step towards a common framework useful for the production of comparable European data on different culture-related topics [32]. The structure of ESS-net-Culture is based on three key concepts: cultural domain, function and dimension.

At the same time, other studies are oriented to build a set of ad hoc indicators to measure the creativity of EU member states in sustainable development policies, such as the "KEA European Affairs European Creativity Index" (ECI) [33], which takes into account a number of "factors" of the cultural dimension, often not included in other indices, such as participation in cultural events, financial support for creativity and the role of technology.

In the perspective of measuring the social, environmental, and economic dimensions of the cultural phenomenon, it could be useful the latest tool developed by UNESCO – the framework of "Thematic Indicators for Culture in the 2030 Agenda" [34] – whose main objective is to measure and monitor the contribution of culture in the implementation of the SDGs. The framework aims to assess both the role of culture as a productive sector and the cross-cutting contribution of culture in different policies at national and local levels. The methodology uses existing data, qualitative and quantitative, to assess the contribution of culture also in terms of cultural heritage, creative industries, local culture and products, creativity and innovation, local communities, local materials and cultural diversity, recognizing the key role of community participation.

The Culture 2030 indicators are categorized according to four cross-cutting dimensions: "Environment and Resilience", "Prosperity and Livelhoods", "Knowledge and Skills", and "Inclusion and Participation". Each dimension combines different SDGs goals and targets to capture the multifaceted and cross-cutting contribution of culture to sustainable development. In particular, the "Environment and Resilience" dimension attempts to assess the level of safeguarding and sustainable management of cultural and natural heritage, the urban environmental quality of public spaces and cultural infrastructure and the inclusion of traditional knowledge in a culturally sensitive planning. In this dimension, the introduction of a specific target on climate change helps to understand how natural, historically derived, local building practices, and intangible cultural heritage can help mitigating the risks of climate related disaster, support resilience and enhance the adaptation capacities of communities [34].

Another European study crucial to understanding the implications of cultural sectors in sustainable urban development is the "Cultural Creative Cities Monitor"[35–37], aiming to assess performances of European cultural and creative cities in terms of sustainable growth through a set of 29 indicators. The indicators are organized into nine "domains" that reflect three key "dimensions" of cultural and creative cities: "Cultural Vibrancy", "Creative Economy" and "Enabling Environment", using comparable quantitative and qualitative data. The Monitor tool is particularly interesting when it is also applied to the evaluation of creative urban regeneration practices at the local scale [38,39].

These indicators frameworks can represent the starting point for new sustainable development strategies for the port intended as a cultural and creative infrastructure: a "cultural gateway" to the city.

In this perspective, this paper aims to investigate the possibilities of developing a "Port-cities Creative Heritage Enhancement" (PCCHE) approach by answering the following questions: how to measure port heritage creative transformations for sustainable urban development? How cultural creative actions and policies can build new productive values systems for sustainable port-city system interaction?

Taking into account the above-mentioned research questions, the contribution has been structured according to the following path: Section 2 describes the methodological

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approach and the main methods and tools used for the ex-ante evaluation; Section 3 presents the analysis and description of the results deriving from the ex-ante evaluation of Naples port-city cultural alternatives for sustainable urban development; Section 4 discusses the results, and Section 5 presents the conclusions.

## 2. Materials and Methods

Taking into account the above reflections, the research considers creative reuse of cultural heritage as a potential for sustainable managing of urban transformations and for the inclusion of local knowledge in sustainable port-city planning policies.

The "Port Cities Creative Heritage Enhancement" (PCCHE) approach (Figure 1) aims to understand and evaluate the different multidimensional components of possible cultural creative alternatives, underlining the capacity to generate social, environmental and economic impacts.

The methodological proposal has been articulated in the following phases: 1. Problem structuring, 2. Defining alternatives, 3. Evaluating alternatives, 4. Preferences comparison. The ex-ante evaluation process has been implemented for four Naples port heritage alternatives, developed on the basis of the main categories developend in European cities and in collaboration with Port System Authority of Naples, defined for understanding how to build cultural maritime identity (Konvitz, Clemente, ecc), innovation and creativity, human capital and knowledge for port-city sustainable development.

The methodological approach explores the synergy among port heritage enhancement and port-city sustainable development, bringing together the different dimensions of the "Cultural Creative Cities Monitor" with the dimension "Environment and Resilience" of UNESCO Culture 2030 tool.

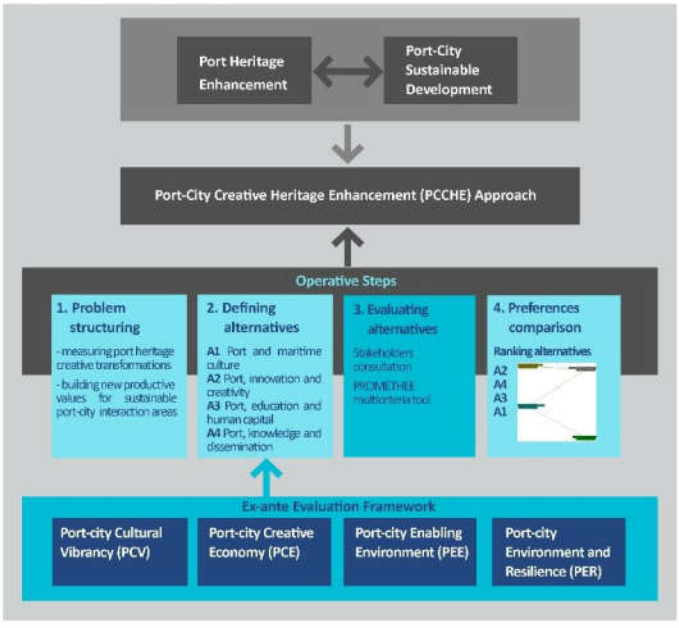


**Figure 1.** The "Port Cities Creative Heritage Enhancement (PCCHE)" approach (illustration: authors).

In this perspective, the analysis considers four key dimensions as the significant aspects of port-city creative and sustainable regeneration:

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1. Port-city Cultural Vibrancy (PCV) for capturing how cultural and creative infrastructures implement port-city attractiveness;
2. Port-city Creative Economy (PCE) in terms of creative activities and creative-knowledge-based jobs for understanding opportunities deriving from maritime culture innovation;
3. Port-city Enabling Environment (PEE) for highlighting the level of human capital involved or interested in port-city sustainable development.
4. Port-city Environment and Resilience (PER) for understanding the role and contribution of culture on port heritage sustainable management and urban environments quality.

The ex-ante evaluation framework elaborated for the PCCHE alternatives underlies how an appropriate evaluation/planning framework should consider multiple goal-directed interactions between cultural values and environmental issues for port-cities interaction areas sustainable development.

The PCCHE alternatives collect some Naples port heritage buildings and public spaces (Figure 2) that are classified in: A1 Port and maritime culture; A2 Port, innovation and creativity; A3 Port, education and human capital; A4 Port, knowledge and dissemination.

**Figure 2.** The Port of Naples cultural heritage: historic buildings, architectures and symbolic spaces (illustration: authors).

The A1 "Port and maritime culture" include typical activities of a potential cultural hub that promote maritime culture in terms of art, history and archaeology. A1 defines a system of actions deriving from cultural institutions projects or cultural NGOs events for creating awareness about more sustainable choice in port-city planning.

Within the A2 "Port, innovation and creativity" all the initiatives are related to possible cultural creative enterprises, industry 4.0 and start up incubator for experimenting new environmentally friendly procedures and encouraging sustainable consumption habits in reusing port heritage.

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The A3 "Port, education and human capital" is regarding to universities and research centres for improve studies on maritime culture and environment involving also institutions, NGOs and citizens.

Within the A4 "Port, knowledge and dissemination" are included spaces and buildings for community initiatives on port-city interaction. Bottom-up participatory activities can make it easier for citizens to transfer and adopt sustainable practices and also engage them in policymaking.

In collaboration with the Port System Authority of Central Tyrrhenian Sea (Naples, Salerno and Castellammare) and thanks to the Google datastudio tool we've collected some relevant data for each Naples PCCHE alternatives (Figure 3): (i) number of buildings, (ii) total surface area (sqm), (ii) volume (mc), (iii) number of concession buildings, (iv) number of building in delivery, (v) total estimated cost of interventions; (vi) percentage (%) of historic buildings, industrial archaeology and urban landmarks.

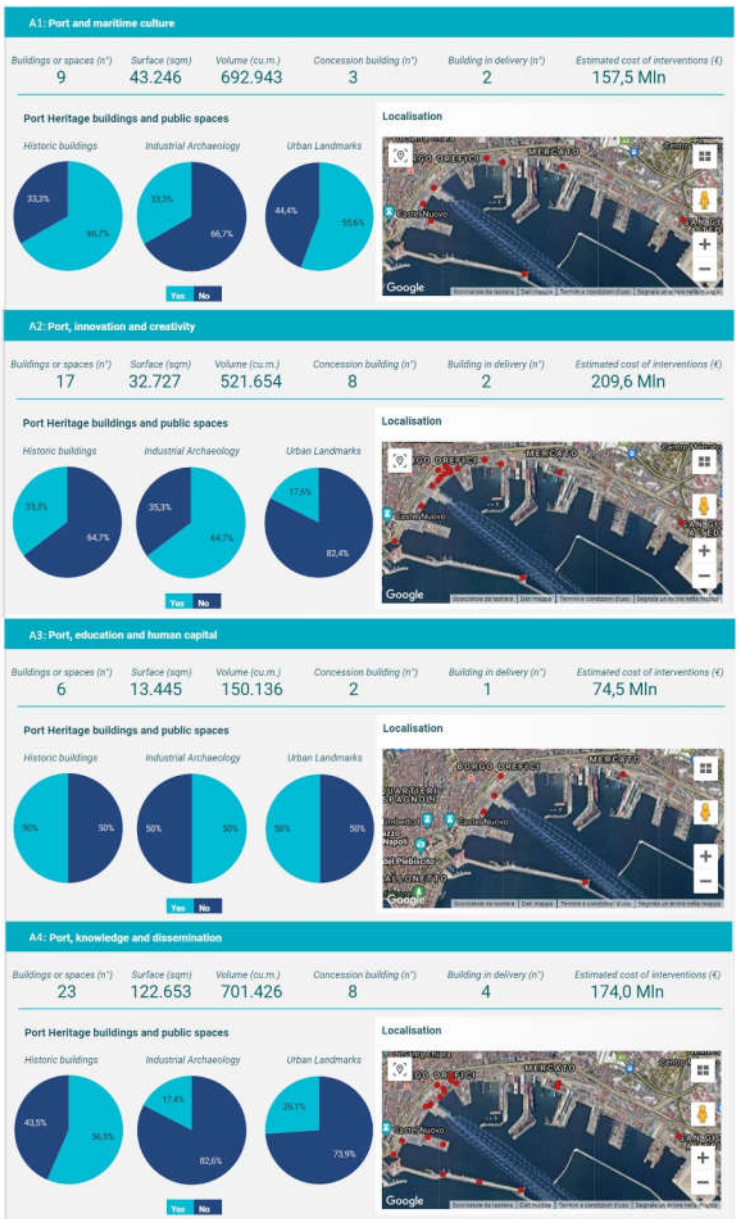


**Figure 3.** The Naples PCCHEE alternatives (elaboration of authors – Google datastudio).

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For assessing the Naples PCHEE alternatives, resulting from the analysis of port heritage and the consultation of port-city stakeholder and professionals (), we consider the following domains, dimensions, criteria starting from the Cultural Creative Cities Monitor and UNESCO Culture 2030 frameworks. The analysis aims to compare the different creative alternatives for Naples port heritage enhancement, highlighting the potentials of sustainable and cultural activities in valorizing cultural heritage within port-city interaction areas. Starting from the ex-ante evaluation framework (Table 1), the indicators selected (PCV.1.1., PCV.1.2., PCV.1.3., PCV.2.1., PCE.1.1., PCE.1.2., PCE.2.1., PCE.2.2., PEE.1.1., PEE.1.2, PER.1.1., PER.1.2.) use some data gathered from AdSP-CNR IRISS 2021-2022 project database and some data from best practices comparable to the different alternatives. About A1 "Port and maritime culture" some data are collected from the Rotterdam Maritiem Museum, the Maritime Museum of Barcelona, National Archeological Museum of Naples. For A2 "Port, innovation and creativity" the choice is related to Rotterdam University of Applied Sciences, the creative hub of Neighborhood houses' network in Turin, PortXL Rotterdam, Barcelona Tech City. Regarding A3 "Port, education and human capital" the information are gathered from Rotterdam Maritiem Museum and Escola Europea Intermodal Transport of Barcelona. For A4 "Port, knowledge and dissemination" the main data come from two community hubs: Neighborhood houses' network in Turin and Foqus in Naples.

**Table 1.** The ex-ante evaluation framework for a "Port Cities Creative Heritage Enhancement (PCCHE)": dimensions, criteria and selected indicators.

| Dimension | Criteria | Indicators |
|---|---|---|
| **Port Cultural Vibrancy (PCV)** | *PCV.1. Cultural venues and facilities* | PCV.1.1. Recoverable surface (sqm) |
| | | PCV.1.2. Number of urban landmarks (n°) |
| | | PCV.1.3. Percentage of empty spaces to reuse (%) |
| | *PCV.2. Cultural participation* | PCV.2.1. Number of participants in cultural activities (n°) |
| **Port Creative Economy (PCE)** | *PCE.1. Creative attractiveness* | PCE.1.1. Number of creative activities (n°) |
| | | PCE.1.2. Creative activities revenues (€/year) |
| | *PCE.2. Creative knowledge-based jobs* | PCE.2.1 Number of employment (n°) |
| | | PCE.2.2. Number of enterprises or start-up (n°) |
| **Port Enabling Environment (PEE)** | *PEE.1. Human Capital* | PEE.1.1. Number of partners (n°) |
| | | PEE.1.2. Number of learning and education activities (n°) |
| **Port Environment and Resilience (PER)** | *PER.1. Environmental strategies for heritage* | PER.1.1. Policies or actions to reduce environmental impact at heritage sites (scale 1-5) |
| | | PER.1.2. Buildings integrated with sustainable or natural techniques/materials (%) |

Within the dimension of Port Cultural Vibrancy (PCV), the criteria PCV.1. "Cultural venues and facilities" and PCV.2. "Cultural participation" are related to port cultural life, and can be considered a key component of urban quality and sustainability conditions in port-city planning. The related indicators are respectively: PCV.1.1. Recoverable surface (sqm); PCV.1.2. Number of urban landmarks (n°); PCV.1.3. Percentage of empty spaces to reuse (%); PCV.2.1. Number of participants in cultural activities (n°).

The two criteria PCE.1. "Creative attractiveness" and PCE.2. "Creative knowledge-based jobs", related to the dimension Port Creative Economy (PCE), describe the capacity to attract talent, investments and qualified professionals in creative fields for guaranteeing innovation in maritime culture for sustainable urban development. For these criteria, the selected indicator are: PCE.1.1. Number of creative activities (n°); PCE.1.2. Creative activities revenues (€/year); PCE.2.1 Number of employment (n°); PCE.2.2. Number of enterprises or start-up (n°)

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For the dimension Enabling Environment (EE), the criteria PEE.1. "Human Capital" identifies the different kinds of human resources that help build the conditions to encourage cultural engagement in sustainable behaviors and projects. In this case, the indicators are the following: PEE.1.1. Number of partners (n°); PEE.1.2. Number of learning and education activities (n°).

Regarding the dimension of Port Environment and Resilience (PER), the criteria PER.1. "Environmental strategies for port heritage" valorises natural resources as a foundation for creative regeneration of maritime heritage. The main indicators consist: PER.1.1. Policies or actions to reduce environmental impact at heritage sites (scale 1-5); PER.1.2. Buildings integrated with sustainable or natural techniques/materials (%).

The comparative analysis has been applied to the designed alternatives through a multi-criteria decision support system: the PROMETHEE-GAIA method of Preference Ranking Organisation Method for Enrichment Evaluations family [40,41].

The PROMETHEE method is an outranking approach for ranking and selecting a set of alternative actions based on different criteria. The PROMETHEE-GAIA technique enables for compensating a disadvantage on one point of view with benefits from other points of view, as well as determining a degree of agreement among stakeholders on the ranking of alternative solution.

| Naples Port Heritag... | PCV.1.1. | PCV.1.2. | PCV.1.3. | PCV.2.1. | PCE.1.1. | PCE.1.2. | PCE.2.1 | PCE.2.2. | PEE.1.1. | PEE.1.2. | PER.1.1. | PER.1.2. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unità | unit | unit | unit | unit | unit | unit | unit | unit | unit | unit | 5 punti | unit |
| Cluster/Gruppo | ◆ | ◆ | ◆ | ◆ | ● | ● | ● | ● | ■ | ■ | ● | ● |
| **Preferenze** | | | | | | | | | | | | |
| Min/Max | max | max | max | max | max | max | max | max | max | max | max | max |
| Peso | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| Funz. di preferenza | Usual | Usual | Usual | Usual | Usual | Usual | Usual | Usual | Usual | Usual | Usual | Usual |
| Soglie | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto | assoluto |
| - Q: Indifferenza | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| - P: Preferenza | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| - S: Gaussiana | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| **Statistica** | | | | | | | | | | | | |
| Minimo | 13445 | 2 | 25 | 17500 | 44 | € 3.420.000 | 42 | 0 | 21 | 15 | 3 | 25 |
| Massimo | 122653 | 7 | 80 | 440000 | 81 | € 5.250.000 | 168 | 3000 | 90 | 65 | 5 | 80 |
| Media | 53018 | 4 | 54 | 276375 | 64 | € 3.902.186 | 95 | 755 | 52 | 46 | 4 | 54 |
| Deviazione standard | 41600 | 2 | 22 | 170849 | 14 | € 778.422 | 46 | 1296 | 28 | 20 | 1 | 22 |
| **Valutazioni** | | | | | | | | | | | | |
| S1 'Port and mar... | 43246 | 3 | 25 | 228000 | 60 | € 3.420.000 | 88 | 0 | 90 | 15 | medio | 25 |
| S2 'Port, innovat... | 32727 | 2 | 70 | 440000 | 70 | € 3.469.372 | 81 | 3000 | 68 | 65 | molto buono | 70 |
| S3 'Port, educati... | 13445 | 4 | 80 | 17500 | 44 | € 5.250.000 | 42 | 0 | 30 | 44 | molto buono | 80 |
| S4 'Port, knowle... | 122653 | 7 | 40 | 420000 | 81 | € 3.469.372 | 168 | 18 | 21 | 60 | buono | 40 |

**Figure 3.** The Naples PCCHE evaluation matrix (PROMETHEE-GAIA software).

The approach could also be a beneficial negotiation tool for reaching an agreement between conflicting points of view among diverse decision-makers, as well as a tool for better understanding the challenges of making good decisions.

The main data are recovered from port-city initiatives in European contexts but also in Italian cultural and community experiences of heritage enhancement in terms of cultural participation, creative attractiveness, creative knowledge-based jobs and human capital. The data related to cultural venues and facilities and environmental strategies for heritage are concerning the ongoing research project named "Census and enhancement of the historic-architectural heritage, port functions and areas of port-city interaction of the Ports of Naples, Salerno and Castellammare di Stabia" resulting from the collaboration agreement 2021-2022 between Institute of Research on Innovation and Services for Development (IRISS) of National Research Council of Italy (CNR) and Port System Authority of Central Thyrrenian Sea.

## 3. Results

The results achieved help to visualise evaluation/planning critical issues and potentials, engaging key stakeholder to achieve consensus and validating or invalidating the different alternatives.

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The profile of A1 "Port and maritime culture" (Figure 4) is more relevant for the indicators PCV.1.1. "Recoverable surface", in terms of buildings and public space appropriate for this function, and PCE.2.1 "Number of employment", PEE.1.1. "Number of partners", highlighting the possible economic opportunities generated on the territory and also the capacity of attracting people building alliances.

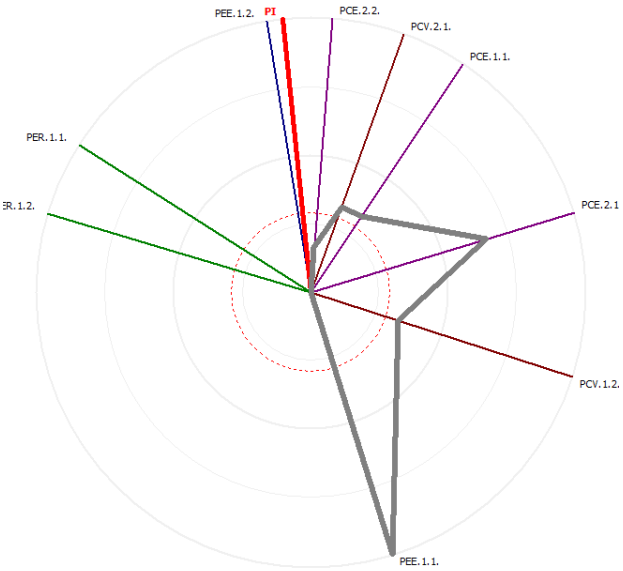


**Figure 4.** Evaluation of alternatives: GAIA Webs of A1 "Port and maritime culture".

The performance of "A2 Port, innovation and creativity" (Figure 5) are described using the following indicators: PCV1.3. "Percentage of empty spaces to reuse", PCV2.1 "Number of participants in cultural activities", showing the potentials in regenerating port-city interaction areas in terms of innovative economic activities and social participation within new cultural facilities; PCE.1.1. Number of creative activities, PCE.2.2. Number of enterprises or start-up, highlighting the ability to activate new jobs' opportunities in the creative sector; PEE.1.1. Number of partners, PEE.1.2. Number of learning and education activities, showing the ability of creative professionals to find new productive relationships, to increase their capabilities and to transfer their skills; PER.1.1. Policies or actions to reduce environmental impact at heritage sites, PER.1.2. Buildings integrated with sustainable or natural techniques/materials, implementing opportunities related to sustainable management of cultural and natural heritage.

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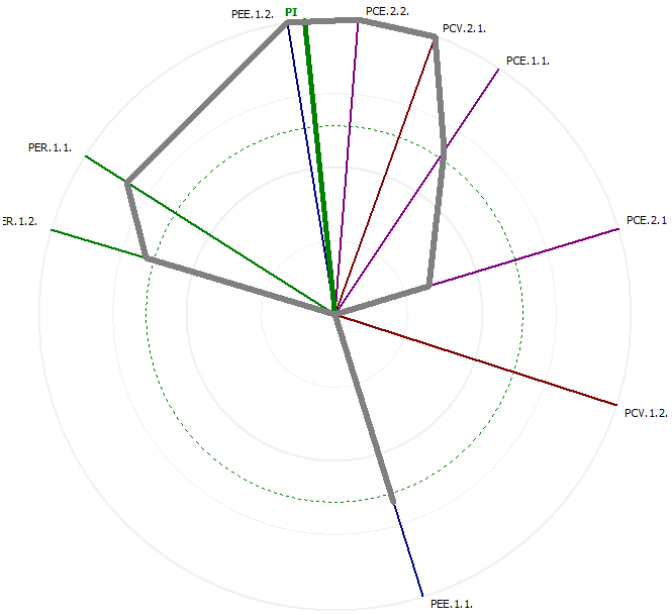


**Figure 5.** Evaluation of alternatives: GAIA Webs of A2 "Port, innovation and creativity".

The profile of A3 "Port, education and human capital" (Figure 6) identifies the following relevant indicators: PCV.1.2. Number of urban landmarks, PCV.1.3. Percentage of empty spaces to reuse, demonstrating the potential of these buildings and public space to become cultural infrastructures for implementing port-city attractiveness; PCE.1.2. Creative activities revenues, highlighting economic opportunities related to cultural creative activities PER.1.1. Policies or actions to reduce environmental impact at heritage sites, PER.1.2. Buildings integrated with sustainable or natural techniques/materials triggering urban environmental quality of public spaces.

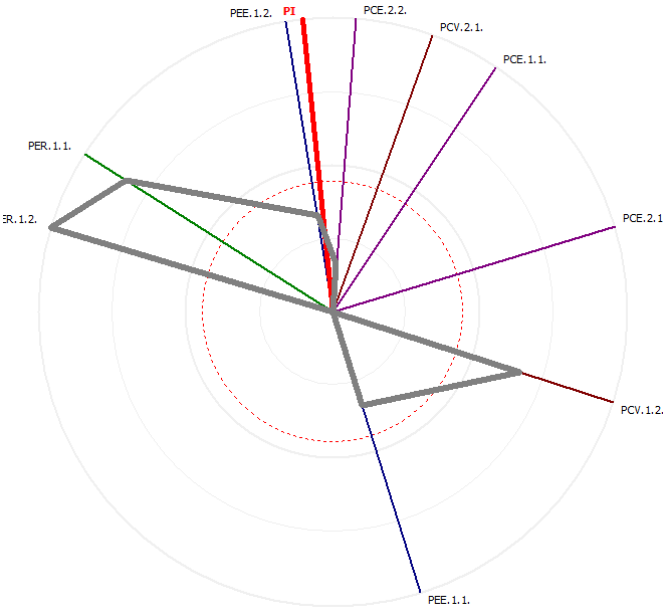


**Figure 6.** Evaluation of alternatives: GAIA Webs of A3 "Port, education and human capital".

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The profile of A4 "Port, knowledge and dissemination" (Figure 7) considers the following key indicators for measuring its better performances: PCV.1.1. "Recoverable surface", PCV.1.2. "Number of urban landmarks", PCV.2.1. Number of participants in cultural activities, for emerging the implementation of port-city attractiveness through dissemination activities; PCE.1.1. Number of creative activities, PCE.2.1 Number of employment, PCE.2.2. Number of enterprises or start-up, for showing the economic opportunities from knowledge-based jobs; PEE.1.2. Number of learning and education activities, demonstrating the inclusion of sustainable knowledge in a culturally sensitive planning.

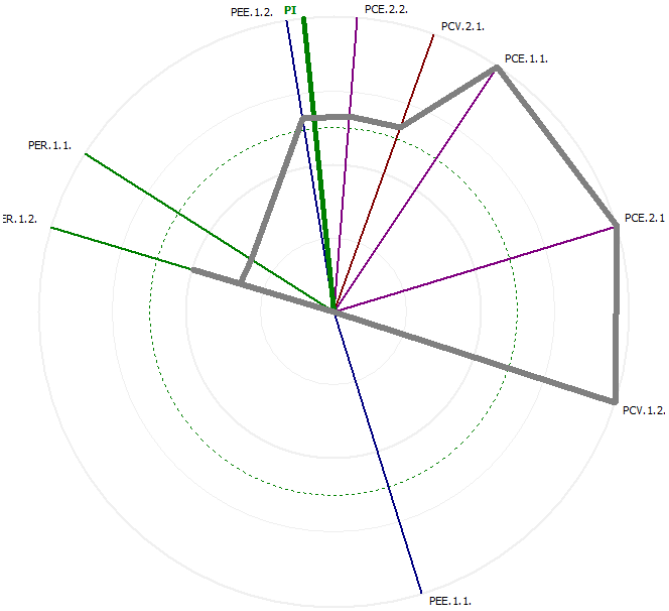


**Figure 7.** Evaluation of alternatives: GAIA Webs of A4 "Port, knowledge and dissemination".

The GAIA visual analysis (Figure 8) allows for a better understanding of the options available, as well as analyzing and explaining the decision problem. The findings of the GAIA Visual Analysis are shown in Figure 8, along with the position of the indicators and the final ranking of the PCCHE alternatives. The PROMETHEE decision stick and PROMETHEE decision axis in the GAIA Visual Analysis give a sensitivity analysis tool. The preferred choices are positioned in the direction of the decision axis, as shown by the GAIA plane.

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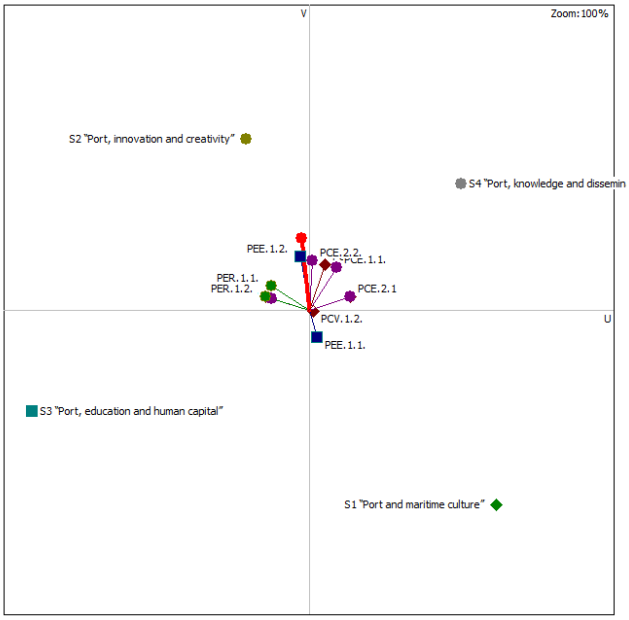


**Figure 8.** Evaluation of alternatives: the GAIA Visual Analysis.

The complete ranking identifies A2 "Port, innovation and creativity", followed by A4 "Port, knowledge and dissemination", A3 "Port, Education and human Capital" and A1 "Port and maritime culture" as shown in the PROMETHEE Diamond and PROMETHEE Network (Figure 9).

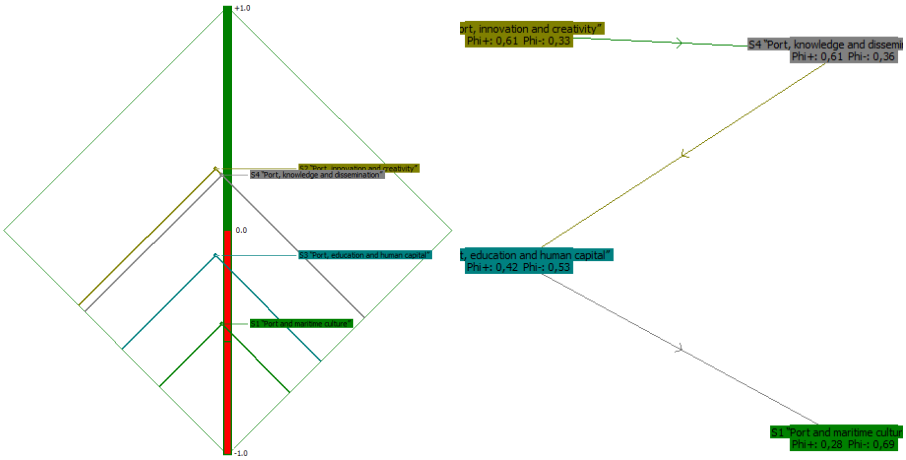


**Figure 9.** Evaluation of alternatives (a) PROMETHEE Diamond and (b) PROMETHEE Network.

The decision-making model in use is aimed at giving the decision-maker with a thorough study of the situation as well as appropriate guidance.

The data analysis suggests that A2 "Port, innovation and creativity" is the most balanced alternative in terms of activating innovative planning and evaluation models of port heritage creative transformations for sustainable urban development. The reason can be related to the introduction of new types of creative economy and sustainable actions and policies as engine of new port-city system interaction. The alternatives "A4 "Port, knowledge and dissemination", A3 "Port, Education and human Capital" and A1 "Port and maritime culture" highlight how culture and creativity are key factor for a common sense of be-longing to port heritage. It is essential to develop a high level of engagement

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of both local communities and scientific experts for focusing on this creative heritage enhancement and discovering new potentials of disruptive innovation in port-city planning and evaluation.

**4. Discussion and conclusions**

In the current international debate, culture and creative action on climate change and environment resilience is a strategic priority [12,21]. The key features of cultural alternatives for sustainable urban development consist in providing spaces for a flexible functions and collective acting on and thinking about uncertain futures.

Starting from these assumptions, the paper has attempted to describe a different perspective on cultural alternatives for sustainable urban development by adopting an evaluation and planning approach for Naples port heritage enhancement. In this perspective, the cultural creative alternatives are designed for highlighting how cultural values, talents and creativity [42,43] together with environment and resilience dimension [44,45] can address urban development through new challenges of safeguarding and sustainable management of cultural and natural heritage.

Taking into account the above reflections, the research considers at creative enhancement of cultural heritage as a way to manage urban transitions more sustainably and to incorporate local knowledge into long-term port-city planning.

Creativity, as an integrated and driving component, can make a difference in the processes of urban sustainable development trough: promoting awareness about more sustainable choices; engaging in policymaking by raising citizens' understanding of environmental issues; transferring and adopting sustainable practices; greening the cultural creative sectors with new environmentally friendly procedures, etc.

The symbiotic effect of creative enhancement of cultural heritage could lead the definition of new trajectories of sustainable urban development, particularly in port-city interaction areas. Indeed, Europan port-city interaction areas [46,47] have been transformed into laboratories of cultural and creative experimentation for the sustainable management of cultural heritage and urban quality of public spaces [34].

The evaluation framework identifies four main dimensions, derived from literature analysis and stakeholders consultation, Port Cultural Vibrancy (PCV), Port Creative Economy (PCE), Port Enabling Environment (EE), Port Environment and Resilience (PER) and the related criteria, and indicators that are selected to develop the ex-ante evaluation of Naples PCCHEE alternatives.

Taking into account the explored research questions, we can highlight that the PCCHEE alternatives analysed and the results achieved identify human capital, creative talent, and environmental capital as main productive values in the regeneration of city-port interaction areas. The identification of ex-ante evaluation framework could meet local, long-term development goals for defining and measuring port-city planning policies between cultural values and environmental issues.

In the framework, it is considered crucial to build appropriate indicators that allow for the integration of subjective components, explicitly stating the perspectives of the various actors (local authorities) participating in the decision-making process as well as users (local communities).

The four alternatives are analysed to identify new potential uses of the existing heritage combining maritime culture, creativity, innovation, sustainable strategies and community interactions. The application of hybrid evaluation approaches and Multi-Criteria Analysis [48–50], able in combining different techniques and tools, allows to explore the introduction of new types of creative economy and sustainable actions as engine of new port-city system interaction.

The multi-criteria evaluation methods identify the overall performance of the different alternatives and suggests that A2 “Port, innovation and creativity” is the most balanced alternative in terms of activating port heritage creative transformations for sustainable urban development. The alternative is able to respond in a balanced and positive way

to key indicators of the Port Cultural Vibrancy (PCV), the Port Creative Economy (PCE), the Port Enabling Environment (PEE), and the Port Environment and Resilience (PER). A2 alternative, including cultural creative enterprises, industry 4.0 and start up incubators activities, is the possible engine of innovative planning and evaluation models able to investigate how natural, historically derived, local building practices, and intangible cultural heritage can help mitigating the risks of climate related disaster, support resilience and enhance the adaptation capacities of communities.

The strength of this approach lies in planning innovative interventions combining different interests and impacting on people sustainable behaviours individual or groups, in a creative manner. A continuous action of awareness-building of the urban sustainable development is necessary, which accompanies the physical transformations of a territory.

The weak point certainly concerns the complexity of different social and institutional conflicts inside the port and the difficulty to manage economic resources for sustainable policies and actions.

The challenge consists in making communities and institutions understand that investing time and money in the creative integration between port and city greatly helps a long-term urban regeneration. Indeed, sustainable and collective culture, as reflected in strategies and actions, becomes the connection that facilitate physical transformation and guide the selection of appropriate behaviors

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