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Port-city cultural interactions' influence on sustainable coastal development

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In the context of sustainability, ports are often emerging points of contention involving stakeholders from the maritime industry, local government, and communities. Effective communication and the nurturing of maritime culture can act as a powerful means of facilitating information exchange between ports and cities. A well-established communication channel is crucial for sharing knowledge, actions, experiences, and cultural values, thus contributing to the successful development of a port. Existing research shows that incorporating cultural elements can provide an additional dimension to sustainable development and resilience research, particularly within the realm of port organizational resilience and sustainable progress. Particular attention is paid to small and medium-sized ports, as they are disproportionately impacted by their surrounding social communities due to the intricate connections among culture, heritage, and environmental factors. This investigation focuses on cultural interactions between ports and cities with the aim of understanding their effects on sustainable development in medium-sized port cities and their coastal regions. The research objectives include defining port-city interaction, situating it within the context of sustainable development in coastal areas, outlining the cultural aspect of such interactions, and suggesting pathways to enhance the sustainability of coastal regions through improved cultural exchanges. The research employs a theoretical approach, systematically exploring concepts, theories, and existing knowledge to provide a strong foundation for the investigation. The results underscore the significance of integrating culture into port-city dynamics to bolster sustainable development and resilience in coastal regions. To achieve this integration, adopting cooperative or entrepreneurial business models for port authorities and enhancing municipal participation in port governance structures are suggested. Culture,

as a dynamic influencer, shapes communication and organizational environments, and contributes to achieving UN Sustainable Development Goals. The evolutionary trajectories of port-city interactions not only enhance socio-environmental aspects but also pave the way for long-term sustainability and excellence in coastal regions.

Keywords: port-city interaction, cultural interaction, sustainable development, coastal regions, resilience of ports

JEL classificatory: L25, L32, M14

Dans le cadre de la durabilité, les ports sont souvent des points de controverse impliquant les parties prenantes de l'industrie maritime, les autorités locales et les communautés. Une communication efficace et le développement de la culture maritime peuvent former une combinaison puissante pour faciliter l'échange d'informations entre les ports et les villes. Un canal de communication bien établi est essentiel pour partager les connaissances, les actions, les expériences et les valeurs culturelles, contribuant ainsi au succès du développement d'un port. La recherche existante postule que l'intégration d'éléments culturels peut apporter une dimension supplémentaire à la recherche sur le développement durable et la résilience, surtout dans le domaine de la résilience organisationnelle des ports et du progrès durable. Une attention spécifique est accordée aux ports de petite et moyenne taille, étant donné qu'ils sont particulièrement affectés par l'influence des ports sur les communautés sociales environnantes en raison des liens complexes entre la culture, le patrimoine et les facteurs environnementaux. Cette étude se focalise sur les interactions culturelles entre les ports et les villes dans le but de comprendre leurs impacts sur le développement durable des villes portuaires de taille moyenne et de leurs régions côtières. Les objectifs de la recherche sont de définir l'interaction port ville, de la replacer dans le contexte du développement durable des zones côtières, de mettre en avant l'aspect culturel de ces interactions et de proposer des pistes pour renforcer la durabilité des régions côtières via l'amélioration des échanges culturels. La recherche adopte une approche théorique, explorant de façon systématique les concepts, les théories et les connaissances existantes pour poser des bases solides à l'enquête. Les résultats soulignent l'importance de l'intégration de la culture dans la dynamique des villes portuaires pour renforcer le développement durable et la résilience des régions côtières. Pour atteindre cette intégration, il est proposé d'adopter des modèles d'entreprise coopératifs ou entrepreneuriaux pour les autorités portuaires et de renforcer la participation des municipalités dans les structures de gouvernance portuaire. La culture, en tant que facteur d'influence dynamique, modèle la communication et les environnements organisationnels, contribuant à atteindre les objectifs de développement durable définis par l'ONU. Les trajectoires d'évolution des interactions ville-port améliorent non seulement les aspects socio-environnementaux, mais ouvrent également la voie à la durabilité à long terme et à l'excellence dans les régions côtières.

Mots-clés : interaction port ville, interaction culturelle, développement durable, régions côtières, résilience des ports

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Culture has become crucial in shaping policies for sustainable development and resilience. It drives urban projects that promote cultural diversity and leverage creative initiatives for environmental sustainability and organizational strength. Within Europe, culture plays a strategic role in sustainable development policies (European Commission, 2018; KEA, 2017). Cities can align cultural preservation with climate change strategies by using established national and regional frameworks (Daldanise and Clemente, 2022). Cultural methods provide valuable insights, models, and holistic perspectives for decision makers and citizens in climate change adaptation and sustainable urban development, especially in coastal and port cities. Research has explored the links between consumer behavior, climate change, and culture across arts, social sciences, and humanities, with climate change stories being prominent in recent research (Tyszczyk and Smith, 2018). These stories are shared across various media, including social networks, news, literature, theater, and museums (Painter *et al.*, 2016).

The maritime transportation sector is crucial for economic growth and is deeply connected to the culture and heritage of coastal regions. In evaluating sustainable and resilient organizational ecosystems, the cultural aspect is as important as technological and economic factors. Research has shown that different governance patterns and business models significantly affect the efficacy and appeal of ports (Valionienė et Župerkienė, 2023). A key factor in a port's attractiveness is its interaction with cities, crucial for regional coastal development and sustainability (Valionienė, 2020). Therefore, examining the relationship between ports and cities is imperative. This study includes an assessment of cultural and heritage aspects which develop through port-city interactions, enhancing coastal regions holistically. Ports influence the wellbeing and quality of life in cities, while also presenting spatial, social, and environmental challenges. They transform cities from a socio-economic-technological point of view as well as a socio-cultural one, significantly contributing to social and cultural development. Despite the focus on logistical, technological, and economic interactions in port governance, the cultural element remains underexplored. Yet this cultural interaction is vital for sustainable coastal development.

Existing research postulates that the cultural component can serve as an additional dimension within the frameworks of sustainable development and resilience enhancement research, specifically within the domain of port organizational resilience and sustainable development. This notion hinges on the establishment of a well-functioning relationship between the governance of the port and the local governance of the port city. Notably, substantial attention is directed towards small and medium-sized ports, as these entities are particularly susceptible to the influence of the port on the surrounding social communities, owing to the intricate interconnections among culture, heritage, and

environmental conditions. Several factors underscore the need for an analysis of the interaction between small and medium-sized ports and city governance. Firstly, as presented in the research of Munim and Schramm (2018), medium-sized port cities exhibit robust infrastructural integration with port activities, leading to a strong dependence of the residents' quality of life on the quality of port operations in the context of economic growth. Furthermore, medium-sized port cities typically possess more limited financial resources for supporting and compensating the disadvantages associated with port activities. Moreover, these smaller cities and ports tend to be less attractive to potential investors, resulting in slower development of technological innovations aimed at improving quality of life for residents compared to their cosmopolitan counterparts. Consequently, these disadvantages can manifest as active resistance to new port projects, and in some instances even transform into proactive measures aimed at impeding the progress of such projects and diminishing their prospects. This often culminates in conflicts involving various stakeholders in the port-city interface.

The subject of this study centers on the cultural interaction between ports and cities. The overarching research goal is to explore the impact of port-city cultural interactions on the sustainable development of medium-sized port cities and their associated coastal regions. To this end, the research is guided by specific objectives, which include elucidating the concept of port-city interaction and situating this interaction within the broader context of sustainable development in coastal regions. Furthermore, the study aims to delineate the cultural component within the framework of port-city interaction and, subsequently, to propose potential trajectories for the development of port-city cultural interactions that could enhance the sustainability of coastal regions.

The research methodology employed in this study adheres to the methodological principles of a theoretical approach, which encompasses the systematic exploration of concepts, theories, and existing knowledge within the chosen domain, thereby providing a robust foundation for the investigation.

Port-city interactions' role in the field of sustainable development of coastal regions

Ports are the main export and import node for implementing international trade and integration with global supply by maintaining or creating a high level of connectivity and creating benefits for the national economy. But are also highly complex organizational ecosystems which situated in highly complex environments, starting from their microenvironment, through the mezzo, macro, mega, and giga environment; indeed, port organizational ecosystems are multilayered complex organizational ecosystems combining a number of private

and public capital players whose aim is to be highly involved in global supply chain (Valionienė et Župerkienė, 2023). From this perspective, it is useful to develop the functioning of these organizational ecosystems to maximize benefit for the national and regional economies. Problems will arise in the cases where the port cities are not capitals and centers of countries, and where port cities are a long way from main transport corridors or from the central governance because potential conflict of interests will arise between the benefits and negative impact on national and regional levels. Indeed, such conflict tends to be especially strong in small and mid-sized port city development, where material and human resources are limited, the social impact of the port is very important, and expectations related to port activities are high not only in the economic domain, but also in the environmental and cultural heritage domains (Notteboom *et al.*, 2022). These domains and their integration become more important still in the current climate change context and in the context of environmental challenges in the form of high uncertainties (Lees *et al.*, 2023). This integration makes it possible to analyze the problem of coastal regional development and maintaining resilience, which is strongly related to the quality of living conditions in the areas near the port, including when it comes to protecting the natural functioning of surrounding ecosystems. It is important to mention that sustainability and resilience are two sides of the same coin for human behavior and organizational functioning: sustainability for maintaining stability in the surrounding environment and resilience to keep balance inside organizations in the context of uncertain conditions in the external environment. These conditions can also be found in the newest research on the interaction between urban territories and ports where researchers investigate questions about sustainable and resilient development of coastal regions, but usually only the negative impact of port activities is analyzed (Oniszczuk-Jastrząbek *et al.*, 2018), especially on the regional level where relationships between ports and port city communities are stronger. Ports can become a line of confrontation, and many projects develop more slowly or not at all because of the strong negative position taken up by the communities around them.

Numerous cities worldwide, however, maintain a symbiotic relationship with their port complexes, which have historically shaped their development (Daldanise and Clemente, 2022). Cities' economic vitality is closely linked to ports, providing employment and access to global markets (Hein, 2016). Harbor areas, close to urban activities, are sources of both dynamism and potential conflicts, requiring collaboration between the port and city to mitigate social and environmental issues (Juggie, 2014). Recently, there has been a growing divergence between ports and cities due to globalization and containerization. Factors include terminal relocation, labor requirements, security concerns, labor

internationalization, and improved inland accessibility. Ports now seek more space and waterways, resulting in terminal relocations where mid-sized cities and ports operate. Automation reduces labor needs, aligning ports with global supply chains and distancing them from urban areas, which results in environmental challenges (Notteboom *et al.*, 2022). Ports need public trust and support for expansion, known as a social license to operate (Girard, 2013; Moeremans and Dooms, 2021). Paradoxically, the same processes causing detachment between ports and cities have opened opportunities to rejuvenate neglected port areas, deepening interdependence between communities and maritime businesses (Girard, 2013), since port activities significantly impact environmental ecosystems, accounting for about 60% of all negative impacts (Miola *et al.*, 2011).

A detailed approach, presented in research by Oniszczuk-Jastrząbek *et al.* (2018), allows us to make a few assumptions about future research on the sustainability of port development. First, that activities could be optimized according to the nature of their negative impact: for example, port expansion projects could be developed together with waste management problem solving, including integrated infrastructural decisions on waste management, since these activities have almost the same negative impact measured by the same criteria. Indeed, infrastructural development strongly relies on the rejuvenating a city's infrastructure in cases where there are logistical connectivity and waste management and disposal problems. A second fertile field for research is related to citizens' living conditions, especially in the field of air pollution and congestion in the city, but these problems could effectively be solved in cooperation with the municipalities since their interests are interconnected in this field. Finally, a third projected research field is related to the pressures from global business and public organizations in the form of green logistics, circular economy principles, strict environmental regulations, and intensive evolutions of port and digital technologies influencing the progress of automation, etc.

Clearly, these three assumptions are related to the complexity of the port organizational ecosystem's environment: the first assumption is located inside the ecosystem in the micro and mezzo environment of the port ecosystem. The second one is transmitted to the regional or national level and defined in the macro environment. The third assumption rises to the level of the mega and giga environment because it describes problems on the global supply chain level (Valionienė and Župerkienė, 2023). Pressures for sustainable development and resilience of port organizational ecosystems are also coming from the local businesses working in the port, from the surrounding territories and citizens, from national economies, the international business community, and other global conditions such as climate change and sustainable development in all areas of human life, social responsibility, global digitization and automation, and other global processes.

The interests of citizens and global communities are very clear. Because air and water pollution decrease the quality of life in port cities and negatively influence the diversity of natural ecosystems, the negative impact is felt not only in port cities but in whole coastal regions and worldwide. These assumptions make it possible to describe the importance of port and city interactions not only for integrated and sustainable infrastructure development, but also for the protection of natural ecosystems and citizens wellbeing, while ensuring the sustainability of development and the green logistical supply chain's connectivity and ability to ensure economic benefits on the national level.

For the development of port and city interaction, sustainable development goals and ideas should be revised. Sustainable development goals (SDGs) refer to the wide area of human life and activities and namely the 17 goals published in the United Nations' declarations. At least half of SDGs could be directly related with port organizational ecosystem activities, while others have an indirect relationship with the influences of port activities on social systems of environment. These goals are also the basis of the SDG Action 2030 Plan, developed according to circular economy principles, which explains in detail the blue economy framework and green port conception, including circular green logistics phenomenon (United Nations, 2015). Main principles of blue economy present the importance of port and city interaction for the implementation of SDGs in maritime transportations and for the resilience enhancement of the whole coastal region. One principle is "to recognize that the maritime and land-based economies are interlinked and that many of the threats facing marine environments originate on land" (WWF Baltic Ecoregion Programme, 2016). This is one starting point justifying the need to develop port-city interaction. This point of view enables not only port and city cooperation on creation and development in the legislative field, but also in the sharing knowledge, information, and practices for all stakeholders including citizens and nongovernmental organizations. Other principles of the blue economy also create preconditions for developing port and city interactions:

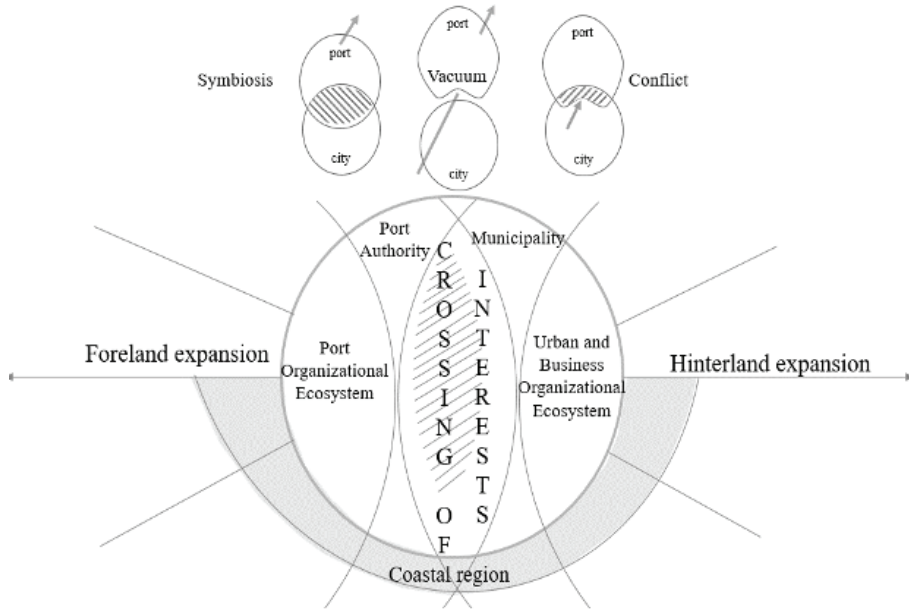
- create a level economic and legislative playing field with an adequate incentive and rules;
- set clear, measurable, internationally consistent goals and targets;
- assess and communicate the performance;
- develop and apply standards, guidelines and best practices that support a Sustainable Blue Economy;
- plan, manage, and effectively govern the use of marine space and resources, applying inclusive methods and the ecosystem approach;
- actively cooperate, sharing information, knowledge, best practices, lessons learned, perspectives, and ideas, to realize a sustainable and prosperous future for all.

Recognizing these principles enables not only port and city cooperation on creation and development in the legislative field, but also the sharing of knowledge, information, and practices for all stakeholders including citizens and nongovernmental organizations. These main principles of blue economy demonstrate that the sustainable development of maritime business and transportation is related with the recognition, creation, setting, assessing, development and application, planning, managing, governing, cooperating, and communicating. These actions could be called the predictors for the development of port-city interaction when it comes to enhancing the resilience of coastal regions by implementing SDGs.

Combining previous research definitions of port-city interaction (Verhoeven, 2010; Warsewa, 2017; Sacco *et al.*, 2018; Hein *et al.*, 2021; Vroomars *et al.*, 2022) shows that the port organizational ecosystem, driven by a port authority (PA), is interlinked with surrounding natural and social urban ecosystems through territorial and functional principles. This relationship can be measured by its impact on coastal region stability. The interaction is visualized in Figure 1, illustrating ports as organizational ecosystems within the context of adaptive complex systems theory. This theory describes maritime transport ecosystems as networks of interconnected business and public units working cooperatively to ensure high logistical connectivity in global supply chains, maximizing benefits and creating added value for stakeholders. Ports and cities, as ecosystem stakeholders, have individual and shared interests. Previous research indicates that effective governance and sustainable development in maritime transport are highly dependent on strong port-city relationships, which enhance coastal region resilience. The added value results from effective port-city interaction and integrated development.

According to Vroomars *et al.* (2022), a conflictual relationship serves as a prerequisite for changing development strategies and fostering effective symbiotic relationships, as depicted in Figure 1. This figure illustrates an overlap of interests between the port and city in development projects where expansions are planned, typically arising when the port seeks hinterland expansion and the city seeks foreland expansion. This intersection provides an opportunity for interaction between the city and the port. In this symbiotic relationship, conflicts may arise whenever developments encroach upon shared interests, necessitating discussions to mitigate risks. By aligning their development directions and creating an integrated strategy, as proposed by Birkman *et al.* (2016), Juggie (2014), and Sánchez (2019), conflicts between port and city can be minimized, ultimately enhancing the resilience of coastal regions. Effective cooperation between the port and the city supports sustainable development of regional business and social ecosystems in harmony with the environment, aligning with strategic frameworks such as the blue economy, SDGs, and national and international environmental regulations.

Figure 1. Definition of port and city interaction in the context of sustainable development



Comtois, 2014; Juggie, 2014; Vroomars *et al.*, 2022

Effective communication and cooperation between ports and cities plays a critical role in addressing conflicts and promoting SDGs within the framework of the blue economy. By adopting modern and comprehensive models for port sustainability and resilience, conflicts can be resolved while incorporating the interests of port cities and their inhabitants. Conversely, enhancing the infrastructure and social aspects of port cities requires considering the needs of the port's organizational ecosystem, its businesses, and residents. Through improved communication and experience-sharing mechanisms, conflicts between citizens and port activities can be minimized, fostering better collaboration for sustainable development. Cultural interactions between ports and cities serve as channels for exchanging information and knowledge, aligning with the principles of the blue economy. This interaction not only enhances feedback mechanisms but also promotes the sharing of information crucial for sustainable development. The interconnectivity within the port organizational ecosystem emphasizes the importance of communication functions in fostering effective collaboration. Evaluation of these interactions can be facilitated through established indicators that encompass various aspects such as recognition, creation, assessment, governance, and cooperation between ports and cities.

Explanation of the culture component in the context of port-city interaction

Researchers have emphasized the vital role of effective communication and maritime culture in facilitating information exchange between ports and cities (Merk and Dang, 2013; Sánchez, 2019; Kowalewski, 2021; Vroomars *et al.*, 2022). Cultural aspects are evident in studies exploring global sustainable development regulations (Hanson *et al.*, 2011; Chiu *et al.*, 2014; Jugovic *et al.*, 2021; Krosnicka *et al.*, 2021), port governance patterns (Serry and Loubet, 2019; Valionienė, 2020; Loubet and Serry, 2022; Notteboom *et al.*, 2022), business excellence (Valionienė and Župerkienė, 2023), and consumer behavior (Girard, 2013). Viewing the port as an organizational ecosystem highlights the cultural element as a crucial link through organizational culture and maritime heritage, with each unit contributing to a comprehensive understanding of the ecosystem.

Indicators identified by Merk and Dang (2013) include port and port city development, transportation, research, spatial planning, environment, and communication. Effective port and city interactions involve enhancing port functions in municipalities, reacting to uncertainties collectively, diversifying the economy in maritime regions, establishing coordination committees for sustainability, and fostering cooperation in maritime activities. Communication is underscored as a foundational pillar for successful interactions, encompassing cultural events, dissemination channels, collaboration with maritime institutions, water tourism development, and projects promoting maritime culture on various levels.

Table 1. Aims of sustainable development goals representing cultural components and their importance

Sustainable development goals	Aims and actions
SDG 8 Decent work and economic growth	Emphasizing policies supporting productive activities, decent work creation, entrepreneurship, and innovation
SDG 9 Industry, innovation, and infrastructure	Connects ports and cities through resilient infrastructures, industrialization, and environmentally friendly technologies
SDG 11 Sustainable cities and communities	Addresses urban transformations, emphasizing cultural and natural heritage for minimizing the impacts of urban agglomerations
SDG 14 Life below water	Underscores the sustainable management of ports and logistical activities

Source: United Nations, 2015.

Analyzing the SDGs reveals the essential role of the cultural component in sustainable port city development, influencing coastal sustainability and resilience across all goals (United Nations, 2015). Specifically, four SDGs outlined in Table 1 hold significance for small and medium-sized ports within this research context. The SDGs provide direct guidance for implementing sustainable development projects, highlighting the importance of the cultural and heritage component. The interplay between SDG orientations for cooperation between municipalities and ports and the SDG's cultural component underscores the cultural aspect's importance in fortifying port-city interaction for the resilience of port activities and coastal regions.

Additionally, the “Agenda 2030” by the Association Internationale Villes Et Ports (AIVP) further emphasizes the cultural component in sustainable development. Ten goals within this agenda, linked to 46 actions, underscore the significance of port culture and identity. This includes fostering a sense of belonging within the port-city community and promoting cultural and recreational services for residents near ports, strengthening the port-city interface. Effective interaction between port and city authorities, as outlined in the document, facilitates support for institutions to develop projects and strategic plans that promote sustainable development by reinforcing the port-city interface through community engagement with culture and regional heritage (AIVP, 2020).

Culture, viewed through the lens of Hein (2016) and Kowalewski (2021), is a versatile element ingrained within organizational and social networks, serving as a vital asset for sustainable development. Beyond traditional stereotypes, culture encompasses visual representations, symbols, and narratives, significantly shaping human behavior and influencing daily life, business practices, and community interactions, fostering cooperation for sustainable growth. Trends focusing on climate change adaptation and scientific integration manifest in creative cultural endeavors for sustainable urban progress, leveraging collaborations with artists and musicians to promote sustainable choices and citizen engagement in environmental policymaking (WCCF, 2018). These actions emphasize the pivotal role of culture in decision-making processes for coastal region sustainability, particularly in small to medium-sized cities with robust community-business relationships.

Research by Guo *et al.* (2020), Cerreta *et al.* (2021), and Vroomars *et al.* (2022) underscores the importance of culture in decision making for port-city planning, particularly in medium-sized port cities where local communities actively participate in governance processes. Culture emerges as a driving force behind collective actions within communities, businesses, and governance structures, influencing sustainable development outcomes.

Studies by Sacco *et al.* (2018), Tyszczyk and Smith (2018) and Lees *et al.* (2023) highlight the impact of integrating cultural and natural values into coastal sustainability. This integration enhances the connections between ecological and social functions within ecosystems, promoting environmentally conscious lifestyles and fostering a culture of sustainability and consumption. The cultural aspect in governmental interactions shapes individuals' understanding of their environment, influencing decisions and behaviors in the region.

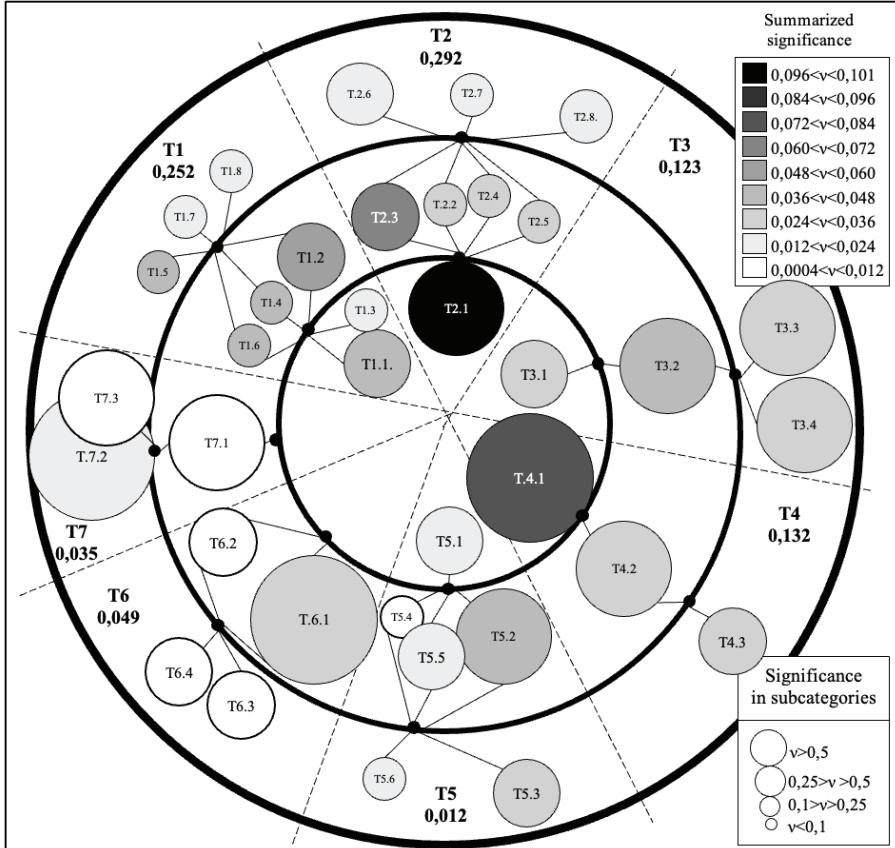
In summary, culture plays a pivotal role in connecting individuals to their surroundings and fostering cohesion, community, and collective actions. This underscores the mutually reinforcing nature of port and city interaction, serving as a tool for integrating natural and cultural values among port, foreland and hinterland, municipal representatives, and the broader regional society. These integrated values illuminate the connections between the ecological and social functions of the landscape, promoting environmentally friendly practices and lifestyles (Appadurai, 2013; Sánchez, 2021; 2019). Ultimately, these factors contribute to the promotion of sustainable development, not only within ports and cities but across entire coastal regions.

Port-city cultural interactions' development scenarios for sustainable coastal development

The study of port city cultures invites researchers to reconceptualize “culture” beyond its association with bounded communities and systems of thought. We argue that culture is not solely located in the collective social identities of port cities and citizens but also in the spatial and infrastructural characteristics shaped by port authorities. These authorities are responsible for the development and utilization of port infrastructure, including connecting infrastructures with port cities, driving sustainable usage within the context of coastal resilience. Given the social histories of spatial and infrastructural developments in port cities, it is crucial to expand the concept of “infrastructure” to encompass social, regulatory, and technological features. This holistic approach is necessary, as culture is viewed as a hybrid component traversing social networks, connecting internal organizational and external social cultures within the port community. Culture is embedded in material and spatial practices, where creativity and responsibility play essential roles as elements of a culture of sustainability, serving as a key resource for future development and ensuring coastal resilience. In addressing the challenges of port city futures, culture must be considered to include all material and spatial practices, visual representations, symbols, values, and popular narratives relating to past, present, and future port city transformations. This

inclusion could be presented in the business model of PA under the different levels of realization of expanded functions (Figure 2).

Figure 2. Empirical business model of port authorities according to mapped functions by their significance



Valionienė and Župerkienė, 2023

Based on the research by Valionienė (2020), a business model of Port Authorities (PA) was developed using various approaches. This model is composed of three hierarchical levels (refer to Figure 2): the local business model, also known as the fundamental or conservative business model (inner circle in Figure 2); the regional business model, also referred to as the cooperative business model (middle circle in Figure 2); and the global business model, also known as the entrepreneurial business model (outer circle in Figure 2). In constructing this model, the core functions of the PA were categorized into six groups across these three levels: T1—infrastructure development, T2—revenue assurance from asset exploration, T3—policy implementation, T4—revenue assurance from regulatory

activities, T5—concession policy implementation, T6—economic dimensions of community interaction, and T7—social dimensions of community interaction. It is important to mention that collections of parameters were constructed based on previous research and theoretical approaches.

As presented in Figure 2, different activities are assigned to each category and classified according to the PA business model parameters. The study was conducted between 2019 and 2020, utilizing a combined methodology that incorporated multi-criteria decision-making techniques such as the Analytical Hierarchy Process (AHP) and Grey Relational Analysis (GRA) to evaluate the significance of all the functional parameters of the PA business model. All of them are presented in circles in Figure 2. Two types of weights can be seen: the circle size indicating the significance within each category (T1 to T7) and the circle color signifying the cumulative weight across all parameters, where the weight value ranges from 0 to 1.

In the context of infrastructure development (T1), the convergence of interests creates an opportunity to strengthen interactions based on sustainable development principles within regional contexts (T1.5). This entails a collaborative approach between two organizational ecosystems, each operating within their respective spheres of activities and interests. While municipalities have broad access to communities through local governance functions that encompass various projects like infrastructure development, spatial planning, and urban area enhancements, the port ecosystem functions under an entrepreneurial model that consolidates all three levels of business models depicted in Figure 2. The entrepreneurial nature of the PA model expands capabilities through communication and cooperation channels (T6 and T7) from economic and social standpoints, promoting comprehensive development extensions in the communication realm and establishing a basis for cultural interconnectedness.

It is also important to mention that in most success stories, the port governance model either included municipal representatives in the management structures or the ports operated under the municipality port governance pattern. This implies that representatives of local authorities need to be included in the governance of the port organizational ecosystem for the creation of co-development projects. In other words, culture in these entrepreneurial models could be connected through participative authority functionality.

As found in the research on port governance effectiveness and port attractiveness (Valionienė, 2020), the communication factor is an important element for the implementation of the entrepreneurial PA's business model; and participative, active, and effective communication (T6 and T7 categories in figure 2) plays a special role in increasing maritime attractiveness for all stakeholders, including the societies of coastal regions. It means that successful port development could

be made possible by creating a properly working communication channel for knowledge, actions, experience, and culture-sharing through cooperative and/or entrepreneurial business models because components of cultural communications are located in categories T6 and T7, which have no implementations in the fundamental conservative PA business model. Maritime culture and cultural components from their economic (T.6.1.) and social (T.7.2) perspectives could become effective elements transferred through the communication channel only in cases where port-city interaction also includes these components. Analysis of the entrepreneurial business model of PA as a driving entity in the port organizational ecosystem found that communication is an important component in the business model, which could be used for transferring maritime culture, sustainable development, co-development of coastal regions' knowledge, maritime training, general education practices, and citizen engagement. In the entrepreneurial model of PA, these functions are located at the expanded functional level in subcategories 7.3, 7.2, 6.1, and 6.4 (Figure 2), representing these opportunities and describing a communication channel which works effectively:

- understandable communication for citizens on the sustainable use of marine and land space and resources, justified by results of a scientific approach to the ecosystem approach;
- active communication and transfer of information about port activities, environment monitoring results, and innovative port projects;
- organizing events on maritime culture and heritage.

In conclusion, it could be said that a theoretical analysis of port-city cultural interaction justified that it is an important and powerful tool which makes it possible to seek business and societal excellence and environmentally friendly actions, which are the main parts of sustainable development. Also, it was identified that a communications channel which works effectively is not only the part of the entrepreneurial business model, but also as an important element for transferring cultural components between port, city, and communities, which could strengthen interaction. These findings are especially relevant for small and mid-sized port cities because the relationship between business, municipality, and society is very strong there. As mentioned before, for the successful development of port infrastructure, a huge amount of investment is required and the strong interaction between port and city, working together in symbiosis, is the main component of attractiveness for direct national and foreign investors. When it comes to the implementation of a symbiotic cooperation model between PA and municipality, cultural interaction is an important strengthening component and could be implemented by both sides including port authority and municipality with their integral programs and actions.

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This analysis concludes that in exploring the concept of port-city interaction within the broader context of sustainable development, effective communication and maritime culture play essential roles in facilitating information exchange. Cultural interactions between ports and cities, encompassing global sustainable development regulations, port governance patterns, and business practices, significantly influence decision-making processes and sustainable behaviors in coastal regions. Leveraging culture as a tool for sustainable urban development, including creative cultural actions and citizen involvement, demonstrates the potential impact of culture on fostering sustainability in small and medium-sized cities with intensive logistics operations. Integrating culture into port-city interactions is crucial for enhancing sustainability and resilience in coastal regions, aligning with the overarching goal of the research to delineate the cultural component within these interactions. Recognizing the importance of culture in building resilient port-city interfaces is key for ensuring long-term sustainability in coastal areas.

The current study successfully outlined dynamic trajectories for the development of port-city cultural interactions, contributing significantly to the discourse on coastal sustainability. By emphasizing the multifaceted influence of culture in shaping spatial and infrastructural domains guided by port authorities, this research provides a comprehensive foundation for sustainable port-city interactions. These proposed trajectories, integrating material practices, spatial considerations, and societal narratives, offer a roadmap for fostering enduring sustainability and excellence in coastal regions. By intertwining cultural insights with developmental pathways, the study advances the understanding and implementation of sustainable practices in port-city interactions. Additionally, the research suggests that establishing strong and effective interactions can be achieved by implementing cooperative or entrepreneurial business models for PAs and enhancing the participation of municipalities' representatives in port governance structures, aligning with the study's focus on enhancing sustainable development in medium-sized port cities and their associated coastal regions.

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