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## Port city symbiosis introduction to the special issue

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# Port city symbiosis: introduction to the special issue

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## Abstract

Port cities and their neighbouring areas, located at the confines between sea and land, are key hubs in the transportation of goods and people. Ports serve global transport needs, while they are embedded in local geographies, topographies, political, economic and historical settlements. People have always been attracted to human settlements at the interface of water and land. These settlements have evolved into large population centres and metropolitan areas. Major cities, economic hubs and trade centres are engines of key importance for expansive territories and the ports in their vicinity, but they are also places at the forefront of many contemporary threats, including sea level rise as a consequence of climate change. Today, according to the United Nations Development Programme, 55% of humans worldwide live in cities and 40% live within 100 kms off the coast, thus in the vicinity of water-related threats. Maritime and logistic flows cross ports and densely built territories, creating additional environmental and other challenges. The war in Ukraine, long periods of drought and excessive water levels due to heavy rainfall in Pakistan are only the latest examples of both the need for and the danger of port activities for cities and landscapes. Nonetheless, a comprehensive understanding of the relationships between ports, cities and their territories is missing. This special issue argues that we need to embrace a holistic, inclusive approach to port city development, based on *ecosystems values*, embedded in various layers of capital: natural, cultural, social, human, industrial and creative. To achieve a port city symbiosis and avoid parasitism—defined here as a relationship where one partner benefits at the expense of another—, new port governance frameworks will have to answer to what knowledge needs to be shared to make multiple value creation in the port city ecosystem happen. For transitions to happen, port city territories will have to nurture ecosystem values to unlock this capital. New governance constellations will have to be based on shared mindsets, deeper understanding of the interests of local communities, and a set of collaborative principles. What exactly the relationships are between port, city and territory, how maritime flows relate to them, and whether or to what degree these connections are symbiotic or parasitic is subject for further exploration.

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The development of the special issue was led by Carola Hein, while the writing of this introduction builds on a concept developed by Maurice Jansen.

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Extended author information available on the last page of the article



Exploring the concept of symbiosis in port city ecosystems is fundamental for human activities, including economic ones, to sustain themselves in healthy, clean, green, liveable port cities and coastal communities. In this introduction we reflect on contributions by authors who examine port city symbiosis in various seaports in the Netherlands, Chile, United States, Portugal, as well as inland ports in France, Belgium, Switzerland and Germany.

**Keywords** Port city · Symbiosis · Port city territories · Ecosystems · Sustainability · SDGs

## 1 Introduction

Ports and their adjacent areas are pivotal due to their strategic location at the interface between land and sea. They play an important part in major transitions which are taking place simultaneously: the transition to a new global energy system for both industry and transport, as well as for housing and working in urban and rural areas. The climate crisis urges people to adapt to even more fundamental realities in terms of living, mobility and consumption, in spaces that are already densely populated. This challenge is widely recognized. The 2020s have been described by the United Nations as a decade of action in which cities, towns and communities are called upon to become socially and environmentally sustainable. Port cities are at the forefront of engaging with the UN Sustainable Development Goals (SDG) as exemplified by the Association of International Port Cities (AIVP) Agenda 2030. Sustainable development and the creation of circular economies will have significant implications for port city territories (Hein and Van Mil 2019; Hein et al. 2023), particularly with regard to the need to reverse commodity flows (waste to value); to re-use, recycle, reconfigure and refurbish products; and the need for shorter and more local and regional supply chains (Savini 2019).

The creation of circularity at the scale of a city, with a port that is set up to facilitate global flows, is particularly difficult due to the complexity of stakeholders in port city territories, their different degrees of power, longevity, and control over space, policymaking, and funding. International companies along the value chain—from shipping companies such as Maersk or CMA CGM to beneficiary cargo owners such as IKEA and Wal-Mart, or commodity traders such as Trafigura or Cargill—have different interests and decision-making takes place within global value chains at headquarters far away from the spaces where port and city interact, including cases where the port withdraws, freeing land for urban activities. Actors within these global value chains have an interest in facilitating flows passing through the port city. Yet, their control over, and interest in, built space is lower than that of a port authority, a local government, a tourist agency, or a non-governmental organisation. All these stakeholders have different goals, experiences, and areas of spatial control. The interests of local people living and working in the port city—port workers, seamen, fishermen, and citizens—are different from those of maritime actors. And yet, collaboration among these actors is important to bring the ecosystem in



balance and resolve conflicts in adapting to major transitions. In this special issue, the concept of the port city ecosystem is introduced to further deepen the understanding of the potential symbiotic relationship between the port and the city, as they have evolved—often intertwined—over time. We argue that care for the port city ecosystem is at the core of the creation of a symbiotic rather than a parasitic relationship.

Historically, port and city have often had a symbiotic relationship: the port needed the human workforce for all the handling of goods and passengers, and the city was a major place for the consumption and transformation of goods from overseas. Parasitic elements and asymmetric relations, such as exploitation of natural resources and environmental degradation, existed but was generally accepted, for the local economy to prosper, to just facilitate trade and transportation of goods and people (Hein and Schubert 2020). Resulting from ever increasing scale of industrialization, containerization and globalisation, ports and their neighbouring cities and territories, became disjointed. In the twentieth century, conflicts over the use of space were solved by a spatial separation of functions; however, in most port cities this has left vast areas of disused waterfronts. Moreover, industries in ports have turned out to be major sources of environmental pollution. As the positive impact of providing work for citizens disappeared, a parasitic rather than a symbiotic relationship between ports and their neighbouring cities and territories emerged, providing benefits and dividends to the private sector at the expense of ecosystems values. Examples are traffic congestion, various forms of pollution (air, water, noise, light, odour, dust), stacks of empty containers, and the loss of aesthetically valued features of coastal and urban landscapes. Under these conditions, ports disappeared from the minds and hearts of port city residents and, over time, opposition to port activities emerged.

While ports and their cities have physically separated because of economies of scale in shipping operations and industrialisation (Hayuth 1982; Hoyle 2000; Haralambides 2017, 2021), the connections between port and city remain important in many ways and areas, including economics, ecology, and society. Understanding and rebuilding these connections in new forms is today a key need. Innovation in the maritime and port sector, but also in urban activity, is more likely in port city territories, as these have more access to skilled labour, corporate and political decision-making power as well as a variety of complementary highly knowledge-intensive economic activities (Hall and Jacobs 2012). At a time when the interrelatedness of port and city is no longer so visible or easily understood, port-related functions located in the nearby city or region are not easily perceived as related to maritime practices, fuelling conflicts between port and city. At the interface between land and sea, often amid fragile coastal ecosystems, port cities perform a balancing act between economy, ecology and society (Arkema et al. 2017). A new awareness of, and approach to, symbiosis can help port city territories find a new balance of coexistence and mutual benefit.

At a time of climate change and multiple environmental challenges, we need to recognize opportunities to develop a new balance for port city territories. This requires recognizing long-standing behaviours and preconceptions. In fact, it often takes a long time for actors to change their behavioural patterns, or the laws and



regulations that guide them. In many cases, development paths are cemented, or “locked in”, to use path-dependence terminology as developed in political science to explore historical institutionalism (Sorensen 2015). Once a development path is established in space such as wharves, docks, or other infrastructure, it can determine port and city functioning for decades, if not centuries, to come. But new challenges, like the energy transition, migratory movements and climate change require the development of new functions, infrastructure and superstructure. They require actors to collaborate at multiple scales and to find new opportunities for shared development of port and city. Over the centuries, port cities have used various types of governance structures—private and public; elected and nominated; democratically legitimised, appointed, and deployed. Digital tools and processes have enabled people to continue working, and consumption patterns have shifted to online platforms, which demonstrates the power of digitization and innovation. However, despite extensive digital work, everyday life still requires physical spaces. A careful inquiry into the potential symbiotic engagement of ports, cities and territories is thus urgently needed. We acknowledge that symbiosis as a concept, as it would apply to port cities, is relatively new and unexplored. As such, the concept needs to be enriched with scientific research on port city ecosystems and their evolution, preferably from various locations and perspectives. Reflecting on both theory and case studies, we argue that port cities are unique as pivots in international trade and transport systems. We believe the next level of port city relationships is not so much a matter of a horizontal alienation or approximation, but it is rather a matter of deepening the relationship across the territory.

The special issue focuses on the spatial, social and cultural interconnections of ports, cities and territories. It explores challenges and opportunities related to the spatial proximity of port territories, urban space and coastal ecosystems. It considers key transitions involving climate change and sea level rise, ecological footprint, resilient infrastructure and sustainable transport and mobility. Contributors examine inclusive stakeholder arrangements, related institutions and governance in port city territories. In this vein, authors examine how innovation ecosystems and startup communities are emerging that can accelerate transitions. The issue brings together the latest insights of researchers from various disciplines who have a keen interest in the interlinkages between ports and port cities. They present recent developments and case studies that demonstrate the symbiotic relationships (or their absence) between ports and their neighbouring port cities. The special issue also discusses how different approaches, practices and mechanisms can reconcile potential conflicts that exist on the boundaries of the port city interface, or within port city territories.

## **2 Framework to assess symbiosis in port city territories: an ecosystem approach**

The special issue posits that a new understanding of symbiosis in port city-territories is needed to facilitate shared governance, planning and design of port-related spaces (the port cityscape) (Hein 2019) beyond the spaces governed by select authorities.



Such an approach is necessary to overcome the sometimes parasitic<sup>1</sup> relationship that has developed over time. Symbiosis is defined as the close connection between different types of organisms that live together and benefit from each other. Each organism provides the conditions that are necessary for sustaining the other as well as the ecosystems of which they are a part. The concept of the ecosystem is often used to describe a natural system, where organisms are interlinked through biotic and abiotic factors to sustain each other. Through these symbiotic relationships between organisms, the ecosystem is able to sustain itself. Symbiosis in relation to the port city ecosystem is inherently rooted in the marine (or riverine) ecosystem in which humans have built social structures and developed economic activities. Ports, cities and their regions flourish, not just because of proximity, but also due to the exchange of resources and people within the ecosystem, which can either nourish or neglect the cluster resources with negative effects on industry, business services, schools, living, and recreation (Haezendonck and Langenus 2019). The ecosystems approach, embedded in the Sustainable Development Goals, distinguishes three hierarchical layers: the economy is built on top of society, whereas society is built upon the biosphere (Stockholm Resilience Centre 2019). To further understand port city symbiosis, we build on the discourse of ecosystem services to describe the exchange of ‘capital’ between the different layers of the ecosystem (Guerry et al 2015).

Ports and port development have been studied from several research domains, often taking a monodisciplinary view. In the last decade, scholars from various disciplines, including economists, sociologists, environmental scientists, and transport geographers, have attempted to give a more holistic perspective on port cities as ecosystems. The United Nations posits that when companies and governments take an ecosystems approach, it makes them more responsive to new information and changing requirements. This requires an integrated social, environmental and economic perspective (United Nations Environment Programme 2020). One of the major challenges for ports lies in how to co-exist with adjacent society while preserving natural ecosystems. A nexus approach starts from the realisation that there are strong and multidimensional interlinkages, and resource security—water, energy, food—is endangered by a conventional, fragmented, approach which will subsequently deteriorate the coupled human and natural systems (Liu et al. 2015). A nexus approach to corporate sustainability aims to enhance resilience of the ecosystem by inducing companies to pursue a portfolio of activities, which aim to contribute to multiple SDGs through the creation of co-benefits, while minimising trade-offs between the SDGs (Van Zanten and Van Tulder 2021). Ports have to develop green strategies and take responsibility to receive the licence to operate from stakeholders who live and work in the proximity of the port (Acciaro 2015; Aregall et al. 2018; Lam and Van De Voorde 2012). The Green Ports initiatives by two large European consortia of maritime stakeholders—PIONEERS under the leadership of Antwerp Port

<sup>1</sup> A parasitic relationship is one in which one parasite organism lives off a host organism, with detrimental effects for the host that may possibly lead to its death (Preston and Johnson 2010). Such relationships can also be seen between ports and cities when port industrial activities overgrow a city, and its negative externalities affect the livability of communities.



Authority and the MAGPIE project under the leadership of the Rotterdam Port Authority—are clear examples how ports are teaming up to drastically mitigate the adverse effects of climate change.

## 2.1 An ecosystem perspective on port city territories

Inclusive port development places ports in the centre among governments, businesses and society and requires authorities to collaborate and search for complementary governance constellations that would benefit directly, indirectly even, new stakeholders (Jansen et al. 2018). The ecosystem approach is a decisive element here. The research framework presented in this introduction takes a ‘capital’ perspective on the ecosystem, in the sense that the ecosystem is rich in resources, which have accumulated over time, just like in natural ecosystems, where sediments and organic materials have shaped the land. These accumulated visible and invisible sources of capital provide the resources for human activities. Using existing concepts and models from environmental sciences, social sciences (economics, management), geography (urban studies) and sociology, the framework distinguishes six layers, proceeding from tangible to intangible capital: natural capital (e.g., river delta), industrial (working) capital, human capital (e.g., labour), cultural capital (e.g., maritime heritage), social capital (e.g., young professionals networks) and creative capital (e.g., entrepreneurs). Such an integrated perspective is considered fundamental to better understand the resources and relationships used and affected by an organisation or groups of organisations. These forms of capital are stocks of value that are increased, decreased or transformed through the activities and outputs of an organisation (The International Integrated Reporting Council 2013). Multiple forms of capital interact to generate goods and services (Guerry et al. 2015). The following section sheds light on each layer of capital in relation to the port city ecosystem. These capital layers are the foundations on which integrated and stakeholder inclusive port development and planning policies can be designed and built.

### 2.1.1 Natural capital of the ecosystem

Port cities are in a pivotal position in terms of the natural ecosystem and its natural capital, which consists of living and non-living components, of value to people either materially or non-materially. For example, a natural harbour gives shelter to ships (e.g., navy), and rivers provide access for waterborne transport; still the most economical mode of transportation. From an ecological perspective, river deltas provide a place for the settlement of communities who exchange resources with other communities overseas. As cities grow, there is no means of sustenance other than exchanging resources and waste with the surrounding land: but port cities need other cities and countries to provide food and building materials (Rees and Wackernagel 2008). In exchange, they are the gateways for society, providing access to markets and a home for talent. This notion suggests that port cities and the industries located in them carry a great responsibility towards society. Maritime industries like shipping and fishing may pursue profit,



but they also generate negative externalities, often leaving the costs and consequences to later generations. Located in these delicate coastal zones, these large urban and economic centres have the capacity to anticipate, adapt and innovate towards new realities. Von Glasow et al. (2013) conclude that coastal mega-cities are at the forefront of change in a positive sense: changes (e.g., creating better quality of living) can best be implemented in these mega-cities, because they are generally more energy efficient and require less transport per capita; therefore they can regulate pollution and manage their environment. These are also places for education and innovation. De Boer et al. (2019) introduced the ecosystem-based port design hierarchy framework, based on a case study in Tema port in Ghana. This design framework shifts the focus from offsetting environmental impact to avoiding and reducing environmental impact as an integral part of planning and design. The framework is based on the integrated coastal policy via Building with Nature (Waterman 2010). Such an integrated approach is crucial for the co-existence of ports and port city communities in delta ecosystems and, by facilitating this co-existence, it makes these communities resilient and adaptive to the effects of climate change and natural disasters.

### 2.1.2 Industrial capital and the ecosystem

Port cities are hubs of capital accumulation. Porter's cluster theory (1990) explains the strength and success of geographic concentrations of industries and economic activities, as competitive advantage is increasingly determined by differential knowledge, skills and rates of innovation. The cluster perspective provides a theoretical framework that can be usefully applied to ports (De Langen and Haezendonck 2012). In principle, the cluster theory is a model of competition, but as environmental management, sustainability and corporate social responsibility have become more important, port authorities have engaged in stakeholder management and embraced corporate social responsibility policies and ecological perspectives that emphasise collaboration. The switch from competition to collaboration is critical for survival in turbulent environments and for strategies based on organisational ecology (Trist 1977). Porter et al. (2011) coined the concept of shared value. Organisations which create economic value in a way that it also creates value for a sustainable society by addressing its needs and challenges will outperform organisations which do not. The ecosystem of shared value is based on the idea that societal problems are too complex to be solved by single actors and can only be addressed by the coordinated efforts of those actors (Kramer and Pfitzer 2016). The industrial capital perspective on ecosystems regards port cities as clusters of economic activity, which are competing in a global marketplace, but prosper nonetheless because of collaborative action and shared value creation. Economic value chains prosper because they are in harmony with ecosystem values, thereby fundamentally preserving and conserving the (marine and/or riverine) ecosystem. By doing so, industrial activities in port cities gain their licence to operate from society.



### 2.1.3 Human capital and the ecosystem

Port cities rely on human capital both for their growth and their long-term innovation. Jane Jacobs (1969) and Richard Florida (2003) argued that human capital is crucial for urban-regional growth. Port cities are characteristic of this development, confirming Florida and Mellander's observation that there is generally a strong relation between regional income levels and technology, talent and innovation (Florida and Mellander 2020). But what makes a city 'smart'? Caragliu et al. (2011) define a city as smart when investments in human and social capital and traditional (transport) and modern (ICT) infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance. Cities speed up innovation by connecting their 'smart' inhabitants to one another (Glaeser 2011) and port cities are notable nodes. Developing human talent is also a way to compete in the global knowledge economy (Lee 2015). The 'knowledge port' concept is complementary to the traditional concept of a port. Instead of the flow of goods, the emphasis now is on the migration of talent and knowledge (Edvinsson 2006). Today's flow of brains is critical (Edvinsson 2006). The 'brainport' initiative in the Dutch city of Eindhoven is exemplary for its focus on coordinated efforts by governments, businesses and knowledge initiatives in advanced technology innovation (Horlings 2014). The human capital perspective on the ecosystem is centred around the bundling of talent and technology into 'smart ports', 'smart cities', also referred to as 'knowledge cities' and 'brain ports'.

### 2.1.4 Social capital and the ecosystem

Social capital stands for the ability of actors to secure benefits by virtue of membership in social networks or other social structures (Portes 2009); this is a key feature of port cities. Coleman (1988) distinguishes three forms: social capital creates obligations and expectations between group members, it has the capability to acquire and share information faster and easier, and thirdly, it sets norms and sanctions, which can enhance or hamper positive achievements by individuals. Social capital develops over a long period of time and is often anchored in institutions. Places with dense ties and high levels of traditional social capital, such as the Baltic Exchange in London, provide advantages to insiders and thus promote stability. Alternatively, places with looser networks and weaker ties—such as 'young professionals' networks of YoungShip in various port cities—are more open to newcomers and thus promote novel combinations of resources and ideas (Florida 2011). Unlike open social networks, a closed aspect of social capital has also a downside: a closed group of actors could develop into a stronghold against other outside (groups of) actors, which subsequently could lead to friction and upheaval between social groups. Workers' unions could be set against employers' associations, supporters' groups of football clubs against close-knit old boys' networks, or the port against city authorities. The revolving port labour strikes in ports on the West Coast of the United States of America are a notorious example of such friction.

For port cities, good governance is key, and it must aim at creating strong and positive social capital (Avent 2016). The ability to accommodate conflicts is



particularly important when there are strong stakeholder groups (De Langen 2006, 2015). This makes social capital—unlike human capital—difficult to exchange and hard to share outside the network. Social capital is a public good, which is created when individual actors deliberately choose to invest—as volunteers, donors or sponsors—in the group or network for the greater good, without asking for a direct return. This makes social capital often a by-product of other activities (Coleman 1988). The social capital of the city comprises the networks and the horizontal and vertical connections that are present within professional groups and associations and, as such, act as lubricants between stakeholders and authorities. Successful port cities know how to effectively utilise this capital, and in such a way that social problems are minimised. Moreover, sustainable port cities manage to bring prosperity while also maintaining balance with the ecosystem.

### 2.1.5 Cultural capital and the ecosystem

Cultural capital is a concept that has yet to be fully acknowledged in the study of port city territories. The concept of cultural capital has been used by many scholars over the span of four decades, starting with Bourdieu (1986). According to this author, cultural capital manifests itself in three ways: in the body and mind of a person (e.g., 'Ich bin ein Berliner'), in an objectified form of status—photos, paintings, books, instruments, machines, etc.), and in an institutionalised form, when culture is widely recognised or confirmed, for example, by a scientific institution or publication. Throsby redefined the concept of cultural capital, using it to stress the value of culture in economy (Kisida et al. 2014; Throsby 1999). He argued for a fourth type of capital in economic analysis, namely cultural capital. Cultural capital is the stock of cultural value embodied in a tangible or intangible asset, which in turn gives rise to a flow of goods and services over time. The concept of cultural capital enables culture to be perceived as a resource. Whether that resource is accessible to people or not, may be a factor leading to monopolisation and cultural capital can be transmitted from one generation to the next (Lareau and Elliot 2003). Cultural capital reflects the nonmaterial benefits people obtain from ecosystems. This could be cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, a sense of place, and cultural heritage values (Daniel et al. 2012). Recreation activities and (eco-)tourism can turn these cultural assets into cultural services and thus generate economic value. Promoting and capitalising on a specific culture and identity of port cities allows residents to develop a sense of pride and to flourish (AIVP 2019). The concept of port city culture, values or maritime mindsets is recently starting to get more attention as evidenced in two special issues of the European Journal Creative Practices in Cities and Landscapes (CPCL 2021a, b).

### 2.1.6 Creative capital and the ecosystem

Creative capital and the capacity to innovate denotes the ability of economic actors to generate scientific, technological and artistic innovation on the basis of relational assets which are socially produced within a city or urban region (Krätke 2011) Port



cities contain an arsenal of creative thinkers whose ideas can be turned into valuable products and services (Florida and Goodnight 2005). The creative workforce includes those employed in a wide variety of industries beyond the creative industries, including computing, engineering, architecture, science, education, arts and multimedia (McWilliam and Dawson 2008). More importantly, companies cluster to gain from concentrations of talented people who power innovation and economic growth. The ability to rapidly mobilise talent from such a concentration of people is a tremendous source of competitive advantage for companies in our time-driven economy of the creative age (Florida 2011). Driving forces for the knowledge city are conceptualised by Edvinsson (2006). These drivers include universities, society entrepreneurship, knowledge cafes (meeting places), diversity, strange attractors (marketing, branding) and ICT and multimedia infrastructure as well as ports. A healthy ecosystem is characterised by its ability to produce, support, and nourish high-growth entrepreneurship (Song 2019). In more recent years, port cities have implemented policies to attract the creative class, especially in those areas where port operations had retreated and port cities had created open spaces, both indoors and outdoors. Several cities, such as Montreal and Rotterdam, have embraced the concept of entrepreneurial ecosystems, thereby attracting startups and incubator centres surrounding universities (Witte et al. 2018). Urban and economic theory suggests that a key contributor to innovation is the ability to bring together a diverse array of skilled and talented people with different backgrounds. Jansen et al. (2021) use the example of the Rotterdam Makers District and highlight the importance of bottom-up initiatives in an attempt to collaboratively construct future realities on the foundations of their port's legacies.

### 3 The port city ecosystem perspective in this special issue

The articles of this special issue adopt different themes and topics of symbiosis (and parasitism) at the port city domain, effectively demonstrating the importance of ecosystem thinking. Using the multiple forms in which “capital”—natural, industrial, social, human, cultural and creative—is turned into value for the port, city and territory, helps understanding the underlying interconnections of human activities within their ecosystem. Below, follow the contributions to the special issue. The authors did not approach the topic through the lens of port city ecosystems or capital, yet their contributions help gain advanced understanding of symbiosis and our proposed multi-layered, multi-capital ecosystems approach. We introduce and review the contributions through the lens of the port city ecosystem and the various forms of ecosystem capital. The different theoretical and methodological perspectives adopted by our authors offer insights for many different parts of the world (Europe, Americas, Asia). Authors specifically explore the role of symbiosis from multiple perspectives to show how the concept can actually facilitate inclusive (societal, sustainable) port city development.

**Eline Punt et al.** (2022) address the port city ecosystem as natural capital in relation to flood risks that exist in the delta. The authors emphasise the need for a shared perspective on port city territories, by exploring the theme of flood risks and



flood resilience in the port city of Rotterdam. Protection against floods can only be achieved by collaboration among diverse institutions. The authors demonstrate that fragmentation and siloed approaches impede successful flood control. Resilient sea-ports require action among diverse stakeholders through shared policies and infrastructure planning at multiple layers. As the authors argue, resilient flood control of critical port infrastructures in fact requires vertical, horizontal and territorial coordination in port city territories.

**Felipe Bedoya and Agustina Calatayud (2022)** emphasise a conflict over the use of space, specifically road infrastructure and traffic congestion, from the perspective of megacities in developing countries. Big data analytics (BDA) of traffic flows were done with Buenos Aires as a case study. Port-related transport often overlaps with urban travel, as in the case of Buenos Aires, a key port city of Latin America. The authors point at the adverse effects of a sophisticated transport infrastructure network, resulting in inaccessibility of port cities and a deterioration of the quality of life, a symptom of parasitic rather than symbiotic relationship between port and city. Using large datasets, the authors identify congestion in port and urban areas to achieve meaningful reductions in truck movements. The case of Buenos Aires illustrates how the continuous growth of human activity in and around megacities in developing economies suffer from negative externalities, i.e., accelerating port-logistics and urban traffic. The authors call for better public policies, designs and measures to balance economic growth with liveability. This article emphasises the importance for actors to collaborate in finding new opportunities for shared development of port and city.

The research by **Bruno Moeremans et al. (2022)** adds important points to the discussion on the industrial port city ecosystem and the question of port city symbiosis. The authors explore the role that fundamental contemporary transitions—containerization, energy transition, sustainable construction, urban logistics and circular economy—have on traffic structure and on the operations of inland ports, and ultimately on local spaces and communities. To understand the impact of these transformations on urban spaces and residents, they first explore the historical development of traffic at seven Western European inland ports between 1998 and 2017. Using the World Café method, they then assess negative externalities, questions of management and -in light of urban stakeholder relations-, port development, urban land and infrastructure use at the port city interface. The researchers acknowledge that the acceleration of an intertwined economic and environmental transition in inland ports may complicate collaborative efforts of stakeholders in tackling local negative externalities. Successful transitions in port cities require an understanding of how to effectively utilise social capital—the orchestration of networks, connections and intangible transactions between stakeholders—that translates into a social license to operate.

**Mohammed Mojahid, Hossain Chowdhury and Ziaul Haque Munim (2022)** focus on the issue of dry port location in heavily populated and congested container traffic systems in Bangladesh, pointing to pressures on the natural ecosystem as a result of a focus on industrial capital, logistics activities and population growth. They vouch for transport by rail as a more sustainable mode, trying to overcome potentially parasitic relationships. Through the case of the port of Chittagong, the



authors demonstrate the interrelation between the port and industrial growth away from the waterfront, thereby expanding the territorial scale of the port city by hundreds of kilometres. The authors focus on rail infrastructure, rather than waterborne transport, which is the *modus operandi* in other deltaic coastal ecosystems, and its role in accommodating ever increasing industrial output, cargo volumes and consequential logistics activities between port and hinterland. Transport by road impacts negatively the urban and natural environment, an example of the increasingly parasitic relationship between the port and its territory. The paper assesses the quality of the various solutions to guide investment decisions and efficient traffic development through a survey taking a business perspective.

**Karel van den Berghe et al. (2022)** use the case of Amsterdam to explore competing interests at the port city interface and effectively the need for social capital as a means of solving these conflicts. The authors acknowledge that the port city conflict in Amsterdam is context specific. At the same time, they wonder whether the ‘port out, city in’ phase that they have observed is part of a more generic evolutionary phase where ports and cities evolve in opposite directions. The authors emphasise the importance of path-dependent developments in a conflictual land-use economic system. As they point out, land-use conflicts in Amsterdam have arisen out of opposing agendas of port and city authorities regarding their vision on the development of the port; the industrial capital of Amsterdam. With the municipality pushing for urban redevelopment, the once symbiotic connection between port and city has been neglected. The authors observe an intentional strategy to break the ties: a phenomenon that raises the question of what is required in terms of mindsets, for port and city to create a common future, rather than choose a path of separate worlds.

**Vítor Caldeirinha, J. Augusto Felício, Manuela Batista, and Michael Doods** emphasise the need for models of collaboration to create new symbiotic relationships between ports and cities through stakeholder inclusion, addressing the question of social- and to a certain extent cultural capital. In their view, symbiotic relationships require implementation of stakeholder inclusive processes. Through surveys, the authors explore the ways in which a positive perception by local communities becomes a competitive advantage for a port and provides its social licence to operate. Stakeholder inclusive processes, however, entail the risk whereby co-created, balanced solutions may often lead to conflicts rather than resolutions, both for the port and the city. Participation, outreach and communication become key factors in local community engagement. In line with the argument of this introduction, the authors conclude by stating that shared value frameworks—rooted in local history, culture and port practices—are needed to facilitate the emergence of new governance frameworks.

**Hernán Cuevas Valenzuela et al. (2022)** argue for a different perspective on port city evolution, effectively pointing to the need for the development of more social capital. They argue that questions of interdependencies and uneven development have been neglected, or generally overlooked. Their exploration of the global value chain—forestry products and coal in the case of Coronel (Chile)—paints a more comprehensive picture of the evolution of port cities in both developed and developing economies. Port cities do not function in isolation, but always in a network or



in pairs, because this is how cross-border and cross-continental global value chains are set up by multinationals. The acknowledgement of the negative externalities at ports of origin emphasize the importance of port-city symbiosis. This also hints to a need for shared responsibilities—from origin to destination, with port cities as connectors in international value chains. In other words, whenever port city authorities try to develop their ports sustainably, it is no longer sufficient to only consider their own territories. A more comprehensive approach to such developments would also require transparency of authorities and actors on their impact in port cities and remote territories upstream in the global value chain.

**Stephen Ramos (2022)** argues that port city symbiosis can either be sustained or disturbed by policy decisions that influence trade flows on the other side of the ocean. The author also speaks from a social capital perspective. He explores questions of global transformation and regional ecosystems through different levels of symbiotic and parasitic relationships. He specifically examines the current energy transition and its impact on port city territories through the lens of biomass—a politically sensitive form of renewable energy source. The international supply chain perspective helps the author to identify linkages of local, regional and international governance, displaying the broader significance of port city growth and potential decline, resulting from the transition towards renewable energy sources. According to Ramos, port city ecosystems are vulnerable to governance-related interventions, especially where there is a limited variety of commodities using the port city as a gateway to international markets. Policy interventions used to respond to the volatility of energy markets can disrupt cargo flows and increase the risk whereby investments in port facilities and infrastructure development will not have the expected return on investment. Policy making requires coordination and calibration of actions, which is the outcome of new hybrid governance forms that connect public and private actors on a wider international territorial scale.

## 4 Conclusions

As these eight papers show, multiple forms of capital can be nurtured to create new capital but can also be neglected when actors are not taking care, or recognize the shared value of the port city ecosystem. Together, the eight papers of this special issue point the way to a much needed shift in port city studies that focus on the territory, on ecosystems, and on values. The papers address several dimensions of port city ecosystems and capital, yet, they primarily focus on interlinkages between natural, industrial and social systems, sometimes hinting on deeper historical and cultural values. Unlocking the value from the port city ecosystem requires a deep understanding of such interlinkages, as well as the coordination mechanisms to use them effectively. For decision-makers to cope with the imminent threat of climate change, an awareness of the interdependence between natural- and industrial capital is fundamental, in building resilient cities in coastal ecosystems that are especially vulnerable to the effects of



climate change. A major complication for effective transitions in the port city space is when these forms of capital are considered in isolation, or in the absence of social and cultural capital. The ecosystems perspective allows adaptation to new realities during and after the transition by advancing knowledge on human-oriented mechanisms.

This introduction provides an outline for an ecosystems-based approach in port planning and development. We present a synthetic framework of port city symbiosis that juxtaposes nurture and neglect of capital components in the ecosystem (Table 1).

In addition to financial capital, capital is fundamentally embedded in an ecosystem and is provided to human societies as a service. For transitions to happen, port city territories will have to nurture these ecosystem values to unlock this capital. New governance constellations will have to be based on shared mindsets, deeper understanding of the interests of local communities, and a set of collaborative principles. The actors involved must foster a mindset of open innovation, rather than closed networks of ‘us’ against ‘them’. Complex societal problems cannot be solved through one viewpoint alone, but require partnerships between port authorities, companies, government institutions, as well as universities. If transition is an important theme, existing conventions and paradigms on re-inventing the (use of) the port city interface and of the multiple dimensions of port flows on port city territories have to be overcome. This requires letting go of short-term thinking and embracing a holistic, inclusive approach to port city development. To achieve port city symbiosis and avoid parasitism, new port governance frameworks will have to answer on what knowledge needs to be shared to make multiple value creation in the port city ecosystem happen. Port city ecosystems are sustained by balancing economy and ecology, by a deeper knowledge and understanding of the interlinkages, by capital reciprocity for mutual benefits, and by commonly shared value frameworks and mindsets.

The insights of this special issue can be used by decision-makers and community leaders around the world, who are increasingly showing interest in integrating *ecosystem thinking* with sustainable business planning, and stakeholder inclusive spatial planning, in an attempt to adapt to new realities resulting from the hazards of climate change. The contributions in this Special Issue also show that questions surrounding creative and cultural capital are still under-researched. The themes of human and creative capital and their role for business innovation ecosystems clearly merit further attention, specifically on the relationship between ‘green’ technology, talent development and business renewal in the blue economy; an approach that is set forth by the European Commission (2021). Maritime economists are invited to join the debate and work together with scientists from other disciplines to explore, develop and test new knowledge pathways that can lead to new design, planning, monitoring and evaluation methodologies that impact ecosystems in such a way that human as well as economic activities can sustain themselves in healthy, clean, green, liveable port cities and coastal communities.



Table 1 Port city symbiosis—an ecosystems approach

Capital	Examples	Share knowledge on	Nurture leads to	Neglect leads to
Creative Capital	Startups, entrepreneurs, intellectual property	Know what's next	Joint future	Separate future
Industrial Capital	Working capital, assets, equipment	Know what sells now	Earnings	Emissions
Human Capital	Labour, talent	Know how to make	Better jobs	Strikes
Social Capital	Social networks, connections	Know who matters	Young talent networks	Old boys networks
Cultural Capital	Heritage harbour, maritime museums, traditions and festivals	Know why it matters	Connected society	Disconnected society
Natural capital	River delta, sheltered ports	Know why it matters here	Protect and preserve	Pollute

Source The authors



**Data availability** Data sharing not applicable to this article as no datasets were generated or analysed for this introduction article.

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