



Port-City relationship in the era of hybridization. A development model

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Abstract

Ports are important nodes and interfaces among land and maritime areas, playing an important and changing role at global, regional and local levels. Their relevance has increased in the years, particularly with the more important transformation and development of the global value chains that has, as a consequence, the transformation of ports into important areas of transport and logistic activities' integration with other, industrial and tertiary ones. This manuscript focuses on a proposed current evolutionary stage in the port evolution, as that of "hybridization" with particular reference to the port-city relationship. The main idea behind the paper is that of the hybridization from different points of views: of the city-port relationships on the waterfront and among urban peripheries and inner harbor facilities; of the port functions, from the single-purpose, specialized terminals to the multi-purpose, hybrid ones; of the port roles, from the pure gateway or hub functions, to the mixed ones. An overview of the major changes intervening in these relationships is analyzed, with particular reference to Bird's model of Anyport, Hoyle's port-city interface and Vigarié's port triptych model. A modified Anyport model with hybridization is proposed, with reference to the most recent evolution of maritime transport. A case study is analyzed and presented with reference to the Port of Trieste (Italy). The port of Trieste was chosen as a case study as it has undergone an important transformation in the most recent years, increasing the quality and quantity of traffic volumes, as well as transforming the layout and set of operations of terminals. The relevance of the port as a case study it is not to be found in its dimensions, but in the relative increase intervened, as well as a case were the different stages of the evolution of ports can be found, including that of hybridization, suggested in the present research.

Keywords: Ports, Cities, Waterfronts, Peripheries, Inland terminals, Regions, MIDA, Anyport Model

1. Introduction

Ports represent important interfaces in the connections between sea and land, namely between the maritime routes and the terrestrial ones, connecting distant production sites with

local, coastal and internal markets. Their role is global in scale, but also local, particularly in the city-port relationship that has evolved in the years, and in the port-region relationships, also in terms of the changing role of industrial production and development. The specialization

of port and industrial areas happened in relatively recent times, while more recently the requalification and redevelopment of the old waterfronts toward urban uses took place. The current stage can be defined as that of hybridization, where transport modes mix in port operations on the shorelines and in the inland terminals. City and port functions mix, on waterfronts, but also in more internal and peripheral areas, following urban sprawl and the port-related function inner relocation.

In the paper a revision of the Anyport model (Bird, 1963) is proposed, in light of the on-going changes, as well as a reflection on the changes occurred in the MIDAs – Maritime Industrial Development Areas around ports. The occasion is that of reflecting on the overall changing set of relationships that occur between port and its different components and dimensions, following the needs of a growing urban logistics and to the locations becoming necessary from the widespread diffusion and importance of the last mile in the door-to-door urban distribution. An important role is also played with reference to the new inner harbor spaces, where logistic functions supporting port activities are mixed and confused with the urban ones, often without a proper coordination. Pressures are put on waterfronts and peripheries following the evolution of cities and their ports.

The paper is organized as follows. In Paragraph 2 Materials and Methods are presented. Here an overview of the evolution of the port functions in terms of its relationships with the city, the hinterland and the maritime domain is presented. The concept of Vigarié's port triptych, the Hoyle city-port interface and Bird's Anyport models are recalled, in light of the current changes. A methodological proposal of a modified Anyport model is presented, to include the stages of regionalization and hybridization of the port functions. In Paragraph 3 an application of the model to the case study of the Port of Trieste (Italy) is presented, to observe the different stages and the evolution towards the hybridized stage. Conclusions and a future research agenda is presented in Paragraph 4.

2. Materials and Methods

The relationship among cities and ports have been studied in the recent past in transport studies, spanning from the economical (Marchese, 1970; Musso, 1996) and geographical (Toschi, 1960; Lucia, 1990; Vallega, 1970, 1992, 1997) points of views (Hayuth, 1982), as well as focusing on their roles of organization of the peri-urban and coastal spaces (Muscarà, 1982; Soriani, 2006, 2011, 2017; Soriani and Calzavara, 2016; Ghelardoni, 2011; Ibrahimi, 2017; Van Mi and Hein, 2019). The particular relationship among the two sides of the “dyad” port-city passed through different elements of coexistence, conflict and separation. To-date, port-cities are facing important changes, coming out from the different relationships being set among the two components, the “port” and the “city” ones, and in terms of the functions played by port as a node in a transport system.

The changing dynamics – including the ecological, digital and energy transitions – of ports can be referred to a progressive fading of a neat separation among a strong specialization of functions of ports and cities. This happens together with changes intervened in the financialization of markets, that involved also the port and transport sector, as well as the differentiation of activities related to ports, that brought again, after a long period, port and transport related activities into urban contexts – i.e., tourism. Also, the issues related to security, and the application of advanced technologies, are helping in approaching cities and their ports (Borruso et al., 2021).

Also, the changing and mixing role of ports, between gateway and hub functions, and the perspective of reshoring of companies after a massive globalization of the markets of the previous decades, are changing the maritime ranges and the hinterland shapes and distances, de facto bringing opportunities to cities hosting ports – global transition, also towards sustainability (Battino and Leonisio Munoz, 2022).

Similarly, a fading separation between industrial and logistic functions arises at urban and peri-urban levels, with transformation intervening in the industrial activities towards logistic, port-related ones (Balletto et al., 2022).

2.1 Materials

2.1.1 Port as a node and as a gateway

It is important to remember the concept of the port as a gateway and as a node. Two concepts are apparently similar but that host important differences. The port as a gateway implies its nature as an interface between the maritime and the land domains, a “door” from the sea towards the land markets. As a node, the port is an important connecting point within an articulated transport system, which implies the presence of different point/nodal structures, links between them, and flows on such links and among nodes.

The two concepts can partly overlap, as a gateway is a node, in the connection between the flows to/from the sea, and those from/to the land, at local, regional or global scales. The concept of node can be extended to enclose ports that also can be classified according to two main families, quite neat in their separation until a few years ago, as gateways and hubs. In such a distinction, pure gateway ports serve a hinterland connecting it to the maritime domain. Pure hub ports, on the other side, hold little connections with the hinterland, but play an important role as a node in connecting other ports within different ranges (De Cordemoy, 1909; Olivier and Slack, 2005; Rodrigue, 2020; Notteboom et al, 2022).

The development and consolidation of the standardized container, led, in time, to the consolidation of ports as intermodal nodes within transport networks (Taaffe et al., 1996; Notteboom et al, 2022).

2.1.2 Vigarié's port triptych model

An important consideration was developed by Vigarié (1983; 1992) introducing the concept of port triptych, modeled on the three elements as hinterland-seaport-foreland, with a symbiotic relationship between hinterland and foreland, and the seaport itself acting as an important interface, as a port-space where, furthermore, a port-city relationship is set. Such an area becomes also relevant in terms of industrial location, particularly in the early stages of industrialization itself, with heavy industries

favoring their location in close proximity of the waterfront, in order to minimize transport costs by sea and also benefiting from the wide set of connections with the hinterland. It is the development of the MIDAs – Maritime Industrial Development Areas, as recalled by Vallega (1996), in which, in their most recent evolutions, a privileged relationship between port and industrial activities is set, no more, and not always, heavy and polluting as in the early stages of the industrialization. In recent times, logistics and transport have become industries per se, de facto occupying space formerly used by heavy manufacturing – the steel industry as well as the assembly industry.

2.1.3 Hoyle's port-city

These elements contribute to the changes intervening and to the evolution of the pressures within the city-port relationship. In this sense, Hoyle's model (1988; 1989; 2000; Hoyle and Knowles, 1992) was developed to summarize the evolution and the changes between the two tiers of the city-port¹. These face on one side the transformation of cities towards service-based and financial services, and on the other side the need, for port activities facing the quest for intermodality, to be better connected with inland terminals and logistic centers.

The six stages span from the primitive port city of the ancient city/port up to the 19th century, where a close functional association between city and port exist in the first stage, to the second one of the city of the 19th and early 20th centuries of the expansion of the port and city functions. Then, it moves to the third stage of the modern port-city, with the introduction of containerization in the mid-20th century. The fourth stage follows with a retreat of port functions from the waterfront in the Sixties and Eighties of the 20th century, than the fifth with the redevelopment of the same waterfront in the Seventies and Nineties. A sixth stage of renewed relationship between port and city, following the evolution of globalization and intermodalism, continues the model, in the period from the end of the 20th century and the early years of the 21st

¹ The model can be found summarized at this link <https://bit.ly/Hoyleurbanport>.

one. It is to be recalled that the fifth and sixth stages deal with a sort of reconciliation of the port-city functions with the development of new linkages, with a revitalization turning back from that separation of functions that mainly characterized the largest part of the 20th century.

2.1.4 Bird's Anyport model

The relationship between city and port has been studied and modeled by Bird (1963), after studying the development of British seaports in time, successively modified (Bird, 1971) and compared to other city-port development models (Hoyle, 1989, 1992, 2000). Bird devised a set of chronological phases of development of city-ports, combining the evolutions of the two-tiers: of the city and, in particular, of the port side. In Bird's vision, each stage holds a typical layout of port functions and facilities, descending from the technological, organizational and managerial settings of the shipping and maneuvering processes of the time. The Anyport model in particular highlighted a continuous specialization of port functions, in time, de facto separating the port from the city, pushing the core port area out from the urban center and developing port infrastructure and facilities farther from the urban core (Li, 2019).

The model was originally set in five stages, demonstrating how port facilities develop, starting from an initial port site with small quays very close to the city center and warehouses in close proximity. The evolution in port and ship technologies and sizes, as well as in cargo handling, lead to the movement of docks and wharves gradually away from the city center and central business district in particular, with the gradual specialization of terminals in dedicated positions. Notteboom et al. (2022) devised three major stages in the Anyport model development that can be summarized in setting, expansion and specialization².

Setting. A port set up depends on geographical considerations, particularly for sail ships, and an evolution of the port city is towards trading, shipbuilding quays in close proximity of the

center, fishing activities, with, in the pre-industrial era, port-related activities based on wholesaling and warehousing. A strong city-port relationship is set, given the spatial and social mix of port and urban activities.

Expansion. The industrial revolution made the difference in the development of the city-port relationships and several changes occurred, from the expansion of quays, to the growing amount of freight and passengers moved, to the size increase of ships and, consequently, the need for adequate warehouses and proper docks to be realized. Industrial activities start to be located in close proximity to the waterfront to gain economies of scale and location, railways start to be spread and allow a wider integration of the port towards a wider regional area. Maritime Industrial Development Areas (MIDAs) start to be realized (Vallega, 1997). The port expansion started towards external areas in search of deeper waters.

Specialization. The next stage implies the specialization of port functions and, consequently, terminals, that need to be specialized and dedicated to handle differentiated freights, that imply different techniques for handling, storage and movement: containers need wide spaces and dedicated intermodal facilities (i.e., cranes and railways), ores, grain, petroleum and coal require dedicated warehouses and handling. Naval gigantism in all the different sectors implies dredging and/or greater depths and longer quays. As a consequence, facilities closer to the urban center become obsolete and their activities need to be moved out from the urban core, in search for wider space for freight management, handling and storage. Older, central urban obsolete facilities become the object of reconversion plans towards urban uses (i.e., residential, services, parks, etc.).

Notteboom et al. (2022) and Rodrigue et al. (2020) stress how further challenges to the model were introduced by containerization that led to the development of a wide network of satellite terminals and inland terminals connected to the port facilities themselves. This leads to a port regionalization, meaning the capacity of the port to transform its territory and therefore extending the port-related functions to

² The model can be found summarized at this link <https://bit.ly/Anyport>.

the entire region of influence of the port itself³.

2.2 Methods – Hybridization in port-city relationships (The Hybridized Anyport Model)

Important related changes in transport and logistics, as containerization, globalization, naval gigantism, etc., led to specialization of ports and terminals with a separation of functions and activities and a regionalization of major port systems, that, according to the most of the authors cited, occupied an important share of the end of the 20th century and beginning of the 21st century. Further changes are however on-going, in line with the specialization of terminals and regionalization of ports, and such a concept could be defined as Hybridization, to be observed at different scales and according to different points of views.

2.2.1 A proposal. An extended, hybridized Bird's model

As observed in the previous paragraph, the Bird's Anyport model ends up with the stage of specialization of functions and separations between the city and port activities, with hypothesized evolutions towards a regionalization of port functions. An extension of the model is hereby presented with the proposal of a further stage, that of hybridization. Starting from the model as summarized by Notteboom et al. (2022) and Rodrigue et al. (2020⁴) the model as in Figure 1 is proposed. In the model, we can observe the different stages and evolution of city and port spaces. The urban expansion is represented, with core, fringe and peri-urban spaces, as well as the port one, with the gradual extension of the port towards more external locations, where specialization of terminals can occur, as well as a presence of deeper waters and better connections with the road and rail transport infrastructure and terminals. Also the reconversion of older, urban port facilities is presented. The model is hereby extended to host suburbanization of urban

spaces, as well as the development of inner harbors and of the urban/periurban transport and logistic centers, as well as the changing function of terminals, from single to multi-purpose ones. In this sense, the model is adapted to host a four-tier hybridization, with their localization in space, according to the following organization.

1. City-port relationship (on waterfronts; on peripheries. Areas "1" in Figure 1);
2. Transport & logistic/industry relationship (Area "2" in Figure 1);
3. Port functions (From single-purpose terminals to multi-purpose, hybrid terminals; Areas "3" in Figure 1);
4. Port roles hybridization (From pure gateways & hubs, to mixed uses; Area "4" in Figure 1).

2.2.2 City-port relationship (on waterfronts; on peripheries)

There is a consolidation of relationship between waterfronts and inner harbors, among quays and dry ports, both those in proximity to the shoreline, and those internal with respect to the port region. As previously point out, the relationship between cities and ports on waterfronts has changed in time, for a period of strong coexistence in the pre-industrial era, to the quest for regeneration and redevelopment towards urban uses. This period spanned for the entire last quarter of the 20th century in many port-cities of the world, from London, to Hamburg, to Genoa, etc. (Rocca, 2011; Di Bella, 2011). It is not only the old waterfront, however, the main character involved. Recently, the urban waterfront continues to play an important role in port functions, particularly when cruise and other passenger marine traffic is involved, with a mixed, hybrid use of the urban coastline, for urban and maritime uses and purposes.

³ The model can be found summarized at this link <https://bit.ly/Portsystem>.

⁴ Available at the link: <https://bit.ly/Anyport>.

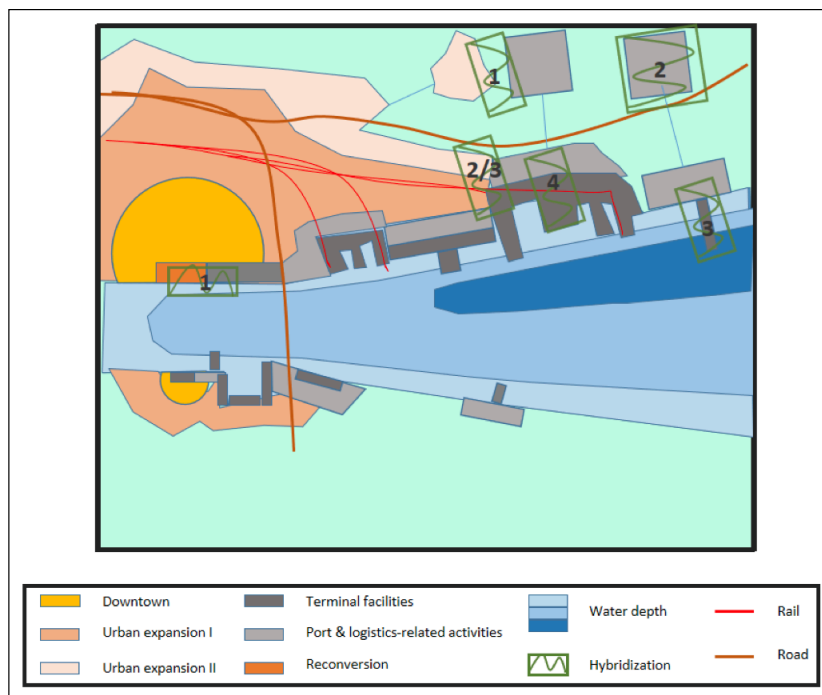


Figure 1. Hybridization and regionalization of city-port functions. 1. City-Port relationship; 2. Transport & Industry relationship; 3. Port functions (from single-purpose to multi-purpose terminals); 4. Port roles hybridization (From pure gateways & hubs, to mixed use).

Source: author's elaboration after Bird (1963) and Notteboom et al. (2022).

Tourists in cruise ships prefer central urban docks and not peripheral ones, to enjoy the amusements of the cities they visit. Consequences of that can be the coexistence of flows on the waterfronts, both of pedestrians (citizens and passengers) and of transport means (urban public and private traffic, together with that serving the cruise-ships calling at home ports or ports of call: buses and coaches, vans and trucks, etc.).

Furthermore, peripheral peri-urban spaces live a hybridization of functions. The development of inner harbors in locations separated from the waterfronts, follows the changed and changing – functions and relations played by ports, needed as areas for handling, managing, storing and warehousing freights, other than as break of bulk and transshipment to other transport means. The changing needs of cities in terms of last mile distribution for the city logistics implies the development of dedicated centers, in semi-central and peri-urban locations. These activities and their functions can therefore co-exist and, potentially, interact

and impact, with other ones, such as industrial, retail and residential, creating other forms of hybridized spaces (Areas 1 in Figure 1).

2.2.3 Transport & logistic/industry relationship

A fading separation between industrial and logistic functions arises at urban and peri-urban levels, with transformation intervening in the industrial activities towards logistic, port-related ones. The deindustrialization and post-industrial development produced, as one of their outcomes, the transformation of their spaces towards transport and logistic functions. Waterfront – based former or dismissing industrial sites are more and more converted into transport and logistic platforms, given their proximity to the shoreline that can be well-suited for handling the growing and unitized freight. Similarly, the more internal industrial locations, in a period of changing size and characters of the manufacturing industry, as well as the transformation of the pure transport sector into a

per se transport & logistic industry, led to a coexistence of activities and functions in proximal spaces, once dedicated to “pure” industrial and manufacturing purposes (Areas 2 in Figure 1).

2.2.4 Port functions (From single-purpose terminals to multi-purpose, hybrid terminals)

Specialized terminals in ports are still present, but the most modern evolutions of platforms are heading towards the multi-purpose concept. This is needed to better and faster adapt to the changes in unitized freight transport, as well in the ship and quay’s technology. On one side, it is true that containers are widely used for a wider set of categories, i.e., covering commodities once moved as bulk cargo – coffee beans are just an example, to-date more and more moved in containers. On the other side, containers are not moved just by means of dedicated LO-LO (Lift-on/Lift off) containerhips – needing dedicated cranes on quays – but more and more via RO-RO ferries (Roll-on/Roll-off), together with semi-trailers and swap-bodies (other forms of unitized freight cargo). Multi-purpose platforms need a minor provision of dedicated infrastructure as fixed cranes, but are easily modifiable in order to host mobile ones, and therefore adapted to host both LO-LO and RO-RO ships. Road and rail connections also allow connecting to hinterlands and to exploit intermodalism and multimodalism. Furthermore, formerly dedicated terminals – for special cargo or bulk cargo – more and more allow handling of unitized cargo freight (Areas 3 in Figure 1).

2.2.5 Port roles hybridization (From pure gateways & hubs, to mixed uses)

The traditional separation among gateway and hub ports, dominant throughout the Nineties of the past century, is somehow fading, with particular reference to the containers’ movement, following also the important changes intervened in the international shipping (Ruggiero, 2011) and in the business models as fostered by major maritime groups in port’s choices. Major changes occur in the hub ports, with a strong reinforcement of the bigger ones and a downsize or suffering of the minor ones,

often reconfigured as mixed hub-gateway ones, particularly for those ports better connected by land networks (rail and road). In many gateway ports, hub and transshipment functions are increasing, with a consequent transformation of functions and a renewed weight of their territorial systems. The development of pendulum routes in the recent years, brought to a higher relevance of ports, or port systems, in the mixed movement, both related to serving a hinterland, and to play transshipment functions, with a higher percentage of containers deposited on quaysides, ready to be sent towards other maritime destinations (Tadini and Borruso, 2022; Russo et al., 2021; Ivona, 2011). This required higher amount of spaces on terminals for containers’ disposal and handling (Area 4 in Figure 1).

3. The Hybridization of the City-Port Relationship. A case study

As a case study of the concept of hybridization in its different flavors, an overview of a medium-size port as that of Trieste is hereby analyzed. More in depth descriptions of the Port of Trieste and its past and recent evolutions are proposed by different authors (Roletto, 1941; Borruso and Porceddu, 2011; Borruso and Borruso, 2012; Tadini and Borruso, 2022). Some basic information is hereby reported. The port of Trieste lays in proximity of the Northeastern Italy-Slovenia border at the crossroads of the main international routes between the Mediterranean and central Europe. It is the first Italian port for overall tonnage moved and the first rail-port, with more than 50% of containers and 40% of semi-trailers handled in the Port of Trieste moved by train, with a dominant quote of traffic serving international destination, particularly dedicated to serving a Central and Eastern European hinterlands.

The Port of Trieste is a unique case as an international Free Port regime with several easements in terms of transit, freight storage and custom duties. Such benefits recently could be moved from obsolete, old port locations also to more proficient inland terminals. In particular, the reform of port authorities from January 2016 led to a changed relationship between the port and neighboring areas or areas linked to the urban context.



Figure 2. Hybridization and regionalization of city-port functions. Port-City Urban relationship. Source: author's elaboration. Google Earth base data.

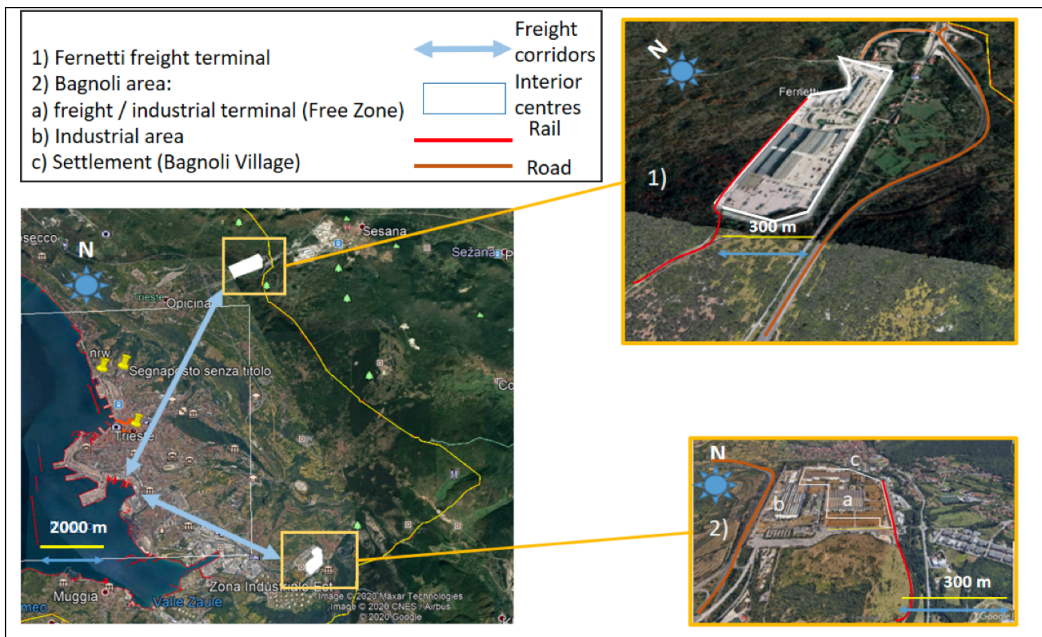


Figure 3. Hybridization and regionalization of city-port functions. Port-City Periurban relationship. Source: author's elaboration. Google Earth base data.



Figure 4. Port of Trieste Pier 7 Container Terminal (Photo: Giuseppe Borruso, May 2022).

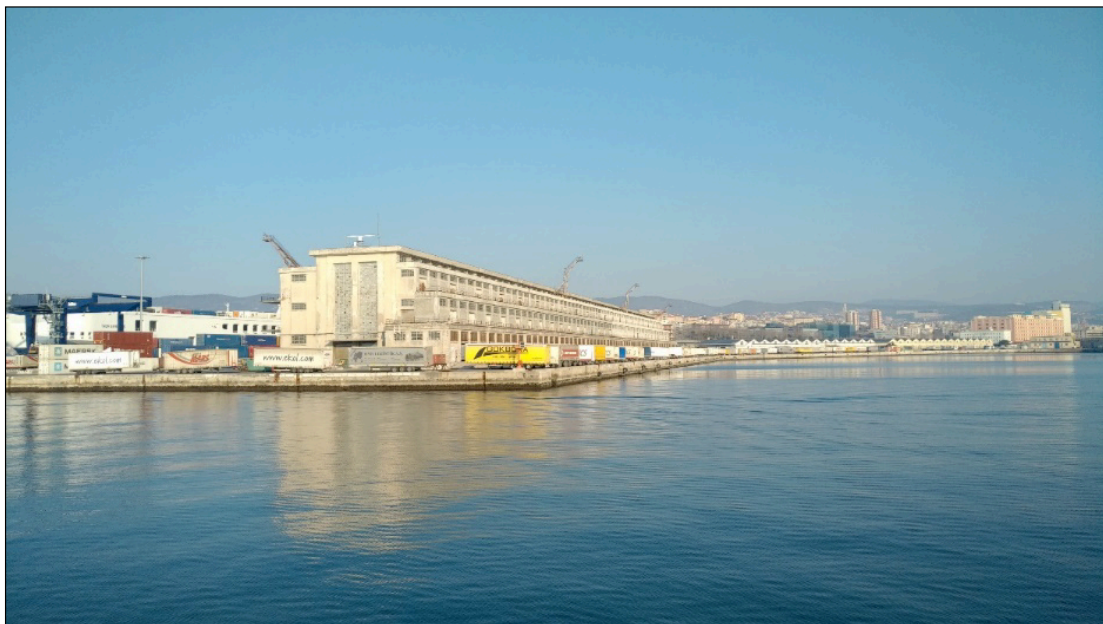


Figure 5. Port of Trieste Pier 6 Multi-purpose Terminal (Photo: Giuseppe Borruso, August 2021).

From the analysis of Figure 2 we can examine the most recent evolutions of the port functions in the direction of hybridization as previously presented, from specialization to regionalization of the city-port system.

Historically, the port of Trieste developed on the lower part of the old roman-medieval town facing the sea (a). In the austro-hungarian period from the 18th century, the new city was built (b) around the Grand Canal, the heart of the then port-city, together with the docks and quays on the waterfront (1). The mid and late 19th Century saw the realization of the then New Port – now Old Port (c; 2) in proximity to the railway line and station. The modern port developed from the late 19th Century and early 20th Century in the Southern part of the city (3) farther from the core of the city itself, with successive evolutions and specialization of terminals – multi-purpose (Logistic Platform, Figure 2 d; Pier 6 Multi-purpose Terminal, Figure 2 f; Figure 4), containers (Terminal 7, Figure 2 g; Figure 5), oil, etc.

The development of inland terminals followed (Figure 3) with the out-of-town transport and logistic centers as Ferneti Freight terminals (1) and Bagnoli Freight – free zone terminal (2, a) operating as dry ports of the port of Trieste and important intermodal logistic nodes allowing the hinterland connections.

Examining this set up in light of the Hybridized Anyport model, we can observe the city-port set up as follows.

1. City-port relationship (on waterfronts; on peripheries).

When considering waterfronts, the Old Port was split in two areas after the migration of one of the Free Port areas towards the Bagnoli FreeEste logistic center (Figure 3-2a): area (c) and (2) in Figure 2, now respectively destined to urban redevelopment and port-related activities exported reconversion – from freight terminal to cruise – leisure terminal. The urban waterfront (Figure 2-1) hosts a major arterial road other than a pedestrian promenade, mixed to port-related functions as a cruise terminal and short-range public transport and medium range passenger ferry routes.

Due to the out-of-town development of inland terminals and dry multimodal terminals, peripheral and peri-urban areas coexist with different functions, other than those of residentiality and services. The already mentioned Bagnoli FreeEste logistic center (Figure 3-2a) lays in close proximity of Bagnoli village (Figure 3-2c), with an increased pressure in terms of noise, heavy traffic movement due to the increase of transport and logistic activities.

2. Transport & logistic/industry relationship.

The evolution of industrial manufacturing, often including deindustrialization or the shift towards different forms of manufacturing, is strictly connected with that of ports. In Trieste area, the old, now dismissed still mill “Ferriera”, located in proximity of the waterfront and of the Trieste’s neighborhood Servola, is leaving pace to the expansion of the port itself, destined to become an important part in the development of the Pier 8 as a new container terminal (Figure 2-e).

Similarly, the large engines manufacturing plant located in Bagnoli formerly occupied a wide area (Figure 3-2 a and b). Recently a part was destined to the FreeEste terminal (Figure 3-2b) with logistics, warehousing and multimodal transport functions, other than the perspective of hosting, on its own, brand new manufacturing plants, strictly connected to the logistic activities and the free zones benefits. A recent evolution is putting question marks on the evolutions of the remaining manufacturing plant (Figure 3-2 a), whose management, the Finland – based Wartsila company, recently decided for re-locating the production line in Finland.

3. Port functions (From single-purpose terminals to multi-purpose, hybrid terminals).

Despite the Port of Trieste is still hosting dedicated, specialized terminals, as those dedicated to cruise and passengers traffic (Figure 2-1), those to the pure container movement (Figure 2-g), or those to liquid bulk, more recent and dynamic terminals are more and more acting as hybridized multi-purpose terminals, capable of managing RO-RO ships as well as LO-LO ones, and with a

mixed range of unitized freights handled, including semi-trailer tracks, semi-trailers, swap bodies and containers. Nearly 14% of the 757.255 TEUs moved in the Port of Trieste (excluding the Monfalcone Terminal, part of the same Port Authority System) in 2021 (Adriaports, 2022) were handled in multi-purpose terminals (Figure 2-f and d), 86% of them in the single-purpose Terminal Pier 7 (Figure 2-g; Figure 4).

4. Port roles hybridization (From pure gateways & hubs, to mixed uses).

The Port of Trieste is playing a major role as a rail-port gateway to the regional hinterland and to a wider, international one, including mainly Central and Eastern European destinations. However, a consistent quote of transshipment is present, therefore attributing a minor role as a hub to the North Adriatic port: 30% of the 757.255 TEUs handled in the sole Port of Trieste in 2021 were transhipped, therefore not related to the hinterland of the gateway port (Assoport, 2022).

4. Conclusions

In the evolution of the port-city relationship, hybridization can be seen as a further multi-scalar stage, concerning the local, regional and global scales of transport, where ports act as nodes and as territorializing elements, as well as in terms of the organization of activities. The history of the port cities highlights periods and spaces of interaction, coexistence, mutual benefit, conflict through time, and a potential hybridization in the present time, with continuous spill-over effects between the urban and the port components of the port-city dyad. Planning and political economical instruments not always include all the different flavors of such relationships, that regard cities and ports on the waterfronts but also on the inner and outer peripheries, where the suburban expansion and the (dry and inland) port terminals setting in the region occur. Urban, industrial and transport &

logistics policies in fact do not always consider each other, nor their extent is considering entirely the variety of cases and examples, i.e., the presence of the private logistic centers responsible for last-mile distribution in urban environments, or the mixed-use functions played by inland terminals in transport and logistics activities.

Ports and their cities continue to be linked by important relationships that to-date are facing several challenges and opportunities, other than important research agendas, still little explored. These are linked to the improvement and innovation of the connections of mobility and security. New technologies allow a better control over security issues that potentially allow a better coexistence of passenger and pedestrian flows in central urban contexts, as well as of freight traffic. Maritime and inland connections become particularly relevant to guarantee the sea-land modal integration and, in parallel, reduce road congestion and carbon footprint, diverting freight traffic from road to rail. This implies interactions with urban and periurban spaces, at the same time favoring the transformation of the industrial sector, from the port-related heavy manufacturing towards lighter, smart productions, as well as favoring the transformation of the same transport and logistic sector into an industrial sector per se, with a structural and territorializing effect over port-cities and regions.

Also, the futuristic smart cities and ports head towards integration and hybridization. Neom's The Line and Oxagon, the futuristic projects of smart, linear city and a floating industrial port in the Red Sea, share the idea of a hybridized future of relationship between ports and cities, in renewed relationships between sea and land.

The same future evolutions imply also the transformation towards green-ness and energy efficiency, in the quest towards the circular economy and embracing the aims of the sustainable development goals (SDG).

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