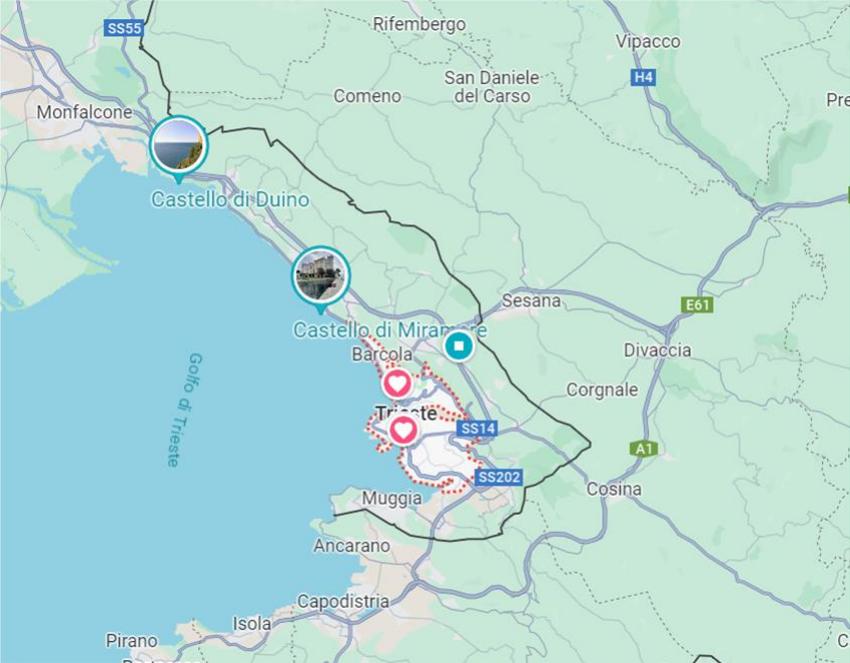# City - Port relationships under geographical and urban planning perspectives.
Case studies from Italian experiences
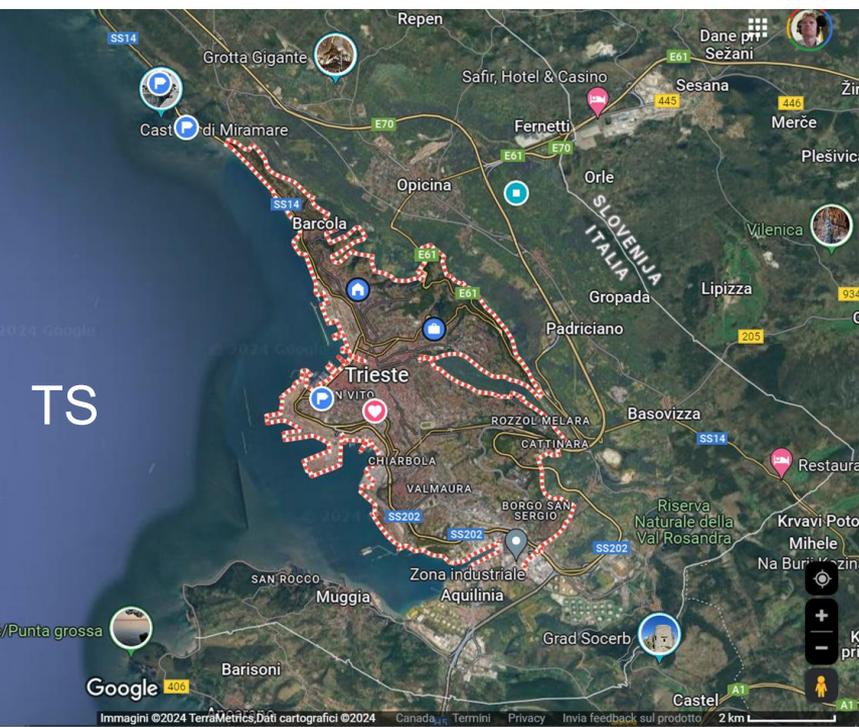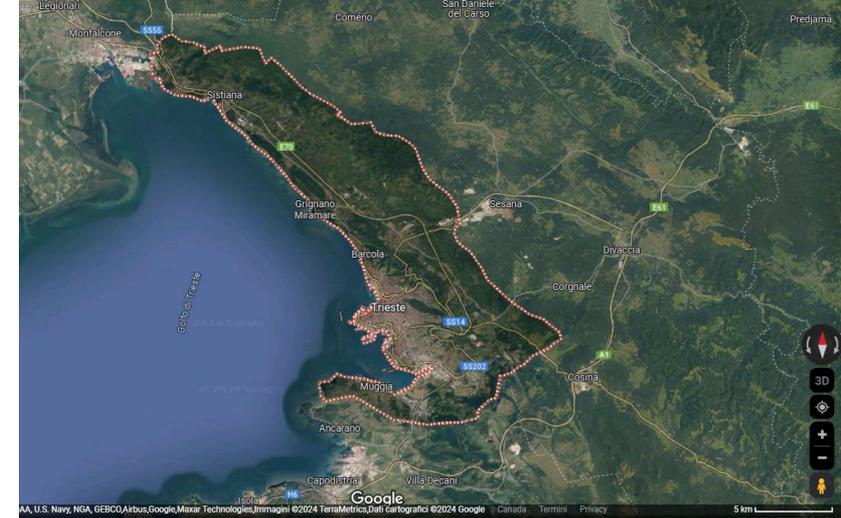
Giuseppe Borruso
University of Trieste (Italy)

Ginevra Balletto
University of Cagliari (Italy)

TS
Population (2023):
199,032 (228,952)
Area (km²):
85.11 Kmq (212,83)
Density (in/km²):
2,341.8 (1,075.77)

Province by 6 municipalities
Population (2023): 228,705
Area (km²): 212,5
Density (in/km²) 1,103.28
Middle age (2023): 49

TS

Overview

The present research is based on an analysis performed combining different models developed in time to study the **city-port relation** (Bird's Anyport model) as well as location in space (Weber model of industrial location) within a circular framework.

A city-port interference and interaction **matrix** is developed, to analyze the areas of potential development of the circular activities, in particular those related to building maintenance, demolition and reconstruction

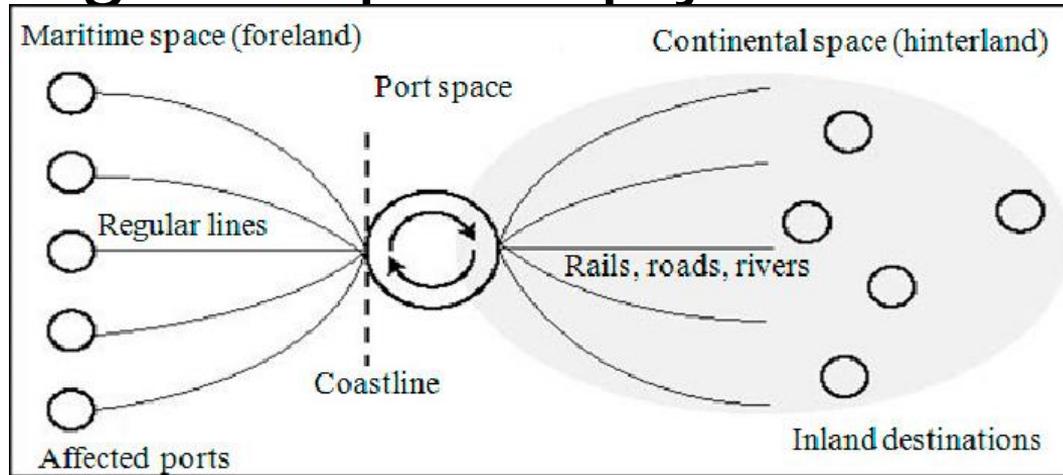# Ports and Urban Land Use
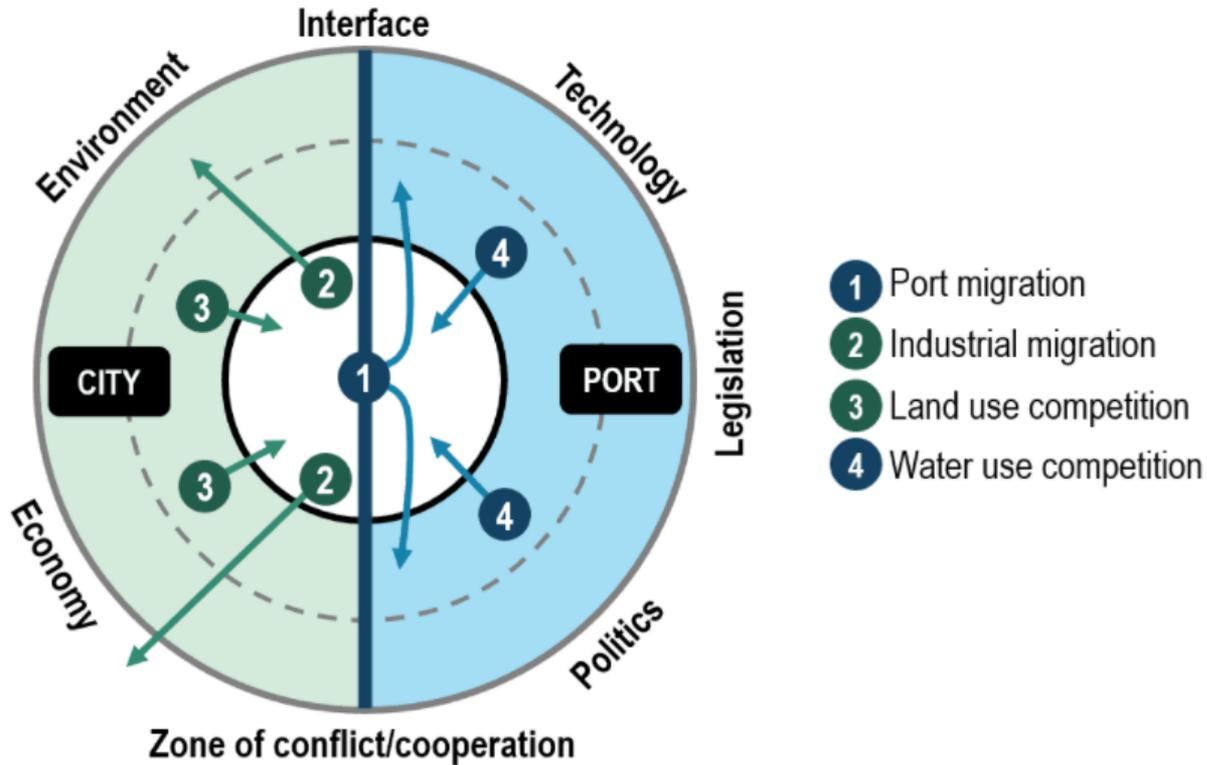

Ports and Urban Land Use

Vigarié's port triptych model.

Maritime space (foreland)

Continental space (hinterland)

Port space

Regular lines

Rails, roads, rivers

Coastline

Affected ports

Inland destinations

Hoyle's 6 stage model

STAGE	SYMBOL		PERIOD	CHARACTERISTICS
	○ City	● Port		
I Primitive port/city	◖●		Ancient/medieval to 19th century	Close spatial and functional association between city and port.
II Expanding port/city	◖----●		19th - early 20th century	Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries.
III Modern industrial port/city	◖----●		mid - 20th century	Industrial growth (especially oil refining) and introduction of containers/ro-ro require separation/space.
IV Retreat from the waterfront	◐ ●		1960 s - 1980 s	Changes in maritime technology induce growth of separate maritime industrial development areas.
V Redevelopment of waterfront	⊕ ●		1970 s - 1990 s	Large-scale modern port consumes large areas of land/water space; urban renewal of original core.
VI Renewal of port/city links	⊕----●		1980 s - 2000+	Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration.

The port's evolution (Anyport - Bird, 1963)
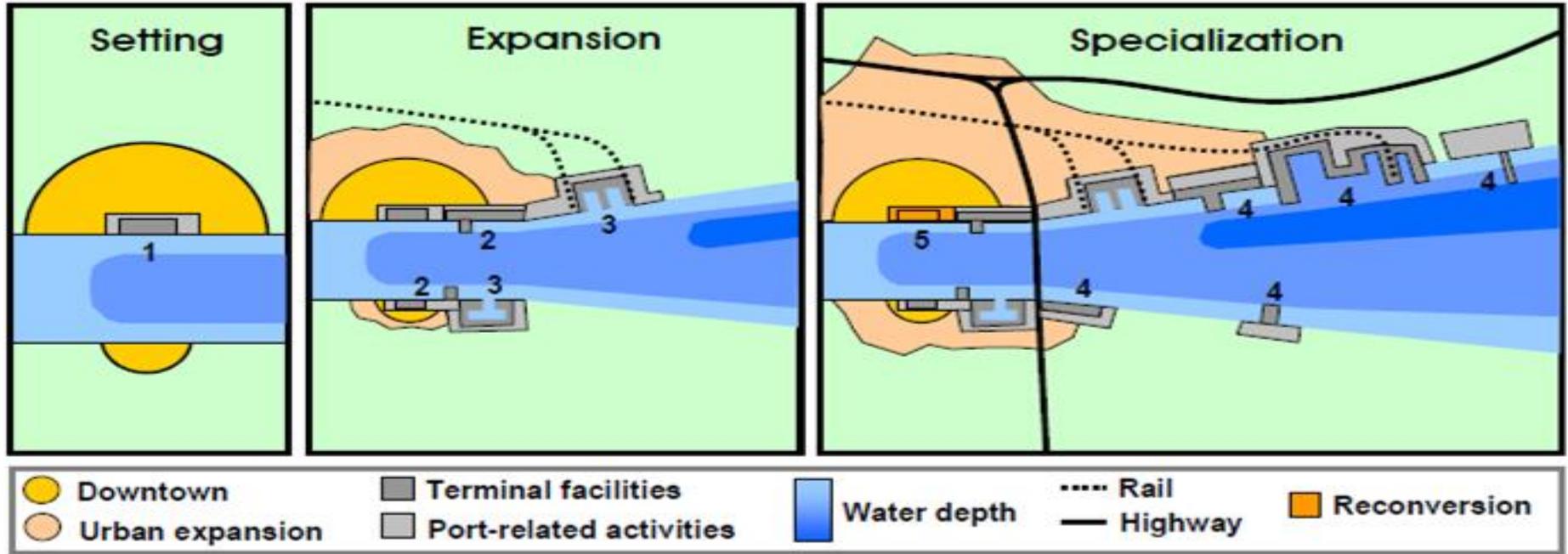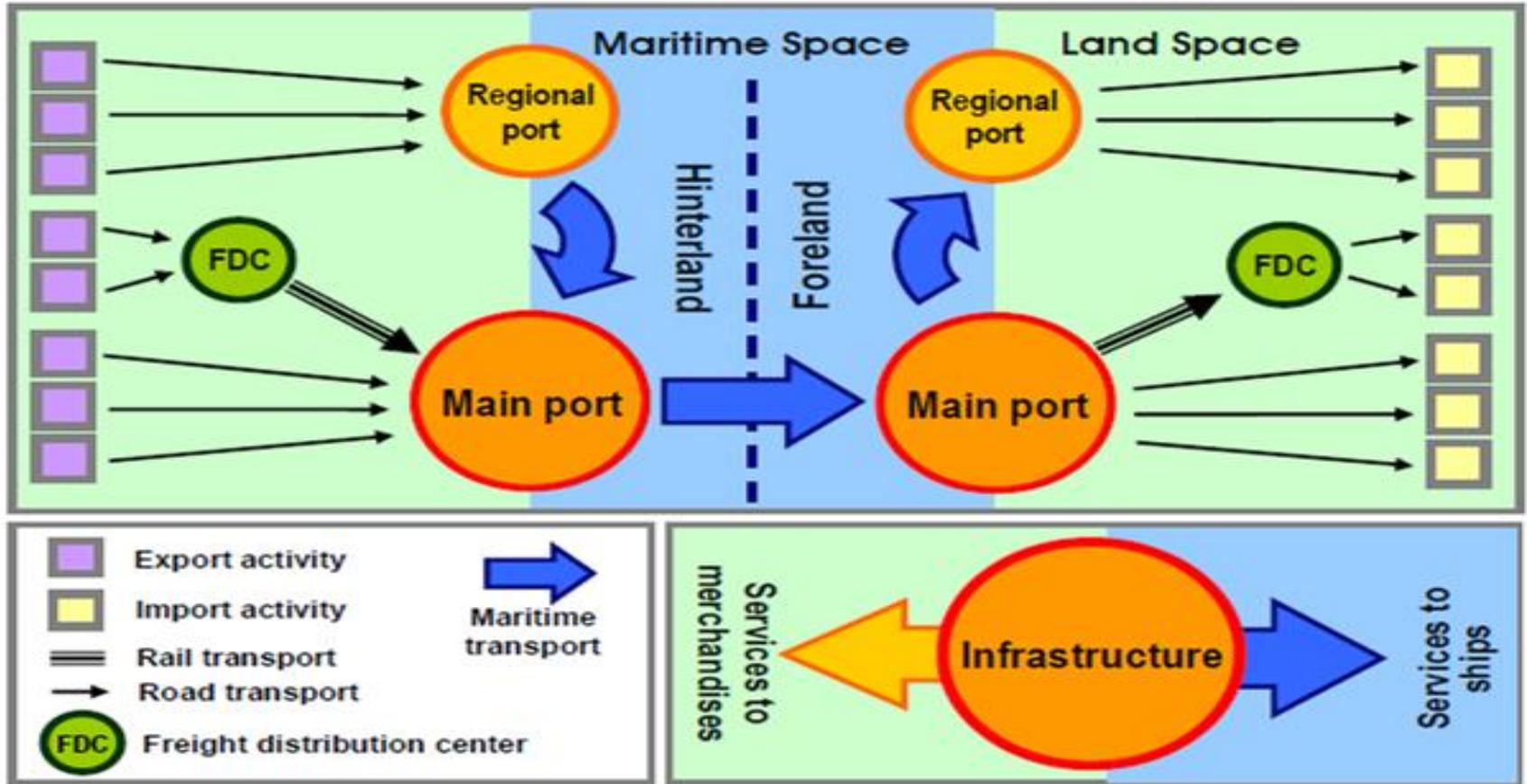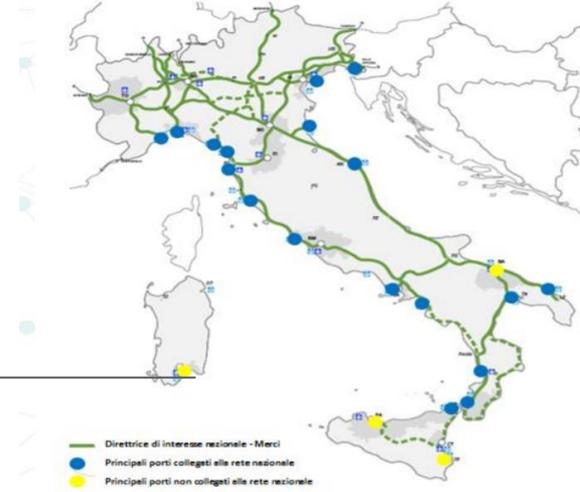
The Hybridized Anyport Model
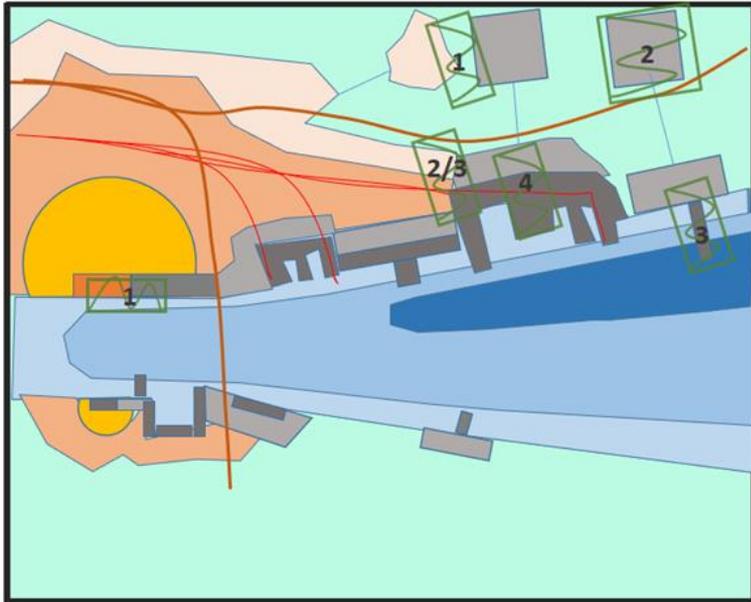
1. City-port relationship (on waterfronts; on peripheries. Areas "1");

2. Transport & logistic / industry relationship (Area "2");

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

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

Port functions

Case studies: Trieste

Le Autorità di Sistema Portuale

TIME PERIOD GOING FROM	01/01/2022 to 31/12/2022			01/01/2023 to 31/12/2023			Difference	
	IN	OUT	TOTAL	IN	OUT	TOTAL	TOTAL	%
TOTAL THROUGHPUT (Ton.)	48.861.746	8.731.067	57.592.813	47.351.040	8.273.885	55.624.925	-1.967.888	-3,42%
LIQUID BULK	37.882.282	0	37.882.282	37.345.812	0	37.345.812	-536.470	-1,42%
Crude oil	36.917.006	0	36.917.006	36.337.378	0	36.337.378	-579.628	-1,57%
Refined (petroleum) products	901.033	0	901.033	969.421	0	969.421	+68.388	+7,59%
Gaseus, liqufied or compressed petroleum products and natural gas	0	0	0	0	0	0	0	
Chemical products	64.243	0	64.243	39.013	0	39.013	-25.230	-39,27%
Other liquid bulk	0	0	0	0	0	0	0	
DRY BULK	624.307	25.411	649.718	422.614	21.197	443.811	-205.907	-31,69%
Cereals	125.464	0	125.464	66.669	0	66.669	-58.795	-46,86%
Foodstuff/Fodder/Oil seeds	0	0	0	0	0	0	0	
Coal and lignite	0	0	0	0	0	0	0	
Ores/cement/lime/plasters	57.800	0	57.800	94.600	0	94.600	+36.800	+63,67%
Metallurgical products	435.986	0	435.986	261.345	0	261.345	-174.641	-40,06%
Chemical products	0	0	0	0	0	0	0	
Other dry bulk	5.057	25.411	30.468	0	21.197	21.197	-9.271	-30,43%
GENERAL CARGO	10.355.157	8.705.656	19.060.813	9.582.614	8.252.688	17.835.302	-1.225.511	-6,43%
Containerized (including Ro-Ro containers)	4.792.472	3.962.336	8.754.808	4.606.431	3.803.740	8.410.171	-344.637	-3,94%
Ro-Ro (excluding Ro-Ro containers)	4.559.772	4.244.380	8.804.152	4.239.074	4.084.890	8.323.964	-480.188	-5,45%
Other general cargo	1.002.913	498.940	1.501.853	737.109	364.058	1.101.167	-400.686	-26,68%

ADDITIONAL INFORMATION								
NUMBER OF CALLS			2.290			2.144	-146	-6,38%
GROSS TONNAGE			86.916.570			87.239.425	+322.855	+0,37%
NUMBER OF LOCAL AND FERRY PASSENGERS	5.034	6.393	11.427	4.317	6.054	10.371	-1.056	-9,24%
Local (< 20 miles journey)	0	0	0	0	0	0	0	
Ferry passengers	5.034	6.393	11.427	4.317	6.054	10.371	-1.056	-9,24%
CRUISE PASSENGERS			437.336			468.599	+31.263	+7,15%
Home Port	162.788	167.571	330.359	162.440	162.610	325.050	-5.309	-1,61%
Transits			106.977			143.549	+36.572	+34,19%
NUMBER OF CONTAINERS (in TEUs)	470.642	407.163	877.805	461.754	390.439	852.193	-25.612	-2,92%
Hinterland	279.459	316.731	596.190	253.077	310.730	563.807	-32.383	-5,43%
Empty	58.722	114.744	173.466	48.142	134.629	182.771	+9.305	+5,36%
Full	220.737	201.987	422.724	204.935	176.101	381.036	-41.688	-9,86%
Transshipped	191.183	90.432	281.615	208.677	79.709	288.386	+6.771	+2,40%
Empty	53.324	4.500	57.824	84.579	0	84.579	+26.755	+46,27%
Full	137.859	85.932	223.791	124.098	79.709	203.807	-19.984	-8,93%
NUMBER OF VEHICLES	175.839	161.308	337.147	166.972	157.236	324.208	-12.939	-3,84%
Number of Ro-Ro units	161.264	159.063	320.327	147.465	151.105	298.570	-21.757	-6,79%
Number of private vehicles	44	177	221	43	1.044	1.087	+866	+391,86%
Number of commercial vehicles	14.531	2.068	16.599	19.464	5.087	24.551	+7.952	+47,91%

Bosco Urbano
Urban forest

Il Bosco urbano, o Asse Natura, si sviluppa idealmente con un percorso SE-NO e ha una lunghezza di circa 3 km, dal Molo IV fino ad arrivare al terrapieno di Barcola - Parcheggio di Bovedo. Sull'area troveranno spazio una pista ciclopedonale lenta, percorsi pedonali e da corsa, nonché una corsia dedicata a mezzi di servizio e soccorso.
Lungo lo sviluppo del Bosco Urbano passerà la linea della cabinovia integrata negli spazi verdi tra i percorsi dedicati alla mobilità lenta.

The Urban Forest, or Asse Natura ("Natural Axis"), is laid out along a SE-NW path with a length of about 3 km, from Molo IV as far as the Barcola terrapieno - Bovedo Car Park.
The area will have a slow cycle and pedestrian path, footpaths and jogging routes, as well as a lane dedicated to service and emergency vehicles.
The line of the cableway will pass along the Urban Forest route, integrated into the green spaces and amidst the routes dedicated to "slow" forms of access.

Ecological cycle

A circular economy is the aim of the management and maintenance of the Urban Park through a circular system producing more energy than it consumes and which consumes waste instead of producing it, and is thus self-sufficient in its management and maintenance.
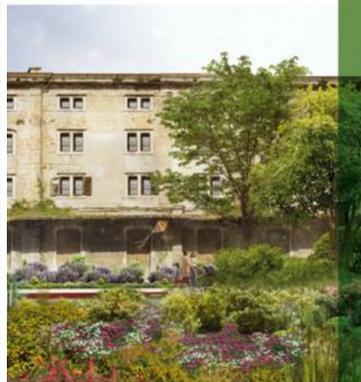
Binari

Verrà mantenuta la maggior parte dei binari dei percorsi ferroviari ottocenteschi che con il loro tracciato e i loro scambi diventano elementi fondativi del progetto del Parco, determinando così lo scheletro delle connessioni e la linea di orientamento dell'intero sistema.

Rail Tracks

Most of the tracks of the 19th century railway routes will be maintained, which - with their layout and their points - become founding elements of the Park project, thus determining the skeleton of connections and the orientation line of the entire system.

Da Barcola al centro di Trieste

3 km di sviluppo
4 aree di progetto sui moli
2 piazze urbane
1,9 km di piste ciclabili
200 stalli per biciclette
600 alberi

From Barcola to the centre of Trieste

Laid out along 3 km
4 project areas on the various docksides
2 urban squares
1,9 km of cycle paths
200 bicycle stands
600 trees
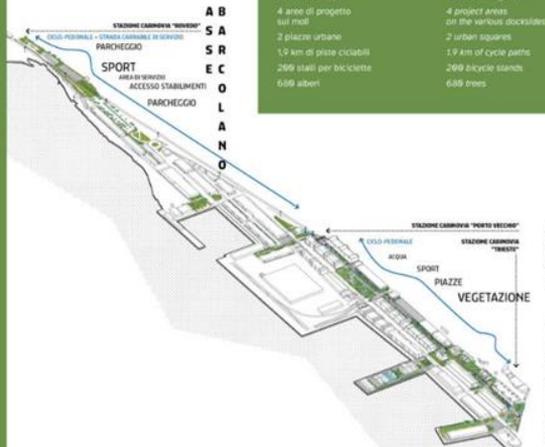
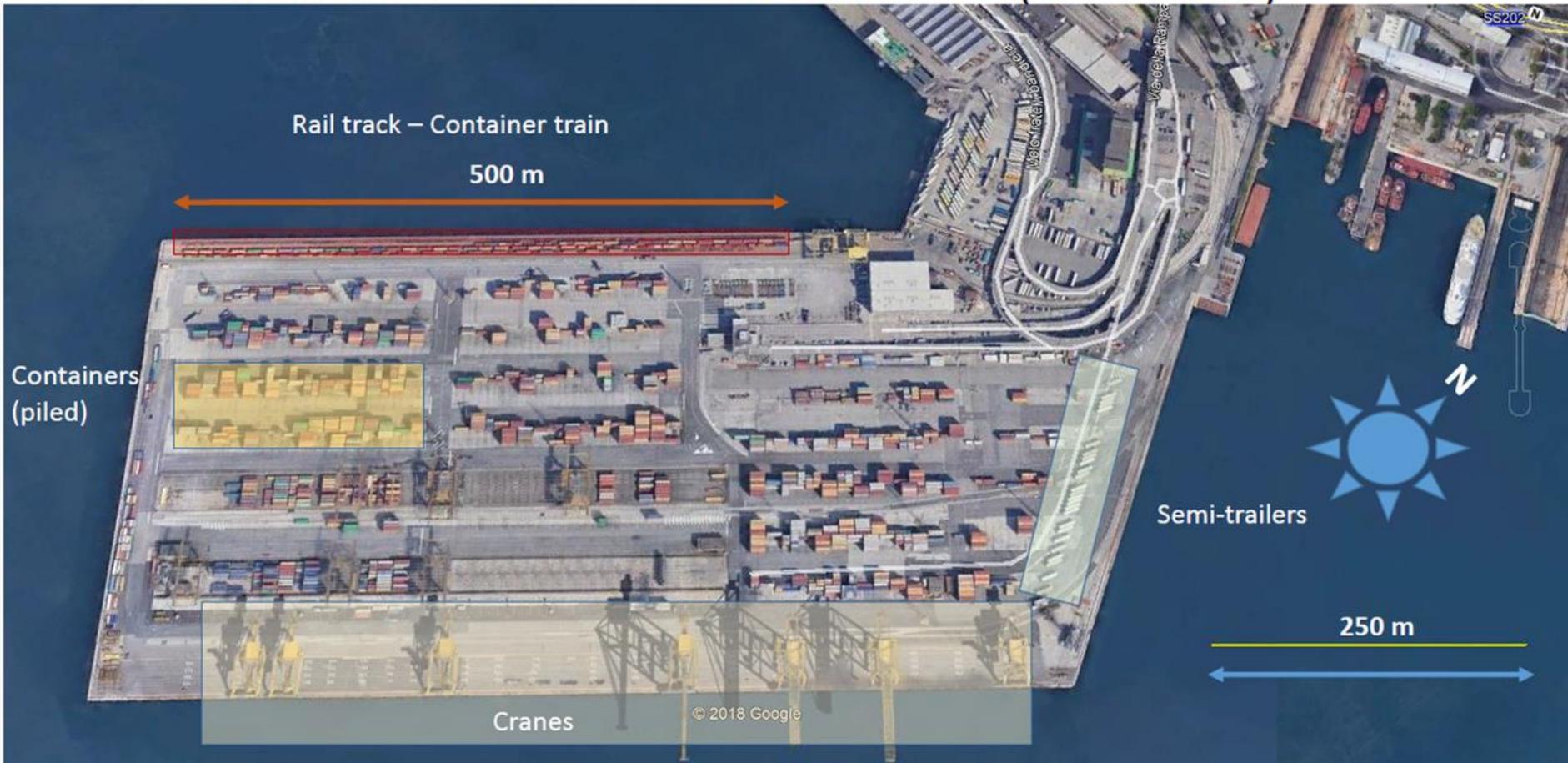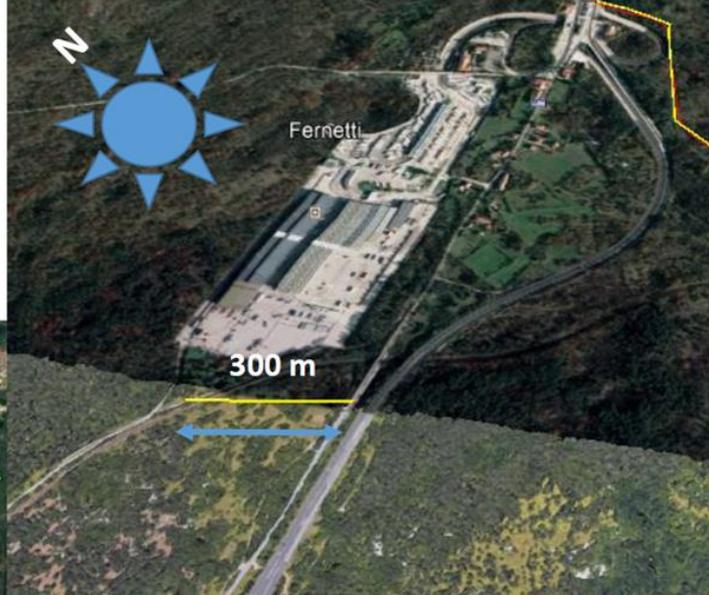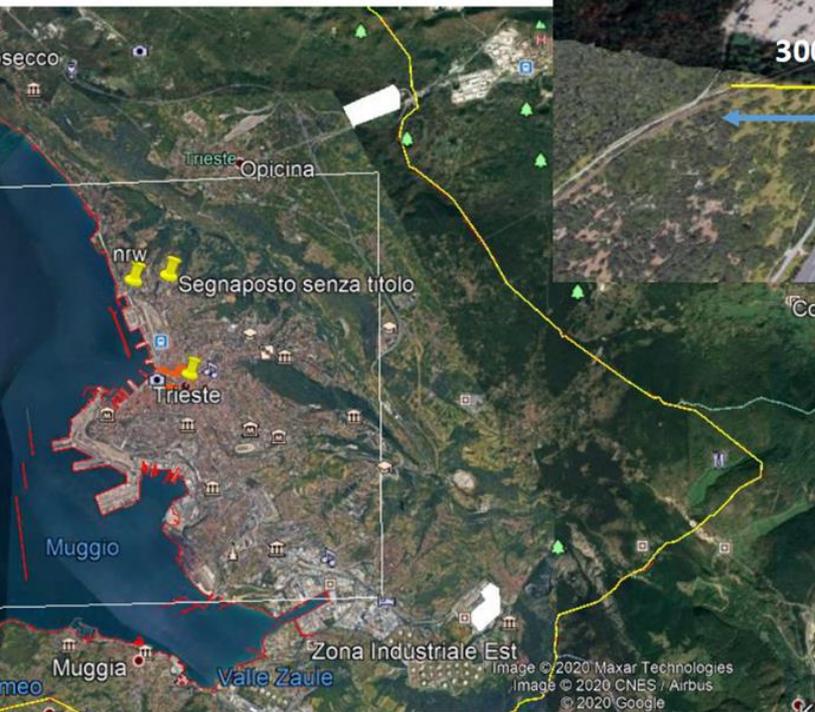A port today – the City and Port of Trieste

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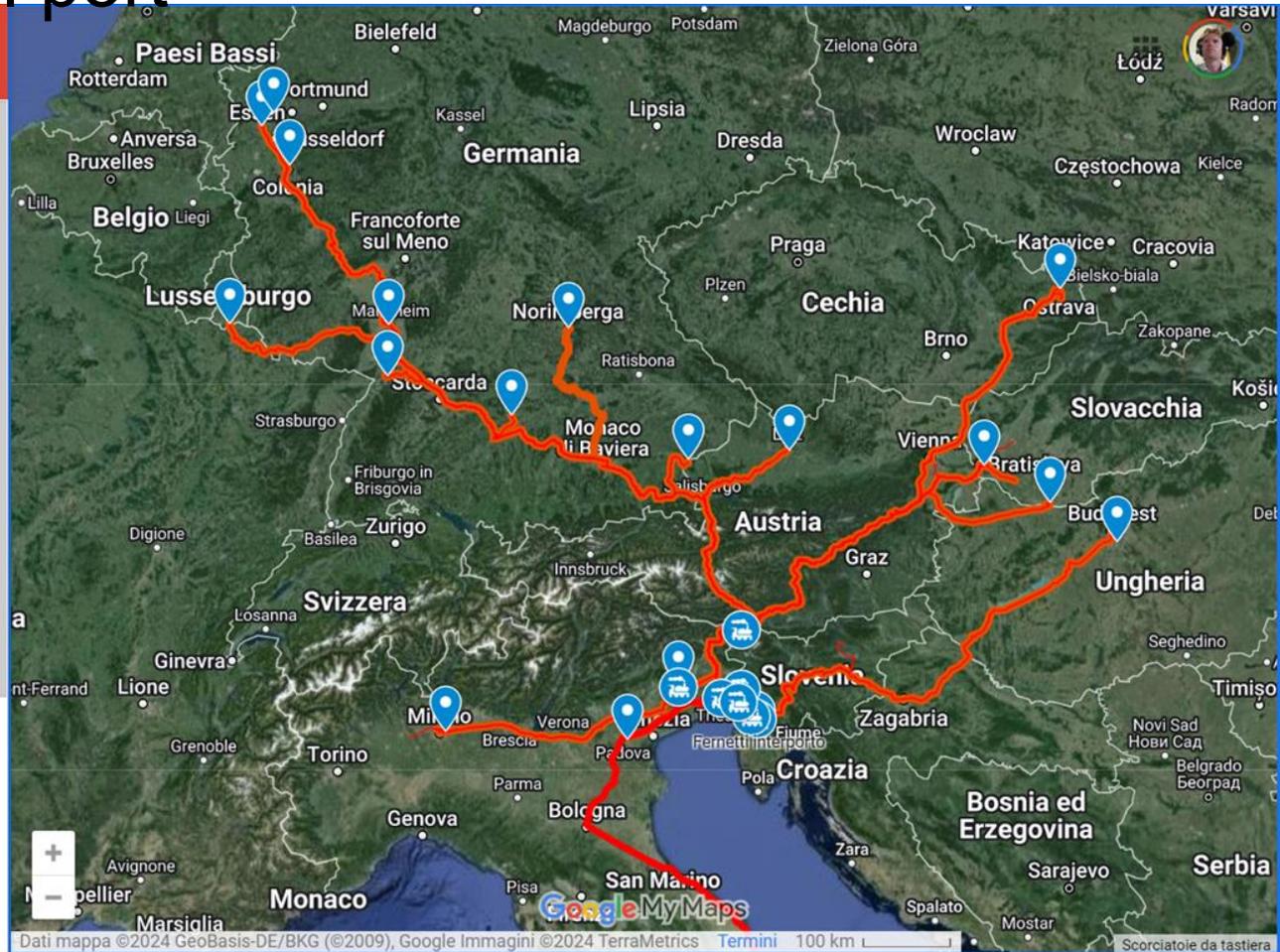Source: author's elaborations. Google Earth base data.

Molo V & VII (Piers 5th & 6th) – Multipurpose terminals

Warehouses

Quays

Semitrailers

Containers

Rail track – Ro-La (Rollande Landstrasse- 300 m ca)

100 m

Container terminal «Molo VII» (7th Pier)

Dry ports

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

Trieste as a rail port

Port of Trieste Development Plan

Legenda

- canali_navigazione
- nuova_configurazione_porto
- confini_doganali
- aree_patrimoniali
- confini_demaniali
- fascia_corridoio_ecologico
- L1a_porto_nuovo
- aree_pesca
- linea_di_costa
- limite_specchi_acquei_concessi_al_2014
- LV_verde
- viabilità
- ambiti_non_residenziali
- ferrovia_nuovo_scalo

zone_omogenee_tav_03

- D1
- L.C1
- L.C2
- L.C3
- L.C4
- L.C5
- L.C6
- L.D
- L.I1
- L.I2
- L.I3
- L.MG
- L.P1
- L.P2
- L.Pe
- L.PV1
- L.PV2
- L.PV3
- L.PV4
- L.PV5
- L.PV6
- L.PV7
- L.PV8
- L.S
- L.U1
- L.U2
- L.U3
- L.V
- S1
- S6
- acque_demaniali

Framework of the evolution of port- city relationship and methodology: circularity in location and port-city symbiosis matrix
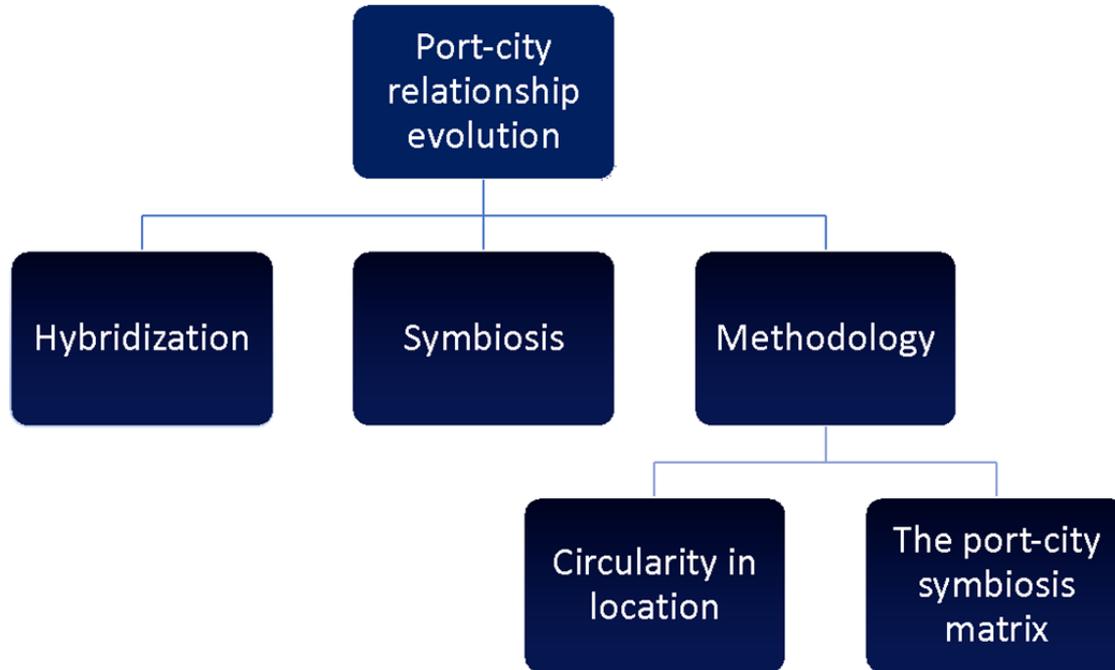
Circularity in location and hybridization

$$T = t*w_r*d(R) + t*w_m*d(M)$$

Resources   Production   Market

Scenario 0
Theoretical: *location on a line*
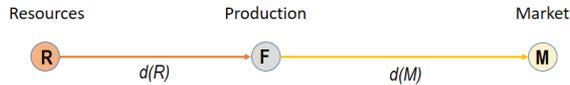
Scenario 1
R = Caves
F = Batching plants

Scenario 2
R1 = Caves
F = Batching plants

Scenario 3
R1 = Caves

Scenario 4
R1 = Caves
F = Batching plants
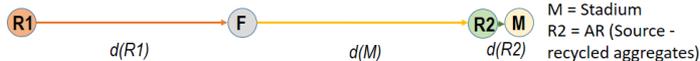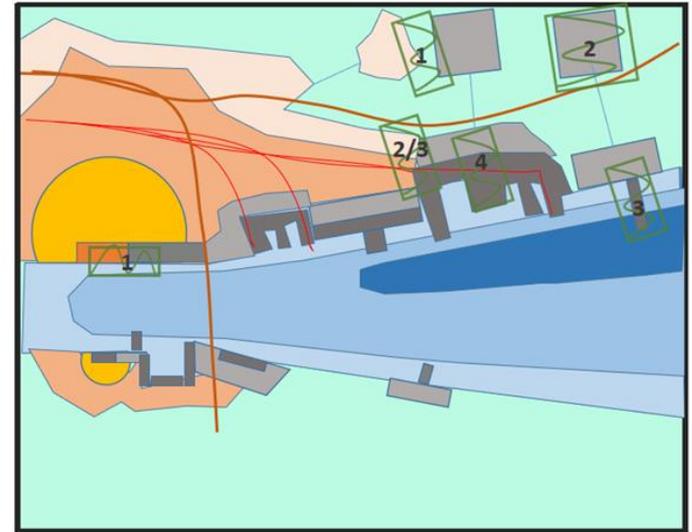
To understand Port-City relationships

First step
analysis of strategic and urban
planning tools
Approved (AP)
Adopted (AD)
In Progress (IP)

Port Cities Symbiosis

Tools	Port and Urban planning			
AP - AD - IP	Port - Cities	Transport	Industrial area	Freezone
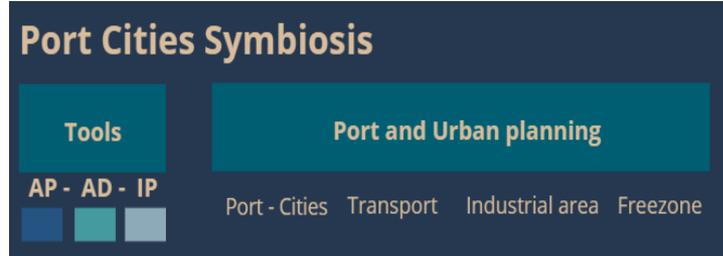
**Analysis
matrix**

Port-City relationships - Trieste
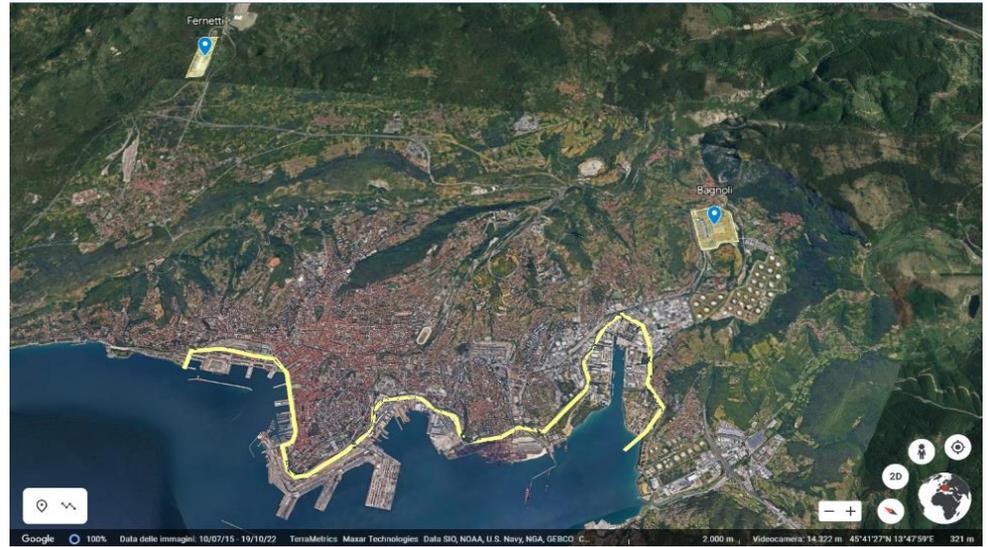
Port of Trieste
Port System Authority of the Eastern Adriatic Sea
(Friuli Venezia Giulia Region)

peculiarity
International port, serving as a gateway to central Europe

Publications

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

Giuseppe Borruso[a]
[a] Department of Economics, Business, Mathematics and Statistics, University of Trieste, Trieste, Italy
Email: giuseppe.borruso@deams.units.it

2021 21st International Conference on Computational Science and Its Applications (ICCSA)

**A Review of Best Practices to Reduce the
Environmental Footprint of Port Areas in the
Adriatic Region**

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Abstract— In the past decades, a large number of actions and projects has been carried out to reduce the environmental footprint of port areas, especially in the European Union. This knowledge is a strong basis for future actions and shall be considered by any stakeholder who approaches the topic. In this context, the SUSPORT project involve all major ports in the Italy-Croatia region to build a network for improving ports' environmental sustainability and energy efficiency. The first step is represented by an analysis of the current situation of the port areas and a review of best practices put in place in other ... The present work reports the results of such an anal within the wider context related to the preliminary activ constituting the baseline for the pilot actions. Her collection of actions, pilot projects and/or experience provided dealing with the improvement of environm sustainability and energy efficiency within the port areas. collection encompasses all the port operations as well a environmental policies already put in place by port author worldwide. Moreover, the selection has been carried on ...

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The Port – City Relations in the Era of Hybridization

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Not Only Waterfront. The Port–City Relations Between Peripheries and Inner Harbors

**Computational Science and Its
Applications – ICCSA 2022 Worksho**
(ICCSA 2022)

Home > Computational Science and Its Applications – ICCSA 2023 Workshops > Conference paper

Rail Ports as Nodal Gateways in the Sea – Land Connections and the Challenges of Sustainable Globalized Markets: The Case of Adriafer and the Port of Trieste

**Computational Science and Its
Applications – ICCSA 2023 Worksho**