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Air-/Seaport Cities: On Metropolitan Territory of Hub Cities

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1 ABSTRACT

Increasing urbanization is transforming cities and regions into metropolitan areas facing current environmental, energy, economic, and social challenges. Some of these metropolitan regions include important infrastructure, transport, and spatial corridors. A new and complex type of spatial organization is emerging there, primarily based on logistical, economic, and political decisions. This phenomenon mainly affects cities and regions with seaports and airports as “brainports” (transport and mobility centers, supply structures, such as logistical centers for the transport and distribution of goods, trade centers, industry, commerce, etc.). The functionalisation of spaces in such territories leads to a recognisable spatial pattern with certain characteristics that clearly differ from other spatial structures and causes a hierarchisation of spatial organisation.

These ever-growing structures, which are geared toward function and profitability, consume a lot of space and land, which is considered one of the most important resources when it comes to reducing the carbon footprint and enabling sustainable spatial development. Therefore, there is a special, forward-looking motivation to transform this spatial complexity with many potentials and resources into a sustainable, integrated spatial development for the city, the region and the neighboring communities. This is because these structures are an ideal opportunity to combine thematic principles such as building and spatial planning, climate and energy supply, quality of life, mobility, noise reduction, economic balance with spatial quality, etc. HubCities as a method and strategy show how such structures can become a transparent, networked and resilient place that also focuses on the human scale.

HubCities is a relatively young topic in spatial and urban development, which only developed at the end of the twentieth century (e.g., through the low-cost airline boom since the liberalization of air transport in 1997 and globalized containerization) as a result of complex processes. There is a lack of temporal distance and the associated historical analysis to comprehensively explain, present and strategically use these processes.

The aim of this paper is to use the term Hub Cities to illustrate the significance, impact, approach and potential of airport and seaport locations and their surroundings for spatial development. The questions raised are illustrated using the example of the airport area and logistics center of Graz (Austria, which is part of the NUTS 3 metropolitan region), the seaport of Koper with visionary ideas of a networked passenger airport (Slovenia), and the port city and regional passenger airport city of Trieste (Italy, which is not part of the NUTS 3 metropolitan region, presumably because the broader area is located in two different countries).

HubCities is thus a long-term strategy for airport and seaport locations and their surrounding areas that identifies the problems and potentials of today's urban development and provides a historical account of the phenomenon (e.g., a shift of important urban functions to the surrounding area). HubCities is a transferable mindset that prevents further urban sprawl, protects landscapes, green and open spaces, and promotes an appropriate mix of uses in sensible locations. It is a program that develops and combines smart systems, solutions, and methods that can be transferred to other airport and seaport regions.

Hub cities lead to the loss of familiar forms, but at the same time new spaces, structures and actors emerge. They all require spatial embedding in order to sustainably achieve the desired qualities of a location that is close to its citizens and typical of the region. HubCities can become the cities of the tolerant society of the future and an impetus for resilient spatial development, in which spatial quality is an added value and a resource and, above all, a prerequisite for the sustainable development of the airport (city) and seaport (city) location, the community, the city and the region.

Keywords: Metropolitan Territory, HubCities, Seaport City, Airport City, Urban Development

2 CHALLENGE, GOAL AND POTENTIAL OF HUBCITIES

2.1 Introduction: What are the challenges?

Increasing urbanization is transforming cities and regions into metropolitan areas facing current environmental, energy, economic, and social challenges. Some of these metropolitan regions include important infrastructure, transport, and spatial corridors. A new and complex type of spatial organization is emerging there, primarily based on logistical, economic, and political decisions. This phenomenon mainly affects cities and regions with seaports and airports as “brainports” (transport and mobility centers, supply structures, such as logistical centers for the transport and distribution of goods, trade centers, industry, commerce, etc.). The functionalization of spaces in such territories leads to a recognizable spatial pattern with certain characteristics that is clearly different from other spatial structures and results in a hierarchization of spatial organization (Fig. 1).

Fig. 1: From left to right: Spatial organisation of the HubCities (yellow rectangle) around Graz Airport (AT), around the seaport of Koper (SLO), around Trieste Airport and around the seaport of Trieste (IT). Source: GoogleMaps.

Several challenges arise in these areas (Fig. 2).

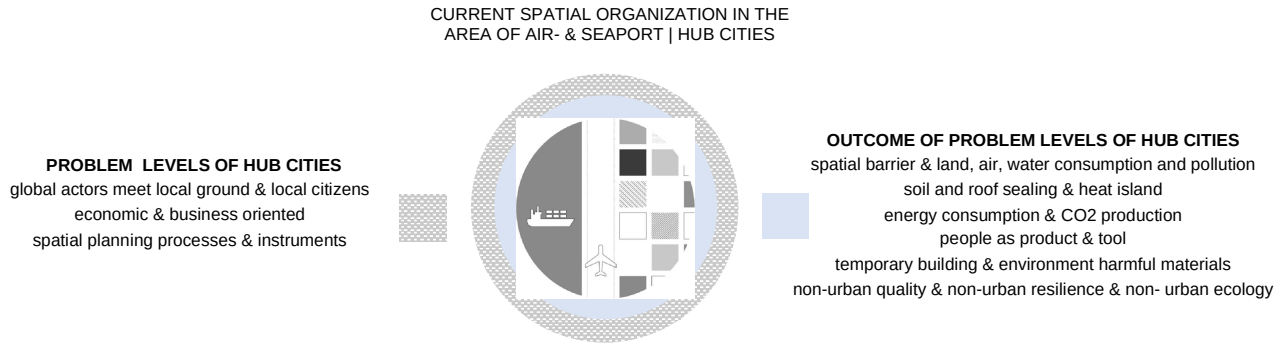

Fig. 2: Problem level and result of the problem level in the field of air and sea ports. Source: S. Pansinger, L. Ažman Momirski.

First and foremost is the conflict of interests: HubCities are both a local and a supra-local place, where global actors with global interests use local spaces while often overriding and ignoring local interests. Global companies have great financial and political power that they use in the spatial expansion of their local territory. Communicating their spatial intentions and decisions to other actors in the surrounding areas does not occur.

Consequently, a second challenge arises: in HubCities conflicting spatial development coexists. Namely, the functionalization of spaces leads to recognizably unbalanced spatial patterns (e.g., large volumes and floor plans of buildings that do not correspond to the human scale, or spatial structures that are clearly different from other spatial structures and cause an abrupt hierarchization of the spatial pattern). Because the actors are oriented toward the (objective) figures of economic growth, these structures often consume all ecological, social, and spatial resources without creating new ones, although they have the potential to do so because of their size and importance. Conflicting functions, physical barriers, spatial interventions, soil consumption, and land uses are not negotiated between actors, leaving spatial development incompatible and in serious disagreement. It also becomes clear that today's planning instruments cannot adequately capture and thus control structural change and its dependence on the interactions between air and seaport locations and the city. This poses the risk of further undesirable developments in terms of capacities or resources, energy supply, noise pollution, land designation or land availability.

The third challenge is the spatial planning process, which makes such spatial development possible. The instrumentarium of spatial development decisions is largely in the hands of the mayors of the local municipalities. They are usually not experts in spatial development, nor are they familiar with contemporary approaches to co-design, negotiation, citizen participation, and citizen science. A top-down approach is still largely used in spatial planning at the local level. This leads to conflicts with citizens (e.g., various types of pollution, ownership of the land, and sale of the land).

2.2 HubCities: a term for airport and seaport territory?

HubCities is a relatively young topic in spatial and urban development, which only developed at the end of the twentieth century (e.g., through the low-cost airline boom since the liberalization of air transport in 1997 and globalized containerization) as a result of complex processes. There is a lack of temporal distance and the associated historical analysis to comprehensively explain, present, and strategically use these processes.

On the other hand, the European air transport sector is one of the strongest parts of the European economy and a world leader. Each year, 900 million passengers travel to, from and within the European Union, representing one-third of the global market. In 2015, Airports Council International estimated the total economic impact of airports and aviation-related activities in the EU at €338 billion. Aviation can act as an "economic multiplier," promoting and generating further economic activity. Geography is not the only factor that determines the location of successful international airports. The availability of suitable infrastructure, labor and tax systems, and historical, cultural and trade links also play a role (Transport EU, 2022).

The presence of seaports in regions is closely linked to the economic development not only of the adjacent cities but also of their territories. Interpreting statistical data in the way that the EU relies on its seaports for trade with the rest of the world (74% of goods imports and exports, 37% of intra-EU trade, and 400 million passengers per year) means that there is adequate hinterland support for seaports and cities in terms of services, infrastructure, labor, etc. (Blue Belt, 2022: Ports, 2017).The European port system created at least 2.5 million jobs (in full-time equivalents) in 2017, both directly and indirectly, i.e. in a broader territorial context. Port cities are consistently among the economically stongest cities (Key figures on Europe, 2017). The European Commission considers ports as "engines of economic development and sources of prosperity" (Ports 2030, 2022). Port cities rank high in human capital indicators (population growth, working age population, entrepreneurship, quality of education, quality of healthcare, etc.) (Fusco Girard, 2013).

Airport cities, seaport cities, and their regions share many characteristics with other industrial and urban areas. Their gateway functions are arguably similar, although the former do not have the same historical embeddedness in their local urban environment as seaports (Konvitz, 2012). These ever-expanding structures, designed for function and economy, consume a lot of space and land, which is considered one of the most important resources when it comes to reducing carbon footprints and enabling sustainable spatial development. There is a special, forward-looking motivation to transform this spatial complexity with many potentials and resources into a sustainable, integrated spatial development for the city, the region and the neighboring communities, because these structures are an ideal opportunity to combine thematic principles such as building and spatial organization, climate and energy supply, quality of life, mobility, noise reduction, economic equilibrium with spatial quality, and so on.

Airports and seaports delimit large industrial and logistics areas within metropolitan regions. Metropolitan regions are characterized by a dense concentration of functions that integrate them into social and economic networks on a supraregional, European and global level. Studies define metropolitan regions according to different criteria. The "administrative" approach to defining a metropolitan region is a management and control tool based on the status of predefined legal or administrative units (OECD, Espon Functional Urban Areas (FUA)), which include cities or densely populated areas, core areas, and less densely populated areas from which people commute to work in the core areas. The "morphological" approach defines metropolitan areas as contiguous urban settlements that reach a certain level of density or urbanization. The "functional" approach is based on the functional relationships or interactions among units in the metropolitan area. The "network" approach refers to the multidirectional and multilevel interactions among actors in a metropolitan area (Vazquez, Morollon, 2012).

HubCities is a specific urban processes of the present in the metropolitan territoriy of airports and seaports. We would like to introduce the morphological approach in the context of HubCities.

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2.3 Goals and potentials of Hub Cities

The primary goal of this paper is to systematically identify and define the HubCity pattern in the area of airports and seaports.

The aim of the paper is also to demonstrate, under the concept of HubCities, the significance, impact, approach and potential of airport and seaport locations and their surroundings for spatial development. The dynamically growing air and seaport territory is an ideal and innovative testing ground for intelligent, networked and integrated solutions, where sustainability requirements can be examined under the given multifactorial conditions. Thus, the goal is not only to integrate the airport and seaport area with its surroundings through ecological, economic, and technological interactions and networking, but also to create a new kind of spatial quality that ensures spatial sustainability (Pansinger, 2017) and thus contains potentials for further urban and regional development. This process requires change and this change demands concepts that generate and bundle new systems, solutions and methods.

It is in this HubCities environment that the complex challenges of our time and new approaches and strategies can be brought together to develop a comprehensive model and gain an edge in knowledge for resilient spatial organization around the airports and seaports of tomorrow. The operation of airports and seaports will not be sustainable for the foreseeable future, as cleaner fuels are still in the development phase. We can't solve this challenge with urban planning, but by developing a sustainable spatial organization around it, we can help improve our footprint. HubCities is a research and implementation project for the future of seaport and airport territories with an international appeal. The basic question is: What can we learn from HubCities for the future?

The questions raised are illustrated using the example of the airport area and logistics center of Graz (Austria, which is part of the NUTS 3 metropolitan region), the seaport of Koper with visionary ideas of a networked passenger airport (Slovenia), and the port city and regional passenger airport city of Trieste (Italy, which is not part of the NUTS 3 metropolitan region, presumably because the broader area is located in two different countries). The impacts between the airport and seaport locations, the city and the landscape are noticeable and visible.

By applying the smart cities criteria and indicators (e.g. smart economy, smart energy, smart mobility, smart environment, smart people, smart housing, smart governance, etc.) to these case studies, the comparative conclusions not only take into account environmental, economic and technological synergies and networks, but also open up perspectives for innovative and resilient spatial quality.

The HubCities approach thus has an important task: to translate condensed and controversial demands into a balanced and sustainable spatial organization of the seaport and airport territory. Historically: If port cities were thriving commercial centers and harbingers of a new, more open society, then today both airport cities and seaport cities can be the cities of the tolerant society of the future (Fig. 3).

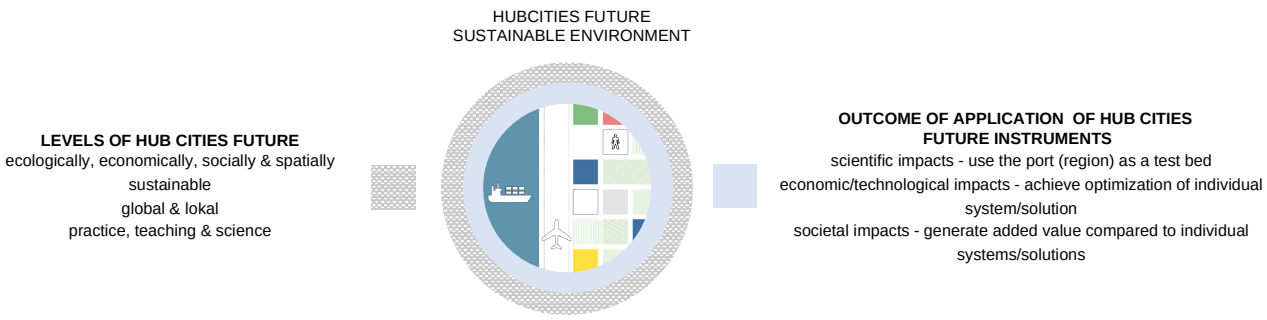

Fig. 3: HubCities Future – new spatial organisation in area of airport and seaport. Source: S. Pansinger, L. Ažman Momirski.

3 METHODOLOGY AND FIELD OF ACTION

3.1 General methodology (Fig. 4)

Step 1: The topic of airports and seaports (brainports) as HubCities is first presented and analyzed on an inter- and transdisciplinary theoretical level and then transferred to the real testbed. The results will provide an explanation for the spatial developments of HubCities, simultaneously supporting them and bringing

together new fields of action in an interdisciplinary and sustainable way. What is required is a readjustment of the spatial planning control options and the implementation of the current challenges in terms of environmental, economic, social and spatial (design) sustainability. This gives the spatial structure of HubCities a new significance for urban and regional development. Graz, Koper and Trieste were selected as test territories.

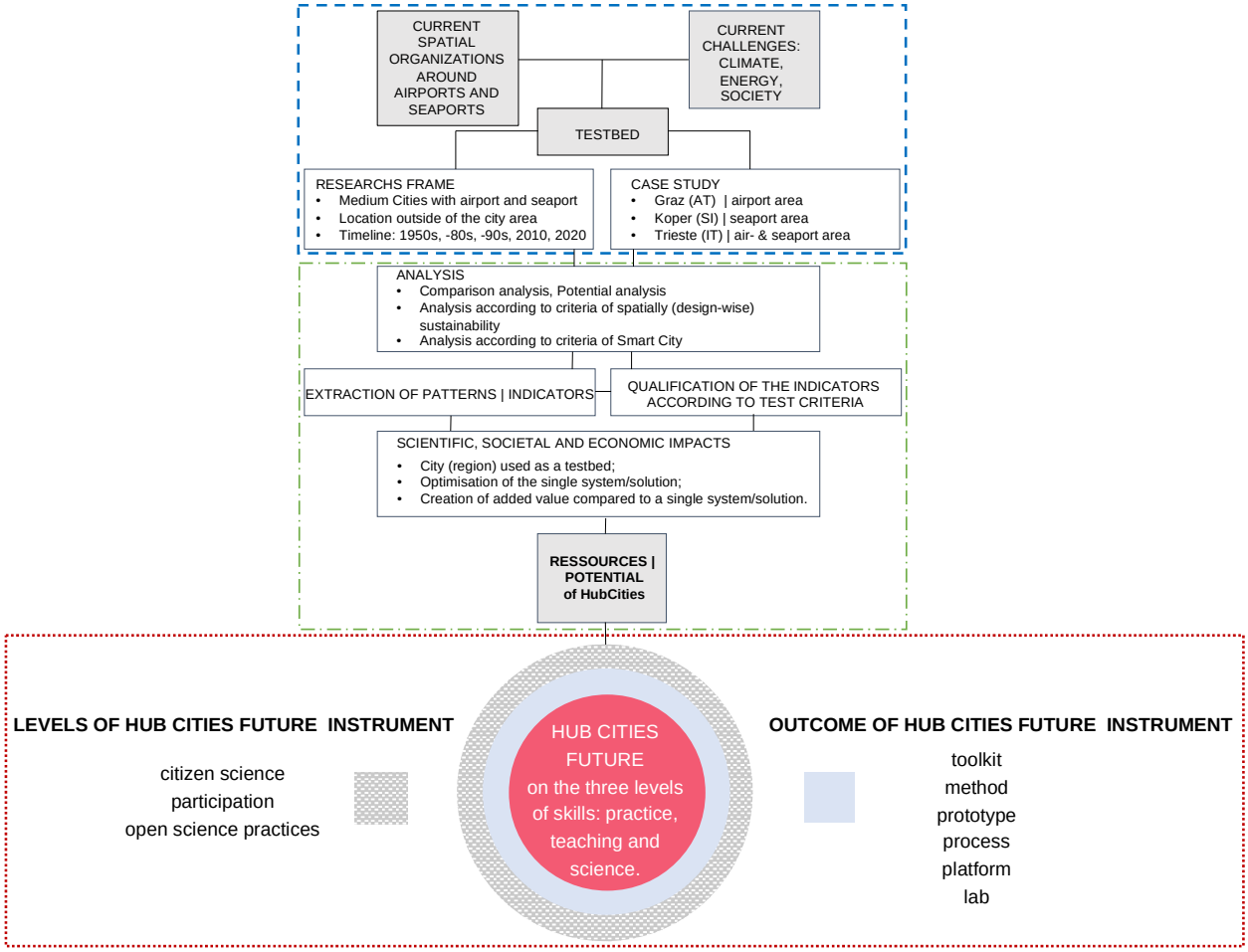

Fig. 4: General methodology and fields of action. Source: S. Pansinger, L. Ažman Momirski.

Step 2: The selected case studies should answer the following questions:

- What different spatial structures can be identified and what is their dependence on the location of airports and seaports?
- Which indicators can be used to systematize and qualify these structures and is there a logic or scheme of their structure to predict future developments?
- According to which criteria are the results of the analysis evaluated and why?

Step 3: Is the last step in the methodology, which is supported by three tools: Citizen Science, Participation, Open Science Practices. The main point is to bring citizen science into the process of spatial planning (biology dominates the topics of citizen science projects and spatial planning is not yet aware of how to use it). Citizens are involved in the design of HubCities, from defining the questions and developing premises to discussing the results and answering new questions. Citizens can also initiate action projects aimed at promoting interventions in local spaces.

RESULTS

3.2 Graz

Where should the area surrounding Graz Airport develop?

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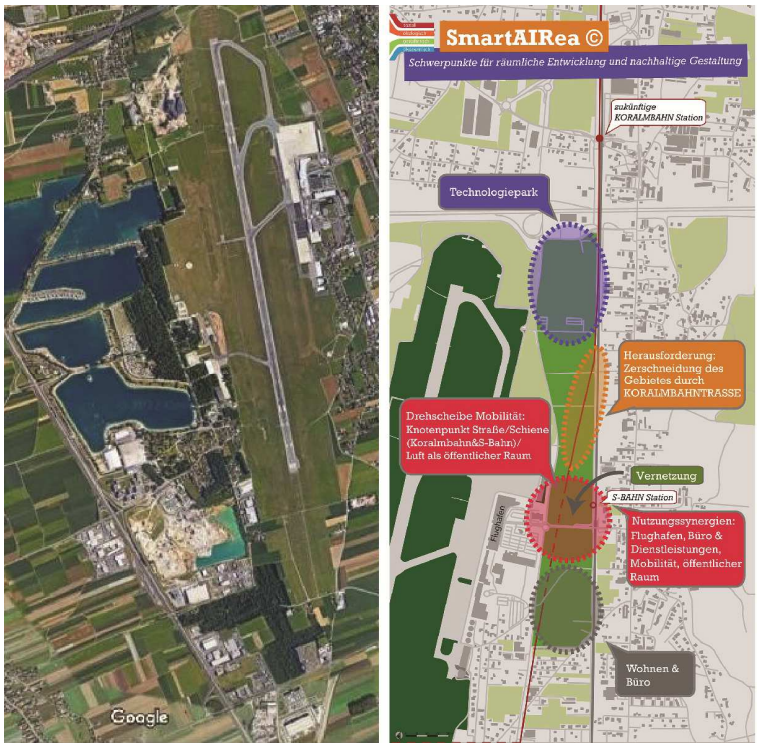

Fig. 5: Current spatial organisation around airport Graz and smartAirea – www.smartairea.eu One of the results shows that a polycentric development or the activation of the individual spatial areas of the airport environment offer the possibility of securing the spatial quality of the airport environment and thus at the same time the airport location in the urban-rural dimension. The challenges lie in a responsible process design that takes into account not only ecological, economic and social aspects, but also design and spatial aspects. Source: S. Pansinger, GoogleMaps.

Step 1: The airport is located in the south of Graz, about 9 km from the city center, mostly in the village of Abtissendorf in the municipality of Feldkirchen and to a lesser extent in the cadastral municipality of Thalerhof in Kalsdorf. The spatial embedding of the Graz airport site in the reference system of settlement, district, municipality, region, country/nation is one of the prerequisites for its positive effect on spatial and urban development. The originally independent areas of the airport surroundings are to grow together through activities (eating and recreation, living and working, traffic and communication) (Fig. 5). This refers to the following points:

- One of the development goals is to create a framework of public spaces and green spaces in the Graz airport area. In the sense of the network principle and in connection with the infrastructure, this area creates a design continuity and thus new social hotspots.
- The airport environment should also be seen as a non-partisan endeavour that transcends spatial boundaries, is planned for the city as a whole and with the involvement of the neighbouring communities, and whose specific development criteria (regional concepts) must be jointly formulated and implemented.
- Involvement of the surrounding communities, which are not in a position to manage possible renewal processes in the airport environment due to their size and importance.
- The airport environment requires variable concepts such as SmartAIRea (Fig. 6) or changes to existing instruments (land use plan, development plan, etc.) due to the long-term unpredictability of the processes taking place there. Economic fluctuations alone can paralyze cohesive planning. The built fabric around the airport should therefore have continuous uses and connectivity to functioning urban areas and be able to respond flexibly to changes.

Step 2: SmartAirea has an interdisciplinary and transdisciplinary structure and impacts on practice, teaching and science at the following levels:

Goal 1. Using the city (region) as a testbed: The area around the airport is used as a testbed for implementation. The proposed scenarios include intelligent, networked and integrated solutions for sustainable spatial organisation and mobility.

Goal 2. Achieve optimisation of individual systems/solutions: Focusing on individual solutions alone was not appropriate to move from the "no progress area to the SmartAIRea". In this project, the following topics were also considered for development: building networks, energy networks, integrated mobility solutions and the involvement of relevant stakeholders and decision makers.

Goal 3. To create added value compared to individual systems/solutions: The involvement of all relevant actors, both as project partners and in the planned workshops, is the basis for creating added value compared to individual solutions. Linking information from the Status Qou determination contributes significantly to its acceptance by stakeholders.

Fig. 6: Digital and analog exhibition and participation process SmartAirea. Source: S. Pansinger.

Step 3: Various measures, means and ways were used to transmit and disseminate the information and project results: Networking activities with the LoI partner and relevant local stakeholders, public events (workshops, kick-off meeting and follow-up meeting), reports in newspapers and on the radio, participation in events and presentations, model making (analog and digital), creation of a homepage (www.smartairea.eu) and integration in university education. At the end of the project an exhibition was displayed at Graz Airport (Fig. 6).

3.3 Koper

Fig. 6: Masterplan of the Port of Koper. Source: L. Ažman Momirski.

Step 1: The port of Koper is the youngest modern port in the Northern Adriatic (Ažman Momirski, 2004) (Fig. 6). Already at the beginning of the development of the port of Koper, an airport was planned. In 1962, the Portorož Airport was built in a landscape park, which is very sensitive to interventions. Therefore, the extension of the runway of Portorož Airport envisaged by the Municipality of Piran is problematic.

Step 2: We examined the possibility of locating the airport near Koper. However, the spheres of influence of four major international airports overlap on the Slovenian coast. Therefore, it does not make sense to build a

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large airport (with a longer runway) in this area because of the high competition between airports, but it does make sense to locate a medium-sized (regional) airport. The size of such an airport would be smaller than Ronchi or Pula, but larger than the current Portorož airport. The proposed location of the new airport could be in the valley of the Rižana River below Dekani, about 3.5 km east of the port of Koper (Fig. 7). The location is close to the main transportation routes (Ljubljana-Koper highway and Koper-Trst highway). The Koper-Ljubljana regional road and the Ljubljana-Koper railroad line pass by the site. In the coming years, a second railroad line Koper-Divača will be built in the area (Maček, 2016).

A morphological analysis of the area shows that the airport site itself is relatively undeveloped. Along the northwestern boundary of the site, the building fabric is concentrated in the IPLAS industrial area. Such a program is also found along the northern boundary of the site. The airport site also borders the outer edge of the Dekani settlement and, in the southeastern part, the area of the concrete plant. The southwestern edge of the area is adjacent to some residential buildings.

This is a rather large and technically demanding intervention in the space. However, such a project is justified if, in addition to the clear benefits for the coastal economy, one of the main objectives of the task is achieved: the removal of the airport infrastructure from the protected areas on the Slovenian coast.

Step 3: Although some activities involving citizen science have already taken place within the framework of the WeCount project (measurement of traffic volume with low-cost sensors on road sections in the vicinity of Koper), further citizen science actions are in preparation, including the involvement of citizens in the collection of data on living conditions around the port of Koper.

Fig. 7: Proposal for new Koper Airport. Source: Miha Maček.

3.4 Trieste

Fig. 8: Spatial organisation of the seaport of Trieste, and spatial organisation around the airport Ronchi in Trieste. Source: GoogleMaps.

Step 1: The port city of Trieste transformed from an extraordinary and flourishing port city in the nineteenth century to one of the many port cities of the twentieth century on the northern Adriatic (Ažman Momirski, 2021). The golden era of the port city of Trieste was followed by its decline in the twentieth century. Today, the Port of Trieste is striving to adapt to the competitive world of ports. Since 1957, the master plan for the Port of Trieste has been amended twenty-four times. In 2010, a new plan was approved. The Free Port of Trieste currently includes five different free zones. Three of them are reserved for commercial activities (the Old Free Zone, the New Free Zone and the Timber Terminal) and two for industrial activities (the Free Zone for Mineral Oils and the Free Zone for the Zaule Canal). The port of Trieste is located between the city and

the sea, and its quays are long - the port has grown along the coast - but lacks storage and handling areas. Trieste had already used valuable urban space for port activities (Fig. 8).

Ronchi Airport was initially a military airport of the Royal Italian Air Force from 1935. After 1954, with the political decision to give Trieste to Italy, the role of the airport was recognized as fundamental for the development of the northeast of Italy. Commercial traffic began in 1961, and in 2016 the airport was officially renamed Trieste Airport. Currently, it is used as a regional airport for low-cost flights. For Ronchi Airport, the question is whether it is possible to integrate the landscape and airport infrastructure in an environmentally "sustainable" way (Cipriani, 2014). Many airports (but also seaports) are located near ecologically sensitive areas.

Step 2: In 2016, the Port Authority adopted a new regulatory plan (Piano Regolatore del Porto di Trieste - PRP). The functional structure of the port and outlines the main infrastructural developments are redefined. Through direct and indirect impacts, the plan foresees the development and revitalization of the wider port area, including adjacent industrial and logistics facilities and municipalities. Although the redevelopment project is often seen as a compromise to make the planned port expansion more acceptable to the people of Trieste, it requires a shared vision among the main local players in urban development and a collaborative approach to urban and spatial planning to make it a reality.

Step 3: Citizens Science in environmental research is already present in Trieste. MaDCrow, a research and development, involves citizens as data collectors while improving public environmental awareness and participation in scientific research. The goal of the project is to create an innovative technological infrastructure for real-time collection, integration and access to data to generate knowledge about the sea water quality and marine ecosystem of the Gulf of Trieste (Diviaccio et al., 2021). However, a citizens science approach for urban planning at the level of the airport city and seaport city is missing.

4 DISCUSSION

The spatially integrated design of the airport and seaport environment as well as the spatial implementation of multimodal mobility networks from macro to micro infrastructure space, energy systems and supply and the structural-technical coupling of climate protection measures motivate the city and the airport and seaport operators to reduce conflicts and tensions. Thus, the airport and seaport environments develop mutually, but also separately.

The results enable strategic management of the potentials and resources of this spatial organization and make HubCities a driving force of resilient, sustainable spatial development. This is a field of study with great potential that has been little explored in practice. It is the first holistic study of airport and sea port city territories paralely.

The transferability of the results to other HubCities is given and thus also the development of new fields of action. Furthermore, the methodology is not only applicable to HubCities, but wherever the organization of space results from the interplay of different poles or a "in-between" arises. Currently, the following are the main areas where a discourse between global and local interests is taking place: Train station, industrial facilities, etc. They all require spatial embedding in their surroundings in order to achieve certain locational qualities.

The relevance of the Hub Cities project is explained not only by its transferability, but also by the fact that 42% of airport sites are operating at a loss and are therefore at risk of regulatory action and closure. This makes these territories, some of which are already up for disposition, and especially the highly contested surrounding areas, of immediate relevance in terms of urban and regional planning. The pan-European potential through scaling, duplication or even conceptual transfer is thus enormous. Pandemic and current war events also change the role of airports and seaports.

5 CONCLUSION

HubCities develop a new approach for a long-term strategy for airport and seaport locations and their surroundings; the approach is transferable and applicable in practice as well as in science and education; in other HubCities regions. The approach prevents further urban sprawl, safeguards landscapes, green and open spaces, promotes an appropriate mix of uses in sensible locations, generates and combines intelligent systems, solutions and methods.

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HubCities as a method and strategy shows how such structures can become a transparent, connected, and resilient place that also focuses on human scale.

HubCities takes into account and analyzes the transport and spatial corridors that have since emerged, intersecting and settling around the location of the airport and seaport. Each node and territory is a unique mix of uses and opportunities for exchange and change - yet shares architectural and urban design similarities in the form of a specific pattern.

The HubCities approach is forming a new profile of urban planners who will be able to coordinate and use citizen science in conflict situations in urban planning. A long-term outcome will be a first integrative view of the space and environment around airport and seaport cities or HubCities - where local and global interests meet. Through such a new process in spatial planning involving citizen science, the promised paradigm shift in spatial planning, practice, research and education will take place. Spatial planning is a profession, that is too often not based on facts, but on estimates. For providing more reliable scenarios of the spatial development, we need more reliable starting points.

HubCities aims to strengthen the focus on the end user, their tasks, goals and motivation. The requirements of the end user become clearer, and as a result, design teams can better align their decisions with those necesities.

HubCities are thus the missing link between spatial strategies at the micro level and national spatial development plans at the macro level, especially for airport and seaport territories. Hub Cities is thus its umbrella term.

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