TURKU
Urban Research Programme

RESEARCH BRIEFINGS
1–2025

# Digital integration generates synergies driving the development of a smart port-city

The city center of Turku is expanding towards the harbor, enhancing the symbiosis between the city and the port. Digitalisation enables efficient and sustainable interaction between the city and the port. The City of Turku strives to become a smarter city by prioritizing data efficiency, environmental sustainability, and social inclusion, while the Port of Turku aims to enhance smartness in terms of augmented efficiency, user-friendliness and security measures. *The Smart Port City project* explores the links between these goals. It lays out a vision of a Smart Port City where city, port, as well as inhabitants, and visitors are recognised as key stakeholders.

## RECOMMENDATIONS

Create a strategy for data sharing between the city, port and the stakeholders (3rd party businesses) for exchanging capacities in building up/improving the services for citizens.

Use historical data for infrastructure planning, as it requires minimal digital investment and provides valuable insights into traffic and facility use to support port strategies.

Integrate data from city departments, the port, and external sources into a shared repository accessible through various interfaces.

Implement collaborative design tools and pilot projects that engage citizens and tourists as active co-creators of smart and sustainable city, leveraging their roles as contributors, such as advertisers, content producers, and service developers.

**AUTHORS**
Irina Wahlström[1], Kristel Edelman[2], Riikka Franzén[2], Anastasia Tsvetkova[1], Yiran Chen Zhou[1]
Åbo Akademi University[1]
University of Turku[2]

**RESEARCH**
Document analysis (13 documents; 933 pages), online survey (159 respondents), semi-structured interviews (12 interviews with 14 interviewees), benchmark port visits (2), workshops with citizens (1) and key stakeholders (1)

**THEMES**
Smart city, smart port, digitalisation, smart port-city, digital interfaces, citizens, stakeholders

**WOULD YOU LIKE TO KNOW...**

## A smart port-city uses digital technologies to enhance sustainability, streamline operations, and improve quality of life

The integration of cities and ports is an increasingly important trend in port-city planning. While research on smart cities and smart ports is expanding rapidly, these areas of inquiry often remain isolated from one another. The co-existence of a smart port and a smart city in a "smart port city" ideally takes a form of holistic integration where the port is an integral part of urban life and where both entities benefit from shared infrastructure, data, and digital technologies. This helps in streamlining operations, minimizing negative environmental impacts, and improving quality of life for both residents and visitors. In this symbiotic relationship, the parties support each other by capitalising on digital systems and automation to manage resources, traffic, and logistics more efficiently.

**1. Shared data and connectivity:** a smart port-city ecosystem capitalises on and benefits from the free flow of information. Real-time data from port, such as number of unloaded vehicle units, can assist city traffic systems planning in optimising routes to alleviate congestion during rush hours. This connectivity extends to resource management, with shared insights on energy consumption between the port and the city, helping them to reach and further develop sustainability goals.

**2. Environmental sustainability:** a smart port-city builds on environmental-friendly initiatives. Ports adopt green energy solutions, such as onshore power and electrified equipment and vehicles, thus reducing emissions. This benefits also the wider city environment. In return, cities can extend their green zones and prioritize public transport systems that harmonize with port logistics, creating a low-carbon urban area around the port.

**3. Mobility and access:** smart mobility solutions can be integrated seamlessly, allowing goods and people to move efficiently between the port and the city. Autonomous vehicles, drones, and on-demand public transportation can serve both port workers and city residents, ensuring smooth transit for goods while improving local accessibility and convenience.

**4. Enhanced safety and security:** port city security protocols in a smart ecosystem can involve advanced surveillance, cybersecurity, and emergency response systems that work across port and city. This ensures rapid response and unified protocols, reducing risks related to passengers, cargo and community.

**5. Economic and social integration:** the smart port city model can drive economic growth by creating job opportunities, supporting innovation, and attracting businesses that benefit from the efficient supply chain and connected infrastructure. Social benefits include improved urban planning, reduced pollution, and better public and multifunctional spaces. For example, repurposing existing terminal buildings into multifunctional cruise terminals enhances the city's appeal for both residents and visitors.

## “Smart City” covers not only technology but also the inclusion of citizens and sustainable environment

We analysed the meaning of a “smart city” from the citizens’ perspective to indicate that smart cities do not need to be only about technology, but they can also incorporate the voices of the inhabitants. City representatives’ insights enabled us to contextualise the concept of a smart city in Turku.

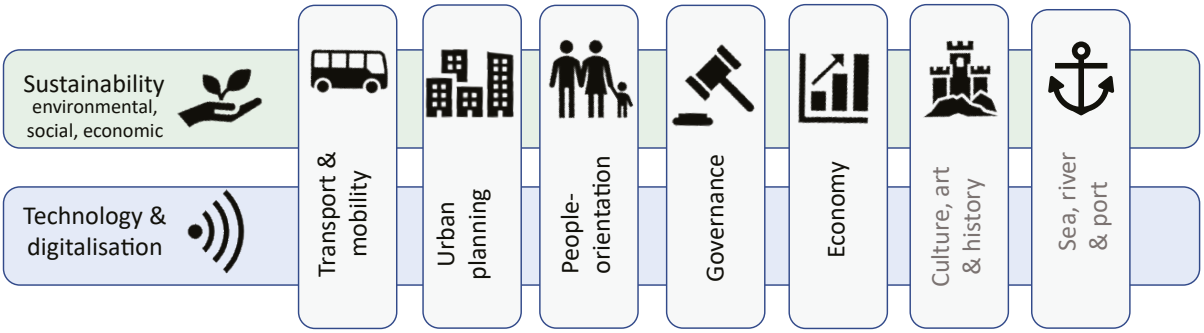


**Figure 1.** City's and citizens' views on smart port-city

From the **citizens perspective** the smart city should concern:

**Traffic and mobility:** fluent, pleasant and safe traffic, highlighting user-friendly public transport with good connections and possibilities to walk and cycle in addition to other green mobility options.
**Urban planning:** pleasant environment designed for people; green areas and adaptable spaces for different activities in balance.
**People-orientation:** a city should be planned for, and it should serve people; it should enhance the quality of life and well-being as well as support inclusiveness and equality.
**Governance:** citizens wish the city representatives to act in an ethically responsible manner, to have an innovative and future-oriented mindset, and to lean on data and citizen engagement in their decisions.
**Economy:** citizens wished for a stable and diverse economic environment that fosters employment, as well as circular economy-based solutions.

Sustainability, as well as technology and digitalisation are the cross-cutting themes that emerge throughout the highlighted areas (see Figure 1). This includes caring for the environment and nature, creating green spaces, and applying sustainable development practices to become climate-smart. Technology and digitalization enable easy access to information and provide seamlessly functioning digital services that are designed to serve people.

The analysis from the interviews with city representatives highlights the importance of *data, environmental sustainability*, and *social inclusion* as core elements of a smart city. For example, traffic data in Turku is already used for adaptive traffic lights and will inform traffic rearrangements for the Linnanniemi area. Additionally, data on museum visits could help calculate the economic impact of tourism, guiding decisions on investments like the new Museum of History and the Future, which aims to attract visitors and boost local service use. Sharing data with other stakeholders could enhance service development and foster synergies between the city and local businesses.

The **environmental sustainability** of a smart city supports Turku in its aim to achieve climate neutrality by 2029. This requires better understanding and further development of the competencies needed to achieve the goal of becoming environmentally sustainable. The Turku Climate Plan guides the development of the Linnanniemi area, implementing circular economy principles, adaptive reuse, sustainable materials, and the preservation and enhancement of green public spaces. In addition, **social inclusion** is considered as critical and an integral component of the smart city.

### Linnanniemi – the physical interface between the port and the city – will undergo major development

Linnanniemi, extending from the Castle of Turku to the harbour area, will undergo significant changes, bringing urban life closer to the port. Benchmarking visits to Tallinn and Riga provided insights into similar development projects in other port-cities. Multifunctional public spaces, both inland and waterfront, are vital to Linnanniemi. Our citizen survey indicates that the area is already used for outdoor and leisure activities. The castle, the port, and the closeness of the sea form the core identity of the area (see Figure 1, themes in grey colour). The Castle is expected to remain the “No. 1” for survey respondents. This aligns well with the development plans, which accentuates the Castle as the most prominent landmark amongst the new, lower constructions.

The city’s plans to improve the area’s multifunctionality and seasonality aim to attract both residents and visitors. Tourists play a key role in co-creating a smart, sustainable port city while seeking information, sharing feedback, and producing digital content that promotes the city. Especially conscious travellers, who make sustainable choices, could participate in co-creating sustainable tourism.

### Digital interfaces and data sharing in a smart port-city need to be enhanced

Both the city and the port authority collect data, which is used for planning and real-time decision making as visualized in Figure 2. Data collected within a unit is typically used only by that same unit, that is, within the same city department or within port. There are plans to increase port’s digitalization. However, it is unclear how this will affect the data exchange between the city and the port. Several opportunities for additional digital services for citizens, tourists, and businesses were identified, including digital solutions for space sharing of the terminal buildings and improved information about urban touristic attractions for tourists.

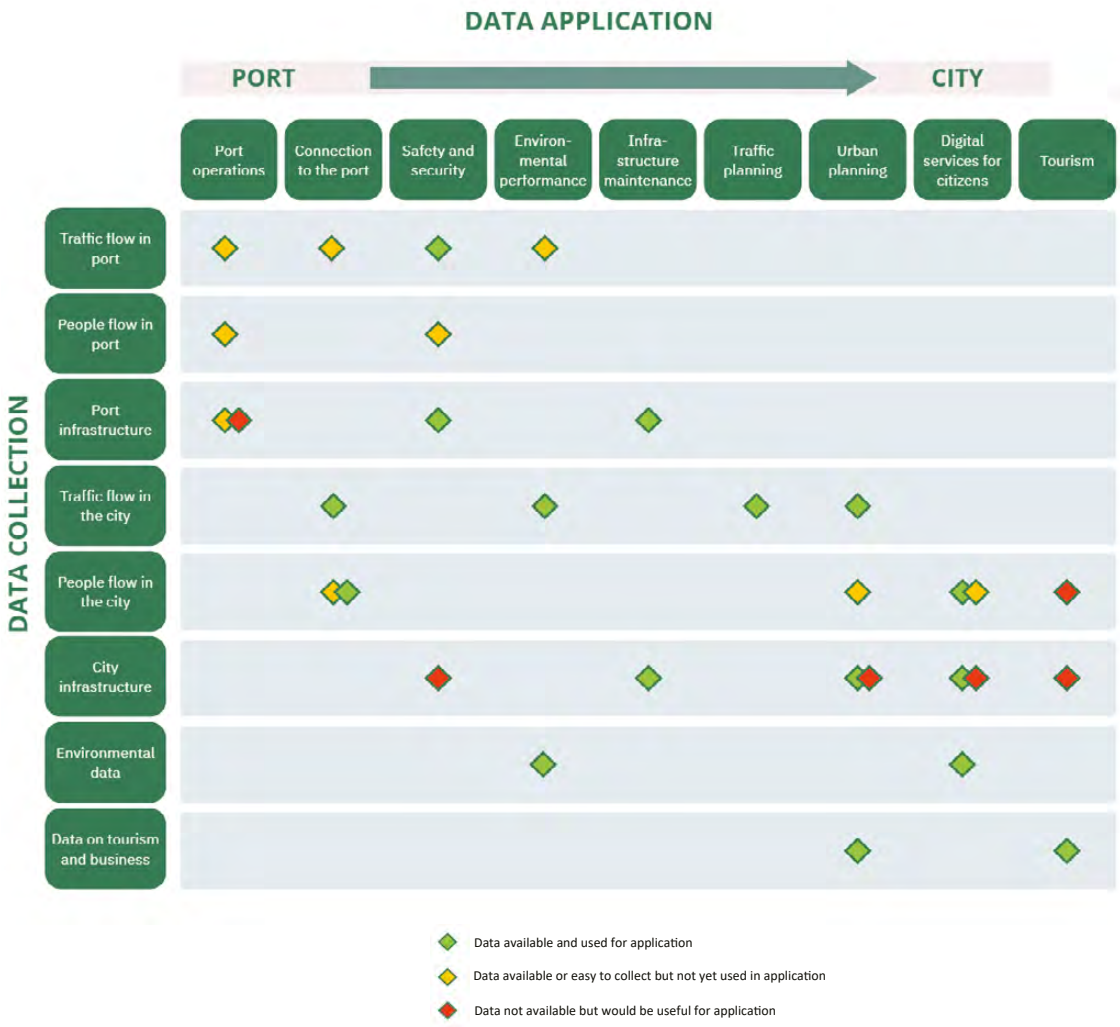


**Figure 2.** Smart port city data application matrix

We were able to identify five types of potential digital interfaces that are crucial for harnessing the potential of data and digitalization in this case:

**1. Data integration and sharing** are essential for a smart port city, enabling mutual performance improvements. For instance, data on parking, traffic, and passenger flow can enhance smart mobility solutions.

**2. Existing digital infrastructure** can be leveraged for integration, such as extending the city data model for port development discussions.

**3. Real-time data interfaces** between the city and port are challenging as they require investment, but they are essential for optimizing traffic and passenger flow. They often require the involvement of third parties from commercial sector.

**4. Historical data is sufficient for regular planning** of infrastructure, requiring lesser digital infrastructure investments.

**5.** Integration also requires **data sharing with external actors.** For instance, tourist spending data could support local smart economy.

Establishing digital interfaces between city and port faces commonly challenges, including data security risks, costs and data silos. To enable effective digital interfaces between the port and the city, a phased development of digital infrastructure is needed (Figure 3). The first step is to integrate relevant data collected by the city, the port, and external actors into a comprehensive repository. Then, differentiated repository accessibility should be provided to various users through dashboards, statistics, application programming interfaces (APIs), and open data. Over time, data analysis can facilitate decision-making and support predictive analytics to understand seasonal variations, trends, and patterns. Finally, full automation and AI could support digital services and automated processes.

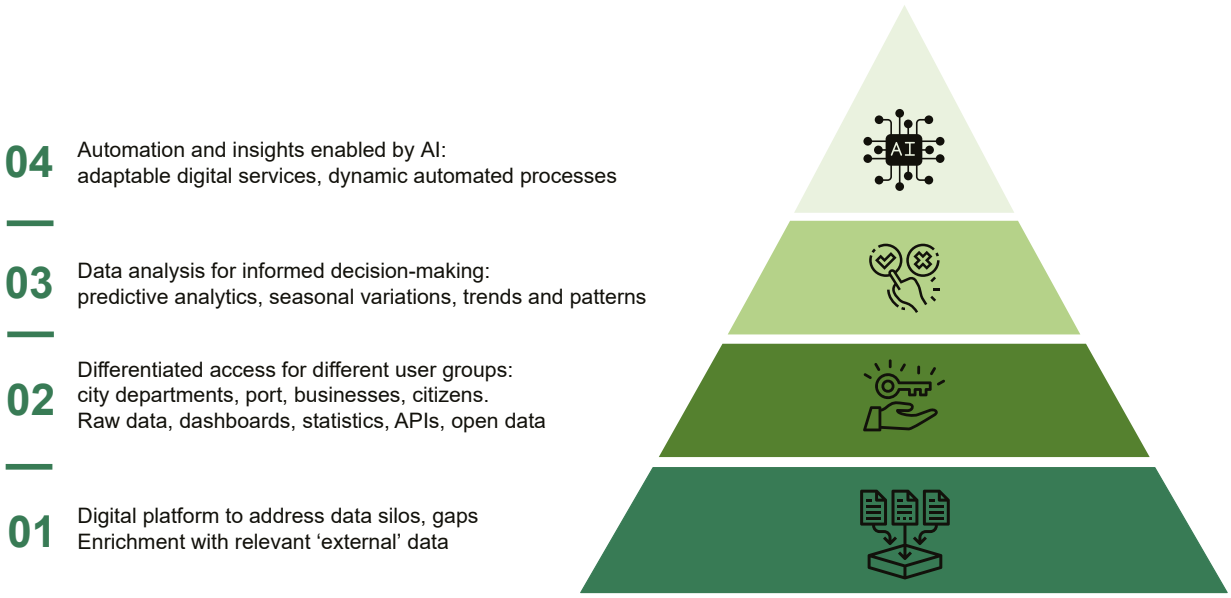


**Figure 3.** Development of digital infrastructure in smart port city

Smart Port City research deepened the understanding of city-port symbiosis, highlighting how digitalisation and smart aims of the city and the port can contribute to the creation of an integrated urban environment. To continue this research, further analysis is needed on legislation regarding the handling and sharing of private data, focusing on how legal frameworks can balance innovation potential with protection of privacy. Additionally, while digital tools often facilitate citizen engagement, they may also increase the digital divide by excluding certain groups with limited access or capabilities. Future research should explore how smart technologies can exacerbate these barriers and develop strategies to ensure inclusive participation across all communities.

**READ MORE**

Al Sharif, R., Pokharel, S., 2022. Smart City Dimensions and Associated Risks: Review of literature. *Sustainable Cities and Society*. 77(19), 103542. https://doi.org/10.1016/j.scs.2021.103542

Albino, V., Berardi, U., Dangelico, R.M., 2015. Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology* 22, 3–21. https://doi.org/10.1080/10630732.2014.942092

Giffinger, R., Wien, T.U., Fertner, C., Kalasek, R., Milanović, N.P., 2007. Smart cities-Ranking of European medium-sized cities. Final Report. https://doi.org/10.34726/3565

Plan the City with the Port: Guide of Good Practices. AIVP: The Worldwide Network of Port Cities. URL: https://www.aivp.org/wp-content/uploads/2021/01/AIVP-guide-of-good-practices-english_adherent.pdf

Özgece, N., Edgü, E., & Ayıran, N. (2022). Assessing imageability of port cities through the visibility of public spaces: the cases of Famagusta and Limassol. *Space and Culture*, 25(4), 535–52.

**HOW THIS RESEARCH WAS CONDUCTED**

Data collection included document analysis, semi-structured interviews, and stakeholder workshops. The document analysis included a review of research reports, city strategies, visions, and port strategies and programs. An online survey, launched in October 2023, gathered citizens' views on smart city concepts and digital application usage at the port-city interface. Available in Finnish, Swedish, and English, it ran for 2.5 months, yielding 159 responses. The project also included benchmarking visits to Tallinn and Riga, 12 interviews with 14 city and port representatives, and two workshops—one joint one with the city and port stakeholders and one open to the public to explore challenges and opportunities related to smart city and port concepts.

**CONTACT INFORMATION**

**Irina Wahlström**
Project Manager
Åbo Akademi, Laboratory of Industrial Management
irina.wahlstrom@abo.fi

**Research Briefings** (Tutkimus-katsauksia) report concisely results of the projects funded from the Turku Urban Research Programme. The authors are researchers.

ISSN 1799-5124 (e-publication)

**EDITOR**
Hanna Mattila, research director
hanna.mattila@turku.fi

**PUBLISHER**
The City of Turku
P.O.Box 355 (Yliopistonkatu 27a),
20101 Turku, Finland
turku.fi/en/about-turku/turku-urban-research-programme

Cover photo: The City of Turku / AFTER PARTY