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37TH BLED ECONFERENCE

RESILIENCE THROUGH DIGITAL INNOVATION: ENABLING THE TWIN TRANSITION

JUNE 9 – 12, 2024, BLED, SLOVENIA
CONFERENCE PROCEEDINGS

Andreja PUCIHAR
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SMART CITIES ON THE WATERFRONT: CITIZENS' PERSPECTIVES ON SMART CITY IN THE CONTEXT OF A PORT CITY

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This paper explores how smart city is defined by citizens in the context of a port city, and which aspects are prominent due to the significant role of a ferry port in such cities. Through a case study of a port city comprising a survey of its citizens, this research investigates citizens' perceptions of a smart city, contextualised in the actual use of the area close to the port and expectations towards the development of this area. Utilizing thematic analysis of survey data, key themes identified include traffic, environmental sustainability, technology and digitalization, and the importance of focusing on people, their wellbeing and quality of life. The findings emphasise the citizens' wish for prioritising environmental sustainability and wellbeing in the development of the smart city in a context of a port city and show that improvements in traffic around the port area and urban planning are seen as most topical.

Keywords:
smart city, citizens, digitalisation, port city, ferry port

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1 Introduction

In the pursuit of sustainable, economic, and spatial co-existence with cities, an increasing number of ports have had to adjust, rearrange, and optimize their operations and infrastructure as a response to urbanization, expanding residential areas and other alternative land use needs by their seafronts. Previous studies suggest that through urban development and renewal projects, port areas become more physically connected to the city, with the potential for the emergence of new urban spaces (Bruns-Berentelg et al, 2022; Carta & Rosnivalle, 2016; Hermelin & Jonsson, 2021; Nowacka-Rejzner, 2015). Therefore, the relationship between ports and cities is changing. Ports are not anymore viewed as economic entities only, but their role is becoming increasingly integrated into the residential functions of urban areas (Van den Berghe & Daamen, 2020).

The port city case we are focusing on is experiencing the same kind of development pressures as many other old port cities: the lucrative seafront area would rather be seen in recreational or residential use, the traffic to and from the port is considered a problem for the city, the environmental concerns and demands are becoming stricter. In this paper we draw from the literature on smart cities and explore what kind of specific characteristics it entails when the context is a port city. The survey results discussed in a paper focusing on citizens are part of our ongoing study Smart Port City, which is inspired by recent research on the digital integration of cities and ports, emphasising the role of various actors in a smart city-port ecosystem (Beškovnik & Bajec, 2021). In addition to other actors we have concentrated on in our research, we consider citizens as one of the key actors in a smart integration of a city and a port[1].

Through a case study of a port city comprising a survey of its citizens, this research investigates citizens' perceptions of a smart city, contextualised in the actual use of the area close to the port and expectations towards the development of this area. Our research question is as follows: *how a smart city is perceived by citizens in the context of*

[1] The overall study includes interviews with representatives of the city, the port and the tourism sector followed by the survey analysed for the current paper. Our research continues with workshops with the representatives of key actors we have identified in a context of a smart port city, including citizens.

a port city? The results of the study are structured based on focal themes as an outcome of the thematic analysis utilizing NVivo software.

2 Theoretical background

2.1 Smart City in a context of Port City

Cities and ports have been "connected systems" with the path of "independent lives and developments" (Beškovnik & Bajec, 2021, p. 433). However, several old port cities have undergone a transformation process that has enabled the city and the port to continue their symbiotic co-existence. Similar changes are occurring in a port city, a case in our study, having a long history of being a port city with the recent developments in relation to smart city and smart port. In the current paper, we aim to bring the literature on smart city to the context of port city for building the framework for the analysis.

The research on smart cities has generally adopted the understanding of smart city as "urban planning and administration project of embedding digital technologies into the urban fabric, and a reconfiguration of digital urban economies" (Burns et al., 2021 p. 463 on Kitchin et al., 2015; also Kitchin, 2014). Innovative uses of technology enable the optimisation of resources, support the enhancement of effective and fair governance, enable new forms of collaboration and contribute to sustainability and quality of life of city inhabitants (Gretzel et al., 2015; Ahvenniemi et al., 2017). In a context of physical infrastructure, the aim of the smart city is to blur the lines between physical and digital by contributing into the integration of technology (Gretzel et al., 2015).

To contribute to the understanding of the digital side of the smart city Szpak et al (2024) make a distinction between the concepts of "smart city" and "digital city". While smart city research emphasises the development of its sustainable environment, this aspect has not been the domain of interest of the digital city (Szpak et al., 2024, p. 5) mainly because the smart city literature has been evolving from the digital to the direction of sustainable cities (Zheng et al., 2020). From the perspective of information and communication technologies, cities "urbanize technologies" by testing new solutions and modify them accordingly (Szpak et al., p. 5 on Sassen, 2015).

By enabling the "networking of people, organisations, and infrastructures so that social, ecological, or economic added value is created and implemented in the city life" (Szpak et al., 2024, p. 5), the primary aim of the smart city is to deploy innovative technologies for the enhancement of its sustainable development (reducing greenhouse gas emissions as one of the examples, Ahvenniemi et al., 2017). For the conceptualisation of the smart city, the following dimensions might be brought out: (after Cohen, 2014 smart city wheel and Al Sharif & Pokharel, 2022; Moura & Silva, 2019; Qonita & Giyarsih, 2023): smart environment - smart buildings, resources management, sustainable urban planning; smart mobility - intelligent transport system and parking solutions, mobility-as-a-service; smart people - inclusion, education, creativity; smart living - healthy, safe and culturally vibrant; smart economy - entrepreneurship and innovation, productivity, local and global connection, and smart governance - contribution to decision-making, transparency of governance, public services and open data.

With supporting sustainability, efficiency, and citizen participation in urban spaces (Townsend, 2013) as positive aspects, the concept of smart cities has been criticised due to its normative understanding of how the future cities should be, emphasising the importance of the flow of capital, human resources (Burns et al., 2021; Burns & Andrucki, 2021) and the neoliberal ideology (Grossi & Pianezzi, 2017). While one of the aims of smart city is to enhance citizens' participation (Townsend, 2013), the research lacks such bottom-up approaches (Caragliu et al., 2019) as the studies on technological developments have gained too much prominence (Cardullo & Kitchin, 2019; Mosco, 2019).

Ports cities are mainly characterised by their spatial relation with the water (Hein, 2016; Özgece et al., 2022). Located next to the sea, the water becomes a crucial element for the construction of the port city identity (Özgece et al., 2022), alongside its long history and the ongoing urban transformation process as in a context of a port city case presented in our paper. At the same time various port cities have a challenge for dealing with traffic congestions and air pollution (Lehmacher et al., 2021). These challenges are supported by smart solutions, such as different types of sensors and other means to digitally increase the situational awareness in port, as well as to track and report the emissions from the port (see also Tsvetkova et al., 2021) to contribute into the smooth co-existence of the port and the city. The latter is crucial to consider as otherwise the outcome might be port and city separation in

its "economic, spatial and cultural development" as it has happened in a case of Rotterdam (Hein & van der Laar, 2020, p. 265).

On the one hand we emphasise the integration of physical and digital infrastructure from the side of the city and the port, that is supported by the new technologies. On the other hand, by incorporating the citizens' perspectives on the port city, the approach broadens from infrastructure to the overall urban context where the urban developments of the case study area have a great potential for the recreational purposes as well. Our research aligns with the recent approaches for digital infrastructure developments in a port city integration, which are understood from the framework of ecosystem, that enables to build a novel approach for digital integration of port and city when adjusting with increased urbanisation, mobility, and business developments (Beškovnik & Bajec, 2021). In this paper we consider citizens as one of the key actors in a port city ecosystem from the perspective of its smart development.

3 Methodology

3.1 Data collection

The study we present in the current paper is part of a single case study (Yin, 2003; 2009) of a port city located in Northern Europe. The broader aim of our research is to investigate how to balance the needs of the port and the city in its physical transformation and how digitalisation could support it. The expansion of the urban public space at the area under study, with the mix of residential and office spaces, will connect the city centre with the sea. The development process has started with the construction of the new passenger terminal and aims to bring more art, culture, and urban greening into the area, at the same time emphasising the history and preserving the current built environment with low scales of new constructions. The main underlying objective for developing the area is the Turku Climate Plan, as city of Turku was selected as one of the 100 cities in Europe to become climate-neutral by the end of 2029.

In this paper we concentrate on citizens' (local residents, recreational users, visitors, and ferry passengers) perceptions of a smart city based on a collected data with online survey. Despite of the several attempts the city has made, the urban

development plans of this area have received little attention from the citizens. Therefore, an additional aim of comprising the survey was to raise awareness of the future developments of this specific area amongst the city inhabitants[2]. The survey was designed to understand the citizen's perceptions of the smart city by studying the reasons for visiting this specific area and the respondents' usage of digital applications and technologies in relation to their engagements with the evolving port city interface (for the survey questions please see the Appendix). Most of the questions were open-ended to allow citizens to express their views and opinions in their own words and without time limitation to answer the questions.

Initiated in October 2023, this survey remained accessible for two and a half months. To maximize inclusivity and reach, the survey was made available in (two) native languages of the targeted demographic and in English. The survey was promoted through the project's dedicated web page, various communication platforms, and local media, culminating in 159 responses. Of the respondents 88% (139) were representing residents of the entire port city (in distinction from the port and city interface area studied), 8% (13) residents of peripheral municipalities and 4% (7) of other domiciles. Diverse digital tools were used for respondents to get aware about situation around port area. Even though 14% of respondents did not use digital tools, the rest of them mentioned using numerous digital tools. 50% of the respondents use urban public traffic applications, other mobility applications were also mentioned, such as bike, scooter, or ride hailing applications. Ship-travelling is another main reason for people to visit the port area, therefore, shipping companies' website and applications are relevant information sources. Touristic attractions (museums), local businesses and events are also important information sources for respondents.

[2] In a first phase of our study, while interviewing the representatives of the city in addition to the representatives of the port, we became aware of the challenge to reach the citizens when the question is about the development of this specific area we are concentrating on. This supported our choice of comprising the online survey, although we acknowledge the in-depth perspective the interviews would have enabled to provide. We continue this research in our workshops with citizens, that enable to go more deeper into the themes emerged from the analysis of the online survey.

3.2 Data analysis

In our analysis, we applied content analysis in its more qualitative form (Drisko & Maschi, 2016; Krippendorff, 2018; Schreier et al, 2019), meaning that we did not employ predeveloped categories, but they were data-based. Our analysis resembles thematic analysis (Lochmiller, 2021; Rapley, 2021), but also has characteristics of content analysis with calculating frequencies of themes mentioned in the data. The analysis was performed using NVivo software (Version 14) and initiated open coding of the survey answers, simultaneously developing data-based codes and subcodes. During and after the coding, the codes were organised by moving, merging, grouping, hence creating meaningful themes. The frequencies of mentioning a theme were calculated to enable identification of the most often mentioned themes. The themes structured for the analysis are supported by the quotes extracted from the answers to the open-ended questions of the survey.

4 Results

4.1 Reasons for visiting or using the area of the port city

The 159 survey responses received on what currently and before the initiation of the urban transformation process attracts people or why people visit this specific area starting from the centre and reaching to the harbour and the sea, generated altogether 425 mentions falling under 13 main themes. These mentions and their frequencies are listed in the Table 1 below.

As demonstrated by the mention distribution and frequency, the area's cultural and service offering, historical value, geographic versatility, and verdancy provide several reasons for spending time or visiting the neighbourhood. The significance and exploitation of the area's functionalities may be emphasized or differ to a certain extent between different respondent groups (residents, visitors, tourists, and ferry passengers) and by the distance of the place of domicile to the area in question.

Among the neighbourhood residents, the opportunities for daily outdoor activities (walking, jogging, exercising), participation in events and the utilization of the area's service offering (restaurants, cafés) in beautiful settings, are emphasized among the themes.

"I go there for walking the dog, strolls, events, restaurants or just to soak in the atmosphere. When I want to refresh myself and see new people but still be in my own peace, I go to the Castle environment. Yet, it feels like that area could have more potential. A bit like Sleeping Beauty's slumber." (R[3] 7)

Table 1: Reasons for visiting and their frequencies

Reason for visiting	Examples	Frequency
Outdoor activities, well-being & leisure	physical activity, recreation, spend time to find a tranquil hideaway, observe and meet other people	85
Tourism and travelling	travelling with ferries, leisurely visits, hotel stays	50
Attractions, historical settings, and nature values	visits to historical medieval Castle	50
Nature values	parks, verdancy, river, riverbank, sea, uncrowdedness, tranquillity	61
Museums		35
Eating and drinking	restaurants, cafés, pubs	33
Events and exhibitions		31
Port activities and environment	observe ships, visit terminal facilities	20
Transport, mobility, and accessibility	cycling and pedestrian routes, water bus, public transportation	15
Other	educational institutions, errand running, parking	14
Residency within the neighbourhood	living	13
Work	workplace, meeting and conferences attendance	12
Hobbies	photography, guided exercise	7

For city residents living further away and for people arriving from peripheral municipalities/other domiciles (as given in section 3.1), the outdoor and recreational activities are more accentuated to weekends, holidays, and/or summer season. For these groups of respondents, easy accessibility, good mobility, and transport options are highlighted in connection with the visits to the area. *"I often cycle to the Castle area*

[3] R stands for Respondent

and back to the city centre along the riverbank." (R 33). Easy accessibility and transit to and from the ferry port, whether travelling by car or public transportation, is of essence for those travelling by ferries, whether city residents, visitors, or tourists. *"Smooth access to ships at the port, walking routes along the port and riverbank, and events"* (R 22).

For tourists and visitors, the most recurring themes encompassed the attractions, museums, and nature values. "*When I have friends visiting from other places I take them to the castle"* (R 139).

Inquiring into the use of the focal area by the citizens allows to better interpret the viewpoints on smart city presented in the following section.

4.2 Citizens' view on smart city

The citizen's view on smart city is constructed by combining the answers to questions "What makes a city "smart" in your opinion?" and "What aspects would be important for you in the development/transformation process of the Linnanniemi?". The most often mentioned themes are presented in Figure 1.

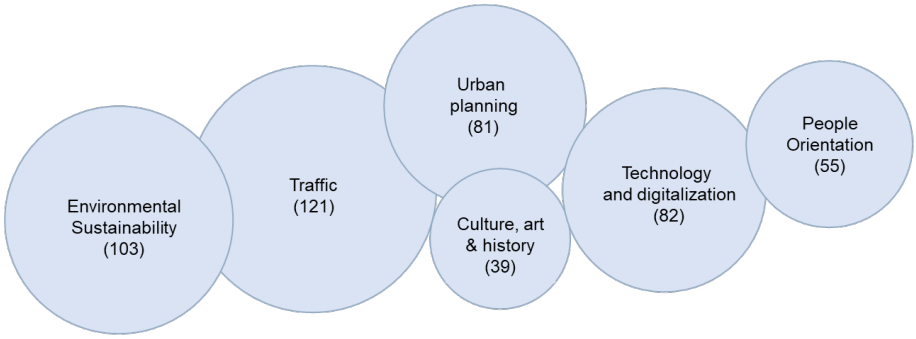

Figure 1: Main themes of citizens' view on the waterfront[4]
Source: Own

Traffic was the most often mentioned theme among the answers (121, including green mobility). The respondents saw that the traffic of a smart city should be easy for people, safe, fluent, environmentally friendly, with functioning parking

[4] The size of a bubble indicates how often a topic was mentioned; the overlaps among circles are not indicative of topic overlaps.

arrangements, easy connections with public transport (bus, train, tram, ferry) and new modes of transport. Utilizing technology and digital solutions were often mentioned related to traffic, for example when planning a trip, in public transport, in managing the traffic flow to and from the port or using AI in managing traffic lights.

Concern for environmental sustainability was broadly present in the answers (103 mentions). Additionally, if we include the answers concerning green mobility, which are currently considered under the traffic theme, but also contribute to environmental sustainability, it will make this theme even more prominent.

"A city is especially climate smart when cars are not the first priority, when it comes to forms of mobility. In a smart city, it is extremely important that the main focus is on green and climate friendly alternatives such as collective transport and of course walking and cycling... Climate and environment should always be the first things to consider in all infrastructural planning. That makes a smart city." (R 6)

Various aspects of environmental sustainability were brought up, for example applying sustainable development and living (e.g. recycling), being climate friendly, adapting to climate change, and using renewable energy. Many respondents wished for better abilities to enjoy the nature and the waterfront, and more of green areas that are considered contributing to the attractiveness of the place and the well-being of people.

Utilizing technology and data was the third often mentioned theme (82). It was seen designed for making people's life easier for example by offering easy access to information or services, in a simple, user-friendly way. Technology was seen to be useful in healthcare, traffic/mobility, communication, experiences, smart buildings, city planning and maintenance, but also in enhancing sustainability and diversity.

"A city that employs lots of smart solutions that are important for residents and visitors, such as in public transport, tidiness and city maintenance" (R 130)

The respondents wished for seamless, integrated, and secure digital services, and a long-lasting, sustainable digital infrastructure that is built not only for the sake of having technology but serving a purpose. Less than 40 % (60 out of 159)

respondents linked smart with technology, digitalization, or data, and many addressed only built environment, sustainability or mobility in their answers.

The People orientation theme highlights that smart should be used for the people, enhancing equality and inclusiveness, the wellbeing and quality of life of both residents and visitors. Listening to people's views and engaging them was considered an important task for governance. On the other hand, people were asked to be involved, smart, liberal, and polite to others.

From the perspective of urban planning, the smart city is seen as adapting to the citizen's needs and is flexible according to the amount of its user's. It contributes into the positive residing or visiting experience with the aim of being "*more than expected"* (R 49). The main expectation is people oriented urban planning, so that residents and visitors of the city feel that they are the priority. When developing the area that connects the city centre with the sea, the case study area in our research, it is expected that there would be a lot of public space, low constructions, urban greening, it would be inclusive, involving various activities and cultural happenings. There are several historical buildings in the area, the castle being the most important; the castle is a landmark that tells the history of the city. The respondents saw the castle as "*No. 1"* (R 59) and *"the crown of the city"* (R 41), that all urban development needs to adapt to.

5 Discussion

Our aim was to comprise an understanding of how citizens, including local residents, recreational users, visitors, and ferry passengers, perceive a smart city in the context of a port city that in our case study is located in the Northern Europe. We directed the citizens' attention to the waterfront area near and around the port which is going to experience substantial urban development in the coming years, and where the port's presence is most observable to the citizens. The sustainability aspect of the smart city (Ahvenniemi et al., 2017; Szpak et al., 2024) is clearly present in citizens perceptions of the meaning of the smart city. Especially the environmental sustainability can be seen as a cross cutting theme in the data of our study, that could be supported by the enhancement of environmentally friendly traffic and smooth interconnectivity of its various modes, the aspects that become crucial in a context of this specific area perceived by citizens, especially when travelling with the ferry.

Several attempts have been made for managing the traffic congestions (see also Lehmacher et al., 2022) from the side of the port and the city. However, the mobility-as-a-service or intelligent transport and parking solutions are currently the challenges of improving smart mobility (Cohen, 2014, also Al Sharif & Pokharel, 2022; Moura & Silva, 2019; Qonita & Giyarsih, 2023) in our case study area. Survey respondents have highlighted these aspects as crucial elements of the smart city within a context of a port city. Because of the location of our case city by the river and the sea, the river and the sea are an integral part of the identity of the city (Özgece et al., 2022) and the enhancement of its presence in everyday life of its inhabitants is perceived as part of the smart city in a context of a port city, as our study indicates. This, together with the increase of the general awareness of environmental issues, such as climate change and biodiversity loss, may explain the strong emphasis on environmental sustainability and nature in the data. Our case city is part of the EU Mission Climate Neutral and Smart Cities, which has influenced the strategies and plans for the development of the area close to the port. Therefore, the smart city is often linked to climate concerns in the survey responses, that could be supported by the people-oriented development of the infrastructure, seen as part of the sustainable urban planning under the smart environment (Cohen, 2014). As cities are facing the requirements of enhancing the wellbeing of their growing populations, this cannot be achieved without new technologies and digitalization (Szpak et al., 2024). In our study, this could be seen as an invisible side of the smart city as the citizens expect that developments of technology and digitalisation would just make their lives easier by offering easy access to information or services, in a simple, user-friendly way. The expectations of the survey respondents meet the city's urban planning principles for this area, currently covered mainly with asphalt. The transformation in upcoming years will be towards controlled rewilding with the mix of residential and office spaces and the expansion of public space with park and urban greening with the aim of bringing art and culture into the area.

6 Conclusions

The aim of our study was to comprise an understanding of how city inhabitants and visitors perceive a smart city in the context of a port city. According to our findings, the most prevalent themes in the data were traffic, environmental sustainability, technology and digitalization, urban planning, people orientation and culture, art & history of this specific area under study. Our findings show that citizens emphasize

the utilisation of smart solutions for people and their wellbeing, whether related to traffic, services, sustainability, or urban planning, as well as environmental sustainability. This echoes the insight that the human component should never be overlooked in development of smart cities (Cardullo & Kitchin, 2019; Kitchin 2014; Mosco 2019; Szpak et al, 2024). The key topics specific to a smart city within the context of a port city include seamless traffic and mobility from the city to the port, as well as the preservation of the natural, historic, and cultural environment of the waterfront area, including the sea and the port. The results of our study support the recent directions in the smart cities literature, with the emphasis on environmental sustainability (Ahvenniemi et al, 2017). These results presented in the current paper will be developed further based on the results of the upcoming workshops with citizens. Further research could consider the impact of the different population characteristics on the perception of a smart port city, such as the gender, age, income levels, etc., which were not accounted for in this study. The effect of the primary use of the port area on the perception of the smart port city also requires further investigation.

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Appendix

The survey questions.

1. Please provide your residential postcode
2. What makes a city "smart" in your opinion?
3. What does a smart and sustainable city mean for you?
4. What attracts you or for what purposes do you use/visit the Linnanniemi area (the area extending from Forum Marinum through the Turku Castle Park to the Port of Turku)?
5. What aspects would be important for you in the development/transformation process of the Linnanniemi area?
6. What digital solutions (Apps, WEB pages etc.) have you used in connection with the harbour area and/or surrounding area of Turku Castle (e.g. mobility & transport, parking, tourism, events, cultural offerings, local businesses, carbon foot monitoring or other - what)?