CHALLENGES FOR PLANNING CLIMATE CHANGE RESILIENCE THROUGH THE CO-CREATION LIVING LAB APPROACH IN THE MEDITERRANEAN COASTAL TOWN OF PIRAN

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Abstract

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Climate change resilience for urban coastal communities is a pressing matter considering hazards like sea-level rise, coastal flooding and erosion. Adapting to such changes and creating climate change resilience should be an all-stakeholder process. This paper discusses the early stages of stakeholder participation through a co-creation living lab (LL) approach in the Mediterranean coastal town of Piran. To achieve climate change resilience ecosystem-based approaches (EBAs) are used as tools, while in Piran the novel coastal city LL (CCLL) approach is supposed to facilitate a process to achieve acceptance and implementation of such EBA solutions, through consented decision of representative stakeholders from each of the quadruple helix framework, including citizens. During this process several organisational limitations were encountered such as the question of incentivizing stakeholders, man-hour devotion, appointing contact persons within large organisations, and the challenge of organising continuous personal face-to-face meetings. Parallel to previous findings that defining a shared vision is necessary for a successful CCLL, we emphasize that newly retrieved specific challenges identified through personal communication with stakeholders, and capitalising on those, further motivated the stakeholders. These specific challenges represent pressing issues, for example: how to retrieve and revalorize the historical water management system; how to improve the existing early warning system; how to empower and educate, through climate action, the town's community that is facing population decline through tourism gentrification. The experience by the authors of this paper suggests that continuous interaction with stakeholders and facilitating multidisciplinary activities based on stakeholder's prior knowledge and experience, are best practices in the co-creation of the urban living lab.

Keywords

Climate adaptation, ecosystem-based adaptation, participatory governance, stakeholder engagement, urban living lab

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1. Introduction

In line with the recent urgency of the international community to address climate crisis issues, Living Labs (LL) (Hossain et al. 2018) have been implemented across European cities as a creative tool to achieve effective governance. Although there is no single definition, LLs are generally recognized as social experiments that bring together stakeholders to develop new technologies, products, services and ways of living to find solutions to particular challenges (Bulkeley and Castán Broto 2013; Voytenko et al. 2016). Nowadays the most pressing global challenges are climate change and sustainability.

Climate-change adaptation in LLs can be built through implementation of ecosystem-based approaches (EBAs). Such EBAs are naturally occurring ecosystems that as a physical whole with its natural physics processes could be seen as an example of a nature-based adaptation strategy, and implemented in urban areas can provide a solution to a particular climate change hazard (Wamsler et al. 2016; Nesshöver et al. 2017).

Coastal regions especially face the challenge of finding solutions to become resilient to climate change hazards like the on-going sea-level rise, coastal erosion, coastal flooding, as well as extreme events like storm surges, landslides, and especially in the Mediterranean, droughts and heatwaves (Tiwari et al. 2022). Hence, the European Commission (EC) funded the SCORE project (Smart Control of the Climate Resilience in European Coastal Cities) that builds on the extension of LLs towards Coastal City Living Labs (CCLLs), which offer a framework for deploying social innovation to be understood as a type of innovation networks in a coastal city (Nyström et al. 2014). Stakeholders within CCLLs are considered as co-creators who act as informants, but also have the power to shape outcomes by contributing with their knowledge and expertise (Stakeholder Engagement in Urban Living Labs 2019; Noble and Enseñado 2022). Such participatory co-creation approach in a CCLL for planning and implementation are needed in order to achieve societal, environmental and economic benefits (Frantzeskaki 2019; Tiwari et al. 2022), and hopefully resilience. Furthermore, LLs/CCLLs lead to acceptance and adoption of solutions by citizens (Kumar et al. 2020), and ensure a citizen/stakeholder-shared sense of ownership of the planning processes and outcomes (Ferreira et al. 2020).

Although stakeholder engagement exists as a practical challenge, little sources are available for the early stakeholder participation stages. Several authors point out the existence of a single challenge that is placed in a real-world setting, the active roles of stakholders in a co-creation process and the multidisciplinary dimension (Maiullari and van Timmeren 2017; Westerlund and Leminen 2011; Higgins and Klein 2011). While Noble and Enseñado (2022) emphasize the need to establish very clear LLs aims early on.

The previously mentioned SCORE project aims to design, implement, and evaluate a novel CCLL framework for 10 European coastal cities (Barcelona/Vilanova, Basque Country, Benidorm, Dublin, Gdansk, Massa, Oeiras, Piran, Samsun, and Sligo), integrating EBAs with smart technologies. As well as aims to implement a smart city early warning system for extreme events, and ultimately wants to demonstrate enhanced climate change adaptation and resilience. In the SCORE project, the authors

of this paper and their previously involved colleagues, under the approval of the municipality of Piran, and together with SCORE project partners have been establishing the CCLL Piran. While specific baseline conditions for the cluster of CCLLs will be reported elsewhere, the main climate change hazards specific for the CCLL Piran have been identified previously (Kumer et al. 2022), with summer drought/heatwaves and winter coastal flooding being the major climate change threads. Additional CCLL Piran challenges have been topic of suggestions and discussion in main stream media (Kumer and Meulenberg 2022).

The aim of this paper is to: (1) explore the implementation of the newly established CCLL Piran by understanding the expectations, perceived benefits and challenges of the participating stakeholders related to climate change; (2) shed light on the theme of stakeholder engagement and present issues in establishing any LL for co-creating climate change resilience that will serve all and enhance attractiveness of the city to citizens, businesses and tourists; (3) offer suggestions for managing future LL collaborations to inform further evidence-based policy; (4) emphasize the role of social sciences and humanities in co-creation climate adaptation processes through CCLLs.

2. Background

The history of Piran (first mentioned in 7th century AD), which lies at present-day Slovenia's Adriatic coast, is very diverse and turbulent. That is made obvious by taking a closer look at the period from the start of 20th century until today. The political situation in the town of Piran and its wider hinterland has changed several times. Demographics of the area have changed together with the political situation. A quick summary of historical development is necessary for the understanding of the current trends and challenges that Piran faces in recent times.

After the World War I ended, the lands which today are a part of Slovenia were occupied by the Kingdom of Italy. The position of Slovenes and Croats has rapidly worsened after the establishment of the Rapallo border. Forceful assimilation and genocidal pressures had forced many people to leave their homes and seek refuge outside of the Kingdom of Italy (Čermelj 1965) and the region has become peripheral in the context of the Kingdom of Italy (Zupančič and Pipan 2018). After Italy was defeated in World War II, the lands of today's Slovene Littoral became a part of the Free Territory of Trieste. This territory was split into Zone A (Trieste with surroundings) and Zone B (north-western part of the Istrian peninsula including Piran). Slovenes migrated from Zone A to Zone B, while Italians migrated in the opposite direction (Pirjevec et al. 2005).

Another turning point was the Treaty of Osimo, which brought about border arrangements between Italy and Yugoslavia (Zupančič and Pipan 2018). With the treaty the border that until then served as a separator of Italy and Yugoslavia turned into a bond between the two as the openness of the border allowed for a faster cross-border flow (Bufon 2004). This allowed Koper to establish itself as a local centre (Zupančič and Pipan 2018) and it took a central role of the whole Coast. At the same time, the coastline was quickly becoming more urbanized together with the immigration from other parts of Slovenia and other countries of Yugoslavia (Bugarič

2008). After the accession of Slovenia to the European Union the littoralization continued.

Despite the ever-increasing number of residents in all coastal municipalities the number of Piran residents fell from 4287 in 2008 to 3802 in 2022, which amounts to an 11% decrease (SURS 2022). The reasons for emigration from the town are numerous. The research of the wider area of Slovenian Istra point out problems such as: the lack of job opportunities for young highly educated people, emigration into regional centers and abroad, the inaccessibility of parking spaces for the residents, high prices of real estate, unfavourable property ownership (non-residents and short-term rentals), restrictions when renovating buildings, the lack of services in the old town center, concentration of health care services in larger urban centres such as Koper, pressure on the local infrastructure due to ever-increasing tourism (especially in the summer as the infrastructure was not intended for such a concentration of people), the lack of drinking water in summer months (Hudnik 2015).

In 2011, 34.5% of all the properties in Piran were uninhabited. This percentage rose to 41% in 2021 (SURS 2022). Due to increased interest for Piran as a tourist destination the properties are turning into apartments. Furthermore, the properties that were in the past not intended for living are being turned into tourist accommodations. Touristification (tourism gentrification) that is plentiful present in Piran is most noticeable in the winter months: During this time the town is relatively empty (Bugarič 2008). The data on tourist arrivals to the municipality of Piran points to the increase in demand for non-hotel tourist accommodations. In comparison to the record year of 2019 (before the COVID pandemic), in post-COVID 2022 the overnight stays dropped by 1% and the hotels observed an 11% decrease in overnight stays. On the contrary, the other tourist accommodations in the wider municipality observed an increase of stays for a little more than 20% (Portorož Tourist Board 2022).

The negative sides of tourism in the city are most evident at the peak of the tourist season as the increased number of town-visitors correlates to the driest period of the year. During this time, both the water distribution system and the sewage network are already experiencing overload, due to the increasingly severe droughts. Both systems in Piran are in a state of disrepair while the much-needed renovation is severely slowed down and made difficult due to the cultural heritage protection which practically involves the whole city center of Piran, as well as that construction activities (and repair) can only be executed outside of the tourist summer season: meaning winter season of which the execution window is even more reduced due to unfavourable weather conditions (Burja, precipitation). The pressure of tourism can be seen in the morphology of the town. Restaurants and bars have, during the years, usurped public space.

The various waves of migrations to the Primorska region have brought about new residents with different ways of living and understanding of the region. At the same time, the migration waves and its new multi-cultural society pressed away the original residents and the awareness of cultural heritage such as the knowledge of traditional water-permeable paving methods, town wells, urban gardening and traditional pocket gardens. Perhaps this is the reason why the renovation of the town's infrastructure does not use the traditional techniques of paving with permeable materials anymore

and why the green space management uses non-native plant species that are more vulnerable in the local climate. Due to disappearing of the old and traditional solutions the freshwater wells are also deteriorating (Fig. 1).

All the aforementioned problems that pester Piran make adapting to climate change more difficult. The droughts are longer and more severe and the sea-level rise will cause floods to reach higher ground. Due to the multi-layered problems, the usual short-sighted cookie-cutting and pieces (crumbs) distribution practice does not seem a sustainable solution. There is a need for the involvement of all stakeholders of the town and the search for sustainable long-term solutions that are acceptable for all involved. Activation, connection and empowerment of the civil society is only the first step on the long road to the development of Piran as a climate resilient town.

Fig. 1: Left: Example of an anti-flood barrier that has been traditionally used in old-town Piran. / Right: Top part of a stone water well in old-town Piran. The floor on which the water well is positioned, is used as patio, but is basically the ceiling of a cubic water cistern.
Source: Kumer (left) and Kralj (right) 2022.

3. Establishing the Piran CCLL

In this section we will present the challenges of co-creation of the CCLL Piran. SCORE's objective is to establish a living laboratory with local stakeholders according to the quadruple helix framework, meaning authorities, academia, entrepreneurs and citizens.

3.1 Setting up quadruple helix stakeholder CCLL and their engagement

Hence, before the Grant Agreement with the EC was signed, the municipality of Piran was approached, and allowed through a memorandum of understanding to have the academic Science and Research Centre (ZRS) Koper (to which the authors of this paper are affiliated), to operate within the municipality and establish the CCLL. Various stakeholders were approached first by means of emails and phone calls, and it proved difficult to explain SCORE's objectives through these channels. Selected stakeholders were invited to take part in the first 3-day workshop which was organized in a central hotel in Piran during the first year of SCORE (April 2022). At the workshop the baseline data on climate change hazards, Piran's geographical, social and historic situation, and impacts of climate change hazards, were firstly displayed. Much of these results were concluded from the prior data collection efforts, where ZRS accessed and requested public available data from the various responsible administrations and organisations. Stakeholders learned about priorities and possible objectives, discussed recruitment of other potential stakeholders for the CCLL and were informed that the SCORE project over the next few years, will provide a platform where they can meet and consult.

After the workshop, consecutive personal face-to-face meetings with intense conversation, were scheduled to clarify in detail the SCORE project and its objectives. Usually, there was some reluctance in engaging, hence the first appointments were delayed. Despite the reluctance, in general the first face-to-face conversations with all stakeholders were very positive, and provided an abundance of information on basic urban infrastructure, meteorological and geographic data, as well as, opinions, suggestions and questions.

The reluctance in engaging seemed to be especially true for organisations of semi-public sector. On the other hand, representatives of civil groups were much more willing to collaborate and readily available for face-to-face discussion and interactions, while private sector and businesses, generally seek for their individual interests and/or business opportunities.

Interesting is that virtual on-line web meetings did not work good for the citizens and several public organisations. While for example, the authority as represented by the municipality and academia, are completely accustomed to be repeatedly meeting on-line.

Eventually, the Piran CCLL established itself under guidance of ZRS Koper, and with input by representatives of the quadruple helix stakeholders (see Fig. 2).

The identified stakeholders will be differently engaged in the various SCORE activities, and will have different roles within the CCLL Piran. This is important both in the further engagement process, and inquiring to take on specific duties within the CCLL.

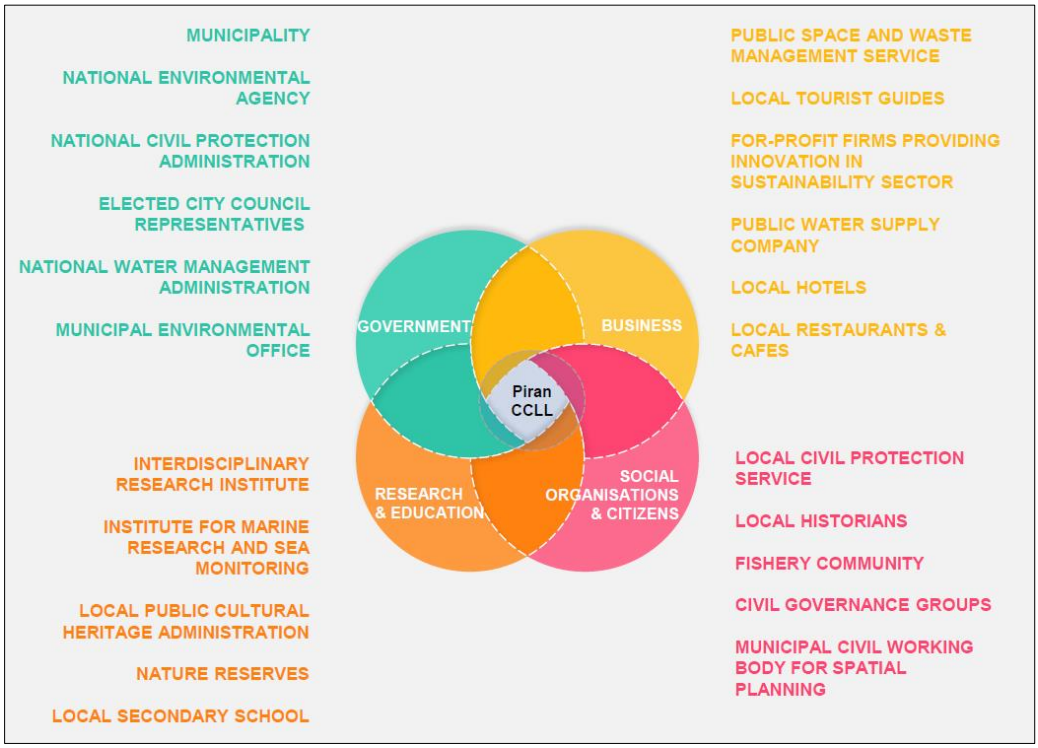

Fig. 2: Quadruple helix stakeholders in CCLL Piran.
Source: Kumer, Meulenberg, Kralj 2022.

Of particular worth mentioning in regard to the engagement challenges, are the following particular situations for CCLL Piran:
First, the time personnel of (semi-) public sector stakeholder organisations will be able to dedicate to CCLL activities. Establishing the CCLL Piran by ZRS researches was already time-consuming, so voluntary involvement in CCLL activities, will need an incentive. Most likely for each stakeholder organisations different incentives. In relation to this see the following sections on the various CCLL activities in development.
Second, the research team involved from ZRS Koper turned out to be a changing mixture of man hour devotion and disciplines. As understanding the complexity of SCORE's multi—work packages duties is difficult to understand by stakeholders, even so, comprehension by academic personnel does also take a share amount of time. And while the specialized research of each team member was used to very good use, in combination with limited man hours, the project was delayed, in establishing first contact with relevant stakeholders.
Third, further engagement of the initially contacted persons depended mostly on the approval of their superiors. In general, the (semi-) public sector organisations did appoint a contact person (that usually turned out the firstly contacted person). Interesting is that this further engagement seems to be influenced (lingered) by the local elections for mayor and representatives of the various civil and minority groups. Besides, repeated updating, and continuous follow-up face-to-face individual meetings did seem the most efficient way towards establishing a fruitful collaboration

for co-creation. Note that this approach is very time-consuming for the researchers setting up the CCLL, but satisfying, as a co-creation approach seems evident from it. Fourth, due to slow progress in the engagement of organisations as a whole, in combination with the above reasons it was decided to approach persons directly, and personally invite them to be an active member of the nucleus of the CCLL Piran. As such, these persons will be educated on SCORE activities and objectives, and take this experience beyond the project duration of SCORE, hoping to ensure active climate change action for Piran.

3.2 Defining key challenges for engaging stakeholders

Rather than emphasizing a shared vision (as suggested by Steen and Van Bueren 2017; Noble and Enseñado 2022), which in this case would be a climate resilient Piran, the initial focus was on retrieving specific challenges faced by individual (through expert opinion) and groups of stakeholders. Therefore, an important step was to identify the challenges regarding climate change that are considered relevant to stakeholders (from A to E). The identification was done based on face-to-face meetings with stakeholders, reviewed literature and various pre-existing sources.

A. Disappearing of Piran's historical water management system

Certain group of stakeholders emphasized Piran's reputation as the »city of wells« and saw the importance of preserving historic wells and water reservoirs. These historic water storage structures fell into disrepair in the second half of the 20th century when due to the growing number of people, it was replaced by the current system that provides fresh tap water (Mužič 2017; Janković 2017). As the severe drought of the summer of 2022 led to water restrictions in the coastal region, the idea of historic water storage preservation and possible reactivation was suggested before, along with possibilities for the city's retainment and re-use of rain- and drinking water (Kumer and Meulenberg 2022).

Some stakeholders were particularly knowledgeable about public pocket parks that existed in the past (and are now dilapidated), although Piran has always been densely built-up with little room left for urban greening.

The third element represents permeable pavements in the form of cobblestone pavements of streets, alleys and squares. These traditional cobblestones are porous to water and have been proven to improve urban drainage (Ščuka 2019). Some stakeholders pointed out that this historic paving technique is disappearing even though in the past porous pavement structures allowed rainwater to seep through. While nowadays, due to the use of non-porous concrete the limited runoff increases the risk of urban flooding.

B. Enhancement of early-warning system

Coastal storm surge is the most frequent and costly extreme weather event occurring during the autumn/winter season (October-March) in Piran (Kolega 2006; Kumer et al. 2022).

Enhanced ability to forecast peak discharges and timely issue flood warnings, provides the possibility to set up the needed civil protection and emergency measures, minimising the impacts in terms of economic losses. The significance of an effective early warning system lies in the recognition of its benefits for the local people.

Therefore, it needs to actively involve all the inhabitants at risk, through the facilitation of public education and awareness of these flooding risks, disseminate messages and warnings efficiently, and ensure that there is a constant state of preparedness and that early action is enabled (Establishment of early warning systems 2022).

Although the early-warning system concerns different stakeholders, it was decided to first discuss the challenges of forecasting peak runoff only with experts who are directly involved in the civil protection system (either professionally or as volunteer). The early warning system that already exists in Piran could be improved by including future coastal climate services for local-scale impact studies (Anton et al. 2022) and providing additional sensors (tide gauges and infra-red video cameras) along the Piran coast to provide more accurate and more local (urban) information on the sea level and wave height in or near the town. Suitable locations for these sensors were discussed (Fig. 3), as well as the issue of raising public awareness. The SCORE project will introduce the citizen science approach using low-cost sensors (Ahmed et al. 2022), to collect data and determine the best location for future sensors.

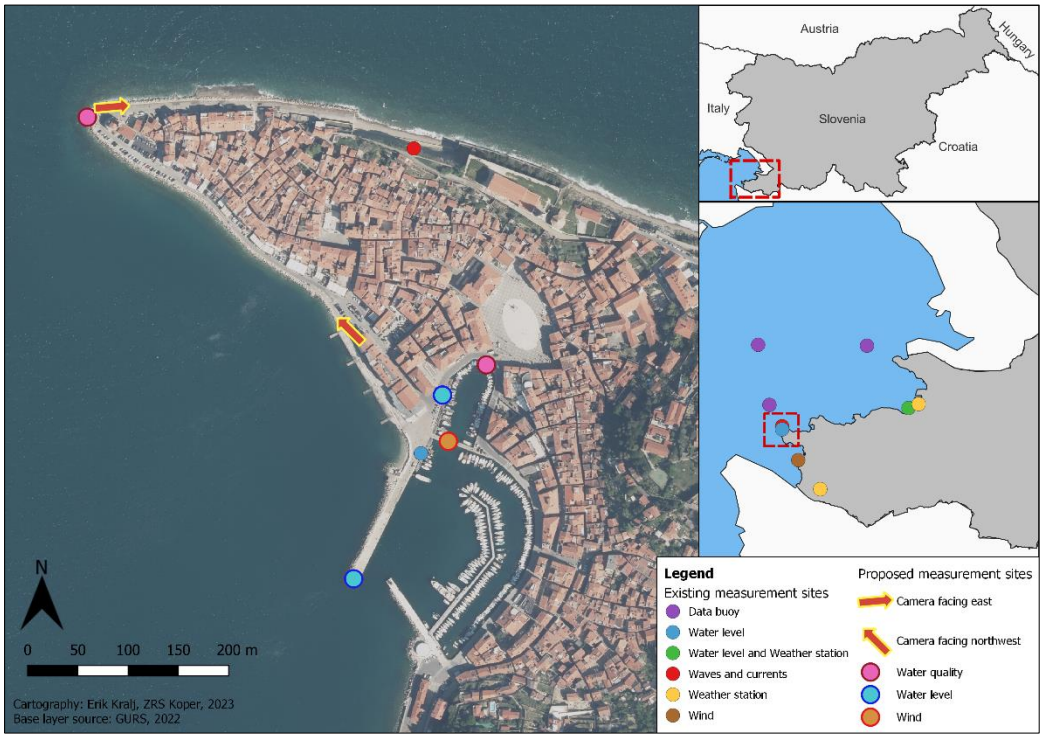

Fig. 3: Sensor locations (existing and proposed) contributing to Piran's early warning system.

Furthermore, the experts pointed out that the local population is insufficiently prepared and not willing to react quickly, even when the alarm system is activated. Local authorities aren't very efficient in educating the public, which the experts illustrated with the case of the SMS/text flood alert system, which is managed by the

municipality, but most people have never heard of it and it's not clear whether it actually works.

C. Summer water scarcity
The severe drought that occurred during the heatwaves of the 2022 summer seemed like an ideal opportunity to address the issue of water security for the town of Piran (Kumer and Meulenberg 2022). Stakeholders agreed on the need to invest in improving the municipal water distribution system, but they also understood that seeking for new water sources is an unsustainable solution to address water scarcity. Therefore, the only long-term solution is more efficient water use, which includes water reuse and rainwater storage. Interestingly, within the local community condensation water is collected from the air conditioning system in a bucket in front of their house and using it to water their plants, water the garden, for houseplants, or for outdoor chores like washing patio floors and garden paving.

Some stakeholders recognize the importance of reactivating the wells in Piran (Mužič 2017; Janković 2017), which were once the only source of water for the people of Piran (both as drinking and outdoor chores water). Although the infrastructure of such water wells, cisterns and waterways are considered protected cultural heritage, today they are in varying conditions (i.e. they have been converted into cellars, are abandoned, used as trash collector, and contain unclean water.) Only a minority of these are in use.

Another solution that some stakeholders agree upon is appropriate is to recycle and reuse wastewater for purposes other than drinking. Water reuse offers promising opportunities to redirect freshwater resources for other purposes such as direct potable use. Here the collection and reuse of air-conditioners condensation water during summer, can make a substantial contribution.

D. Reducing the effect of urban heat island and flood risks
Urban geometry is one of the factors that influences the phenomenon of urban heat island in a densely built historic town like Piran. During the day relatively narrow streets lined by tall buildings reduce surface and air temperatures. Such towns along the Adriatic coast feature low percentages of greenery. However, various small green spaces have always been present in Piran (i.e., public pocket parks, private palace gardens and semi-private gardens along the historic Piranese defence walls).

Some stakeholders are actively working to preserve or revitalize historic green spaces. However, it seems that the city could have benefits by introducing additional green spaces in becoming climate resilient. Therefore, there is a need to introduce green and blue infrastructure in the form of EBAs that provide greater benefits to people, not just heat reduction. Examples include rain gardens that act as »bioretention cells« where rain collects and filters out pollutants and sediments into the ground. Similarly, »bioswales« or depressions collect excess (flood) water containing pollutants, which is then filtered and discharged back into the sea.

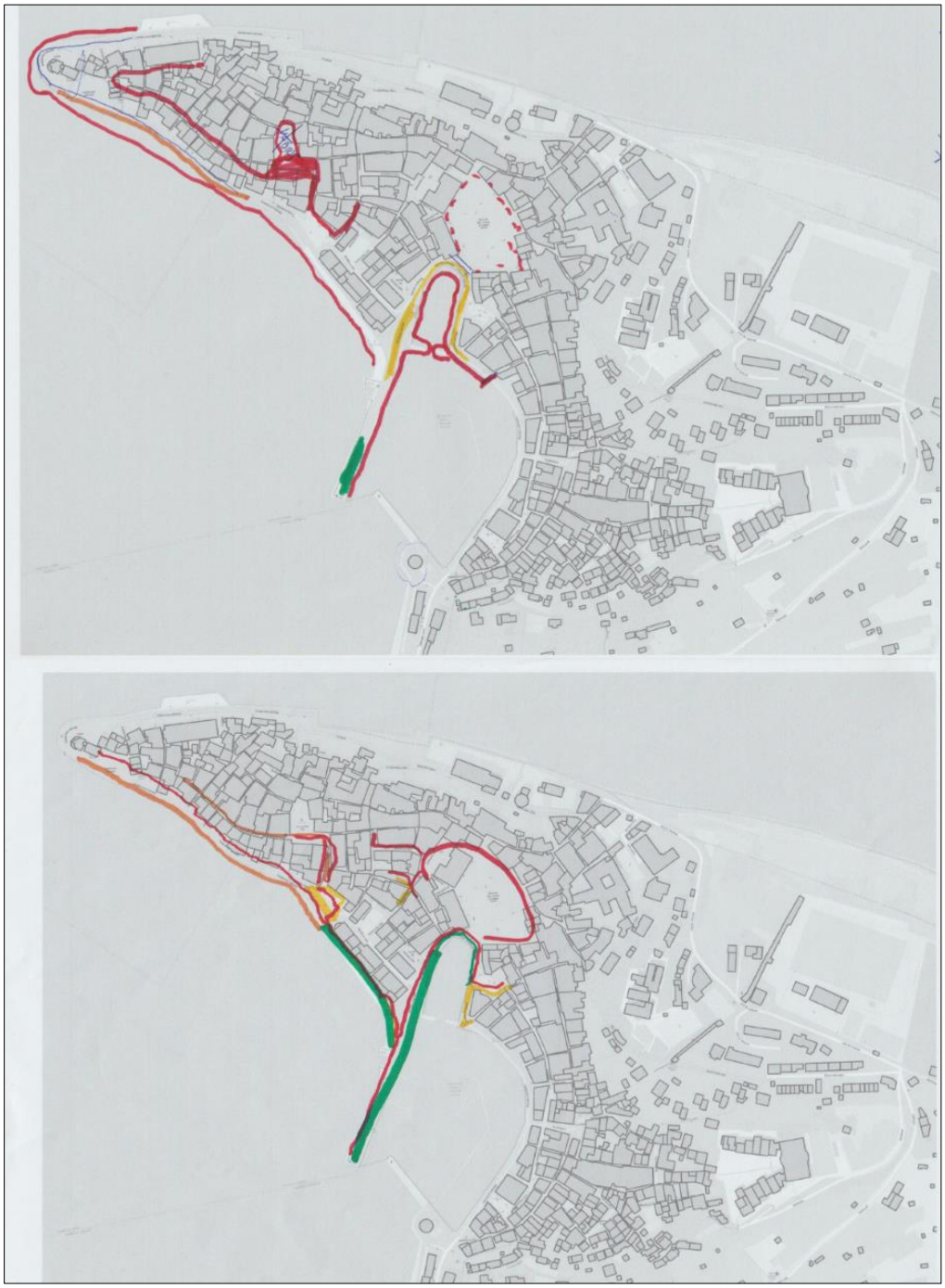

Fig. 4: Coastal flooding in Piran. Mapping performed by two different experts (green: frequent floods, yellow: occasional floods, red: rare floods).
Source: Kumer, Meulenberg, Kralj 2022.

E. Informing, motivating and engaging the local community
Decisions and solutions related to climate resilience depend on involvement of the local community. Therefore, in parallel, it was decided to activate the stakeholders that work with specific members of the local community (e.g. local high school, local initiative, local political representative, press): 1) The press is contacted to disseminate project's solutions to a wider local population; 2) A local high school is approached to engage pupils and their parents to educate them about climate change related hazards through gamification and citizen science approaches; 3) Local political representatives and representatives of community initiatives are approached to understand local needs and suggestions.

4. Discussion and conclusion: Planned approaches for achieving climate resilient Piran

This paper illustrates and discusses the stakeholder engagement process in the co-design of a climate-resilient Piran. We emphasize challenges that occur in the initial phases of establishing a CCLL.

Stakeholder mapping appeared to be a creative process as the initial »desk-research« on quadruple helix stakeholders didn't suffice. The most important stakeholders were discovered through a snowball technique where existing stakeholders (after having face-to-face conversations with them) recruited future stakeholders from among their acquaintances.

Two types of challenges could be identified, of which the category »organisational limitations« comprises incentivizing stakeholders, man-hour devotion, appointing contact persons by large organisations, organising continuous personal face-to-face meetings.

The second category of challenges belongs to the »motivational challenges«, those that have the power to motivate the stakeholders to become engaged in the CCLL. Stakeholders generally do not have a professional motive to voluntarily participate in social innovation processes like CCLL. Therefore, to engage stakeholders, special attention must be paid to them. The procedure of collecting stakeholder-identified challenges induced encouragement among the stakeholders for engaging and partaking in further CCLL capacity building. The identified challenges comprised pressing issues in Piran: addressing the historical water management system; upgrading of the early-warning system; addressing summer water scarcity; reducing the effects of urban heat island and coastal flood risks; and motivating (informing, engaging) the local community to take action.

In the background, two other issues are very much influencing the previously mentioned challenges:
(1) For several decades the municipality of Piran is trying to implement measures against the summer droughts and the winter coastal flooding. Recently, the latter got much attention, since the municipality's suggestion of hard-measure concrete re-establishing/fortification of the coastal embankment, is being countervoteed by civil movements. This issue introduces a bipolar society, where climate change adaptation seems to become a politically-charged topic for most members of the community,

with both the public and the authorities losing the view on the necessity of even simple, but effective measures that can easily be taken into consideration.
(2) Additionally, it should be noted that the centre of the town of Piran is situated on the tip of peninsula. This is an old historic town directly alongside the seaside. The whole of that area is covered in cultural heritage: from old palaces, to residential houses to the typical coble-stone paved roads, alleys and squares. This immediately sets the level of opportunities for climate change nature-based solutions: any intervention or adjustment of the town's infrastructure will need to be in line with the national legislation on cultural heritage (Fondazione scuola dei beni e delle attività cultural 2022). Therefore, EBAs like e.g., the integration of vegetated surfaces in buildings, such as in roofs or walls, will need to respect the same legislation, and hence, will perhaps rule out various »pure« EBAs, and request introduction of hybrid forms. An on-going Piranese debate on climate action lead by the CCLL Piran, would press on how to use the public space efficiently (e.g., the introduction of rain gardens or bioswales could mean the transformation of two-way streets into one way streets with substantial reduction in number of personal vehicles). For sure the CCLL Piran needs to be very open-minded and creative with introduction of any climate change adaptive activity.

One of the main issues, however, remains introduction of EBAs on top of the not-to-be-ignored protected cultural heritage. Piran CCLL is designing a unique strategy of finding the thin line between cultural heritage preservation and introducing EBAs as a major climate resilience strategy (Fondazione scuola dei beni e delle attività cultural 2022). There is a strong realisation that interdisciplinary knowledge needs to be combined e.g. like history, fishery, linguistic, social, environmental and marine sciences, and not limited to academics but emphasizing the inclusion of expertise local knowledge from professionals, especially citizens, in order to be efficient and successful in establishing climate resilience (Meulenberg et al. 2022). In that sense, having already turned in this direction, differentiates Piran CCLL from the other SCORE CCLLs. Globally Piran CCLL and its activities could be regarded as a unique example for historic Mediterranean town willing to introduce combined cultural heritage/ecosystem-based climate change adaptations.

While SCORE continues with its activities, we are already looking beyond 2025 when the project finishes. Piran CCLL as a social innovation designed within SCORE, could become the core platform for designing climate resilient strategies. Therefore, to assure continuity of Piran CCLL, the municipality (along with all other stakeholders) should recognize its power and ambition oriented towards innovative solutions.

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References

Ahmed, T., Creedon, L., Anton, I. and Gharbia, S. 2022: The use of low-cost sensors for monitoring coastal climate hazards and developing early warning support against extreme events. EGU General Assembly, Vienna, Austria.

Anton, A., Paranunzio, R., Gharbia, S., Baldini, L, Ahmed, T., Giannetti, F., Brandini, C, Ortolani, A., Meulenberg, C, Adirosi, E., Hawke, S., Pilla, F, and Iglesias Rodriguez, J.G. 2022: Challenges in retrieving and using climate services' data for local scale. Impact studies: insights from the SCORE project. EGU General Assembly 2022, Vienna, Austria.

Bufon, M. 2004: Med teritorialnostjo in globalnostjo, sodobni problemi območij družbenega in kulturnega stika. Knjižnica Annales Majora.

Bugarič, B. 2008: Strukturnovsebinske preobrazbe slovenskih obalnih mest. Urbani izziv, 19(1).

Bulkeley, H. and Castán Broto, V. 2013: Government by experiment? Global cities and the governing of climate change. Transactions of the Institute of British Geographers, 38(3).

Čermelj, L. 1965: Slovenci in Hrvatje pod Italijo med obema vojnama. Slovenka matica.

Establishment of early warning systems 2022: https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/establishment-of-early-warning-systems

Ferreira, V. Barreira, A. P. Loures, L. Antunes, D. and Panagopoulos, T. 2020: Stakeholders' engagement on nature-based solutions: A systematic literature review. Sustainability, 12(2).

Fondazione scuola dei beni e delle attività culturali 2022: Three key questions on culture, cultureal heritage and climate change. Proceedings of the round table.

Frantzeskaki, N. 2019: Seven lessons for planning nature-based solutions in cities. Environmental science & policy, 93.

Higgins, A. and Klein, S. 2011: Introduction to the living lab approach. Accelerating Global Supply Chains with IT-Innovation: ITAIDE tools and methods.

Hudnik, Š. 2015: Sociološka analiza Slovenska Istra. Univerza v Ljubljani, Fakulteta za arhitekturo.

Janković, D. P. 2017: V iskanju vode med piranskimi trgi in dvorišči: katalog piranskih vodnjakov in pitnikov danes in v preteklosti.

Kolega, N. 2006: Slovenian coast sea floods risk. Acta geographica Slovenica, 46(2).

Kumar, P. Debele, S. E. Sahani, J. Aragão, L. Barisani, F. Basu, B. ... and Zieher, T. 2020: Towards an operationalisation of nature-based solutions for natural hazards. Science of the Total Environment, 731.

Kumer, P. Meulenberg, C. 2022: Podnebno odporna obalna mesta: Kako pripraviti obalno prebivalstvo na vse pogostejše ekstremne vremenske dogodke. Delo.

Kumer, P. Meulenberg, C. J. W. and Hawke, S. M. 2022: Piran Coastal City Living Lab (CCLL): Challenges and opportunities. SCORE consortium meeting, Sligo, Ireland. Poster 11.

Maiullari, D. and van Timmeren, A. 2017: Building Scenarios in Urban Energy Transition: A trans-disciplinary method for integrated spatial energy design. Proceedings of 33rd PLEA International Conference: Design to Thrive.

Meulenberg, C., Hawke, S.M., Cavaion, I., Kumer, P. and Lenarčič, B. 2022: Understanding interdisciplinarity through Adriatic maricultures and climate change adaptation. Visions for Sustainability, 18.

Ministrstvo za kulturo 2022: Pravni režim varstva kulturne dediščine eVRD.

Mužič, J. 2017: Piranski kamniti biseri. Slovenske novice.

Nesshöver, C. Assmuth, T. Irvine, K. N. Rusch, G. M. Waylen, K. A. Delbaere, B., ... and Wittmer, H. 2017: The science, policy and practice of nature-based solutions: An interdisciplinary perspective. Science of the total environment, 579.

Noble, K. and Enseñado, E. M. 2022: Analyzing co-creation levels of urban living labs in Europe. Visions for Sustainability, 18(7060).

Nyström, A.-G. Leminen, S. Westerlund, M. and Kortelainen, M. 2014: Actor Roles and Role Patterns Influencing Innovation in Living Labs. Industrial Marketing Management, 43(3).

Pirjevec, J. Klabjan, B. and Bajc, G. 2005: Vojna in mir na Primorskem: Od kapitulacije Italije leta 1943 do Londoskega memoranduma leta 1954. Knjižnica Annales Majora.

Portorož Tourist Board 2022: V Portorožu in Piranu lani več kot 1.83 milijona turističnih prenočitev.https://www.portoroz.si/si/medijsko-sredisce/sporocila-za-javnost/8435-v-portorozu-in-piranu-lani-vec-kot-1-83-milijona-turisticnih-prenocitev

Ščuka, A. 2019: »Lahko bi rekli, da mesto diha skozi peščenjak«, Žurnal24. https://www.zurnal24.si/popotnik/lahko-bi-rekli-da-mesto-diha-skozi-pescenjak-337495

Smart Control of the Climate Resilience in European Coastal Cities. https://score-eu-project.eu/.

Statistični urad Republike Slovenije (SURS) 2022: Število stanovanj po naseljenosti, naselja, Slovenija, večletno. https://pxweb.stat.si/SiStatData/pxweb/sl/Data/Data/0871201S.px/

Steen, K. and Van Bueren, E. 2017: The defining characteristics of urban living labs. Technology innovation management review, 7(7).

Tiwari, A. Campos Rodrigues, L. Lucy, F.E. Gharbia, S. Rodrigues, L.C. Lucy, F.E. and Gharbia, S. 2022: Building Climate Resilience in Coastal City Living Labs Using Ecosystem-Based Adaptation: A Systematic Review. Sustainability, 14.

Voytenko, Y. McCormick, K. Evans, J. and Schliwa, G. 2016: Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. Journal of cleaner production, 123.

Wamsler, C. Niven, L. Beery, T. H. Bramryd, T. Ekelund, N. Jönsson, K. I. ... and Stålhammar, S. 2016: Operationalizing ecosystem-based adaptation: harnessing ecosystem services to buffer communities against climate change. Ecology and Society, 21(1).

Westerlund, M. and Leminen, S. 2011: Managing the challenges of becoming an open innovation company: experiences from Living Labs. Technology Innovation Management Review, 1(1).

Zupančič, J. and Pipan, P. 2018: Slovensko morje in obala – Severni Jadran v geopolitični perspektivi ter problemi razmejevanja med Italijo, Slovenijo in Hrvaško. Geografija stika Slovenske Istre in Tržaškega zaliva. Filozofska fakulteta, Oddelek za geografijo.

CHALLENGES FOR PLANNING CLIMATE CHANGE RESILIENCE THROUGH THE CO-CREATION LIVING LAB APPROACH IN THE MEDITERRANEAN COASTAL TOWN OF PIRAN

Summary

Coastal urban living environments are threatened by extreme weather events like storm surges leading to coastal flooding and coastal erosion, and typical climate change hazards like sea-level rise and droughts and heatwaves of which speed, frequency and intensity are generally increasing. Hence, climate change resilience for urban coastal communities is a pressing matter and adapting to such changes and creating climate change resilience should be an all-stakeholder process.

This paper discusses the early stages of stakeholder participation for addressing climate change hazards in the Mediterranean coastal town of Piran. Here the initialized living lab proposes a co-creation stakeholder platform where representatives of the quadruple helix including citizens, through a co-creation approach, address the local issues of climate action and adaptation. Discussion will democratically evaluate the options and possible urban sites to introduce ecosystem-based approaches that can contribute to build resilience and contribute to increased quality of citizen's life. Ecosystem-based approaches in urban environments are nature-based solutions that reflect natural ecosystems and their processes, and by introduction in an urban environment might be capable of e.g., reducing heat stress and changing the urban water cycle, hence contributing to climate change adaptation. Ecosystem-based approaches can comprise: open green areas like (pocket) parks, green roofs and green walls, green corridors, planting of trees, bioswales, water parks, etc. Preferably also trying to connect such sites by introduction of designated urban walking or cycling trails.

The urban background of Piran is a history-generated population of mixed cultural backgrounds, while the infrastructural setting of the town's centre (buildings, street pavements, etc.) at the peninsula is protected by cultural heritage legislation. Both these are crucial factors influencing the process of stakeholder engagement and revealed several challenges identified as: 1) limiting organisational challenges, as well as 2) more specific challenges.

The most obvious organisational limitation was how to motivate stakeholders: What are their perceptions on climate action? What is their knowledge on ecosystem-based approaches? What would they recommend to implement? Another challenge was how to devote stakeholder time to project activities, including education regarding climate change and face-to-face interviews. Along this came the challenge to find a dedicated spokesperson within each professional organisation, simultaneously willing to reach out within the organisation for more specific information and/or expertise. It needs to be mentioned that capitalizing on stakeholder-identified specific challenges turned out to be the best motivator. Especially, since the specific challenges represent pressing issues. For example, various stakeholders mentioned the water-scarcity during summer and addressed how to retrieve and revalorize the historical water management system of the town (as part of the cultural heritage usage). Also, various stakeholders – both volunteer and professionals - addressed the existing early-warning system and how to improve and enhance it. While another challenge will be to find the right balance (and locations) between reducing the effect of urban heat

island in the summer and flood risks in the autumn/winter through the implementation of ecosystem-based approaches. A specific challenge of critical importance turns out how to empower and educate - through climate action - the town's polarized community that is facing population decline through tourism gentrification.

Previously it was reported that defining a shared vision is necessary for a successful coastal city living lab (CCLL). The SCORE project now initialized such approach in the CCLL Piran. Parallel however, we emphasize that the implementation of multiple focus groups, addressing the specific challenges identified through interviews and continuous and repeated personal interaction with stakeholders, while facilitating multidisciplinary activities based on stakeholder's prior knowledge and experience, are best practices in the co-creation of the urban living lab.