Fostering Climate Action and Resilience: Engaging the Local Community in a Living Lab

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This chapter examines the role of climate change communication within the framework of the Coastal City Living Lab, focusing on the Slovenian coastal town of Piran as a pilot area under the Horizon 2020 SCORE project. The study emphasizes the significance of community engagement and participatory governance in enhancing climate resilience in coastal urban areas vulnerable to sea-level rise, storm surges, and heatwaves. Through the Living Lab methodology, local stakeholders co-create adaptive solutions while communication strategies bridge scientific knowledge with public understanding. Key activities include knowledge transfer, capacity building, and consensus-building efforts designed to address climate risks specific to Piran. This chapter highlights the importance of communication in fostering stakeholder collaboration and sustaining climate resilience initiatives beyond project lifecycles, underscoring the critical need for locally grounded, inclusive adaptation measures in the face of escalating climate challenges.

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SPODBUJANJE PODNEBNIH UKREPOV IN ODPORNOSTI: VKLJUČEVANJE LOKALNE SKUPNOSTI V ŽIVI LABORATORIJ

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Ključne besede:
podnebna komunikacija, podnebne spremembe, podnebna odpornost, trajnostni urbani razvoj, obalna mesta

To poglavje preučuje vlogo okoljske komunikacije v okviru pristopa živega laboratorija, s poudarkom na slovenskem obalnem mestu Piran kot pilotnem območju v okviru projekta SCORE (Obzorje 2020). Študija poudarja pomen vključevanja skupnosti in participativnega upravljanja za krepitev podnebne odpornosti v obalnih urbanih območjih, ki so izpostavljena dvigu morske gladine, neurjem in vročinskim valom. S pomočjo metodologije živega laboratorija deležniki sooblikujejo prilagoditvene rešitve, medtem ko komunikacijske strategije premoščajo vrzel med znanstvenim znanjem in javnim razumevanjem. Ključne dejavnosti vključujejo prenos znanja, krepitev zmogljivosti in prizadevanja za dosego soglasja, ki so zasnovana za obravnavo podnebnih tveganj, značilnih za Piran. To poglavje poudarja pomen komunikacije pri spodbujanju sodelovanja deležnikov in vzdrževanju pobud za podnebno odpornost tudi po zaključku projektnih aktivnosti, kar poudarja ključno potrebo po lokalno utemeljenih in vključujočih prilagoditvenih ukrepih v luči vse večjih podnebnih izzivov.

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1 Introduction: Climate Communication in Practice

The rapid urbanization of global populations has brought significant climate-related challenges to urban areas, including flooding, droughts, and disruptions to public health and food security (Marschütz et al., 2020; Mehryar et al., 2022; Tyler et al., 2016; World Bank, 2023). To address these challenges, the concept of resilience has gained prominence in urban climate adaptation discourse, focusing on enhancing the capacity of urban areas to absorb and recover from climate impacts (Leichenko, 2011; Mushir, 2019; Wang, 2022). Coastal urban areas, in particular, are at heightened risk due to their geographic exposure, emphasizing the need for robust disaster preparedness and adaptive urban planning (Nicholls & Cazenave, 2010; Hallegatte et al., 2013; Kumer et al., 2022; Kralj et al., 2023).

Building resilience in urban environments requires effective community engagement and communication strategies that bridge the gap between scientific knowledge and public understanding (Moser & Dilling, 2007; Wolff et al., 2021; Kralj, 2024). This need is especially evident in climate risk communication, where local perceptions and cultural contexts shape the reception and propagation of information (Kahan et al., 2011). Moreover, the urgency of climate risks is often heightened by extreme weather events that are both personally experienced and widely covered by the media. These high-impact events serve to increase the public's perception of vulnerability and the need for adaptive measures, ultimately motivating community action and policy responses (Lorenzoni & Hulme, 2009; Moser, 2010). Effective communication not only raises awareness but also facilitates collective action by demystifying scientific concepts and contextualizing climate risks for diverse communities (Karacaoğlu & Akbaba, 2024).

Climate communication is a relatively new sub-field within communication studies. In the context of this study, it did not emerge primarily from theoretical frameworks, such as conceptual frameworks and their linguistic realization, but rather from a practical need to communicate climate issues more effectively (Moser, 2010). As such, climate communication in this study can be primarily understood as a set of purposeful activities. As such, climate communication is part of environmental communication, focusing on two key aspects: adapting to the target audience and encouraging co-creation and engagement (CRED, 2009).

Living labs have emerged as innovative platforms for co-creating sustainable solutions through community-driven experimentation and stakeholder collaboration (Voytenko et al., 2016; Kumer et al., 2022). These open-innovation systems support real-world testing and iterative development of climate adaptation strategies, emphasizing local knowledge and participatory governance. Within this framework, communication plays a crucial role in aligning stakeholders, building trust, and ensuring the effective dissemination of climate resilience strategies (Chafiq, 2018).

This chapter aims to explore the role of climate communication within the living lab setting, particularly focusing on coastal urban areas vulnerable to climate change and demonstrates the living lab case study of Piran in Slovenia as implemented through the SCORE project (SCORE, 2025b). It discusses how effective communication strategies can enhance community engagement, support adaptive governance, and promote resilience through participatory co-creation processes.

1.1 Description of the pilot area

Our pilot area is the Slovenian coastal town of Piran. With its rich cultural heritage and pronounced vulnerability to climate change impacts - such as intensifying coastal flooding, longer droughts and heat waves, more frequent storm surges, and sea-level rise (Machado de Almedia, 2023; Kolega, 2006; Brečko Grubar et al., 2019; Poklar & Brečko Grubar, 2023) it serves as a compelling case study. Its geographical position, socio-political dynamics, and existing environmental challenges (Kumer et al., 2023) made it a suitable setting for the implementation of a living lab approach under the SCORE project. The town's relatively small size also allowed for a close-knit engagement process, fostering meaningful interaction with local stakeholders.

The town of Piran is already experiencing several accompanying problems related to climate change, with the most prominent being more frequent flooding events in winter and increased heatwaves and water shortages in summer. The former issue highlights the need to enhance the early warning system (Kralj et al., 2023), while the latter calls for strategies to mitigate the urban heat island effect. However, the community's awareness of climate risks tends to spike only during or immediately after these events, leading to a temporary increase in climate action. For instance, during the summer 2022 water scarcity, the local community became acutely aware of the water shortage and exhibited heightened sensitivity toward water use,

particularly when it involved non-essential activities such as filling private pools (Kumer et al., 2022).

Informing, motivating, and engaging the local community proved to be a major issue in Piran due to their absenteeism and the problems related to tourism gentrification (Kumer et al., 2023).

Efforts to empower and educate the local community have faced significant organizational challenges, including difficulties in incentivizing stakeholder participation, allocating sufficient manpower, appointing contact persons within large organizations, and maintaining consistent face-to-face interactions.

Figure 1: Piran's old town is mostly situated on a low-lying peninsula, making it vulnerable to sea-level rise and storm surges. The northern hilly areas in the picture on the right are prone to flooding during intense rainfall due to impermeable surfaces. Its scenic setting has led to increased tourism and a decline in the local population. These combined factors reduce Piran's resilience to climate change impacts.
Source: Jasna Kumer, 2023

1.2 Activities to address climate resilience of the coastal urban community

This chapter focuses on activities that were mainly implemented through the research project entitled Smart Control of the Climate Resilience in European Coastal Cities (SCORE, 2025b). This Horizon 2020 project lasted from 2021 to 2025 and focused on enhancing the climate resilience of European coastal cities. It aimed to tackle challenges, intensified by climate change, such as extreme weather events, coastal erosion, and sea-level rise. The project's goal was to assist coastal cities in becoming more resilient to the challenges brought by climate change.

The Intergovernmental Panel on Climate Change (IPCC) defines climate resilience as "the capacity of social, economic and environmental systems to cope with a hazardous event, trend or disturbance, responding or re-organizing in ways that maintain systems' essential function, identity, and structure while also maintaining the capacity for adaptation, learning and transformation" (IPCC, 2014). As the coastal urban areas are some of the most economically, historically, and culturally important demographic centers facing many challenges, it makes sense to pay attention to them and improve their climate resilience to help them maintain their many roles. SCORE aims to achieve that by, among other things, fostering social innovation.

Climate resilience can be built in six steps: namely (1) awareness-raising and advocacy, (2) climate risk assessments, (3) implementation of appropriate actions and interventions, (4) mobilization of resources, (5) monitoring and tracking of progress, and (6) knowledge sharing (UNFCCC, 2020).

SCORE took part in all of these, and climate communication played a crucial role in many of these. Communication itself was one of the cornerstones of the project (Hawke et al., 2025), as all the collaborating pilot areas were working on improving their own climate resilience while actively sharing their experiences and newly acquired knowledge with others, consequently expediting the resilience-building process.

2 Living lab approach: co-creation, stakeholder engagement and climate communication

SCORE brings together 10 coastal urban areas across Europe, creating a platform for knowledge exchange, peer learning, and collaborative innovation. This collaboration enables the sharing of best practices, comparative analysis, and the co-development of tools and methods tailored to specific urban and environmental contexts. Each city implements its own coastal city living lab, (CCLL) while contributing to the overall objectives of the project.

The Living Lab approach (see Hossain et al., 2019 for the review of Living Lab literature) is a user-centered, open innovation system that integrates research and innovation processes through co-creation in real-life settings. It is designed to bring together various stakeholders, including citizens, researchers, businesses, and public authorities, to collaboratively develop, test, and refine solutions in practical, everyday environments. This approach emphasizes multidisciplinary collaboration, where participants from different fields work together to address complex societal challenges. Through co-creation, end-users are actively involved not just as testers but as contributors throughout the innovation process, ensuring that the solutions developed are relevant and impactful. Participatory methods, such as design thinking, are often employed to facilitate stakeholder engagement and to capture valuable feedback. The real-life context of Living Labs allows innovations to be tested and adapted in actual environments, which increases their applicability and effectiveness. This method is particularly effective in fields like urban development, healthcare, and sustainability, where stakeholder participation and real-world experimentation are crucial for success.

The SCORE project is structured around environmental justice. Inclusivity was outlined as a general engagement strategy, aligned with the Living Lab methodology, which fosters citizen science (Hawke et al., 2025). This approach ensures that various stakeholders are not only involved, but also their capabilities, needs, and aspirations are integrated into the project design and implementation. Involving different groups in the decision-making process and citizen science activities is a step towards achieving environmental justice, as it reduces disparities in access to information collection and decision-making power regarding climate resilience.

2.1 Establishing the Piran Living Lab

The establishment of the Piran CCLL began with strategic stakeholder mapping. , As a primary partner, the municipality of Piran facilitated the initial identification of key stakeholders alongside the Science and Research Centre (ZRS) Koper. The first major event was a three-day workshop held in Hotel Tartini in April 2022, where baseline data on climate change hazards and local geographical, social, and historical contexts were presented (Kumer et al., 2022). This event marked the beginning of active stakeholder involvement, with the participants representing local authorities, educational institutions, civil society groups, and local businesses.

A snowball sampling technique (Goodman, 1961) was employed to further expand the network of stakeholders, where each identified participant was asked to suggest new contacts from their professional and personal networks. This method allowed the living lab to gradually grow its community of engaged members, making the network more resilient and diverse, as well as allowing us to identify individuals that would otherwise have gone unnoticed due to low visibility in institutional channels and the informal, often volunteer-based nature of their work. The primary target audience included entities influencing the spatial development of Piran, with an initial focus on institutional partners before extending the engagement to the local community.

Continued personal face-to-face meetings followed the initial workshop to build trust, explain the objectives of SCORE, and clarify the roles of different stakeholders. While there was some initial hesitation from semi-public sector organizations, civil groups were notably enthusiastic and quick to engage. In contrast, the private sector mainly expressed interest in relation to business opportunities. Over time, the living lab successfully established a nucleus of core participants from the quadruple helix, setting the foundation for co-creation activities aimed at enhancing climate resilience in Piran.

2.2 Climate Communication in the Living Lab

Communication plays a key role in any living lab, as it allows for successful cooperation and eventual co-creation. Since SCORE deals with adaptation to climate change and climate resilience, it is inherently rooted in climate communication

(Moser, 2010). SCORE represents ongoing communication - from stakeholder identification and activation to partnership establishment and post-project continuation of activities. This continuous engagement is crucial for maintaining momentum and fostering collaboration among diverse stakeholders. Communication is not only central to these processes but also underpins the selection of hazards, the identification of Ecosystem-based Adaptations (EbA) and Nature-based Solutions (NbS), and all other key activities.

The project also expanded into less traditionally climate-focused topics, such as cultural heritage preservation, as part of broader resilience-building strategies. By tailoring communication methods to different target groups, the project ensured higher engagement levels and a more effective co-creation process.

In this study, we engaged stakeholders in Piran who represent the quadruple helix model (Figure 1): government, social organizations & citizens, research & education, and business. While all of them participated in at least one project activity, not all remained involved throughout the entire project duration.

Decision-makers (Government) aim to represent a broad spectrum of interests and typically adopt positions that seek to reconcile differing stakeholder demands. They want to avoid political conflict by supporting solutions that appeal to the broadest public segment. They are often constrained by political cycles.

Citizens (Social organizations & Citizens) of Piran primarily focus on preserving Piran's cultural heritage. They generally support solutions that maintain local aesthetics and do not significantly disrupt everyday routines. Their motivation is to protect familiar spaces, maintain quality of life, and ensure that adaptation does not compromise Piran's identity. Included here is general population who do not necessarily come from the local area.

Academia (Research & Education) operates independently of local political or business pressures and tends to support science-based, innovative approaches. Their motivation is to generate and apply knowledge, promote education, and contribute to evidence-based policymaking. Included here are teachers and students.

Experts are considered separately from academia due to their specialized knowledge (e.g., in cultural heritage protection or civil protection services) and play a key role in informing practical solutions. They act as intermediaries between science, policy, and practice.

Businesses prioritize maintaining their economic activities and are generally resistant to interventions that may impose restrictions or negatively impact their operations. They oppose interventions that could limit operations or increase costs (e.g., building restrictions, water use limitations). Their engagement in constellation like a living lab is often conditional – linked to clear economic incentives or reputational benefits.

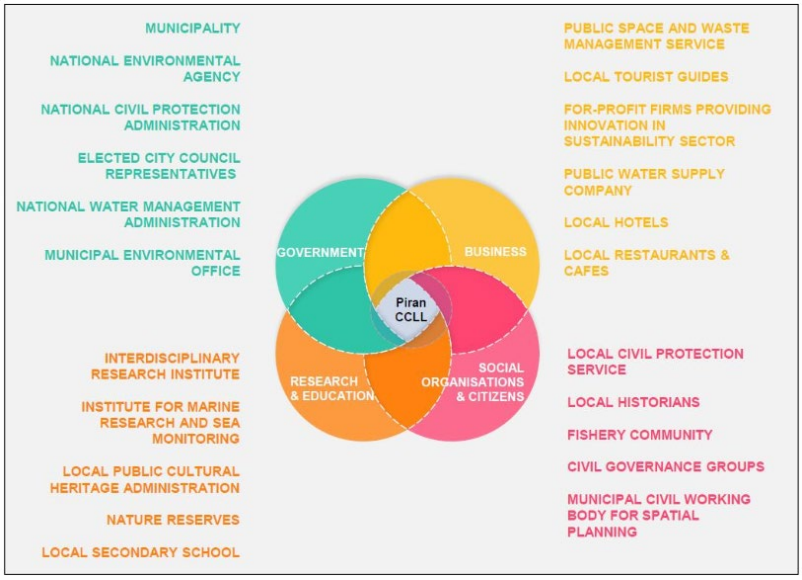

Figure 2: The distribution of Piran CCLL quadruple helix stakeholders
Source: Kumer et al., 2022

Effective climate communication in the Piran CCLL served multiple goals:

– Knowledge transfer: Peer-to-peer sharing of experiences and acquired practical knowledge on climate change.

- Education: informing the general public and active stakeholders through events in various settings focused on climate change and climate resilience.

- Consensus building: mediating the process of recognizing the local context of climate change.

- Capacity building: Improving capabilities to adapt to climate change and facilitating knowledge exchange between the stakeholders. Communication should be tailored to target groups.

- Dissemination: Sharing the project results with the public, intended to spark interest and/or involvement.

- Awareness-raising: attracting stakeholders with no previous interest in the topics of climate change, climate resilience, or adaptation.

- Networking: approaching peers for potential collaboration and establishing future knowledge transfer channels.

- Research: collecting data for further analysis (understanding the local actors and the study area).

All these goals were achieved through the use of various communication tactics. The first stage involved roles reversal – interviews with citizens, trying to understand their perception of climate hazards, based on their professional expertise and lived experience. The second stage involved one-way, educational approach in which citizens were informed on all the (other) climate threats and NbS/EbA solutions that could be used in improving the climate resilience of the town.

3 Communication Activities

While some activities are more oriented toward promoting the project itself and its main topics than others, all of them can be considered promotional events even though they have not been specifically described as such. To achieve these goals, we implemented several communication activities as presented in Table 1.

The direction of communication played an important part in choosing the activities as a part of our efforts within the living lab. The linear transmission models (Lasswell, 1948; Shannon & Weaver, 1949) define communication as a one-way process. This model is useful when the goal of communication process is dissemination of information to a broad audience such as general public. Because this model does not involve a feedback loop between the participating parties that would enable the sender to learn from the receiver and, if needed, adjust the language or further explain any less well-understood concepts, it is necessary to combine such activities with those that employ two-way models of communication. Such models allow for interaction between the sender and the receiver as both parties are taking turns, switching from one role to the other (Schram, 1954). Choosing one over the other depends on the goals of the activity, as well as the available time, technical capabilities, and available personnel.

SCORE developed a complete climate communication strategy that was essential to incorporate the principles of effective communication of climate related topics with most of the project's activities (Hawke et al., 2025). ZRS Koper's role in the listed activities within the SCORE living lab was of a modulating role, either that of the organizer or when non-SCORE activities were organized by another party (e.g., by Piran organizations), that of the participant.

The duration of the communication activities is important, and matters greatly, because certain stakeholders might be limited in how much time they can dedicate during the workday or in the case of the citizens, how much free time they have. It is also important to keep the activities as short as possible, to avoid discouraging the stakeholders attending. While the discussion part of any such activity must be included, it can sometimes extend far beyond the allocated time frame.

Activities must always be planned for the correct number of stakeholders attending. While some events are possible to plan with large crowds of people, some cannot function with too many or too few attendees. When organizing the more engaging kind of events, invitees should be asked to confirm their attendance prior to the event to allow for minor changes to the program and the specific sub-activities. When planning activities with students it is important to keep the groups large enough to encourage discussion and teamwork, but at the same time small enough to prevent disorganization. The optimal number of attendees for such activities is

just the suggested number of total participants, meaning that students could also be split into smaller groups to ensure smooth execution of the activities.

While certain activities are labelled as 'internal' since they were organized with existing CCLL members in mind, they must always remain open to prospective new members.

Geographic scale matters in terms of content of the communication activity. It also affects the pool of potential target groups.

Target groups are drastically different from each other, which must be kept in mind from the start of planning the activity, especially because certain types of communication activities or formats might not only be less appropriate for some target groups, but they might also turn them off.

Value of "Not relevant" for the fields of 'Optimal number of participants', 'Duration', 'Geographic scale' and 'Target group' was put where events are organized by a different organizer (e.g., conferences, summer schools), where online events are utilized and the optimal crowd size cannot be determined, where duration depends solely on the organizer alone, where geographic scale of the event does not matter as the activity can be adapted according to the circumstances, or where the target groups are predetermined by the organizer.

3.1 One-way communication

As a participant, the team attended several scientific conferences, radio talks and interviews, made several TV appearances, and wrote short articles for various printed and online newspapers.

While scientific conferences are primarily aimed at other researchers, the presented results and papers were later used in other dissemination activities and served as a reference for CCLL stakeholders.

Public appearances on the radio and TV targeted the general population and served as a far-reaching way of publicizing the project.

Articles in newspapers were utilized as a way of disseminating the project results, as well as spreading the news about project activities. These were also a way of promoting citizen science activities and future events.

As an organizer, the ZRS Koper team has executed various activities.

A topic relevant survey was targeting pedagogy students and aimed to promote the importance of climate literacy to future educators as a way of impacting the thinking of the younger generations, making them more likely to think critically about the importance of climate resilience.

Fieldwork activities were primarily targeted at students, who were simultaneously learning about their hometown and engaging with the topic of climate resilience.

Figure 3: Students during the field work activity on the topic of renovation and restoration of green areas as a way of tackling climate change in Piran.
Source: Piran Geostory, 2025

The ICT workshop was similarly targeted at students but was intended as more of a discussion-based game about possible solutions to the consequences of climate change based on the needs of different groups of local stakeholders.

Figure 4: Students during the ICT workshop on the topic of NbS for climate resilience building based on needs of different stakeholders in Piran.
Source: Cécil Meulenberg, 2025

The citizen science activity was aimed at the public and was designed to be as simple as possible with the aim to allow participation of as many individuals as possible. To that extent, a web application was used to report locations of uncatalogued rainwater cisterns in Piran (SCORE, 2025a).

Online lectures were once again designed to appeal to the public to promote the project and to educate the public about climate change and climate resilience. These lectures were executed through online channels with the intention to reach interested individuals from near and far.

In-person lectures took place before various workshops with the students from a local high school. They were designed to introduce theoretical background to NbS, EbA, climate change, climate resilience, and adaptation.

The online blog was a way of documenting project outcomes, scientific papers, media appearances and similar activities. Doing so allowed for easier dissemination and informing CCLL stakeholders.

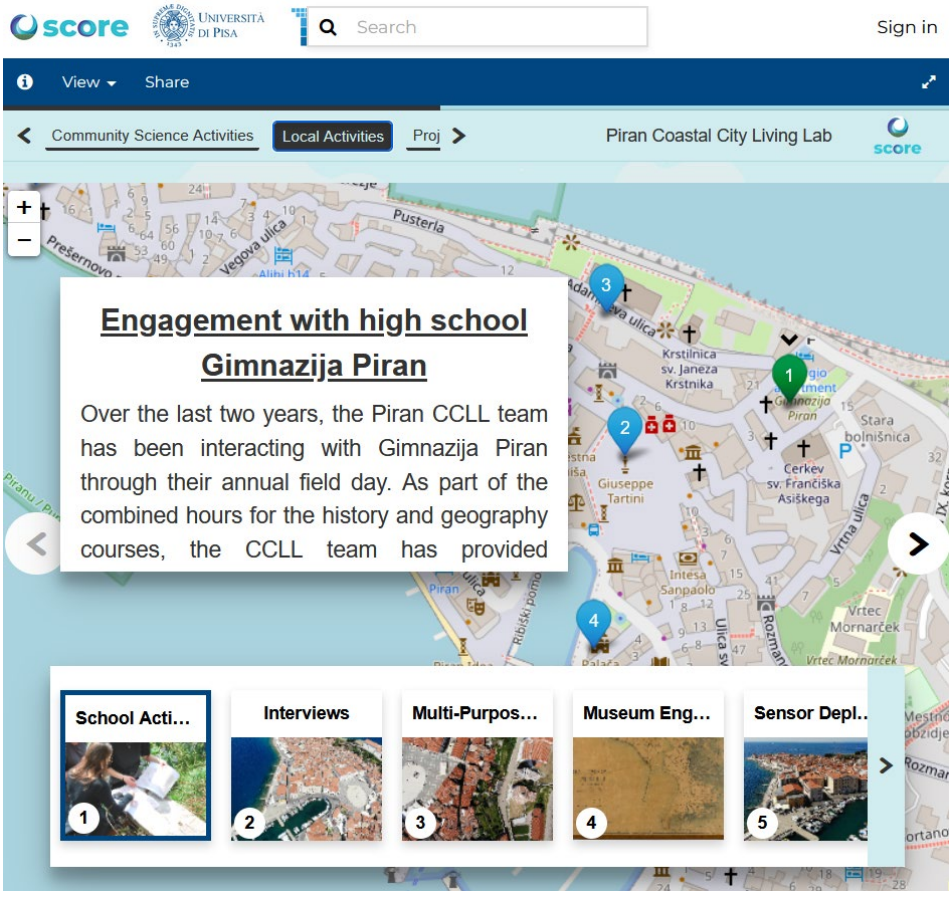

Figure 5: Short blog post about field work with high school students from Piran illustrating one-way communication events as executed for SCORE Piran CCLL.
Source: Piran Geostory, 2025

Public events in synergy with other environmentally oriented projects were mainly a way of promoting the project and its results, as well as educating the groups that are already interested in topics similar to those addressed by the project.. The main target group was the general public.

Higher education cooperation offered a chance to especially promote the scientific outcomes of the project.

3.2 Two-way communication

As a participant, the ZRS Koper team has attended several cross-fertilization events organized by different living labs in the region, a summer school, project board meetings, and several networking events.

Cross-fertilization events of different living labs were an opportunity for knowledge transfer with researchers working on similar topics with goals similar to those of Piran CCLL.

The summer school offered a chance for knowledge transfer with young researchers working on living lab projects around the world.

Project CCLL board meetings were designed to foster creative problem solving with partners facing similar challenges in their own living labs.

Networking events allowed for establishing professional links with researchers from the region, interested in implementing their own living labs, as well as businesses interested in developing or improving their products aimed at enhancing climate resilience, establishing ecosystem protection, and improving cultural heritage protection.

As an organizer, the following activities were carried out: interviews, group meetings, social media chat group, focus group, classroom workshops, synergy events, CCLL workshops, climate walk, social media news sharing, and community activation meetings.

Interviews were primarily a research activity, done in the early stages of living lab building. They helped establish which individuals and which organizations would benefit from being included in the living lab, as well as contribute to it in a meaningful way.

Group meetings were a way of establishing the roadmap of the living lab and determining the actions that needed to be taken. At the same time, they served as a way of building both consensus among the stakeholders and capacity to act accordingly.

The social media chat group served as a direct channel for informing living lab stakeholders. Other than that, it was up to members to start discussions on various climate-resilience related topics.

The focus group was conducted as a part of a whole-day event organized for the stakeholders. While it did function as a way of collecting scientific data, it also worked as a way of consensus-building since it started an in-depth discussion among the participating stakeholders with opposing views.

Classroom workshops were aimed at students and served as a way of educating through doing. Since the students were asked to produce their own climate adaptation scenarios for urban areas of their choosing, this activity allowed for a discussion on what can be changed in those environments as well as how we should go about changing them.

Synergy events were different from those mentioned previously. These were mainly organized for students and researchers working on similar climate-focused projects, either in their methods, goals, or simply the topic.

CCLL workshops took place during full-day events with living lab stakeholders. Like the focus group, these activities sparked debates about important topics around climate adaptation in Piran.

Climate walks were organized several times to make discussions on climate adaptation more versatile. They also worked as a way of creating a more open and informal environment for discussion, allowing for more creative thinking and freer expression, especially from stakeholders representing organizations.

Figure 6: Stakeholders during one of the workshops, organized with the aim of consensus building and capacity building in the Piran CCLL.
Source: Cécil Meulenberg, 2025

Figure 7: Participants during one of the climate walks. The informal outdoor setting supported open dialogue and allowed for a discussion of potential approaches to tackling climate change in Piran, in this case synergy with NATURGO project.
Source: Jerneja Penca, 2025

Figure 8: Examination of one of many hidden wells in Piran. The informal atmosphere during one of the climate walks convinced one of the attending locals to invite the group to her private patio with historical well.
Source: Marinka Šega, 2025

Social media news sharing consisted of short posts on various social media channels. These mainly served as a secondary outlet, sharing links to online events and blog posts. They also served as a way of letting the public comment on previous and future activities.

Community activation meetings were held with the explicit intent of forming an informal working group that will continue certain parts of the SCORE project after its end. A series of such events led to the formation of a group ViTA (Valorization and innovation of traditional architecture and landscape in Piran), which consists of most of the stakeholders of the established living lab whose main goal is to find solutions for preservation of historical wells and cisterns.

Figure 9: Many workshops with local stakeholders and project partners were combined with field trips, allowing for informal time during which stakeholders could connect on a personal level further increasing their ability to cooperate in the CCLL setting.
Source: Peter Kumer, 2023

Table 1: Catalogue of communication activities as part of co-creation approach in the Piran coastal city living lab

Activity	Description	Direction of communication	Project role	Duration	Optimal number of participants	Goals	Living lab activity	Geographic scale	Target group
Cross-fertilization of different living labs	CCLL Piran cooperating with other living labs. Presenting the project results, engaging in discussion on relevant topics, connecting with other researchers from the field of climate adaptation and resilience.	Two-way	Participant	Half-day event	Not relevant	Knowledge transfer Dissemination Networking	External	Regional	Not relevant
Scientific conferences	Presenting the project results, engaging in discussion on relevant topics.	One-way	Participant	Full-day event	Not relevant	Dissemination Networking	External	(inter)national	Academia Experts
Summer school	Presenting the project results, engaging in discussion on relevant topics, knowledge transfer.	Two-way	Participant	Full-day event	Not relevant	Dissemination Knowledge transfer Networking	External	International	Academia
Project board meetings	Knowledge transfer, learning from experiences of SCORE project CCLLs.	Two-way	Participant	Up to 2 hours	Not relevant	Dissemination Knowledge transfer	External	International	Academia Experts
Interviews	Initial meetings with individuals and representatives of organizations, deemed important to then newly formed living lab.	Two-way	Organizer	Up to 2 hours	Individual	Research	Internal	Local	Experts Citizens Businesses Decision-makers
Group meetings	Repeat meetings with existing stakeholders to update, explain, discuss, and further determine each stakeholder's expertise and role in the living lab.	Two-way	Organizer	Up to 2 hours	Small group (up to 5) or medium-sized group (6-15)		Internal	Local	Experts Citizens Businesses Decision-makers
Social media chat group	Creation of a social media chat group, allowing for a more direct information channel. Besides sharing the project news with the members, the group was left to function on its own.	Two-way	Organizer	Not relevant	Large group (16+)	Consensus building Capacity building	Internal	Local	Citizens
Networking events	Events intended to provide a chance to pitch project ideas or offer expertise in certain fields to interested businesses and organizations.	Two-way	Participant	Full day event	Not relevant	Dissemination Networking	External	International	Experts Academia Businesses
Focus group	Discussion on various climate-related topics with local stakeholders.	Two-way	Organizer	Half-day event	Medium-sized group (6-15) or large group (16+)	Research Consensus building	Internal	Local	Experts Citizens Businesses Decision-makers
Topic relevant survey	Primarily a research tool that intended to present climate literacy as an important aspect for educators.	One-way	Organizer	Short format	Individual	Research Education	External	Regional	Students
Classroom workshops	Combination of short lectures and different group work activities.	Two-way	Organizer	Up to 2 hours	Small group (up to 5) or medium-sized group (6-15)	Education Dissemination	External	Not relevant	Students
Field work	Various outside activities to familiarize students with the locations in the local environment where climate hazards and adaptation measures are leaving a mark.	One-way	Organizer	Up to 2 hours	Small group (up to 5) or medium-sized group (6-15)	Education	External	Not relevant	Students
ICT workshops	Geodesign game during which students had to think about priorities of different local stakeholders and propose location-appropriate solutions to tackle climate change.	One-way	Organizer	Up to 2 hours	Medium-sized group (6-15)	Education	External	Not relevant	Students
Synergy events	Hosting students, teachers and researchers from abroad.	Two-way	Organizer	Half-day event	Medium-sized group (6-15)	Dissemination Education Networking	External	Not relevant	Students Teachers Academia
CCLL workshops	Different workshops aimed at reaching a democratic consensus on the priorities for the inclusion of NBS to tackle climate change.	Two-way	Organizer	Half-day event	Medium-sized group (6-15) or large group (16+)	Education Consensus building Capacity building	Internal	Local	Experts Citizens Businesses Decision-makers
Citizen science	An online application to geolocate various existing NbS elements.	One-way	Organizer	Short format	Individual	Research Capacity building	Internal	Local	General public
Online lectures	Online events aimed at informing the public of the project's topics and results, as well as platforming businesses and researchers, active in the region.	One-way	Organizer	Up to 2 hours	Not relevant	Education Dissemination	Internal and external	Not relevant	General public

Activity	Description	Direction of communication	Project role	Duration	Optimal number of participants	Goals	Living lab activity	Geographic scale	Target group
In-person lectures	Introduction to a workshop with students.	One-way	Organizer	Up to 2 hours	Not relevant	Education Dissemination	Internal and external	Not relevant	Students
Radio talks and interviews	Informing the public about pressing climate-related issues of the coastal towns and possible solutions, as well as promoting the project.	Mostly one-way	Participant	Short format	Not relevant	Education Dissemination	External	Regional and national	General population
TV appearances	Informing the public about pressing climate-related issues at the coast and possible solutions, as well as promoting the project.	Mostly one-way	Participant	Short format	Not relevant	Education Dissemination	External	Regional and national	General population
Climate walk	Guided field trip through town highlighting climate threats, impacts, potential solutions.	Two-way	Organizer	Up to 2 hours	Medium-sized group (6-15) or large group (16+)	Education Dissemination	Internal and external	Not relevant	General population Students Experts Academia
Online blog	Periodically updated website, made to showcase the results of the project with embedded videos of online lectures, links to scientific publications, and reports of previous in-person events.	One-way	Organizer	Not relevant	Not relevant	Education Dissemination	Internal and external	Not relevant	General population
Social media news sharing	Posting short news on various social media channels and institute's website.	Two-way	Organizer	Short format	Not relevant	Education Dissemination	Internal and external	Not relevant	General population Experts Academia
Public events in synergy with other environmentally oriented projects	Executing parts of the program set by other projects, such as lectures and field trips.	One-way	Organizer	Up to 2 hours or half-day event	Not relevant	Education Dissemination	External	Local and regional	General public
Higher education cooperation	Preparing lectures for a summer school and master's program on blue economy.	One-way	Organizer	Up to 2 hours or half-day event	Not relevant	Education Dissemination	External	(inter)national	Students Academia
Community activation meetings	Forming of an informal working group that will continue certain parts of SCORE project after its end.	Two-way	Organizer	Up to 2 hours	Medium-sized group (6-15) or large group (16+)	Capacity building Consensus building	Internal	Local	Experts Citizens Businesses Decision-makers
Short newspapers articles	Informing the public about the project activities and mobilizing for citizen science activity.	One-way	Organizer	Short form	Not relevant	Education Dissemination	External	Local, regional and national	General population

4 Discussion: Lessons Learned, Challenges and Solutions

Communication is a cornerstone of successful living labs, enabling effective cooperation, stakeholder engagement, co-creation and ultimately climate action. One-way communication such as traditional media (radio, TV, and newspapers, both printed and digital), was utilized as passive modes of communication. Social media and online platforms, like blogs, a Minecraft server and websites, served as digital touchpoints but lacked interactive facilitation, limiting deeper stakeholder involvement. Two-way communication (Co-creation events, workshops, and local community meetings) was significantly more impactful. Initiatives like climate walks and place-based activities (landscape students visiting Piran's agricultural terraces, highschoolers searching for climate-related elements in the town's center, guided walks for students from abroad enhanced understanding and commitment). Projects like geodesign, a gamified approach to landscape-changing decision-making, demonstrated the potential of interactive learning and co-creation in climate resilience.

The implementation of Piran living lab revealed key lessons about climate communication.

First, the concept of "mental distance" and resistance to acknowledging the consequences of climate change remain prevalent in Piran. Aside from visible sea floods, many of the impacts are not yet apparent in the mindset of the community, contributing to the perception that significant changes are unlikely to occur. Some community members still hold the belief that the effects of climate change would not drastically alter their everyday lives. Consequently, Piran experiences an almost complete lack of investments in climate resilience and natural disaster prevention.

One of the concerns that recently gained attention within the local community—primarily due to increased media attention about what SCORE was doing—is the gradual disappearance of Piran's historical water management systems, including water wells and cisterns. Since the introduction of the public water system, these traditional infrastructures have faced neglect, decay, and even demolition, leading to their abandonment over time.

The declining number of permanent residents, many of whom spend increasing amounts of time in Lucija—a part of the municipality offering better services, parking spaces, recreational opportunities, and green areas—has contributed to an "out of sight, out of mind" mentality regarding climate-related challenges in Piran.

In-person interactions proved significantly more effective than virtual meetings, fostering stronger relationships and clearer communication with stakeholders. Additionally, it became clear that scheduling meetings for working professionals during business hours is counterproductive unless they were officially representing their organizations, highlighting the need for flexibility.

Resilience can be a polarizing topic, especially in certain settings (role of tourism, presence of more pressing issues, preexisting conflicts among the stakeholders). This required careful handling to maintain cohesion. Establishing living labs during the election period was identified as problematic, as political instability and shifting priorities can disrupt stakeholder engagement and delay progress.

Understanding stakeholder motivations was crucial. Individuals with multiple affiliations—such as being both citizens and business owners—often have overlapping interests that can influence their engagement. Recognizing these complexities early on helps manage conflicts of interest effectively. Furthermore, transparency about project contributions is essential. Communicating what support citizens can expect, such as funding opportunities or resource assistance, fosters trust and long-term involvement. However, making promises that cannot be kept should be avoided, as project team changes are inevitable and can lead to setbacks if expectations are not managed realistically.

Identifying the right partners and stakeholders early was another key lesson. While participants may change over time, maintaining a stable core team is crucial for continuity and sustained progress.

Thoughtful stakeholder selection is vital to avoiding conflicts that could derail project goals. Some may have conflicting interests, while others might prioritize their own objectives causing problems for general objectives over shared ones, which can hinder collective progress. Engaging those aligned with the project's objectives helps maintain focus and momentum.

Finally, local context also matters deeply. Thorough planning before setting up a living lab is indispensable. A comprehensive understanding of the area's background and issues is critical. For example, in Piran, Italian speakers were less inclined to join the living lab, due to lack of Italian language proficiency within the team setting the living lab up.

Our experience underscores the critical role of thoughtful planning, transparent communication, and locally sensitive stakeholder engagement in the success of living labs for climate action. The sustainability of projects like SCORE depends on successful communication. One example of successful continuity of the living lab beyond the project duration is ViTA, which seeks to build on newly established connections among living lab stakeholders while drawing attention to the town's cultural heritage.

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