Reflection and Mutual Learning

Challenges and Experiences of Multi-/ Inter- and Trans-disciplinary Collaborations in Citizen Science Initiatives

The Step Change consortium presented and discussed the main lessons learned during the work on its "Citizen Science Initiatives" (CSIs) in relation to **multi-/ inter- and trans-disciplinary collaborations** during the activities of the project together with two external experts: Barbara Smetschka from the Institute of Social Ecology in Austria and Djoera Eerland from the "Buurkracht" in the Netherlands. The output paper was prepared by the Centre for Social Innovation team (ilse Marschalek, Elke Dall, Samire Gurgurovci) with inputs from all consortium partners. We present experiences, tried solutions, and results along with numerous significant lessons learned and linked broad challenges.

Preamble: Understanding Cross-Disciplinarity: Definitions and Distinctions

In this Mutual Learning Exercise (MLE), we define **cross-disciplinarity** as a concept that involves the integration and collaboration of **different academic or professional disciplines** to address complex problems, challenges, or questions that cannot be adequately understood or solved within the confines of a single field. It encourages the exchange of knowledge, methods, and insights from diverse fields to generate a more comprehensive and holistic understanding of multifaceted issues (Menken & Keestra, 2016; O'Rourke, 2014). Thus, examining these definitions and understanding them is crucial for distinguishing various research approaches, as highlighted by O'Rourke (2014).

Multidisciplinarity involves multiple disciplines or bodies of knowledge addressing a common issue. It primarily focuses on **coordinating information without integrating insights** from different disciplines. It compares results and draws conclusions from individual disciplines without full integration. Communication in multidisciplinary initiatives typically occurs in coordinating information rather than in collaboration (Menken & Keestra, 2016; O'Rourke, 2014).

Interdisciplinarity integrates knowledge, methods, and insights from multiple disciplines to tackle complex questions or issues. It can be carried out individually or collaboratively in teams, and successful collaboration depends on effective communication (Menken & Keestra, 2016; O'Rourke, 2014). Yet as O'Rourke (2014) pointed out, not all forms of collaborative research are interdisciplinary.

Transdisciplinarity goes beyond interdisciplinary collaboration by transcending disciplinary boundaries. It achieves this through comprehensive frameworks or problem-oriented research that spans academic disciplines and the public and private realms. It particularly emphasizes mutual learning, joint work, and knowledge integration to address real-world issues. Transdisciplinary research **involves collaboration with non-academic stakeholders, integrating external knowledge and stakeholder values** to determine research topics, methodologies, and interventions for addressing problems (Menken & Keestra, 2016; O'Rourke, 2014). Figure 1 below illustrates these distinct research approaches:
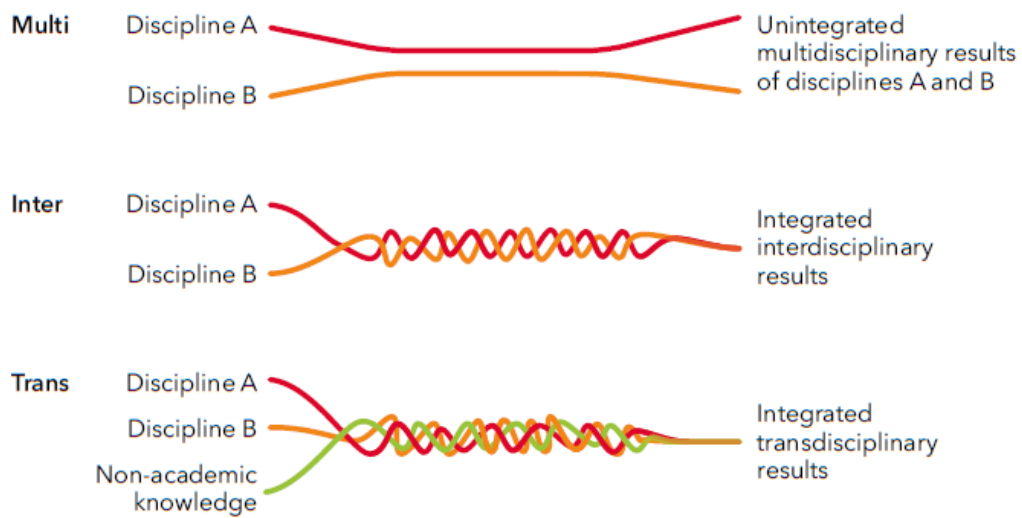
Figure 1: Multidisciplinarity, interdisciplinarity, and transdisciplinarity approaches (Menken & Keestra, 2016)

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1. Navigating Diversity

CSI experiences: Navigating diversity within a community of scientists, practitioners and citizen scientists has been an enriching experience within the Step Change project, especially considering the diverse academic disciplines involved in the project. However, at the same time challenges arise from the variety of terminologies used, reflecting the distinct educational levels and academic backgrounds of the participants. This diversity extends to the varying levels of expertise among citizen scientists, creating intricate group dynamics during collaborative projects.

One notable aspect of these experiences involves striking a delicate balance between different forms of knowledge, including tacit and explicit knowledge, within the group. The fusion of diverse educational backgrounds and expertise levels often leads to a nuanced interplay of different forms of knowledge. Navigating these knowledge differences requires a thoughtful approach to ensure that all perspectives are considered, and contributions from individuals with both tacit and explicit knowledge are valued.

In the process, managing knowledge differences emerges as a critical aspect of facilitating effective collaboration. Encouraging open communication and creating an inclusive environment where individuals feel comfortable sharing their insights has been essential. By acknowledging and leveraging the richness of diverse knowledge, these experiences highlight the potential for innovative solutions to emerge from the collaborative efforts of citizen scientists with varied educational levels and expertise.

Tested solutions: Targeted training sessions play a pivotal role in equipping participants with the necessary knowledge and skills, empowering them to contribute more meaningfully to projects. Simultaneously, the integration of interactive, anonymous tools provides a secure space for individuals to pose questions and share insights without fear of judgment, thereby enhancing participation and openness.

Establishing safe spaces for questions further encourages an environment of open dialogue and collaborative exchange. This approach not only facilitates the free flow of ideas but also nurtures a sense of community among citizen scientists. Beyond this, the integration of local knowledge into scientific research emerges as a crucial aspect. Actively incorporating community-specific insights enriches the understanding and context of research endeavors, resulting in more holistic and applicable outcomes.

Findings: It is essential to balance the integration of local knowledge with scientific rigor. This ensures that research outcomes maintain credibility and robustness, benefiting from the synergy of scientific methodologies and community insights. These applied solutions collectively

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contribute to a citizen scientist engagement model that is informed, inclusive, and effective. By combining targeted training, interactive tools, safe spaces for expression, and the integration of diverse knowledge sources, this approach not only empowers participants but also enhances the quality and relevance of scientific research outcomes.

<u>Key lessons learned:</u>

- **Tailored training empowers:** Offering focused and tailored training sessions empowers citizen scientists, enabling them to contribute more meaningfully to collaborative projects.

- **Interactive tools foster openness:** Implementation of interactive and anonymous tools creates safe spaces, fostering openness and encouraging participants to pose questions and share insights without apprehension.

- **Safe spaces nurture community:** Establishing safe spaces for questions not only encourages open dialogue but also nurtures a sense of community among citizen scientists, fostering a collaborative spirit.

- **Local knowledge enriches understanding:** Actively integrating local knowledge into scientific research enriches the overall understanding and context of projects, leading to more holistic and applicable outcomes.

- **Balancing local knowledge with scientific rigor**: Ensuring a balance between the integration of local knowledge and scientific rigor is crucial for maintaining credibility and robustness in research outcomes.

- **Inclusivity drives innovation:** Inclusive engagement models encompassing diverse training approaches, interactive tools, and safe spaces drive innovation and contribute to the quality and relevance of research endeavors.

- **Inclusivity drives collaboration:** Emphasizing the importance of each actor and approach, along with transparent communication, fosters a culture of appreciation and understanding within the citizen science community, driving collaborative efforts.

- **Continuous adaptation is key:** Recognizing the dynamic nature of citizen scientist engagement, a continuous adaptation of approaches is essential to meet evolving needs and foster a resilient and collaborative community.

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2. Conflicting Methodological Approaches

CSI experiences: Diverse disciplines often bring distinct perspectives and methodologies to the table, leading to differences in data collection, sources, and problems in data integration. These disparities extend to the very foundation of research, including varying understandings of how to elaborate on the research design itself.

The question of whether citizen scientist knowledge constitutes a valid source of information further adds a layer of complexity. The varied backgrounds and expertise levels among citizen scientists may influence the perceived validity of their contributions. Bridging these gaps and reconciling conflicting methodological approaches becomes imperative for fostering a collaborative and effective research environment.

Addressing these challenges requires not only an acknowledgment of the diversity present but also a commitment to finding common ground. Balancing the strengths of different disciplines, respecting varying perspectives on research design, and valuing citizen scientist knowledge as a legitimate source all contribute to a more inclusive and fruitful collaborative research process. As the field of citizen science evolves, navigating these methodological differences becomes an ongoing learning process, emphasizing the importance of flexibility, open communication, and a shared commitment to the advancement of knowledge.

Tested solutions: Emphasizing the importance of each contributor and their unique approach is fundamental in citizen science. This involves actively valuing the diverse methodologies brought by individuals from various disciplines and promoting a comprehensive and inclusive research environment. Transparent communication is key to conveying the significance of these diverse contributions to the general public and fostering awareness of the collaborative nature of citizen science.

Practical solutions were implemented, including the organization of workshops and presentations to facilitate open dialogue among actors from different disciplines, promoting mutual understanding. The development of quizzes served as an interactive tool that demonstrated the value of diverse perspectives within the citizen science community.

To ensure data reliability, measures were taken to implement means for verifying data inputs, recognizing the crucial role of this process. The solicitation of a sense of "confidence" from contributors was adopted, adding transparency and accountability to instil responsible data collection practices. Advance planning of data management was deemed essential for the effective organization and utilization of diverse datasets.

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Findings: In the exploration of trust-building within the context of citizen science, two key findings have emerged. Firstly, there is a significant recognition that openly addressing uncertainties is pivotal in initiating and nurturing trust among participants. This transparency in discussing uncertainties lays the groundwork for open communication and credibility, establishing a foundation for trust within the citizen science community.

Additionally, our workshops highlighted the importance of procedural justice as a guiding principle in citizen science initiatives. Prioritizing fair and transparent processes, particularly in decision-making procedures, is emphasized as crucial. Moreover, transparency also involves being forthright about 'what not to do'. Together, these findings highlight the centrality of transparency and fairness in building and maintaining trust in the dynamic field of citizen science. In the spirit of collaboration, applied solutions involve combining and comparing different data types and sources. This careful integration enables a comprehensive understanding of research outcomes, leveraging the strengths of each dataset. These actions collectively contribute to fostering a culture of appreciation, understanding, and meticulous data management, ensuring the integrity of collaborative research endeavors in citizen science.

Key lessons learned:

- **Transparent communication fosters trust:** Acknowledging uncertainties and engaging in transparent discussions are fundamental for initiating and nurturing trust within the citizen science community.

- **Procedural justice as a trust-building principle:** The emphasis on procedural justice highlights the importance of fair and transparent processes, particularly in decision-making, as a key element in reinforcing trust among participants in citizen science initiatives.

- **Workshops and quizzes enhance understanding:** Practical solutions, such as workshops and quizzes, proved effective in facilitating open dialogue among actors from different disciplines and demonstrated the value of diverse perspectives within the citizen science community.

- **Data reliability requires vigilance:** Implementing means to verify data inputs, soliciting contributor confidence, and planning data management in advance are crucial steps to ensure the reliability and credibility of data in citizen science projects.

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3. Power Relationships, Conflicting Values and Beliefs

CSI experiences: In diverse and complex landscapes like CSIs, stakeholders bring not only diverse backgrounds, unique experiences, and methodological understandings (see above), but also cultural perspectives, and conflicting beliefs and values. These differences often manifest in varied definitions, goals, and perceived significance. For example, governments may wield economic power and prioritize competitiveness, indigenous communities hold cultural wisdom, and NGOs champion ecological diversity. This interplay of perspectives underscores the complexity of navigating power relationships. In the case of nature conservation, these dynamics shape debates about what conservation entails, its goals, and why it matters—a microcosm of the broader challenges in harmonizing divergent interests across diverse stakeholder groups.

For instance, in a CSI, involving civil society representatives, a former politician, and experts, the dynamics of power and influence became evident as the former politician dominated some discussions. This assertiveness created an atmosphere where civil society members felt intimidated, hindering their willingness to express diverse opinions. The challenge was particularly pronounced for the moderators, who found themselves navigating a delicate balance. The former politician's strong presence and dismissal of alternative viewpoints posed a hurdle for the civil society participants attempting to contribute differing opinions. The moderators faced the task of encouraging the civil society representatives to assert their perspectives without fear of dismissal. It was a delicate dance to foster an environment where diverse opinions were not only welcomed but also respected. The struggle extended beyond facilitating discussion to empowering civil society representatives to articulate their positions confidently. The moderators worked to instil a sense of confidence in the civil society participants, assuring them that their opinions were valued, even if they differed from the former politician's views. This required skilful moderation techniques to redirect the conversation and ensure that all voices were heard.

The image below from one of the CSIs of Step Change highlights how people from various backgrounds have different values, beliefs and expectations regarding the processes and outcome(s) of the citizen science initiative. This emphasizes the importance of including citizen scientists from diverse backgrounds while being aware of these differences and offering a constructive approach to addressing these distinctions.

Figure 2: Diverse values and beliefs in Citizen Science Initiative

Tested solutions: In this challenging environment, the role of the moderators extended beyond facilitation; it became a support system for civil society representatives seeking to navigate a conversation dominated by a prominent figure. The aim was to create a space where diverse opinions could coexist, fostering a more inclusive and constructive dialogue. This example underscores the complexities of managing power dynamics and encouraging diverse perspectives within discussions involving individuals with varying levels of influence and experience.

Findings: The success of navigating diverse perspectives lies in fostering an inclusive and respectful dialogue, where values are upheld, mutual trust is established, and differences are acknowledged openly. Skilful moderation, joint definitions, good working relationships, participatory approaches, and flexibility are key elements that contribute to constructive and collaborative outcomes in the face of varied stakeholder views.

Key lessons learned:
- **Upholding and appreciating values:** A foundation built on respect for diverse values fosters an environment where all perspectives are considered valid and contributes to a more inclusive dialogue.
- **Mutual respect over concealing differences:** Encouraging participants to express their views openly, even when differing, allows for a more honest exchange and lays the groundwork for building understanding.
- **Reconciling different views:** Rather than seeking agreement on all points, focus on identifying shared goals or values to bridge gaps and promote collaboration.

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- **Establishing mutual trust:** Transparent communication, consistency, and reliability contribute to the establishment of trust among stakeholders, enabling more constructive interactions.
- **Moderating carefully:** Skilled moderation involves creating a safe space for dialogue, redirecting conversations when needed, and empowering participants to express themselves without fear.
- **Emphasizing joint definitions:** Collaboratively shaping definitions ensures a unified vision, minimizes misunderstandings and facilitates cohesive decision-making.
- **Good working relationships:** Investing in building relationships beyond formal discussions and personal connections can strengthen the overall dynamics of the group.
- **Participatory approaches:** Adopting participatory approaches ensures that diverse perspectives are considered, leading to more comprehensive and sustainable outcomes.
- **Staying flexible:** Having an adaptable approach allows for adjustments in strategies and solutions, promoting resilience and responsiveness to changing dynamics.

4. Language and Communication Issues

CSI experiences: Communication is a cornerstone of the citizen science process, yet it is not without hurdles. Technical language and terminologies can create barriers, while language diversity adds an additional layer of complexity. The rise of digital tools introduces both opportunities and challenges, offering efficiency but potentially excluding those with limited access or technological literacy. Striking the right balance between virtual and in-person interactions becomes essential, as face-to-face meetings provide a depth of understanding that may be lost in digital exchanges.

Tested solutions: Tailoring communication strategies to diverse stakeholder groups has proven to be effective through practical experiences. Simplifying language and incorporating visual aids have enhanced accessibility and understanding, ensuring information is easily grasped. In addition, the production of materials in local languages acknowledges and respects linguistic diversity, thus, reinforcing inclusivity in communication efforts.

The selection of appropriate communication contexts has been pivotal. Personal meetings, especially within the vibrant atmosphere of science festivals, have fostered genuine connections and in-depth discussions. Concurrently, the integration of digital tools in real-time has expanded accessibility, accommodating diverse schedules and preferences.

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Recognizing the unique strengths of a variety of communication tools has been instrumental in successful implementation. From traditional approaches to modern digital platforms, each tool is strategically utilized to align with the specific needs and preferences of different stakeholders.

The involvement of intermediaries, such as skilled moderators, translators, or advanced community stakeholders, has also played a vital role. These individuals serve as effective bridges, facilitating understanding and smoothing interactions. The application of facilitation techniques has further created an environment conducive to open dialogue and collaboration.

In practical terms, these approaches have not only adapted to the diverse nature of stakeholder engagement but also have proven to be instrumental in fostering understanding and collaboration across various perspectives.

Experiences from the "Buurkracht" initiative, meaning neighbor power, highlight the effective engagement of advanced citizen scientists as intermediaries. This approach leverages the strength of local communities, seeking out individuals with the capacity to bear substantial responsibilities and forming collaborative teams. In addressing the technical aspects of CSIs, intermediaries from the community serve as crucial translators, bridging the gap between researchers and the community.

Researchers often provide preliminary presentations of technical solutions to citizen scientists, and these intermediaries play a key role in transforming this information into accessible formats for the broader community. They may create videos or other user-friendly materials to ensure that complex technical details are understood by everyone.

Volunteers for these intermediary roles are often motivated by a variety of factors, such as a desire to contribute to their community or to connect with others, particularly newcomers seeking to become part of the community. The initiative employs both real-life networking approaches and data analysis to identify individuals with characteristics similar to those past community leaders or "strong shoulders".

Figure 3 provided by one CSI, illustrates the different communication channels, distribution of knowledge, translation work, and different communication strategies.
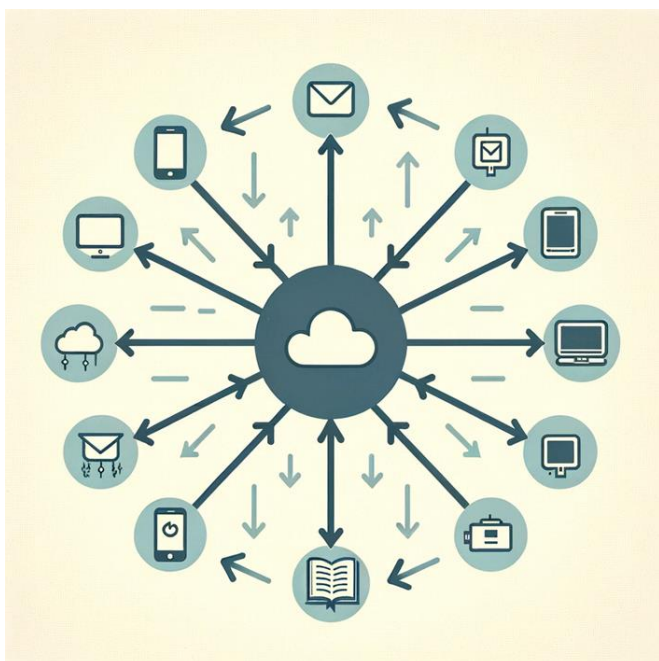
Figure 3: Communication channels in Citizen Science Initiative

Findings: Recognizing change-makers within the community is crucial, especially considering the phenomenon of stakeholder fatigue. Some individuals may drop out or not participate consistently, necessitating dedicated efforts to find suitable methods and timing to retain their involvement.

It is essential to acknowledge that all these processes demand considerable time, effort, and financial resources. Building relationships and establishing trust, in particular, is a time-intensive endeavor. A common saying in the Netherlands aptly captures this reality: "trust comes by foot and leaves on a horse", emphasizing the gradual nature of trust-building and the potential for it to erode quickly if not nurtured consistently.

Key lessons learned:

- **Inclusivity matters:** Simplified language, visual aids, and local language materials enhance inclusivity.

- **Context is key:** Choosing the right context, such as personal meetings or digital platforms, significantly impacts the effectiveness of communication.

- **Strategic tool selection:** Utilizing a diverse range of communication tools ensures flexibility and resonance with varied stakeholders.

- **Intermediaries enhance communication:** Engaging intermediaries and applying facilitation techniques play a crucial role in fostering understanding and collaboration.

- **Continuous adaptation:** Communication strategies should be adaptable, evolving based on the unique needs and preferences of stakeholders.

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5. Stakeholder Inclusion

CSI experiences: In the realm of stakeholder engagement, a set of challenges has surfaced, emphasizing the need for nuanced approaches. Each stakeholder presents unique characteristics and interests, making their inclusion a complex task. The difficulty lies not only in reaching stakeholders but also in motivating them to actively participate. A significant hurdle is the lack of comprehensive awareness about the diverse stakeholder landscape.

A critical question emerges regarding the intersection of a stakeholder's role and their identity as a citizen. Understanding to what extent a stakeholder is also a citizen becomes crucial in determining the most effective strategies for inclusion. The experiences highlight the necessity for tailored approaches that consider individual stakeholder differences and simultaneously explore the dual identity of stakeholders as both contributors and members of the broader citizenry. In navigating these challenges, fostering awareness, personalized engagement, and recognizing the dual roles of stakeholders are essential for creating meaningful and inclusive stakeholder participation in various initiatives.

Tested solutions: In the CSIs, the implementation of thorough stakeholder mapping at the project's initiation played a pivotal role. This comprehensive understanding of the stakeholder landscape allowed for targeted and personalized invitations, a strategic move to engage specific stakeholders effectively. Workshops and presentations were then customized to address the unique needs and interests of the identified stakeholders.

The experiences gleaned from these initiatives underscore the significance of stakeholder engagement as a long-term and relationship-building endeavor. Establishing and maintaining relationships over time not only increased acceptance within the community but also contributed to the overall sustainability of the projects.
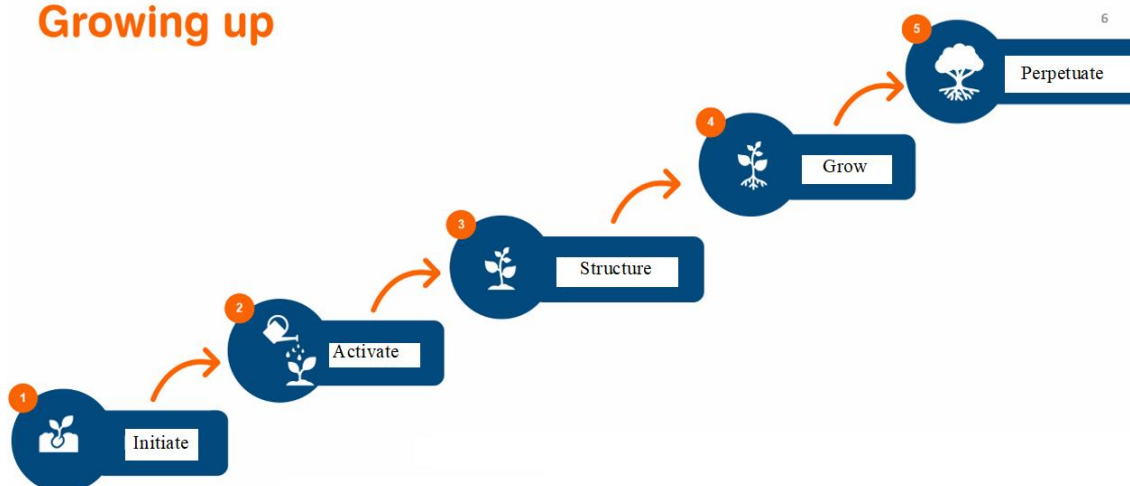
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Figure 4: The "Buurkracht" initiative introduced step-by-step approach for stakeholder inclusion

Findings: A detailed stakeholder mapping at the project's outset proved to be instrumental in enhancing the precision and effectiveness of subsequent engagement efforts. Targeted and personalized invitations emerged as effective tools in securing the active participation of specific stakeholders, emphasizing the importance of tailoring communication to individual needs. Furthermore, the customization of workshops and presentations contributed to increased stakeholder engagement by ensuring the relevance of the content to their unique concerns and priorities. Beyond the initial engagement phase, the focus shifted to the long-term, recognizing the importance of establishing and maintaining relationships with stakeholders over time.

These findings highlight the positive impact of long-term relationships on community acceptance. Continuous engagement fostered trust, making community members more receptive to the project goals and activities. Moreover, the sustainability of the activities was found to be intricately tied to the ongoing cultivation of relationships with stakeholders, emphasizing the enduring importance of relationship-building in the realm of stakeholder engagement (as shown in Figure 2).

Key lessons learned:

- **Thorough stakeholder mapping:** This comprehensive approach enhances the precision and effectiveness of stakeholder engagement strategies.

- **Tailored content to address unique stakeholder needs and interests:** Customization ensures the relevance of information, increasing stakeholder engagement.

- **Targeted and personalized engagement:** Personalization fosters a sense of importance, increasing the likelihood of stakeholder participation.

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- **Establish and maintain long-term relationships with stakeholders:** Continuous engagement fosters trust, positively impacting community acceptance and project sustainability.

6. Technical and Logistical Challenges

CSI experiences: The execution of the CSIs has been marked by notable technical and logistical challenges. These challenges encompass difficulties in managing logistics related to time, location, and other practical considerations – impacting inter-, multi- and trans-disciplinary cooperation. Communication has been a persistent challenge, contributing to delays and short-notice cancellations. Additionally, the task of finding suitable replacements in such circumstances has proven to be another considerable challenge. Overall, these experiences underscore the importance of addressing technical and logistical aspects with precision and enhancing communication strategies to mitigate delays and disruptions in citizen science initiatives.

Tested solutions: In addressing the challenges of interdisciplinary communication within the CSIs, several applied solutions have proven effective. Recognizing the potential of citizen scientists as intermediaries, these individuals can play a crucial role in facilitating communication between diverse disciplines. To streamline collaboration, a proactive approach involves soliciting time slots from all involved actors to organize meetings and workshops, emphasizing regular reminders to ensure active participation.

Persistence and adaptability are key components of successful communication strategies. Organizing with a "Plan B" in mind, such as having substitutes available, helps mitigate disruptions due to unforeseen circumstances or short-notice cancellations. Providing a dedicated platform and appointing a communication focal person further support communication processes, particularly with citizen scientists. This centralized approach enhances coordination, fosteres information exchange, and contributes to the overall effectiveness of interdisciplinary collaboration within citizen science initiatives.

Findings: Leveraging citizen scientists as intermediaries emerged as a successful strategy, showcasing their effectiveness in bridging communication gaps across diverse disciplines. This finding underscores the valuable role that engaged citizens can play in facilitating effective interdisciplinary collaboration. Additionally, the proactive approach of soliciting time slots from all stakeholders for meetings and workshops yielded positive results. This highlights the importance of actively seeking and accommodating diverse schedules to ensure optimal participation, a crucial element in successful interdisciplinary endeavors.

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Regular communication helps keep all parties informed and engaged, reducing the likelihood of disruptions due to delays or cancellations.

The importance of persistence and adaptability emerged as a critical factor in overcoming challenges. In addition to time and persistence, there is a need for a touch of courage—willingness to try new approaches, to step out of one's comfort zone, and to embrace innovation.

Finally, yet importantly, it holds significance to decide what actions to refrain from and to transparently communicate those decisions.

Key lessons learned:

- **Leveraging citizen scientists as intermediaries:** The active involvement of citizens enhances information flow and understanding across interdisciplinary teams.

- **Regular reminders for engagement:** Consistent communication reduces the likelihood of disruptions due to delays or cancellations.

- **Persistence and adaptability:** Anticipating and adapting to unforeseen circumstances ensures continued progress and minimizes disruptions in communication and collaboration.

- **Dedicated platforms and communication focal person:** Establishing clear communication channels enhances coordination, facilitates information exchange, and strengthens overall interdisciplinary collaboration.

- **Courage for innovation:** Embracing courage and a willingness to try new approaches are crucial. Innovation is fostered when individuals are open to stepping out of their comfort zones and exploring new possibilities.

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