

Exploring Libraries, Citizen Science, and the Sustainable Development Goals (SDGs): Insights from Researchers and Project Managers

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ABSTRACT

To promote and accomplish the Sustainable Development Goals (SDGs), research in citizen science and the SDGs is crucial. This study is focused on the experiences and perspectives of Researchers and Project Managers in Citizen Science projects that are connected to the SDGs, as well as the role and engagement of libraries in these projects. This research uses the online interview to gather data and then analyzes the responses to identify the participants' motivation, challenges to overcome, best practices, acquired abilities, and attitudes. The researchers and project managers selected as respondents for this study come from Research Universities' (RU) citizen science projects. The study's findings point to the possibility of enhancing cooperation between libraries and citizen science initiatives to support and advance the SDGs. This research will provide valuable insights into the potential of Citizen Science, Libraries, and the SDGs and make recommendations for future research and opportunities for improvement.

Keywords: Citizen science, libraries, social agents, Sustainable Development Goals (SDGs)

INTRODUCTION

Citizen science (CS) is the practice of members of the public helping with research that has historically been conducted by scientists (Cigarini et al. 2021). According to SciStarter, 2020 in the United States, CS is part of the ongoing "Libraries as Community Hubs for Citizen Science" project. CS toolkits are being developed, evaluated, and made available for and through public library partners, while associated resources are being developed to train, support, and communicate with librarians and citizen scientists. Citizen Science provides a

means for open, holistic, and participatory knowledge generation processes; on the other hand, it promotes openness, which, as opposed to secrecy or exclusion, is critical for the sustainability, accessibility, and quality of scientific knowledge produced through citizen participation (Cigarini et al., 2021). Recent initiatives indicate that libraries in the United States and Europe are expanding their existing activities and programmes, capacity, and infrastructure to provide opportunities for their communities to participate in scientific research through CS (Ignat et al. 2018). According to Cigarini et al. (2021), the implementation of CS in libraries, which are a fundamental component of the Open Science infrastructure, may make it easier to move towards more open knowledge. Citizen science initiatives are often community-based and led in developing countries, especially in sustainable development contexts. Policy acceptance at higher levels is low due to several complex and interconnected challenges, such as lack of institutional capacity, mistrust of project leaders, and potential overlap with existing initiatives (Hecker et al. 2019; Irwin 2018). Thus, the purpose of this study is to understand the potential of libraries' involvement in Citizen Science and SDGs from the perspectives of Researchers and Project Managers in Citizen Science projects.

LITERATURE REVIEW

Recently, there has been a noticeable surge in citizen science programs around the world, with citizens participating in scientific initiatives as novice investigators, supporters, and even observers. Citizen scientists can create experiments, gather information, examine findings, and find solutions. Most citizen scientists use equipment offered by the project directors to obtain data, which is later used by professional scientists and resource managers to address pressing issues and find scientific solutions (Shirk and Bonney 2020). A wide range of new options for community involvement in a relevant variety of issues is being developed because of the rapid growth of crowdfunding techniques, data analysis, and graphical technologies.

Concerning this growth of community involvement in citizen science projects, libraries all around the nation are developing into significant centers for citizen science by providing access to literary materials, proper planning, technology such as computers and the internet, and experts with scientific expertise; while some other libraries even host citizen science programs with specific tools and modules that allow the participants finish their projects using equipment like light detectors and telescopes (SciStarter, 2020). Cigarini et al. (2021) also emphasized that libraries have provided guidance and support in designing information management systems to give citizens their acquired data back after processing. The institutional repository services provided by the library can also be used by these amateur researchers to archive and share their findings (Cigarini et al., 2021). There's a study claiming that academic libraries can provide leadership, information services, research data management services, and research collaborations to support open science by sharing available data, open access resources, educational resources, and even open methodologies (Tzanova 2020).

As all nations are focusing on realizing the sustainable development goals (SDGs), citizen science is seen as another platform that can be further explored to prioritize the goals.

According to the United Nations (UN) in 2015, Sustainable Development Goals is “a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity” (UNDP 2022). Liu et al (2014) believed that citizen science can play a significant role in sustainable development by helping to bridge the knowledge gap between the public and environmental management (Liu and Kobernus 2016). They further stressed how citizen science can empower people by providing them with environmental knowledge and data to make accurate decisions. All these factors support the fundamental goals of citizen science in sustainable development.

RESEARCH DESIGN

This study aims to highlight the potential of libraries' involvement in Citizen Science and SDGs from the perspectives of Researchers and Project Managers. Also, the research analyses were based on the following research questions: how are current Citizen Science projects connected to libraries and the SDGs from the researchers and project managers' perspectives? The emerging potential role of libraries in citizen science and getting engaged with SDGs was explored through the in-depth interview. In-depth, open-ended, and on-the-ground interviews with a variety of participants in this study, including the researchers and project managers from three research universities (RU) in Malaysia were conducted. The selection of the participants was based on the years of involvement in Citizen Science which must be involved more than 2 years actively in citizen science projects in universities. The respondents are two researchers and two project managers. The focus of the citizen science project was more on biodiversity, environmental, and water quality monitoring. The roles of project manager and researcher are similar for both of them, which were following the four characteristics of citizen science that are typical: i) A vast community of scientists and volunteers collaborate and exchange data, to which the general public, as well as scientists, have access, ii) Participants adopt the same procedure, iii) allowing data to be integrated and be of high quality, iv) Data can help real scientists reach actual findings.

Data were gathered using a semi-structured interview approach from February 2023 and continuing until the end of the month. Each respondent underwent one session of online interview through Zoom Online meeting. Video recording, audio recordings, coding, transcription, and accuracy checks were all done during the interviews. To find trends in respondents' experiences and to pinpoint the main topics raised in the interviews, the transcripts of the interviews were coded using the software, Atlas.ti. This study has observed the ethics protocol and all respondents have consented to the interview.

RESULTS

Based on the interviews conducted, the respondents have a wide range of experience in their respective fields from the beginning of the citizen science project at their university. The focus of the citizen science projects was more on biodiversity, environmental, and water quality monitoring. The findings also show that the respondents' roles involved citizen science

projects from the beginning and put a lot of effort into sustaining the CS projects. The following responses were obtained, recorded, and summarized based on the interviews with the respondents. This study aims to highlight the potential of libraries' involvement in Citizen Science and SDGs from the perspectives of Researchers and Project Managers plus, the research analysis was based on the following research questions: how are current Citizen Science projects connected to libraries and the SDGs from the researchers and project managers' perspectives?

Current Citizen Science projects connected to libraries and the SDGs from the researchers' and project managers' perspectives

The in-depth interviews with managers and researchers for citizen science projects revealed that many SDGs were considered when planning and implementing projects, with a focus on SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 8 (Decent Work and Economic Growth), SDG 11 (Sustainable Cities and Communities), SDG 14 (Life Below Water), SDG 15 (Life on Land), and SDG 17 (Partnerships for the Goals).

Increasing the public's knowledge and understanding of scientific issues, as well as encouraging engagement and learning among individuals, were the main goals of citizen science programmes addressing SDG 4. One of the main findings from the research was that citizen science initiatives support SDG 4 (Quality Education), with a particular emphasis on encouraging inclusive and equitable quality education and opportunities for lifelong learning for everyone, was described by one respondent as follows:

"Our CS projects promote ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, especially Goal 4.7, to ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and culture's contribution to sustainable development" (R2, 1b)

Monitoring and enhancing water and sanitation systems, as well as involving local populations in water management, were the main objectives of projects implementing SDG 6.

"In terms of Place-Based Water Quality Monitoring, I think the main focus was on SDG 6, clean water and sanitation" (R2,1b)

Another respondent stressed how important it was for their initiative to focus on SDG 6, saying:

"Basically, our focus was on SDG6, clean water, and sanitation, because we want to look into the water qualities of our rivers and how it impacts on the water supply" (R3,1b)

The study's key finding was that SDG 8 can benefit from citizen science activities (Decent Work and Economic Development) by fostering sustainable economic growth and opening job opportunities. Respondents outlined how their initiatives would produce attractions that would encourage visitors to explore the surrounding areas, which in turn might boost the local economy and create jobs and have observed:

"Our projects could be slightly contributed to promoting sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all, where both projects can create some attractions for people to explore the areas" (R4,1c)

The study's findings indicate that by fostering inclusive, secure, resilient, and sustainable human settlements, citizen science initiatives can significantly aid in the accomplishment of SDG 11 (Sustainable Cities and Communities). According to one respondent, data on the effects of urban growth on regional flora and wildlife can help citizen science programmes achieve this goal:

"Data from iNaturalist can contribute to an overview of the impact of city development on the flora and fauna species surrounding us through mapping of water and air pollution" (R1,1a)

Place-Based Water Quality Monitoring initiatives were also considered to be pertinent to SDG 11 since they can support responsible production and consumption by addressing the issue of poor waste management and its effects on water quality. Two respondents remarked,

"Somehow, Place-Based Water Quality Monitoring Monitoring can be linked to SDG 11, I think, make cities and human settlements inclusive, safe, resilient and sustainable" (R2,1b)

"We want the community to be responsible and understand their place, so the Place-Based Water Quality Monitoring Monitoring project was slightly related to SDG11's goal to make cities and human settlements inclusive, safe, resilient, and sustainable. Also, responsible consumption and production because water quality is mostly affected by improper waste management" (R3,1b)

To stop the loss of biodiversity, the Sustainable Development Goal (SDG) 15 focuses on preserving, restoring, and promoting the sustainable use of terrestrial ecosystems. Our research shows that citizen science initiatives like iNaturalist, Place-Based Water Quality Monitoring, and EcoHub are all in some way related to SDG 15:

"iNaturalist supported Citizen Science and generated awareness, especially on Life on Land and Life below Water" (R1,1a)

"Place-Based Water Quality Monitoring was very much related to Life on Land because part of that is to understand how water quality is related to the land ecosystem" (R3,1b)

"The main goal of the EcoHub project is promoting Life on Land. Most of our activities involved terrestrial area" (R4,1c)

The goal of partnerships for the objectives was perceived as an overarching objective that cut across all the other SDGs, according to further findings on SDG 17 from the perspective of citizen science projects:

“Both Place-Based Water Quality Monitoring and Di Sekitar Kita Biodiversity projects involved partnerships with agencies and local authorities. After the project ended, we are still working together, and are currently reframing Urban Biodiversity” (R2,1b)

Researchers and project managers' comments revealed the connection of the library with CS projects is through SDG 4 and SDG 17. According to one respondent:

“The findings from the CS project may be physically displayed by the library. Instead of a virtual exhibition, the library may, for instance, show images of biodiversity species from the iNaturalist database” (R1,1a)

Such exhibits might be an effective way to engage the public and spread a lifelong learning culture of the value of protecting biodiversity and other SDGs. As stated by another respondent:

“Browse the iNaturalist database to see the artistic multimedia-typed shot, which is available for free download. A virtual exhibition is less effective at raising awareness about CS than a real one.” (R1,1a)

“Our previous three projects had not involved libraries. But, I believed library can be as a venue for sharing session and exhibition related to CS project” (R2,1b)

“Nowadays, people like to search for information online instead of going to the library and searching for the materials. So, what the library can do to bring people to the library is by promoting and creating awareness of CS projects. I believe the library definitely has roles to play in CS. Think of how to engage people to come to the library physically and virtually through the CS project” (R1,1a)

Overall, this study provides insights into how current citizen science projects are connected to libraries and the SDGs. The results can guide further study and the creation of citizen science initiatives that support libraries and work towards sustainable development goals.

DISCUSSION

The purpose of this research question was to examine the relationship between the SDGs and current citizen science initiatives concerning libraries. According to the research, citizen science initiatives can be a powerful tool for libraries to support sustainable development objectives and interact with their local communities. By connecting with the SDGs, citizen science programmes can assist in achieving sustainable development outcomes while also providing important educational and research opportunities for library users. This

relationship to SDG 4.7 aspires to guarantee that all students gain the information and skills necessary to promote sustainable development (Fritz et al. 2019). The emphasis on SDG4, Quality Education, indicates that citizen science initiatives are supporting educational opportunities and skill development, both of which are essential for attaining sustainable development. To raise awareness of SDG 4, the libraries can organize training on information literacy, supply pertinent materials to promote students' learning, and involve library users in recurring information literacy initiatives (Dei, D.-G.J. and Asante 2022). Libraries can also engage their patrons in ongoing information literacy projects that can foster a community of learners and proponents of sustainable development.

These findings show how citizen science initiatives can help to realize SDG 6 by giving residents the chance to monitor and gather information on water quality, find potential causes of contamination, and promote better water management techniques (Dörler et al. 2021). These initiatives can also increase public knowledge of the value of clean water and sanitation, foster community involvement, and empower residents by including individuals in water quality monitoring. Libraries can offer a venue where locals can access and exchange knowledge on water management strategies, sanitation practices, and water quality. Also, libraries can offer instruction and materials so that anyone can take part in citizen science initiatives for monitoring water quality (Scistarter, 2020). SDG 8 was addressed by initiatives that promoted entrepreneurship and innovation as well as the development of STEM-related employment opportunities. SDG 11 projects seek to encourage sustainable urban development, for example, through neighborhood-led planning and green infrastructure projects. The result indicates that citizen science initiatives can help communities become more resilient to environmental threats and advance sustainable urban development. These initiatives can aid in the creation of more equitable and sustainable municipal policies and practices by including individuals in the monitoring and management of local resources (Wuebben, Romero-Luis, and Gertrudix 2020).

Based on findings, citizen science initiatives can be crucial in advancing SDG 15 by raising public awareness of the significance of terrestrial ecosystems, assisting in the gathering and analysis of data, and encouraging the preservation and sustainable use of land resources. iNaturalist raises public awareness of biodiversity and its significance for sustainable development by involving the public in data collecting and species identification (Callaghan et al. 2022). Meanwhile, the significance of capacity-building and knowledge-sharing, which were seen as crucial components for developing effective partnerships and advancing sustainable development more generally, emerged as another major subject regarding SDG 17 (Wuebben et al., 2020). The study's main finding is that through Citizen Science initiatives, libraries can significantly advance scientific understanding connected to the SDGs. Libraries may play a role in ensuring that Citizen Science projects are effective and contribute to the attainment of the SDGs by acting as a resource center, a storage hub, and by offering support in data management and analysis. Libraries in the US and Europe are expanding their programmes, capacity, and infrastructure to give their communities CS research opportunities (Ignat et al., 2018). Yet, they also indicated a desire to work with libraries and showed support for the notion of libraries taking a more active part in Citizen Science programmes. To encourage community participation, libraries can serve as a hub for citizen

science programmes related to SDGs by offering assistance, resources, and knowledge. Libraries can help accomplish the SDG while also giving their users beneficial educational and research opportunities by collaborating with citizen science initiatives.

CONCLUSION

To conclude, this study shows how citizen science initiatives can be used by libraries to engage their communities and support sustainable development goals. According to the findings, to achieve the SDGs, libraries, and citizen science initiatives should work more closely together and actively pursue this alignment. The conclusions of this study can guide future investigations and the creation of citizen science initiatives that support libraries and work toward reaching sustainable development objectives. The major goal of libraries is to support education and research that improves society, which is in line with the objectives of citizen science, which is now acknowledged as a potent tool for environmental study. One of the main recommendations from this study is that libraries work with citizen science initiatives and coordinate their initiatives with the SDGs to contribute to the goals of sustainable development. To promote citizen science and accomplish sustainable development objectives, libraries can be vital partners. Libraries may provide their users with worthwhile educational and research opportunities as well as increase community engagement by adding citizen science initiatives into their programmes. Public libraries can serve as community centers and as a source of leadership in the promotion of citizen science (Cigarini et al., 2021). Libraries are advancing their infrastructure and innovating their services to achieve the UN 2030 SDG goals, and citizen science is a crucial component of this. Therefore, academic libraries must understand their capacity to assist citizen science and to take a proactive approach to its promotion and progress.

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