



Solution Mapping Tools: Identifying a Bottom-Up Approach to Social Innovation

Perangkat Pemetaan Solusi: Mengidentifikasi Pendekatan Bawah-Atas dalam Inovasi Sosial

Raditya Ardianto Taepoer¹, Kenta Ono², Prananda Luffiansyah Malasan³, Meirina Triharini⁴, Arianti Ayu Puspita⁵, Intan Prameswari⁶, Yulia Sugandi⁷

Graduate School of Engineering, Chiba University¹

Department of Design, Chiba University²

Faculty of Art and Design, Institut Teknologi Bandung^{3, 4, 5, 6}

Center for Transdisciplinary & Sustainability Sciences, IPB University⁷

cdha0968@chiba-u.jp

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ABSTRACT

A bottom-up approach to social innovation arises from the issues at the root of the innovation, which usually originates in the lower middle class. An essential approach to design for social innovation is to manage projects with identifiable organizational stakeholders considering relationships in the context of power holders and empowering socially vulnerable and marginalized communities. In local contexts, community participation processes can support grassroots movements toward sustainable systems where the focus is on more complex situations. For a better understanding, the Solution Mapping Tool is explored in this paper through a case study of a workshop held in the least-developed region of Indonesia. The workshop focused on inventing a bamboo distillation device for Moke, a traditional alcoholic beverage made from fermented palm fruits. Using the Solution Mapping Tools, learners were inspired to explore and discover the diverse solutions that communities use and generate daily. The tool helps everyday solutions become visible and identifiable regarding needs, assets, problems and challenges, benefits, and opportunities for the future. The Solution Mapping Tools can also increase learners' empathy towards people, including communities, by providing a place to learn about their daily lives, experiential knowledge, and context. This paper extends existing publications on distributing and learning about local assets as a pre-design process before applying a participatory-based approach.

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ABSTRAK

Pendekatan bottom-up dalam inovasi sosial menimbulkan problematika yang menjadi akar inovasi tersebut, biasanya berasal dari masyarakat menengah ke bawah. Pendekatan penting dalam mendesain inovasi sosial adalah mengelola proyek dengan pemangku kepentingan organisasi yang dapat diidentifikasi, mempertimbangkan hubungan dalam konteks pemegang kekuasaan, dan memberdayakan masyarakat yang memiliki kerentanan sosial dan terpinggirkan. Dalam konteks lokal, proses partisipasi masyarakat dapat mendukung gerakan akar rumput menuju sistem berkelanjutan yang merujuk pada situasi yang lebih kompleks. Untuk pemahaman yang lebih baik, alat

pemetaan solusi dieksplorasi dalam tulisan ini melalui studi kasus lokakarya yang diadakan di wilayah yang paling tidak berkembang di Indonesia. Lokakarya ini berfokus pada penemuan alat penyulingan Moke yang terbuat dari bambu, minuman beralkohol tradisional yang terbuat dari buah aren yang difermentasi. Dengan menggunakan perangkat pemetaan solusi, para pembelajar terinspirasi untuk mengeksplorasi dan menemukan beragam solusi yang digunakan dan dihasilkan oleh masyarakat dalam kehidupan sehari-hari. Perangkat ini memberikan solusi dalam kehidupan sehari-hari sehingga menjadi terlihat dan dapat diidentifikasi dalam hal kebutuhan, aset, masalah dan tantangan, manfaat, dan peluang untuk masa depan. Perangkat pemetaan solusi juga dapat meningkatkan empati para pembelajar terhadap masyarakat, termasuk komunitas di suatu tempat untuk belajar tentang kehidupan sehari-hari, pengetahuan berbasis pengalaman, dan konteks mereka. Artikel ini memperluas publikasi yang sudah ada dalam menyalurkan dan mempelajari aset lokal sebagai proses pradesain sebelum diterapkan pendekatan berbasis partisipatoris.

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Introduction

Pursuing innovative solutions to societal challenges has become increasingly important in our rapidly evolving world. Social innovation, driven by the desire to create positive changes, has emerged as a powerful force in addressing these complex issues. This chapter explores various aspects of social innovation and its intersection with design, highlighting the importance of understanding needs and assets in problem-solving. Furthermore, it delves into the significance of bottom-up approaches, emphasizing the role of community participation in mapping and implementing social innovation initiatives. By delving into these critical areas, we can gain valuable insights into how social innovation and design work harmoniously to catalyze transformative change and foster inclusive, sustainable communities.

Social innovation defines products, services, and models that meet social collaboration needs (Murray et al., 2010). Social innovation can also be understood as solutions to social problems that are more effective, efficient, sustainable, and valuable for society (Phills et al., 2008). Social innovation focuses on stakeholders, i.e., individuals and their relationships. (Emilson et al., 2011). Social innovation emphasizes collaboration and its benefits to society.

The design has extended its definition from giving shape to objects and graphics to a way of describing the problem-solving process and an approach to understanding the complexity of systems and environments. (Coulson et al., 2018). Design in the context of social innovation refers to designing networks or systems involving individuals, companies, non-profit organizations, and local or global institutions, that formulate and implement solutions to social and individual problems (Jégou & Manzini, 2008). There are two stages in the design process for social innovation. The first stage includes three steps: (1) questioning the problem, (2) investigating the natural causes of the problem, and (3) understanding the context by focusing on people. The analyses from the first stage form the basis for the second stage to formulate problem-solving ideas. (Freire et al., 2011).

Understanding Needs and Assets in Solving Everyday Problems

Social innovation is synonymous with multi-stakeholder collaboration. The focus of problem-solving efforts is on the individuals and communities in which the problems are rooted. Investigating and understanding the problem holistically encourages innovation appropriate to the community context. Problems can be translated into needs for solutions that the stakeholder community requires. In addition to issues and needs, each community has assets like people, materials, and facilities. Identifying assets that can be utilized in problem-solving efforts is an essential first step in encouraging social innovation. One of the assets possessed by the stakeholder community is knowledge based on experience in dealing with problems. This knowledge serves as a resource for identifying opportunities and obstacles to problem-solving.

This concept aligns with Design Thinking, where constraints and risks are identified and treated as opportunities (Holm et al., 2019). In seeking problem-solving and fostering social innovation, designers play a role as facilitators of the design process. The designer can act as a catalyst (the questioner), supporting stakeholders by highlighting the issues and important aspects involved. In this context, the designer does not formulate solutions, which is the role of the stakeholder. Another role of the designer is to visualize, prototype, bring stakeholders' ideas and imaginations to life, and assist in prototyping processes to explore possibilities and opportunities (Emilson et al., 2011).

Designers' role in social innovation can be understood through two mental models: "expert" and "participator". The difference between the two is in the roles of the designer and the project subject. In the "expert" mental model, the designer acts as a translator of information sourced from the project subject to solve the problem. In the "participator" mentality, the designer and the subject work together to develop a solution to the problem. The difference can be seen in the relationship hierarchy between the designer and the project subject. Based on the two projects based on these two mental models, a community-focused design where the designer acts as a participator and collaborates with stakeholders results in sustainable programs and projects, thus being more capable of achieving social transformation and innovation (Freire et al., 2011).

Bottom-Up Approach to Social Innovation

The bottom-up approach to social innovation is often called grassroots or frugal. The grass-roots characteristic arises from the problems in which the innovation is rooted, which are often rooted in the problems faced by the lower middle class. This approach contrasts with the traditional top-down research and development process in developed markets. Frugal innovation is people-focused, fit-based, local, and cost-effective through design thinking, creative improvisation, bricolage, and lean and reverse engineering (Bhatti, 2012). An example of frugal innovation is the development of sanitary napkins from water hyacinth fiber in Kenya, which arose from the problems of the high cost of sanitary napkins, the difficulty of people obtaining them, and the use of water hyacinth, which is a pest plant in Lake Victoria, Kenya (Holm et al., 2019). Another example on a larger scale is the development of the Tata Nano, which arose from observations of motorbike use in India, where it was common to find motorbikes being misused to carry more than two people. The Tata Nano addresses the need for a small, economical vehicle for families that previously used motorbikes. Using a small car like the Tata Nano to carry passengers is undoubtedly safer and more convenient than the previous practice of using motorbikes (Bhatti, 2012).

Grassroots-driven innovation can also be seen in the context of the democratization of innovation, where more individuals can carry out innovation because accessing information, facilities, and infrastructure is now easier and cheaper (von Hippel, 2018). A critical approach in participatory design research is managing projects with identifiable organizational stakeholders, paying attention to relationships in power holders' contexts, and empowering vulnerable and marginalized communities. The participatory design makes an essential contribution to innovation democracy. In innovation democracy, innovation is seen as heterogeneous, open, and public, involving users and other stakeholders across organizational and societal boundaries (Björgvinsson et al., 2010). Based on the definitions of innovation democracy and social innovation, stakeholders are significant factors in innovation. The largely bottom-up nature of innovation also characterizes social innovation and innovation democracy.

The development of the internet also drives the democratization of innovation as a quickly and cheaply accessible source of information. The internet also makes it easy to procure tools and materials for experimentation and production. Thus, innovation can take place anywhere. The existence of the internet also allows for collaboration-based innovations that are carried out digitally. Wikipedia is one example of innovation based on digital collaboration, where users can become contributors to Wikipedia articles to accumulate knowledge from various users, resulting in a vast and powerful encyclopedia. Other examples include Google and Amazon, which provide peer-to-peer platforms for information sharing and product trading. This digital collaboration exhibits characteristics of anti-competitiveness and inclusiveness (Cooper, 2005).

Community Participation in Mapping Social Innovation

The bottom-up approach also encourages grassroots innovation that emerges from the community based on the problems faced by the community. In grassroots innovation, communities discuss grassroots innovation goals and strategies in the local context, where community members with common interests negotiate goals and strategies based on common problems and interests. Participatory processes in this context support grassroots movements toward sustainable systems. The participatory process was conducted in the following stages: defining the scope, building community planning, sensing knowledge or awareness, action, reflection, and legacy (Coulson et al., 2018).

An example of a case study would be a multi-site pilot project involving citizens (students, youth, community leaders, and people with different skills who share a common interest) to design solutions to site-specific problems (Coulson et al., 2018). This process emphasizes democratic, collaborative, and participatory processes. The scale of these projects is at the community level, which is large enough to make a difference but small enough to represent individual interests (Sangiorgi, 2011). Citizens and communities, as stakeholders, help to ensure that after the project ends, the program that was the result of the project continues. The real interests of the various parties involved in developing the problem solution led to the sustainability of the solution program, including implementation and maintenance (Coulson et al., 2018).

Method

This study uses the solution mapping method as defined by the UNDP Accelerator Labs. The definition followed that of Saeed's (2020) that solution mapping is an observation of the capability of grassroots communities to uncover and provide answers to problems of daily matters.

The Origin of Solutions Mapping

Solutions mapping in this paper adapts the term used by UNDP Accelerator Labs, which is an observation of the ability of grassroots communities to find and create solutions to everyday problems (Saeed, 2020). UNDP Accelerator Labs are in 91 locations to support 115 countries (United Nations Development Program, n.d.). UNDP Accelerator Labs and collaborators in each country develop tools or platforms customized to their needs and contexts. For example, UNDP Accelerator Lab Philippines developed a field guide called SalikLakBay (Lor, 2021), while UNDP Accelerator Lab India collaborated with Honeybee Network to develop the Grassroots Innovation Database (GRID) platform (The Economic Times India, 2020).

Ethnographic Fieldwork Canvas		What kinds of insights are you looking for?	
People	Place	Activity	Words
	Objects		Nonverbal Cues
Need to Be Maintained		Need to Be Improved	

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Figure 1 DE: Lab Ethnographic Fieldwork Canvas
(Source: DE: Lab Ethnographic Tools, 2019)

In Indonesia, the UNDP Accelerator Lab collaborates with the Design Ethnography Lab of Institut Teknologi Bandung to design a tool to map solutions created by the community. The Design Ethnography Lab (DE: Lab) is a research laboratory that develops design methods and practices based on social, cultural, and political issues. DE: Lab designed a tool called DE: Lab Ethnographic Tools used during fieldwork to gain insights and information for design development through visitation, observation, and interviews conducted within a limited time frame. DE: Lab Ethnographic Tools consist of notes and canvases. Notes are used by individual researchers (in this case, referred to as learners) to guide them in conducting interviews and note down all the findings during fieldwork. The canvas (as presented in Figure 1) consists of nine blocks used in groups when fieldwork has been completed to discuss and summarize the findings noted by everyone. The components of the DE: Lab Ethnographic Tools are described in Table I.

Table I DE: Lab Ethnographic Tools

No	Components	Guiding Questions
1.	Insights	What kind of insights do learners seek? Keep the big picture we want to look for and guide us through our fieldwork.
2.	People	Who is being observed? Are there other actors in the main subject’s story? What is their role? How would learners describe them? Suggestion: Sketch or take photos of the people being observed.
3.	Object	What are the objects on the site? What objects did people use during the observation? Suggestion: Sketch or take photos of the objects.
4.	Place	Where is the location? How are the surroundings? Can the learners describe the situation and context of the environment? Suggestion: Take photos or sketch the general environment.
5.	Activities	What happened during the observation? What are the people doing during the observation? How do learners feel during the participation? What kinds of challenges do learners find? Suggestion: Sketch or capture photos of people’s activities during observation.
6.	Words	What topics are currently being discussed? How are they talking? Suggestion: Use an audio or video recorder during observation.
7.	Nonverbal Cues	What do learners think about the tone? How is the gesture? Can the learners feel the emotions? Suggestion: Sketch or take photos of movements, nonverbal cues, and emotions.
8.	Need to Be Maintained	What findings need to be maintained? How might this have a positive impact and be meaningful in the future? Suggestion: Discuss and summarize together in the group based on each learner’s notes.
9.	Need to Be Improved	What findings need to be improved? How might this negatively impact the future? Suggestion: Discuss and summarize together in the group based on each learner’s notes.

(Source: DE: Lab Ethnographic Tools, 2019)

Building Solution Mapping Tools

Solution mapping and immersion methods aim to build relationships and empathy with people and communities in a place where they can learn about their daily lives, experiential knowledge, and context. Everyday solutions can be used as an entry point to identify needs, assets, problems and challenges, benefits, and opportunities for the future. Solution mapping gives us the insight and sensitivity to identify bottom-up approaches to social innovation while developing strategies for (1) scaling deep (strengthening cultural values, transformative learning, and building communities of practice), (2) scaling out (deliberate replication and spreading principles geographically or numerically), (3) scaling up (decision-making and policy design), or (4) combining any of the three strategies (Moore et al., 2015). Solution Mapping Tools proposed in this paper were designed based on DE: Lab Ethnographic Tools.

Solutions Mapping Canvas

Name of the Solutions _____	<input type="checkbox"/> Objects <input type="checkbox"/> Social Systems	Date _____	Location _____	Learner _____
Users Who are these solutions intended for?	Name (Community) _____ Contact _____		<input type="checkbox"/> Creator <input type="checkbox"/> User	
Pictures/Photos/Sketches Put pictures, photos, or sketches of the solutions	Description (Material, How it Works, Usage) What are the solutions about? What problems have been solved? How does it work? How is it used?			
Benefits What can be learnt from these solutions?	Problems and Challenges What problems, difficulties, or challenges were encountered?	Opportunities What are the opportunities that can be developed?		

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 Designed by Design Ethnography Lab ITB and UNDP Accelerator Lab Indonesia

Figure 2 Solution Mapping Canvas
(Source: Solution Mapping Tools, 2022)

Adapting the DE: Lab Ethnographic Tools, Solution Mapping Tools also consist of notes and a canvas. In addition to the notes that learners can fill in when they are doing fieldwork, the Solution Mapping Notes include an introduction to the bottom-up approach to social innovation, the principles, and guidelines for fieldwork. Solution Mapping Canvas (as presented in Figure 2) consists of eleven blocks used in group discussions and consensus media after fieldwork to map everyday solutions created by communities. The solutions Mapping Tools consist of components as described in Table II.

Table II Solution Mapping Tools

No	Components	Guiding Questions
1.	Name of the Solutions	What is the name of the solution? Each solution should have a familiar name or term (used in everyday life) for the creator or user to distinguish between one solution and another. Suggestion: The same solution usually has a name or term in different places.
2.	Category	Can these solutions be categorized as objects or social systems? Solutions can be tangible (objects) or intangible (social systems). Suggestion: Learners can choose one or both if they support each other.
3.	Users	Who uses and operates these solutions? Are they individuals or communities? Who are the people involved? What are their roles? Describe their characters! Suggestion: Sketch or take photos of the people being observed.
4.	Date	When is fieldwork conducted? Suggestion: If there is a time difference between fieldwork and group discussion, please make a special note.
5.	Location	Where is the location? What is the environment like? What is the context? Suggestion: Take photos or sketch the general environment.

6.	Learners' Name	Write the names of the learner(s) individually or in groups!
7.	Name (Community) Contact	Write the names of individuals and communities observed! Suggestion: Exchange contacts to facilitate communication if learners want to inquire about or follow up on a topic.
8.	Description	What objects or social systems exist around the observation site? What problems are being solved? How does it work, and how is it used? Suggestion: Take photos of the objects or their physical form. If possible, collect the objects.
9.	Benefit	What lesson can be learned from these solutions? Suggestion: Discuss and summarize together in the group based on each learner's notes.
10.	Problems and Challenges	What problems, difficulties, or challenges were encountered? Suggestion: Discuss and summarize together in the group based on each learner's notes.
11.	Opportunities	What are the opportunities that can be developed? Suggestion: Discuss and summarize together in the group based on each learner's notes.

(Source: Solution Mapping Tools, 2022)

Result and Discussion

The main benefit of using Solution Mapping Tools is to develop a more comprehensive understanding of the observed solutions and uncover benefits, issues, and opportunities that can be developed in the future. The Solutions Mapping tool is currently released under a Creative Commons License. It has been introduced through several workshops with various stakeholders, such as government agencies, research institutions, non-governmental organizations, and communities (arts, culture, urbanism, design, and literacy).

The Application of Solution Mapping Tools

The practicability of Solution Mapping Tools is explored in this section through a case study of a workshop held by Design Ethnography Lab and UNDP Accelerator Lab Indonesia, who organized a workshop in Lewolema Sub-district, East Flores Regency, East Nusa Tenggara Province. The Indonesian government has categorized the East Flores Regency into 3T Regions, which stand for frontier, outermost, and least developed regions in Indonesia. 3T Regions are areas with low economic growth due to uneven infrastructure development, limited access to information technology, and geographically remote areas, so people depend on natural resources (Parmin & Taufiq, 2020).



Figure 3 Moke distillation apparatus
(Source: Solution Mapping Workshop, 2022)

As an example of using the Solution Mapping Tools in the workshop, Group 1 focused on findings around the bamboo-based Moke distillation apparatus, a traditional spirit made from fermented palm fruits. It involves traditional techniques taught through generations (Soko et al., 2017). As presented in Figure 3, Group 1 identified the Moke distillation apparatus explicitly (stages of production) and implicitly (cultural significance and importance of Moke distillation to the local community). The solution Mapping Canvas below is reproduced in digital format (previously photos of A1 paper canvas) and translated from Bahasa Indonesia to English. Further details are explained in the following description:

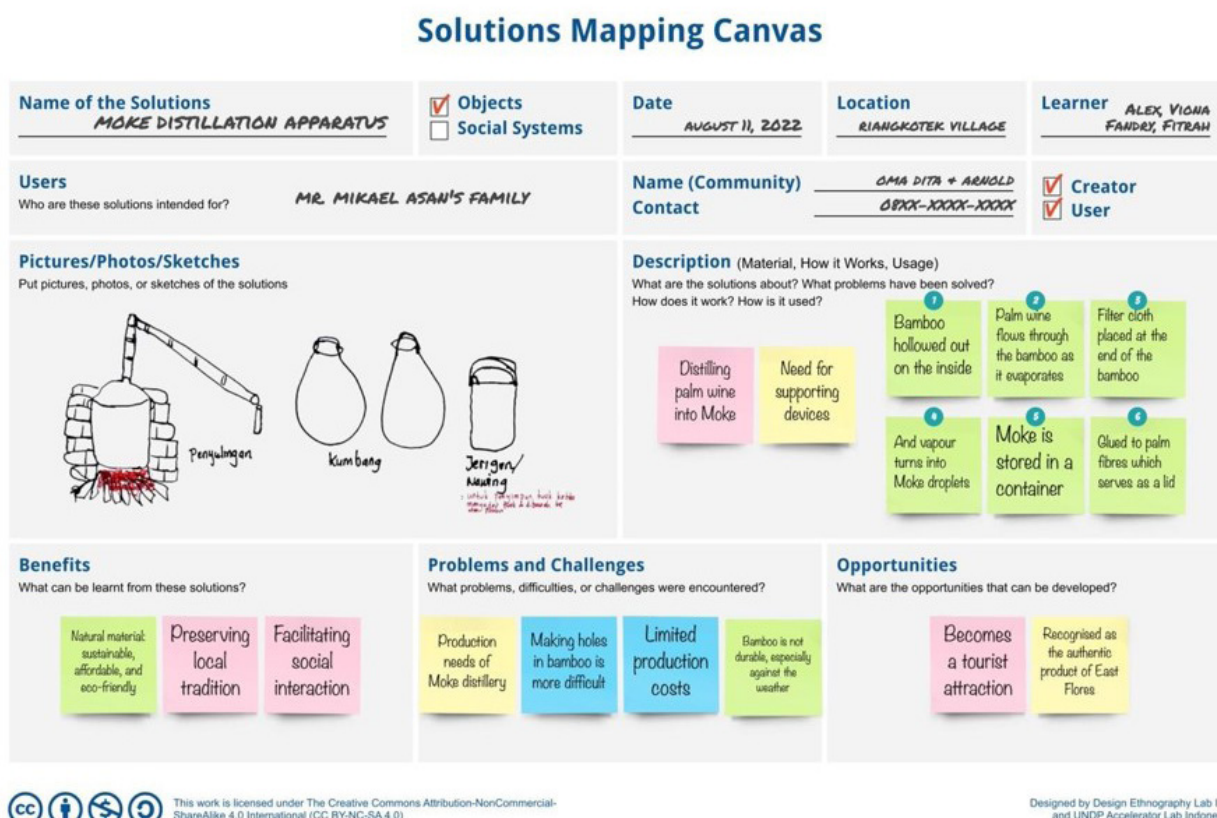


Figure 4 Solution Mapping Canvas applied to the workshop

Name of the Solutions

The name of the solution is necessary to distinguish one solution from another. Group 1 chose the Moke distillation apparatus because Moke is a traditional alcoholic drink symbolizing brotherhood for the people of Flores (Seo, 2014). Moke is also known as Sopi or Dewe in other regions of Flores (Joan et al., 2022). Similar solutions are often found elsewhere under different names.

Category

Solutions are categorized into objects and social systems. Objects in grassroots innovation provide solutions to local problems that fulfill the specific needs of niche-specific needs and ecosystem viability in terms of their flexibility, affordability, and modularity in many cases. According to Group 1, objects (tangible) are easier to observe and trigger topics in interviews, while social systems (intangible) are more challenging to observe. It requires sufficient time and deeper immersion into the community's daily activities. Social systems are considered complex adaptive systems where individual and collective behaviors evolve, including (1) specific sub-systems of the more extensive social system (such as communities, cities, regions, substantial public institutions, or complex organizations), (2) direct-indirect interaction, and (3) cultural systems (Missimer et al., 2017).

Users

Users play an essential role in everyday solutions as they continuously correspond in usage, maintenance, repair, and modification according to their daily needs and problems. Mikael Asan's family owns a Moke distillation apparatus for family and friends to enjoy. After the learners went on a solution safari to the site, discussions were sparked to develop Moke as one of East Flores' signature products. Therefore, Solution Mapping Tools act as design devices that trigger and support design-based initiatives (Manzini & Rizzo, 2011).

Date

Learners should note fieldwork time in cases where similar or more sophisticated solutions are identified in the future. The Solution Mapping Workshop was held on August 11–12, 2022. Twenty learners join the workshop with the following objectives: immerse themselves in the context through a solution safari; conduct observations and interviews with users or innovators; and identify everyday solutions made or used by the community.

Location

Documentation of the fieldwork site is essential to understanding the context of the solution in the environment in which it is located. Riangkotek is a village in Lewolema Sub-district, East Flores Regency, East Nusa Tenggara Province, Indonesia. Natural and human-made factors can inspire the creation of new solutions, as the conditions and circumstances of a location can influence particular social needs (Kumar et al., 2013).

Learners' Name

The names of learners directly involved during the fieldwork are included as a reminder if more in-depth information and experiences are needed in the future. Group 1 members' names are Alex, Viona, Fandry, and Fitrah. Before conducting the fieldwork, the learners attended a workshop on how to use the Solution Mapping Tool. Learners were given time to do fieldwork after gaining sufficient understanding through a two-way discussion. Interestingly, the participants involved in the solution safaris have similar geographical contexts and perspectives to the everyday solution creators and users. This commonality can build new aspirations and understandings of the socio-cultural and local knowledge of the creators and users (Drain & Sanders, 2019).

Name (Community) and Contact

The name of the user or creator and the communities impacted by the everyday solution exchange contacts to facilitate communication if learners want to ask questions or follow up on a topic. Group 1 visited the home of Mikael Asan's family. They met Oma Dita and Arnold (her grandson) and talked with them about the Moke distillation apparatus.

Description

Learners conduct an in-depth interview to uncover the everyday solution: materials used (availability in the surrounding environment), how to use them, and how the everyday solution works. The learners found that the practical reason behind the Moke distillation apparatus was that the makers needed a tool to support the distillation of palm wine into Moke. Learners also gain knowledge about the process and step-by-step of producing Moke as follows: (1) hollowing out the bamboo on the inside (at the node), (2) palm wine flows through the bamboo as it evaporates, (3) filter cloth is placed at the end of the bamboo, (4) vapor turns into Moke droplets, (5) Moke is stored in a container, and (6) it is glued to palm fibers which serve as a lid.

Benefit

In this block, learners build consensus by identifying and discussing the findings of the solution safari, focusing on the benefits and positive impacts, both direct and indirect, for the creators, users, and society. They found that everyday solutions are dynamically linked to utilizing natural materials, maintaining cultural assets, and strengthening social interaction. Frugality, affordability, and circularity should also concern learners in identifying everyday solutions (Gupta, 1997). How everyday solutions are readily available regarding materials and application according to the context, focus on local people and the environment, and allow for creative improvisation in the face of limitations.

Problems and Challenges

Problems and challenges that occur in everyday solutions cause inconvenience for users. Learners found that: (1) many things can be improved in fulfilling the needs of the Moke distillation process; (2) making holes in bamboo is more complicated; (3) there are limited production costs; (4) bamboo is less weather-resistant. Social innovation can transform critical social problems and challenges into opportunities by actively engaging community actors through the enhancement of social, cultural, and environmental resources (Lisetchi & Brancu, 2014).

Opportunities

Learners discuss mapping out further development opportunities, focusing on two areas: (1) developing the Moke distillation process as a tourist attraction in East Flores and (2) developing Moke to be recognized as an authentic product from East Flores. This block can define an action plan agreed upon by the learners. Subsequently, an action plan can foster the development of products, services, businesses, systems, and policies.

Conclusion

Solution Mapping Tools encourage learners to discover the myriad of everyday solutions utilized and created by communities. During the reflection session, they realized the community's resilience and resourcefulness in using surrounding materials to solve daily problems. It helps everyday solutions become visible and identifiable in terms of needs, assets, issues, challenges, benefits, and opportunities for the future. Solution Mapping Tools also have the potential to enhance our empathy and awareness, as demonstrated by the participants' enthusiasm during the workshop for identifying future development opportunities that hold contextual relevance to everyday life.

This paper extends existing publications by understanding local needs and assets as a pre-design process before applying participatory-based approaches. Learners can implement and facilitate solution mapping for the broader community in the future using tools and workshops. Solution mapping is a pre-design process aimed at understanding the available natural resources that can be developed and the capacity of the community in terms of craftsmanship, production techniques, tacit knowledge, and local culture to contribute equally to the participatory design process. With a comprehensive understanding of needs and solutions, communities can develop contextualized grassroots innovations.

Future research can focus on two key aspects of solution mapping: Firstly, it can explore how solution mapping can empower marginalized communities by utilizing inclusive and accessible tools. This involves providing support for local languages, developing interfaces that are accessible to everyone, and incorporating participatory approaches that ensure the voices of marginalized communities are heard and valued. By doing so, solution mapping can be a powerful tool for empowering these often-overlooked communities. Secondly, future research can employ longitudinal studies to evaluate the long-term impact of solution-mapping initiatives. By conducting follow-up evaluations and monitoring the implemented solutions over an extended period, researchers can gain valuable insights into the sustainability and scalability of grassroots innovations.

Additionally, these studies can shed light on the influence of cultural, social, and economic factors on successfully implementing solutions. Longitudinal studies also help to identify potential barriers or challenges and provide valuable input for iteratively refining solution mapping methodologies. By combining the inclusion of marginalized communities with longitudinal approaches, solution mapping can effectively facilitate community development and foster sustainable innovation.

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