

The Value of Participatory Co-Design: A Case Study of Upcycling in Rural Thailand

Abstract

Participatory design (PD) has been increasingly applied to support community-based sustainability initiatives, particularly in rural contexts where local knowledge and material constraints shape upcycling practices. However, limited access to design expertise may affect the long-term viability of such initiatives. This study explores how PD principles intersect with upcycling practices in small communities in Thailand through semi-structured interviews with 22 experts from two groups: community-participation experts and upcycling-design experts. An inductive reflexive thematic analysis identified five themes related to participatory upcycling practices, including creative participation as a pathway to community engagement, culturally appropriate communication for sustaining involvement, the integration of local craftsmanship into product development, the influence of material availability on design feasibility, and limited access to technical skills. The findings suggest that participatory upcycling practices support locally grounded innovation through collaborative knowledge-sharing and culturally relevant design processes. However, their implementation remains dependent on external technical support and resource access in rural contexts. The study highlights the importance of context-sensitive design collaboration in supporting sustainable community-based upcycling practices.

Keywords

Participatory Design, Upcycling, Municipal Solid Waste, Community Engagement, Local Crafts

1. Introduction

Municipal solid waste has become a critical environmental challenge in Thailand, particularly exacerbated by the COVID-19 pandemic. Since the outbreak began in 2020, efforts to curb plastic pollution have stagnated, and plastic waste generation has surged by nearly 40% compared to pre-pandemic levels (Rujivanarom, 2021). This increase was largely due to the rapid expansion of food delivery services and online shopping, driven by shifting consumer behaviour and digital convenience (Simachaya, 2022). In 2023, Thailand generated approximately 26.95 million tons of solid waste, equivalent to 73,840 tons per day, or 1.12 kilograms per person. Of this, only 9.31 million tons were recycled (Department of Pollution Control Thailand, 2023). Khon Kaen Province, one of the most densely populated areas in northeastern Thailand, faces a particularly pressing waste management crisis: its municipality produces around 1,289 tons of waste per day, and this figure continues to rise annually (Atthaporn et al., 2024). These challenges highlight the urgent need for more effective and inclusive waste management strategies. To address this issue, Thailand has implemented several national and local policies. The 20-Year National Strategic Plan (2018–2037) and the Roadmap on Plastic Waste Management (2018–2030) emphasise the circular economy and the Sustainable Development Goals (SDGs). At the provincial level, Khon Kaen has introduced integrated waste management programs through collaboration between public and private sectors, focusing on waste separation, recycling hubs, and waste-to-energy facilities (Atthaporn et al., 2024). At the community level, participatory waste initiatives encourage citizens to engage in sorting, composting, and upcycling, supported by local governments and NGOs (Pollution Control Department, 2020). While these initiatives aim to reduce waste at the source, upcycling offers an innovative and creative complement that transforms discarded materials into products of higher value, aligning with Thailand's broader sustainability goals.

Upcycling presents a practical, community-based strategy for tackling waste challenges in small and rural Thai communities (Intharashuto & team, 2022). It enables citizens to convert environmental liabilities into valuable resources and stimulates local economies through creative reuse (Oestereich et al., 2023). However, its mainstream adoption remains limited due to infrastructural gaps, inconsistent waste separation systems, and low consumer awareness (GC Thailand, 2020; Stratsea, 2023). Addressing these barriers requires stronger policy support and cross-sector collaboration to build public understanding of upcycling's value.

PD provides a promising approach to these challenges by fostering inclusive and context-sensitive solutions through active community engagement (Schuler & Namioka, 1993; Sanders & Stappers, 2008). In Thailand, PD has been increasingly adopted in community-based environmental initiatives that emphasise multi-sectoral participation. For example, the “Baworn Network” (home–temple–school collaboration) exemplifies a participatory approach to waste management, where local communities, religious institutions, and public agencies jointly develop sustainable waste reduction and recycling systems to enhance environmental well-being (Thai Health Promotion Foundation, 2025). In Thailand, PD has been increasingly adopted in community-based environmental initiatives that emphasise multi-sectoral participation. This cultural foundation has been extended to environmental initiatives, including waste management and upcycling programs that integrate local participation and shared responsibility (Phanthata, 2022).

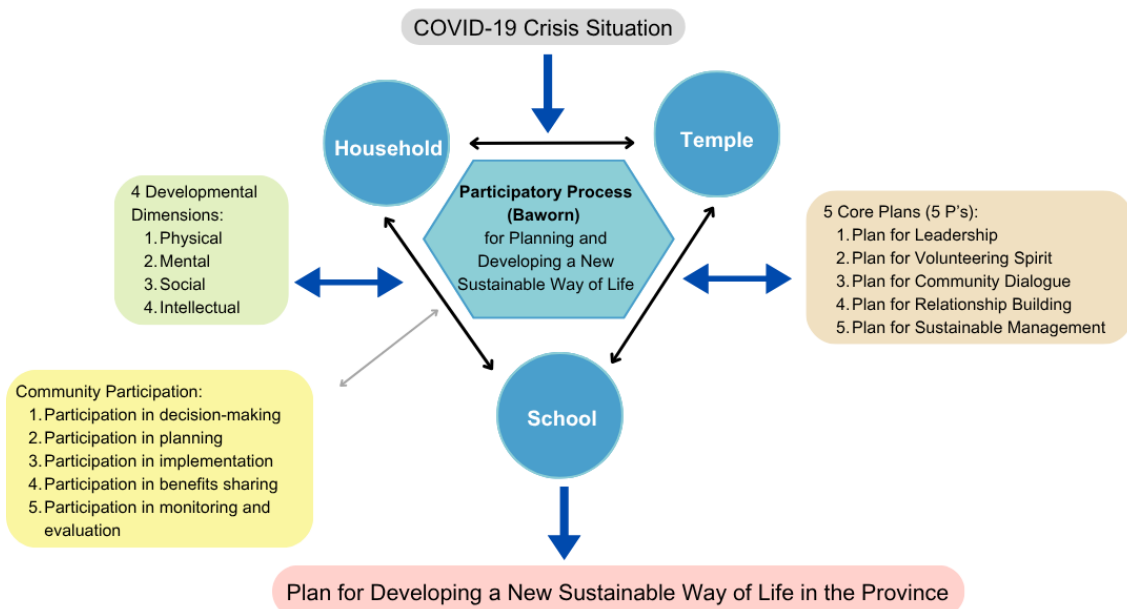


Figure 1 The Baworn Community Participation Model

Figure 1 illustrates the Baworn concept, a community-based participation mechanism for sustainable development through collaboration between three key institutions: households, temples, and schools. The model integrates four dimensions of well-being: 1) physical, 2) mental, 3) social, and 4) intellectual development. Together, these dimensions support shared participation through five principles related to leadership, knowledge exchange, community networking, empowerment, and resilience. Originally developed as part of post-COVID-19 community recovery initiatives, the Baworn model demonstrates how intersectoral collaboration can support collective adaptation and community well-being in Thai society (Pharakruwirojkanchanakhet, Phramethtripariyattiwibun, Pharakhrupalad Suwat Swattanon,

Intayivo, & Pharakhruthammaraporn, 2021). In this study, the Baworn concept is used to illustrate how culturally embedded participation structures may support community-based sustainability initiatives in Thailand. The Baworn network, referring to collaboration between households, temples, and schools, has been widely adopted in Thai environmental and community-development campaigns (Department of Promotion of Religion, Arts and Culture Thailand, 2020). Within waste management contexts, households contribute recyclable waste, temples often function as centres for environmental campaigns and collective activities, and schools support awareness-building related to waste separation and upcycling. The figure therefore provides contextual grounding for understanding how collaboration, trust-building, and shared responsibility are embedded within existing Thai community systems.



Figure 2 Examples of culturally embedded waste management campaigns in Thailand. Compiled by the author based on publicly available campaign materials and previous doctoral research (Lertnimanoradee, 2026).

The influence of the Baworn structure can also be observed in various Thai environmental and waste management campaigns that integrate religious values, collective participation, and community-based sustainability practices. Figure 2 presents examples of waste management and environmental campaigns in Thailand that integrate Buddhist values and community participation into sustainability practices. The integration of religious institutions into waste management strategies represents a distinctive socio-cultural approach to environmental sustainability, particularly in Thailand where temples often function as central community hubs. By framing waste segregation and recycling activities as forms of merit-making (Boon), these campaigns encourage public participation through culturally familiar practices and beliefs. For example, initiatives such as “Trash to Merit” promote the donation of recyclable materials for social and community welfare activities, while temple-based campaigns such as “Waste Bank in the Temple” encourage waste separation and recycling through collective

participation. Other activities, including recyclable donation ceremonies linked to Buddhist traditions, further demonstrate how religious practices can support environmental awareness and community engagement. These campaigns illustrate how cultural beliefs, collective participation, and trust in local institutions may help connect individual waste practices with broader sustainability initiatives in Thailand (Pollution Control Department Thailand, 2019).

In the context of upcycling and waste management, PD promotes the co-creation of products that address local waste issues while integrating local crafts, arts, and traditional techniques. PD encourages the active participation of community members in activities such as waste collection, material separation, creative design, and product development. The approach emphasises collaboration and the inclusion of diverse forms of knowledge, including contributions from local craftspeople, community leaders, and experts from different disciplines. As a result, PD enables upcycling practices that are both culturally relevant and practically responsive to local needs. This approach also encourages community members, particularly those without formal design training, to engage in the upcycling process and develop products that reflect local needs and preferences (Nuttavuthisit, Jindahra, & Prasarnphanich, 2015). In this study, PD is introduced as a collaborative approach that enables communities to explore locally appropriate upcycling practices, strengthen participation, develop practical skills, and increase awareness of material value and sustainability. While waste reduction is one intended outcome, the study primarily focuses on how participatory processes can support long-term community engagement and capacity-building within rural Thai contexts.

Previous studies have highlighted that PD approaches developed in Western contexts may not fully reflect the social, cultural, and organisational realities of developing countries (Hussain, Sanders, & Steinert, 2012). In rural and resource-constrained settings, factors such as social hierarchy, educational differences, limited resources, and unequal power relations may influence participation dynamics and collaboration processes. Furthermore, researchers have argued that participants' capacity to participate should not be assumed, particularly in communities with limited exposure to design processes or collaborative decision-making activities (Byrne & Sahay, 2007). Participatory activities may therefore require adaptation, gradual skill-building, and flexible facilitation strategies that are sensitive to local cultural contexts. Similar challenges have also been identified in participatory waste management and community development initiatives in Thailand, particularly within small and rural communities (Lertnimanoradee, 2026). These barriers include limited awareness of

participatory approaches, restricted access to funding and design knowledge, unequal power dynamics, and difficulties sustaining long-term community engagement. In some communities, limited familiarity with participatory processes may lead to hesitation or uncertainty regarding participation. In addition, differences in social status or relationships between community members and local leaders may affect collaboration and decision-making. Short-term funding structures may also limit opportunities for long-term capacity-building and sustainable community development (Duangputtan & Mishima, 2023). Although PD has strong potential to support community engagement and locally appropriate upcycling practices in Thailand, these challenges suggest that participatory approaches should be carefully adapted to local cultural, social, and resource conditions. This highlights the importance of developing participatory frameworks that support not only waste reduction, but also long-term community participation, awareness-building, and local capacity development.

Despite increasing attention to PD and upcycling, several gaps remain in existing scholarship, particularly within small and rural Thai communities. First, most PD research has been conducted in urban or well-resourced settings with strong infrastructure, higher digital literacy, and access to design support (Burikul, 2022). Rural Thai communities, however, operate within different constraints, such as limited tools, budget restrictions, and varied social structures, yet remain underrepresented in PD studies (Shetunyenga, 2024). As a result, evidence on how PD can be adapted to low-resource, culturally diverse contexts is still limited. Second, current upcycling literature is largely product- or material-oriented, focusing on technical transformation, environmental benefits, or market potential (Channiam, 2024). Far fewer studies examine upcycling as a community-embedded practice that draws on local craft knowledge, cultural identity, and intergenerational participation, elements central to many Thai rural communities (Intrachuto, 2022; Sakchai Sikkha et al., 2022). Third, although Thailand has initiatives promoting community participation, such as the Baworn Network, research exploring the intersection of PD and upcycling is scarce. Few studies investigate how stakeholders collaborate to co-create upcycled products, or how community and professional perspectives differ in identifying challenges, opportunities, and cultural dynamics within the design process (Kunjaro, 2019).

The lack of such a framework limits the long-term scalability and practical adoption of community-based upcycling initiatives. Overall, a clear research gap exists regarding how PD can be strategically applied to support community-led upcycling in rural Thailand by integrating local knowledge, cultural practices, and collaborative processes into sustainable

waste management. To address these gaps, this study investigates how PD can support community-based upcycling practices in rural Thailand through the perspectives of experts in community participation and upcycling design. Specifically, the study explores: 1) how PD supports community engagement and upcycling activities, 2) what challenges and opportunities emerge when applying participatory approaches in rural contexts, and 3) how expert insights may contribute to the development of context-sensitive participatory upcycling guidelines. Ultimately, the study aims to contribute to more sustainable and resilient community-based approaches to waste management in rural Thailand.

2. Literature Review

2.1 Participatory Design

Participatory design (PD) is a collaborative approach that engages users actively in the design process, fostering co-creation and enhancing the relevance of design outcomes to community needs. PD emphasises the involvement of stakeholders throughout the design process. Sanders and Stappers (2008) highlight the growing importance of co-creation and co-design in participatory design. They define co-creation as any collective creativity shared by two or more people, while co-design is a specific form of co-creation focused on the design process. Unlike traditional views that limit co-design to professional designers, the authors broaden the concept to include both designers and non-designers working together, which is central to participatory design's inclusive approach. (Sanders & Stappers, 2008). Building on this, the participation of both design experts and people without formal design training creates opportunities to address problems in diverse and innovative ways, particularly within community contexts. PD allows for the sharing of knowledge between stakeholders, enabling the co-creation of solutions to local issues, such as waste management. By combining professional design skills with local, experiential knowledge, this approach facilitates creative problem-solving tailored to specific community needs.

The existing literature on PD predominantly concentrates on urban environments, often overlooking the unique dynamics of small communities in rural contexts, particularly in Thailand. While traditional PD theories emphasise the inclusion of diverse stakeholders, they do not fully address the cultural and social intricacies specific to rural Thai communities. Schön's (2016) concept of reflective practice underscores the importance of incorporating multiple perspectives within the design process. However, his work does not directly address the challenges and context-specific practices that arise in localised, rural settings. This

limitation reduces the applicability of PD models in rural areas, where community engagement is strongly influenced by social norms and cultural traditions that differ significantly from urban contexts (Schön, 2016). McDonagh (2010) emphasises a design process grounded in empathic research, underscoring the importance of understanding user needs and experiences at each stage. This process begins with designers engaging themselves in users' environments to gather qualitative insights through appropriate research methods, such as passive ethnographic observations. By watching, listening, and absorbing information without disrupting users' actions, designers gain valuable insights into how life-expert users interact with their surroundings. This understanding informs the ideation phase, where diverse ideas are generated collaboratively. Informal conversations also play a crucial role in building trust between designers and life-expert users. Concepts are then developed into prototypes and tested with users, allowing for critical feedback. Collaboration fosters mutual respect, patience, tolerance, and shared objectives, while empathic modelling places designers in the role of the life-expert user, enabling a deeper understanding of their experiences. An iterative loop follows, refining the design based on user input to enhance its relevance and effectiveness (McDonagh & Thomas, 2010).

Considering these points, McDonagh's approach of empathic modelling, where designers step into the user's shoes, ensures that these events are developed with cultural respect and awareness, which Sung (2021) notes is essential for transitioning upcycling from niche to mainstream. Involving local communities through PD methods in upcycling requires careful consideration of the potential for community involvement to enhance local economic development through the creation of upcycled goods. This strategy could be applied to national and public holidays in Thailand, such as creating cards from scrap materials for Mother's and Father's Day, or producing festival-related items like candle drippings trays from plastic bottles or wreaths made from lottery paper for religious festivals. Buddhist principles play a significant role in raising awareness of individual and societal responsibility for waste management in Thai communities. This connection is particularly relevant to sustainable initiatives like waste reduction and environmental stewardship (Sirisoda, 2023). Local organisations promote campaigns aligned with traditional Thai values, such as "Transforming Trash into Merit," "Trash Creates Merit," and "Transforming Garbage Piles into Merit," which are rooted in the Buddhist concept of making merit, which is performing good deeds to foster a better afterlife.

One of the trending upcycled products on Thailand's social media is the 'Plastic Amulet', creatively named 'Pra Sati' (meaning 'mindfulness amulet'). This product is the result of a collaboration between Qualy and Dots Design Studio, symbolising the Buddhist concept of reincarnation. As shown in Figure 3, crafted from various types of plastic waste such as cups, bottles, and packaging materials, the 'Pra Sati' serves as a reminder for people to dispose of waste and use resources with mindfulness, emphasizing conscious consumption and sustainable living. Aligning design guidelines with the values and beliefs of a community can significantly enhance both the relevance and effectiveness of a project. The Pra Sati initiative, for example, has increased public interest and has the potential to reach a broader audience. It raises awareness about which types of waste can be further recycled or upcycled and encourages people to learn about waste segregation. As a result, the initiative not only promotes mindfulness in resource use but also motivates individuals to start separating their waste more actively (Qualy, 2022).



Figure 3 The Pra Sati amulet is crafted from a variety of materials derived from different types of plastics.
Image source: Qualy Design Co., Ltd. (2022).

Additionally, having a dedicated space for learning and promoting upcycling is crucial. Similar to the Upcycling Plaza model in Seoul, South Korea, which successfully fosters upcycling through various programs, such spaces can support community engagement and skill development (Sung, 2021). In the Thai context, temples could play a vital role as community centres and co-working or co-learning spaces, offering easy access for people to engage in and learn upcycling practices (Arnando, PhraSuthirattanabundit, & Srithong, 2020). Figure 4 illustrates the "Wat Do You ทิ้ง?" (a play on words where "Wat" means temple and "ทิ้ง" sounds like "Think" but means "throw away" in Thai) is a campaign designed to promote waste segregation within Wat Thong Temple. It incorporates educational activities and showcases examples of sustainable waste management. The temple's efforts include guiding visitors to sort their waste correctly, categorising waste into detailed types, cleaning waste for further processing, and collaborating with the private sector for recycling (MGR Online, 2024).

This integration of participatory design, cultural relevance, and dedicated spaces could further enhance the reach and impact of upcycling initiatives in Thailand.



Figure 4 Waste Management at Wat Thong. Image source: MGR Online (2024).

2.2 Cultural Contexts in Design and Sustainability

Cultural contexts significantly influence PD and upcycling practices in rural communities, shaping how local traditions and values affect community engagement in sustainability efforts. Zhang (2010) explores the intersection of technology and culture, arguing that design cannot be separated from the cultural contexts in which it operates. They emphasise that understanding the specific cultural dynamics of a community is crucial for designing effective and relevant solutions. This perspective is particularly pertinent in participatory design, where engagement with local customs can enhance community ownership and involvement in sustainability initiatives (Zhang J., 2010).

Waylen et al. (2009) further examine the role of cultural considerations in community-based sustainability projects. The local traditions, values, and social structures significantly impact the success of these initiatives. The study highlights that incorporating cultural elements into sustainability efforts can lead to more effective community engagement by aligning project goals with the community's existing practices and beliefs. This alignment not only fosters greater participation but also enhances the relevance and sustainability of the initiatives (Waylen, Fischer, McGowan, Thirgood, & Milner-Gulland, 2009).

Engaging community members in co-creating solutions that resonate with their cultural heritage can lead to more successful outcomes in upcycling and other sustainability efforts. By valuing local knowledge and traditions, designers can cultivate a more inclusive environment that encourages active participation, ultimately enhancing the impact of sustainability initiatives (Culture Action Europe, 2019). These findings underscore the importance of recognising and integrating cultural contexts in PD and sustainability practices. As communities navigate the complexities of waste management and resource conservation,

leveraging local traditions and values can be instrumental in fostering sustainable behaviours and practices, particularly in small community settings.

Additionally, the discourse surrounding upcycling frequently centres on individualistic or urban-centric projects, thereby overlooking the potential for community-based initiatives that leverage local knowledge and resources. Scholars such as Manzini (2015) and Papanek (1985) emphasise the importance of integrating local craftsmanship and traditional practices into sustainable design, highlighting how these approaches can foster more socially inclusive and contextually relevant upcycling projects (Manzini & Coad, 2015; Papanek, 1985). Fuad-Luke (2009) further advocates for design activism that engages communities by utilising their existing skills and cultural practices, enabling them to address sustainability challenges (Fuad-Luke, 2009). This gap in the literature suggests a missed opportunity to explore how PD can be tailored to empower small communities in rural areas and harness their unique resources for upcycling initiatives.

2.3 Synergies between PD and Upcycling

The intersection of PD and upcycling practices offers insights into how collaborative approaches can enhance sustainability and community engagement. PD emphasises the involvement of stakeholders in the design process, ensuring that their needs, values, and cultural contexts are considered. This approach encourages innovative solutions tailored to local challenges (Schuler & Namioka, 1993). Upcycling, the process of transforming waste materials into new products of higher value, aligns well with PD principles. According to Bridgens et al. (2019), upcycling projects can benefit significantly from community involvement, as local knowledge and creativity play a crucial role in identifying valuable waste materials and envisioning their potential uses. Engaging communities in the upcycling process not only enhances the relevance of the solutions but also builds social capital, promoting sustainable practices at the grassroots level (Bridgens, et al., 2018).

When people participate in design processes, they develop new skills and knowledge while fostering a sense of ownership, commitment, and empathy towards the project. This involvement helps them feel connected to the success and progress of the initiative. In scenarios where PD is applied effectively, the outcomes are more adaptable, customizable, and sustainable. The collaborative environment also encourages participants to contribute to continuous improvement, leading to projects that are better equipped to meet long-term sustainability goals (Wu, Zhuang, Zhang, & Zhao, 2022).

This synergy between PD and upcycling demonstrates that sustainable solutions are not only about technology and material processes but also about engaging communities and respecting cultural contexts. Collaborative efforts in both fields reinforce the idea that sustainability can be fostered at the local level, leading to more resilient and adaptable systems (Manzini Ezio, 2015). This research aims to address these gaps by investigating the synergistic relationship between PD and upcycling practices within small communities in Thailand. By adapting PD principles to the specific socio-economic and cultural contexts of these communities, the study seeks to highlight effective engagement strategies that resonate with residents. This localised focus not only enhances community involvement but also ensures that upcycling practices align with existing skills and cultural norms.

3. Methodology

3.1 Research Design and Approach

This study adopted a qualitative research design to explore how PD principles intersect with upcycling practices within small communities in Thailand. A qualitative approach enabled a deeper understanding of community dynamics, local cultural influences, participatory processes, and design-related challenges within rural contexts. The study was guided by research questions focusing on participatory design, community engagement, implementation challenges, and the development of participatory upcycling guidelines in rural Thailand. Data were collected through semi-structured interviews and analysed using reflexive thematic analysis (Braun & Clarke, 2006). This analytical approach was selected for its flexibility in identifying patterns across diverse experiential perspectives while allowing the researcher to interpret meanings grounded in participants' professional experiences and contextual knowledge. The study specifically focused on two expert groups: 1) community-participation experts, and 2) upcycling-design experts. Expert perspectives were selected because the research aimed to identify facilitation strategies, material practices, sustainability challenges, and implementation considerations that could inform the development of participatory upcycling guidelines for future use within rural Thai communities. Rather than documenting the experiences of a single community, the study sought broader cross-project insights that could support the adaptation of participatory upcycling approaches across diverse local contexts. In particular, the inclusion of upcycling-design experts supported the investigation of how upcycled products may move beyond temporary or purely decorative outcomes toward more functional, durable, and contextually relevant applications. These expert insights were

intended to support the development of more sustainable and practically applicable participatory upcycling strategies for long-term community use.

Ethical approval for this study was granted by the Brunel Research Ethics Online (BREO) system at Brunel University London (Approval Reference: 40317-LR-Nov/2022-42051-1). All participants were provided with an information sheet outlining the study's purpose, data usage, and confidentiality procedures, and gave informed consent before participation. Participants were also informed of their right to withdraw at any stage without consequence. These measures were implemented to ensure ethical transparency and voluntary participation throughout the research process.

3.2 Sampling Strategy and Participants

A purposive sampling strategy was employed to recruit participants with relevant expertise in community participation, rural development, upcycling design, or sustainability innovation. To ensure that participants could provide informed and practice-based insights, inclusion criteria required a minimum of five years' professional or community-based experience in participatory initiatives, design practice, or sustainability-related activities.

The final sample consisted of 22 participants across two expert groups: community-participation experts (n = 10) and upcycling-design experts (n = 12). The sample size was determined based on the need to capture a diverse range of perspectives from both community engagement and design-oriented domains. Data collection continued until thematic saturation was reached, defined as the point at which no substantially new themes or insights emerged from subsequent interviews (Guest, Bunce, & Laura, 2006). Participants were recruited through purposive referral from community organisations, sustainability networks, and professional design communities. This approach enabled the inclusion of individuals with diverse experiential knowledge relevant to participatory upcycling practices in rural contexts. Table 1 presents an overview of participant roles, years of experience, and interview duration.

Table 1 Participant Overview

Group	Code	Expertise / Role	Years of Experience	Interview Duration
Community- participation experts (10)	CE1–CE10	Community leaders, NGO staff, cultural practitioners, public officers	5–10 yrs	45–60 mins
Upcycling -design experts (12)	UE1–UE12	Designers, entrepreneurs, and sustainability practitioners	5–10 yrs	45–60 mins

3.3 Semi-structured interviews

Semi-structured interviews were employed as the primary data collection method, balancing conversational flexibility with systematic coverage of key topics aligned with the research questions. Two interview guides, one for each expert group, were developed to ensure consistency while allowing participants to elaborate in depth on their experiences. The development of the interview guide followed three stages: 1) a review of literature on PD, upcycling, community empowerment, and rural crafting practices, 2) alignment of each question with the research objectives to ensure coverage of relevant thematic areas such as leadership, material sourcing, and design innovation, and 3) a preliminary logic check with two non-participant community workers to refine clarity, phrasing, and sequencing. Interviews were conducted online via video conferencing platforms (e.g., Zoom, LINE, or video call), depending on participants' preferences and accessibility. Each interview lasted between 45 and 60 minutes. With participants' informed consent, all interviews were audio-recorded and subsequently transcribed verbatim for analysis.

Across both expert groups, the interviews explored five core areas relevant to the study: community empowerment (e.g., how community members participate in design or upcycling activities), cultural and contextual influences (including the role of local traditions in shaping sustainability practices), material challenges and opportunities (particularly barriers in sourcing, sorting, and processing rural waste), design processes and collaboration (examining how designers, experts, hospitals, and communities work together), and the future potential of upcycled products (identifying viable, culturally relevant product possibilities for rural settings). Representative questions included: "In your experience, what motivates community members to join upcycling initiatives?", "What challenges commonly arise during PD activities in rural areas?", "Which types of waste materials have the greatest potential for upcycling?", and "How can collaboration between experts and communities improve design and sustainability outcomes?" It is acknowledged that conducting interviews online may have limited participation from individuals with restricted digital access in rural contexts; however, efforts were made to accommodate participants' technological capabilities by offering multiple communication platforms and flexible scheduling.

3.4 Data Analysis Design

Reflexive thematic analysis was conducted following Braun and Clarke's (2006) six-phase framework. First, the researcher familiarised herself with the data through repeated reading of

the transcripts and the development of preliminary analytic notes. Second, initial codes were generated inductively through line-by-line coding, capturing salient features of the data such as trust-building, material availability, innovation processes, design skills, and cultural relevance. Third, these codes were organised into initial clusters by identifying recurring patterns and relationships across participants. Fourth, all provisional themes were reviewed and refined to ensure internal coherence and consistency with the wider dataset, which involved merging overlapping themes and removing weak or repetitive categories. Fifth, the themes were clearly defined and named, leading to five final thematic categories that captured the core dimensions of participatory upcycling practices (e.g., Sustaining Engagement, Cultural Heritage Preservation). Finally, the themes were synthesised into written analytic narratives and visualised through tables and thematic maps to illustrate the conceptual relationships underpinning the findings.

In line with the reflexive orientation of this method, theme development was treated as an interpretative process shaped by the researcher’s disciplinary background in PD and community-based sustainability. Rather than assuming that themes emerged directly from the data, the analysis involved active engagement with participants’ accounts to construct meaningful patterns relevant to the research questions. Reflexive memo-writing was undertaken throughout the coding process to document analytical decisions, support transparency, and minimise unexamined assumptions. Emerging interpretations were iteratively reviewed and discussed with two academic supervisors to enable critical reflection on thematic coherence and analytical rigour, in line with reflexive thematic analysis principles, rather than to achieve coding consensus. Table 2 provides examples from both respondent groups, namely community participation experts (CE) and upcycling design experts (UE), to illustrate how quotes were coded and developed into themes

Table 2 Example of theme development

Participant	Quote	Initial Code	Sub-themes	Themes
CE 1	“...the team encourages community members to share their ideas, such as logo design or drawings of familiar objects like plants and flowers.”	Community-led idea generation	Enhancing local identity through co-design	Engagement through Creative Participation
CE7	“The projects aim to ensure that the products or outcomes belong to the community... In addition to the physical products, community	Ownership and capability building	Community ownership and capacity development	

	members gain knowledge for further product development.”			
UE 7	Upcycling products must be attractive enough; otherwise, people will not use them.”	Perceived aesthetic usability	Design innovation for user adoption	Sustaining Engagement through Communication and Iterative Activities
CE 10	“Innovation is a criterion in contests, leading communities to focus on inventions.”	Incentive-driven innovation	External motivation mechanisms	
UE1	“When considering the concept, it's essential to assess the availability of sufficient raw materials for production... (1) Are there enough local materials? (2) Is production simple enough... without requiring extensive equipment?”	Local material availability and feasibility	Assessing supply continuity and production feasibility	Local Material Availability and Design Considerations
CE 9	“Efforts to repurpose waste into useful items, such as brooms from water bottles.”	Waste-to-product transformation	Local resource utilisation	
UE 3	“We need to understand the material properties first, products may not be durable.”	Material literacy requirement	Technical knowledge constraints	Access to Design Knowledge and Technical Skills
UE 5	“Some elderly villagers cannot cut or shape materials precisely, so we have to redesign the process to be simpler.”	Process simplification for ageing users	Adaptation of tools and techniques	
CE7	“Religious beliefs and local customs play a significant role in motivating community involvement, as volunteer work is seen as a means of gaining personal merit.”	Merit-based cultural motivation	Cultural and religious drivers for participation	Integrating Local Knowledge into Upcycled Products
UE 2	“It is easier to start with familiar crafts such as weaving; new techniques should come later when confidence increases.”	Leveraging existing craft knowledge	Integrating traditional crafts	

Table 2 presents illustrative examples of how participant quotes from community participation experts (CE) and upcycling design experts (UE) were inductively coded, grouped into sub-themes, and organised into overarching themes through reflexive thematic analysis.

4. Results Overview

The thematic analysis identified five key themes that capture the social, cultural, and technical dimensions of PD and upcycling practices in small communities. Across both respondent groups, 1) community-participation experts (CE) and 2) upcycling-design experts (UE), participants described participatory upcycling as a collaborative process influenced by trust, communication, and cultural familiarity, as well as practical considerations such as material

availability, production feasibility, and technical knowledge. While CE participants tended to emphasise leadership, collective engagement, and locally embedded practices, UE participants focused more on material properties, design processes, and product functionality. Together, these perspectives highlight the interconnected nature of community empowerment and design innovation within participatory upcycling initiatives. The following sections present each theme in detail, supported by illustrative participant quotations. The five themes are presented as follows:

Theme 1: Engagement through Creative Participation

Participants from both expert groups described creative, hands-on activities as an accessible entry point for initial community engagement in participatory upcycling initiatives. Several community-participation experts (e.g., CE1, CE3, CE5, CE7, CE9) emphasised the importance of trust-building through ongoing interaction and follow-up activities, while upcycling design experts highlighted the role of simple creative practices in encouraging involvement among individuals with limited design experience. For example, one community participation expert explained: “Regular engagement and interaction are essential to establish trust and deepen the connection” (CE7). Similarly, another participant noted: “Creativity is encouraged within the community through activities during some events and festivals like crafting Bai Sri Phan and mobiles” (CE6). These perspectives suggest that low-threshold creative activities may support early engagement in participatory upcycling processes, particularly in communities with limited prior exposure to design-led initiatives.

Theme 2: Sustaining Engagement through Communication and Iterative Activities

Participants from both expert groups described sustained engagement as dependent on regular interaction and the ongoing adaptation of participatory activities. Several community participation experts (e.g., CE2, CE4, CE6, CE8, CE10) emphasised the role of direct communication between project facilitators and residents in maintaining participation, particularly in contexts where group leaders often mediate information flow. In contrast, upcycling design experts (e.g., UE1, UE3, UE6, UE7, UE11) highlighted the importance of introducing new conceptual or design-oriented inputs to prevent stagnation in community-led production processes. For example, one community participation expert explained: “Problems are often brought up by group leaders, but direct conversations with local villagers also give us a clearer picture” (CE2). Similarly, a design expert noted: “When we look into concepts

like zero waste or circular economy, it opens up useful ideas that can shape how we design things.” (UE3)

These responses suggest that sustaining participation may depend on a combination of continuous dialogue and the periodic introduction of new design-related ideas within participatory upcycling initiatives.

Theme 3: Integrating Local Knowledge into Upcycled Products

Participants from both expert groups referred to the incorporation of local traditions and craftsmanship into upcycling activities. Community participation experts (e.g., CE2, CE5, CE7, CE10) discussed how traditional knowledge could be used to transform discarded materials into culturally meaningful outputs. Upcycling design experts (e.g., UE2, UE5, UE7, UE12) described how such practices could influence decisions related to product usability and perceived value. For example, one community participation expert stated: “They’ve found a way to take what others throw away and, using their traditional knowledge, turn it into something unique that reflects their culture and local identity” (CE2). Similarly, a design expert commented: “We always think about both sides: it has to be good for the environment, but it also needs to be something that people can actually use and feel proud of” (UE2).

These perspectives were reflected in several locally developed outputs mentioned by participants, including woven doormats, Bai Sri trays, hanging decorative mobiles, and funeral flowers made from reused lottery paper and fabric scraps. In some communities, traditional weaving techniques were adapted to transform plastic packaging waste into household products, allowing villagers to build on familiar craft skills while incorporating recyclable materials into everyday use. Other examples included transforming discarded polo shirts by unravelling the fabric into individual yarns, which were then re-woven into traditional Pha Khao Ma textiles, and repurposing discarded nylon fishing nets into durable sleeping hammocks through modified weaving structures. Other activities incorporated cultural symbolism and ceremonial practices, which helped increase community participation and emotional attachment to the products. For example, some communities experimented with upcycling ceremonial marigold waste into naturally dyed fabrics, a process that combined local storytelling, cultural symbolism, and environmentally conscious production practices. Participants suggested that these culturally embedded approaches could also enhance product distinctiveness and support small-scale rural economic activities. These

findings suggest that locally embedded knowledge may shape both material transformation practices and the perceived relevance of upcycled products within community contexts.

Theme 4: Local Material Availability and Design Considerations

Material sourcing was identified as a practical factor influencing participatory upcycling activities. Community participation experts (e.g., CE3, CE6, CE9) described collecting materials through local networks, including unused household fabric within the village. Upcycling design experts (e.g., UE1, UE3, UE4, UE9) discussed working with available waste materials, such as leftover wood or production offcuts, as a starting point for developing functional products. For example, one upcycling design expert explained: “This project started because we were interested in finding a way to make something useful from leftover wood” (UE3). Similarly, a community participation expert noted: “It starts with collecting leftover fabric from people in the village... they usually have pieces they’re not using anymore” (CE6). These accounts suggest that material availability within local contexts may influence both production processes and design feasibility in participatory upcycling initiatives. In several cases, available waste materials directly shaped the types of products that could be developed. For example, leftover hardwood scraps from industrial production, including teak, mahogany, and macadamia wood, were transformed into household furniture and decorative products. Designers noted that the selection of these materials was influenced by availability and durability, usability, and manufacturing feasibility. Other projects utilised discarded car tires to create fashion bags and functional accessories. In these cases, participants described how the material properties of tire rubber, including strength, flexibility, and resistance to environmental conditions, influenced both the product concept and technical production process. Similarly, discarded vinyl billboards were repurposed into reusable bags by combining locally available waste materials with the sewing skills of community members. In some communities, discarded fabric and textile waste were reused to produce bags, mats, and household craft products through simple sewing and weaving techniques that could be carried out using locally available tools and skills. These examples indicate that design decisions were often shaped by material accessibility, local craftsmanship, and production conditions rather than predetermined product concepts. The findings therefore suggest that participatory upcycling practices in rural contexts are strongly influenced by the relationship between material availability, technical feasibility, and local production capabilities.

Theme 5: Access to Design Knowledge and Technical Skills

Limited access to formal design training and technical knowledge was frequently mentioned by participants from both expert groups. Community participation experts (e.g., CE1, CE4, CE8, CE10) referred to constraints such as limited human resources, insufficient funding, and difficulties maintaining long-term participation, which affected their ability to sustain upcycling initiatives. Upcycling design experts (e.g., UE3, UE5, UE6, UE8, UE12) discussed the technical complexity involved in certain production methods and the level of skill required for producing durable and functional upcycled products. For example, one community participation expert explained: “We don’t always have enough people to continue the work, especially when it requires specific skills or time commitment” (CE4). Similarly, a design expert noted: “Making these items isn’t always simple... some methods are quite tricky and need real skill” (UE6). Participants described a range of technical processes involved in participatory upcycling activities, including sewing, weaving, heat compression, coating, pattern-making, and material preparation. In some projects, specialists or external experts were required to support technical experimentation, material testing, or machine installation. Several participants also noted that certain materials required cleaning, processing, or structural modification before they could be safely or effectively transformed into functional products. In community-based contexts, participants emphasised the importance of adapting production processes to locally available skills and accessible tools. For example, some initiatives intentionally used simple handcraft techniques and household equipment to enable broader community participation, while more technically demanding processes were often simplified through workshops, demonstrations, or collaboration with universities and external organisations. These responses suggest that access to technical knowledge, skill development, and appropriate training may significantly influence the implementation, continuity, and long-term sustainability of participatory upcycling practices at the community level. The findings also indicate that successful participatory upcycling initiatives may require balancing technical innovation with the practical capabilities and learning capacities of local participants.

Comparative Insights Between the Two Expert Groups

The perspectives of community participation experts (CE) and upcycling design experts (UE) reveal complementary priorities in participatory upcycling initiatives. While both groups recognised empowerment as a key outcome, CE participants tended to associate it with trust-building, leadership, and creating a supportive environment for villagers to participate. In contrast, UE participants referred more frequently to design innovation and creative

collaboration as ways to encourage engagement. A similar distinction was observed in how sustained participation was understood. CE participants highlighted the role of culturally relevant communication, such as storytelling or linking activities to local beliefs, in maintaining long-term involvement. UE participants, however, emphasised the introduction of new design challenges as a means of sustaining interest and preventing fatigue over time. This contrast suggests that continued engagement may depend on both social interaction and evolving design opportunities. In relation to cultural heritage preservation, CE participants prioritised the continuation of traditional crafts as part of community identity and pride. UE participants viewed heritage practices as a source of aesthetic and functional inspiration that could inform product development. These differing perspectives indicate that local traditions may contribute not only to participation but also to the perceived value of upcycled outcomes.

5. Discussion

The findings provide further insight into how PD may influence community engagement and innovation in upcycling practices within small Thai communities. While CE and UE participants approached these challenges from different professional perspectives, several shared patterns were evident across the dataset.

5.1 Empowerment and Innovation

The findings suggest that PD may support the development of confidence and creative engagement among community members involved in upcycling activities. CE participants frequently associated empowerment with trust-building and a sense of ownership within the community, while UE participants emphasised the role of collaborative design processes in encouraging idea generation and experimentation. This aligns with previous studies, which describe empowerment in PD as emerging through shared decision-making and collective problem-solving rather than through externally imposed solutions (Sanders and Stappers, 2008). However, limited design experience among community members was identified as a recurring constraint that may influence the originality of locally developed products. In some cases, participants described a tendency to replicate existing design concepts rather than develop new ones independently. Similar observations have been noted in community-based co-design contexts, where external facilitation is often required to introduce new techniques while maintaining cultural relevance (Manzini, 2015). The involvement of external designers in this context may therefore be understood not as a replacement for local knowledge, but as a complementary source of technical expertise that supports the adaptation of traditional

practices into new design applications. This reflects broader discussions in the participatory design literature on the importance of balancing expert input with community knowledge to produce contextually appropriate and sustainable solutions.

As illustrated in Figure 5, empowerment in participatory upcycling initiatives may evolve through iterative cycles of trust-building, collaboration, and creative engagement. These

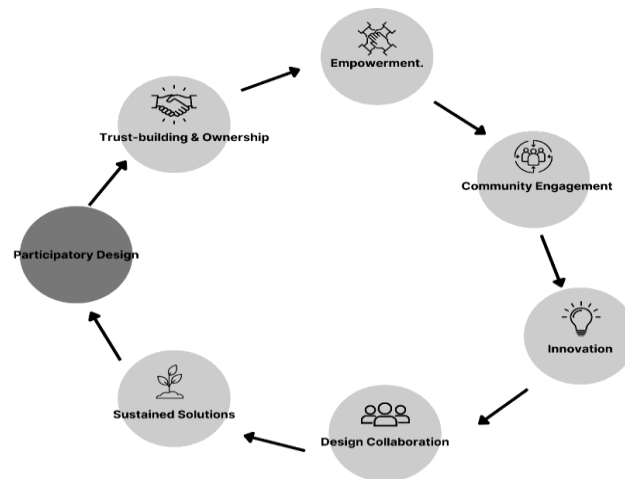


Figure 5. Thematic map illustrating the participatory design cycle for empowerment and innovation.
(Derived from thematic analysis of interview data.)

cycles appear to support the gradual development of locally adapted design solutions that are both culturally relevant and practically viable over time.

5.2 Sustaining Engagement

Maintaining community engagement was not simply a matter of improving communication or organising more activities. In practice, participants described their level of involvement as closely tied to whether they could see clear benefits from taking part, such as learning new skills, generating income, or gaining social recognition within the community. In some cases, villagers were hesitant to join design-related workshops unless there was a clear outcome or incentive, suggesting that participation was influenced by perceived value rather than interest alone. Community-participation experts explained that trust-building efforts, such as follow-up visits or informal conversations through local leaders, could initially encourage involvement. However, these efforts did not always lead to sustained participation, particularly when project activities conflicted with daily routines or livelihood responsibilities. This highlights how engagement is shaped not only by communication strategies but also by practical constraints such as time availability and competing priorities. From the designers' perspective, a different challenge emerged. Communities tended to lose interest when the

upcycling process became repetitive or when the products produced lacked variation. Several participants noted that motivation declined when activities focused mainly on standardised outputs rather than creative exploration. Introducing new materials, alternative techniques, or opportunities to experiment with design concepts was therefore seen as essential for maintaining interest over time. Taken together, these findings suggest that sustaining engagement may depend on balancing culturally meaningful activities with ongoing creative development.

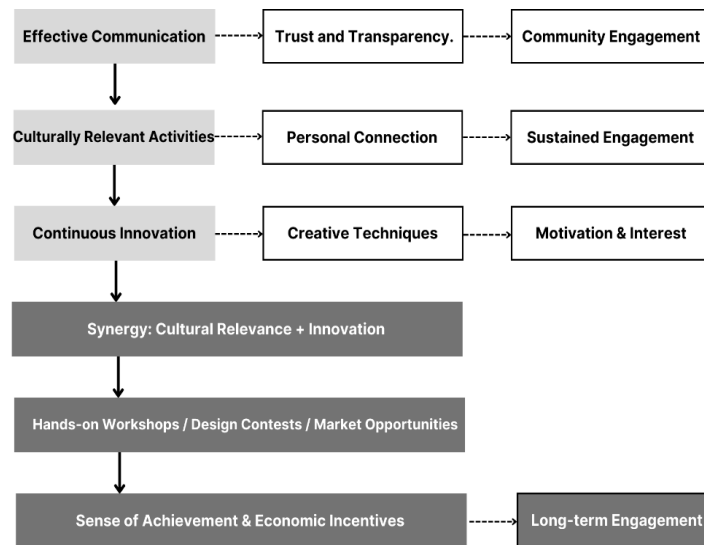


Figure 6. A flowchart representation of Sustaining Engagement.
(Derived from thematic analysis of interview data.)

As illustrated in Figure 6, long-term participation appears more likely when community members feel that the activities reflect their identity while also offering tangible outcomes, such as showcasing products at local markets or participating in hands-on design workshops. In these situations, a sense of achievement or economic benefit can reinforce continued involvement beyond the initial stages of the project.

5.3 Cultural Heritage and Upcycling

Both community-participation experts and upcycling-design experts viewed upcycling as a potential pathway for integrating traditional handicrafts and local wisdom into contemporary product development. In many rural Thai communities, traditional craft practices are gradually declining due to generational shifts and changing economic priorities. Participants suggested that incorporating familiar techniques, such as weaving or natural dyeing, into upcycling activities could help retain these practices in new forms of production. However, integrating traditional craftsmanship into upcycled products was not always straightforward.

While preserving cultural identity was often seen as desirable, communities also faced pressure to adapt their products to meet contemporary aesthetic expectations and market demand. In some cases, attempts to maintain traditional forms limited experimentation, resulting in products that struggled to compete beyond local markets. Conversely, excessive modification of traditional techniques risked reducing their cultural significance, raising concerns among community members about losing authenticity.

External support from design experts and universities was therefore described as both enabling and challenging. On one hand, collaboration provided technical knowledge and exposure to modern design principles, which could help communities develop more diverse and commercially viable products. On the other hand, participants noted that strong reliance on external guidance occasionally led to the replication of designer-led ideas rather than locally generated innovation. This suggests that external intervention may need to be carefully negotiated to avoid unintentionally shaping outcomes that prioritise market appeal over cultural continuity.

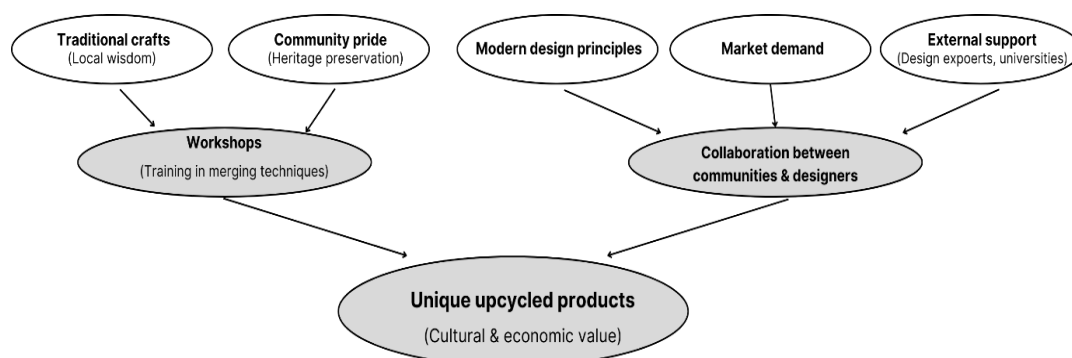


Figure 7. Combining traditional crafts and modern design to create unique upcycled products.
(Derived from thematic analysis of interview data.)

As illustrated in Figure 7, workshops and collaborative design processes may facilitate the blending of traditional skills with contemporary production approaches. When this integration is managed effectively, upcycled products can reflect both cultural identity and economic value. Nevertheless, the findings indicate that sustaining this balance requires ongoing dialogue between community priorities and external design perspectives, rather than assuming that innovation and heritage are inherently compatible.

5.4 Material Sustainability

In this study, material sustainability refers to the long-term suitability and responsible use of materials within community-based upcycling practices, including considerations of material availability, durability, usability, sourcing processes, and practical feasibility. Material

sustainability emerged as a shared concern across both expert groups; however, their perspectives revealed different practical priorities. Community-participation experts tended to focus on issues related to material availability, sourcing processes, and logistical constraints. In rural settings, communities often depend on locally available scrap materials, not because they are always the most suitable for long-term use, but because they are affordable and easily accessible. Participants noted that transportation costs and inconsistent material supply can limit production continuity, particularly when suitable waste materials are scattered across different locations. In contrast, upcycling designers emphasised the importance of understanding material properties to improve product durability, safety, and usability. From this perspective, not all locally available materials are appropriate for transformation into long-lasting products. Designers highlighted that certain scrap materials require cleaning, processing, or technical modification before they can be safely or effectively reused. This introduces an inherent tension between accessibility and performance. While communities may prioritise materials that are easy to source, these materials may not always support the production of durable or marketable outcomes. The findings therefore suggest that sustainable material use in small-community upcycling is shaped by a trade-off between logistical feasibility and technical optimisation. Locally sourced materials may reduce procurement costs; however, inconsistent quality or limited suitability can affect product lifespan and usability. Conversely, introducing more technically appropriate materials or processing methods may improve product performance but increase dependency on external expertise, tools, or equipment.

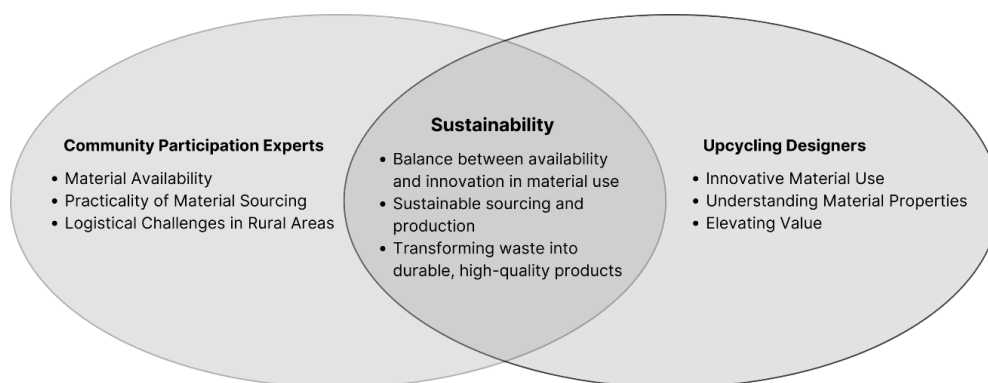


Figure 8. Shared perspectives on sustainable material use in community upcycling.

(Derived from thematic analysis of interview data.)

As illustrated in Figure 8, the overlap between community-participation experts and upcycling designers lies in recognising that sustainable material use requires balancing material availability with informed innovation. Bridging this gap may involve capacity-building

activities such as workshops on material properties, material selection, or processing techniques. However, such interventions must also consider the risk that increased technical requirements could unintentionally exclude community members with limited resources or skills. In this sense, achieving material sustainability involves not only selecting appropriate materials, but also negotiating between practicality, performance, accessibility, and long-term community autonomy.

5.5 Bridging the Expertise Gap

The lack of formal design training within small community settings emerged as a recurring constraint that limits both innovation capacity and the long-term sustainability of upcycling initiatives. Community-participation experts acknowledged that, in practice, many local groups remain dependent on external designers or technical specialists to guide decision-making throughout the upcycling process. While such support enables product development in the short term, it may also restrict the development of independent design capabilities within the community. From the perspective of upcycling-design experts, technical competencies related to material testing, product development, and market alignment were considered essential for improving both product quality and functional performance. Partnerships with universities, design practitioners, and sustainability specialists were therefore viewed as a necessary mechanism for facilitating knowledge transfer and strengthening local capacity.

However, this reliance raises questions regarding the extent to which externally driven expertise can be effectively embedded within community practices over time. Bridging this expertise gap involves more than the provision of technical training; it requires a gradual shift in the role of community members from implementers of externally developed ideas to active co-creators in the design process. When collaborative training initiatives are sustained, communities may begin to appropriate design knowledge and adapt it to their own cultural and material contexts. This transition can support more locally grounded innovation and reduce long-term dependency on external intervention.

As illustrated in Figure 9, structured skills development and collaborative learning can help mitigate barriers arising from limited formal training. Over time, increased technical confidence may enable communities to experiment more independently with upcycling processes, thereby supporting the emergence of more resilient and self-sustaining design practices beyond the duration of externally funded programmes.

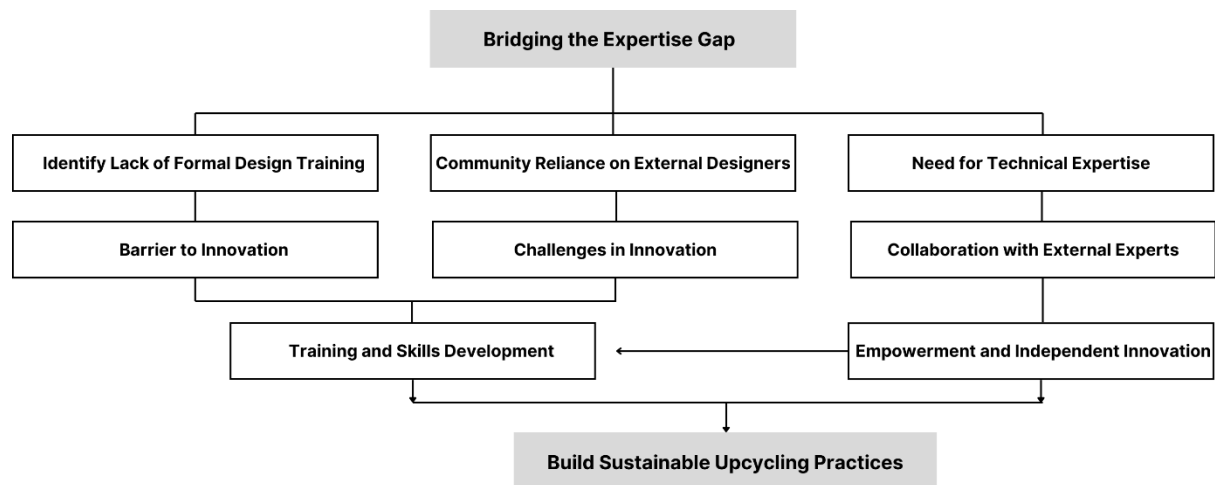


Figure 9. Addressing the lack of design skills to build sustainable upcycling practices.
(Derived from thematic analysis of interview data.)

6. Limitations

This study has limitations that should be considered when interpreting the findings. First, the sample consisted primarily of experts in community participation and upcycling design, which may limit the inclusion of perspectives from community members without formal involvement in participatory initiatives. Second, interviews were conducted online due to geographical constraints, which may have influenced the depth of interaction compared to in-person settings, particularly in rural contexts where digital access varies. In addition, the findings are derived from participants working within Thai small-community settings and may therefore reflect context-specific cultural and material dynamics that are not directly transferable to other regions. Future research may benefit from incorporating participatory workshops or focus group discussions involving multiple stakeholders to further explore interdisciplinary collaboration in real-time settings.

7. Conclusion

This study demonstrates that participatory design, when integrated with upcycling practices, can provide a viable pathway for small communities to simultaneously engage in innovation and cultural preservation. Rather than treating waste transformation as a purely technical process, the findings suggest that upcycling becomes more sustainable when it is embedded within locally meaningful creative practices, such as traditional crafts and community-based production methods. However, the effectiveness of such collaborations is not solely dependent on access to external expertise. While partnerships with designers, universities, and sustainability specialists can support initial knowledge transfer, the long-term viability of

community-led upcycling initiatives depends on the gradual internalisation of design capabilities. In this respect, trust-building and ongoing collaboration play a critical role in enabling communities to move beyond externally guided implementation towards more autonomous forms of creative problem-solving.

These findings align with prior research suggesting that PD can support social innovation and local empowerment (Manzini, 2015). Nevertheless, this study extends existing work by highlighting the material and cultural constraints that shape design practices in small-scale Thai communities, where innovation is often negotiated through the availability of locally accessible resources rather than through optimal material selection. This context reveals that sustainable upcycling is not simply achieved through technological advancement, but through adaptive design processes that balance cultural continuity with practical feasibility. Future research should therefore move beyond generalised participatory frameworks and examine how context-sensitive design tools can better support communities with limited formal training in developing locally grounded, yet economically viable, upcycling practices. Such an approach may contribute to more resilient models of community innovation that are capable of evolving beyond the duration of externally funded interventions.

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