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Walking The Line Between HCD And SCBT: Marine Waste-Art

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ABSTRACT
The rising threat of marine waste, particularly plastic, presents a significant environmental, social, and economic crisis for coastal communities and tourism sectors. Despite a variety of regulatory efforts, workable long-term solutions have remained elusive. This paper introduces a new framework that merges Human Centred Design (HCD) with Sustainable Community-Based Tourism (SCBT) to address these complex challenges. By employing the empathy, definition, ideation, prototyping, testing, and implementation stages of HCD alongside SCBT's triple focus on economic, environmental and social sustainability, this approach offers a well-rounded, community driven framework. A synergy table illustrates how HCD principles align with SCBT objectives, offering strategies to transform marine waste into community assets such as Waste-Art. This integration underscores how local strategies can promote environmental stewardship, economic growth, and community engagement as a comprehensive solution to marine waste.

Keywords: *Human-Centred Design (HCD), Sustainable Community-Based Tourism (SCBT), Sustainable Design, Waste – Art, Sosial Innovation.*

1 INTRODUCTION

Marine waste, particularly plastics, have been intensifying in Malaysia at an unprecedented rate, causing severe potential threats to the environment and coastal communities. It has been estimated that millions of tonnes of plastic wastes are dumped into the global oceans every year (Eriksen et al., 2014; Eerkes-Medrano et al., 2015; Law, 2017), with disastrous implications on marine ecosystems and local livelihoods. On account of the transboundary nature of the plastic waste issue, widespread plastic waste is transported and entered into the Malaysian waters and these may include Langkawi, Penang and Sabah (Chen et al., 2021; Fauziah et al., 2021). The marine waste pollution continued to pose significant consequences to the country's economy and society, which placed strain on the already overstretched waste treatment and management system, and exacerbate the risk of public health deterioration (Kamaruddin et al., 2022).

Despite these efforts, conventional systems have proven ineffective. Therefore, this paper posits an integrated framework that combines Human Centred Design (HCD) and Sustainable Community-Based Tourism (SCBT) as a means to realise culturally relevant and sustainable methods. While HCD emphasises empathy, iteration and user participation (Norman, 2007; Brown, 2009), SCBT stresses

local empowerment and environmental protection (Moli, 2011; Dangi & Jamal, 2016). Waste-Art, which turns trash into crafted objects, showcases how HCD + SCBT can endow the community with the power and generate new awareness. This practice of was seen in many places over centuries (Chen, 2018). A destination advancement depends on the inhabitant's participation (Clarke, 2002) where it can ensure equitable benefit distribution by centring locals in tourism development (Moayerian et al., 2022).

This paper aims to propose a synergy framework scheme between HCD and SCBT in consideration of marine Waste-Art and craft. It will contribute to the existing sustainability literature as well as provide tools for policy makers, designers and community organisers to have a realisation for turning marine waste into Waste-Art and craft.

2 LITERATURE REVIEW

2.1 Persistent Issue of Marine Waste

Marine plastic pollution has been a global environmental issue due to its negative impact on the environment and coastal livelihoods. To mitigate the effects of pollution, Malaysia has proposed several initiatives, such as the Roadmap Towards Zero Single-Use Plastics (2018–2030), the Plastic Bag and Styrofoam Ban, and the National Solid Waste Management Policy (Feei et al., 2020; Agamuthu & Victor, 2011). Although several policies have been proposed to address the issue, its success is not substantial due to enforcement issues and transboundary pollution (Kamaruddin et al., 2021).

Although several technological innovations, such as green biodegradable plastics and chemical recycling techniques, have emerged to address the environmental impact of conventional plastics, each alternative requires time and resources to scale up and be made commercially viable (Ibrahim et al., 2016). Consequently, conventional innovation approaches have demonstrated limitations. This context necessitates a community oriented and holistic approach that tackles both the environmental and socio-economic challenges at hand. This paper provides one such framework by combining both HCD and SCBT with a view to sustain solutions that will empower local stakeholders in the marine waste space.

2.2 Human-Centred Design: Principles, Process, and Application

What is Human Centred design (HCD)? Human-centred design is a way of doing that works directly with the people who will actually use what you're designing and helps them to work out details by prototyping mechanisms, as per The Field Guide to Human-Centred Design, (2023). It is not only focused on what works, but also why and how in terms of user context where users are coming from, the drivers or barriers they have to surmount literally. That approach enables problem solvers to team up with communities, gain a deep understanding of the people they are trying to help, develop new ideas and craft custom-designed solutions for real needs. This leads to improvements in the usability and impact of solutions but is also means community mobilisation, collaboration between all parties involved as well that appropriate perspectives are considered during design process (Borthwick et al., 2022). Don Norman has led the theoretical groundwork for HCD and with numerous research, it expanded into principles. Along with ensuring a common understanding, the International Organisation for Standardisation has also brought human centred designer under its purview. The six HCD principles as outlined in the ISO 9241-210 (ISO 9241-210:2010, 2019) which is a standard for interactive systems are:

1. The design is based on an explicit understanding of users, tasks, and environments.
2. Users are involved throughout design and development.
3. The design is driven and refined by user-centred evaluation.
4. The process is iterative.
5. The design addresses the whole user experience.
6. The design team includes multidisciplinary expertise.

Human centred design process. The HCD process extends upon the theoretical groundwork and basic principles presented in the previous section. But over the past two decades, we have witnessed a seismic shift in the design field prioritising experience driven and human centred approaches to design. Such approaches make experience the focal point in design instead of making it a unitary end point, as is common in usability-centric processes (Hekkert et al., 2023). Results show that, design researchers have given prominence to exploring the multitude of human experiences in relation to interaction between humans and designs. IDEO (2023), the global design consultancy firm which played a key role in bringing HCD to development practice formalised by publishing its widely used HCD Toolkit taking an applied and practical perspective of using principles of HCD. HCD is therefore a broad and flexible problem-solving strategy within almost any area of human experience.

- **Empathise**: Understand user experience through observation and interaction
- **Define**: Identify key problems based on user insights
- **Ideate**: Generate creative solutions
- **Prototype**: Develop quick, tangible models
- **Test**: Evaluate prototypes and refine
- **Implement**: Deploy real-world solutions and ensure adaptability

These phases centre solutions on users while encouraging adaptability. However, HCD's anthropocentrism and resource demands can limit effectiveness for large-scale environmental issues. Thus, HCD must integrate with systemic frameworks like SCBT to achieve deeper sustainability.

2.3 Sustainable Community-Based Tourism (SCBT)

Community-Based Tourism (CBT) has emerged, from the 1970s onwards (and increasing in importance in the late 1990s) as an approach to localise economic development and empower local communities to effectively manage tourism resources in sustainable ways encompassing empowerment, self-reliance and pro-poor strategies (Dangi & Jamal, 2016, Dangi; Meyer, 2009). This is done through enabling income generation, economic diversification, local culture and heritage preservation, health and education enhancement and poverty reduction from community-based livelihood alternatives.

While CBT holds many advantages, without integrated planning and continuous impact evaluation it's often not enough (World Tourism Organisation, 2019). This warrants solutions that are more specific and measurable to the given context which will provide long term relevance (Choi & Sirakaya, 2006). Thus, the movement towards Sustainable Community-Based Tourism (SCBT) facilitates the most important evolution into the inclusion of an explicit sustainability framework to enrich CBT's objective.

Dangi and Jamal (2016) extended the CBT model by aligning it with the UNEP-UNWTO's 12 aims of sustainable tourism, which emphasise economic, social, and environmental pillars. Their SCBT framework offers clear, measurable criteria to guide policy and practice: (1) Environmental: Natural resource protection, waste reduction, adaptive and eco-friendly planning, continuous monitoring, (2) Economic: Local employment, equitable benefit distribution, institutional support, and visitor management, (3) Social-Cultural: Community satisfaction, participation, empowerment, and cultural respect. This structured framework (Table 1) ensures equitable tourism benefits while promoting long-term sustainability. Dangi's work is instrumental in advancing CBT into a more comprehensive SCBT model that ensures SCBT remains adaptable, measurable, and impactful in diverse contexts.

Table 1 Dangi's Framework for Sustainable Community-Based Tourism

	DIMENSION	CRITERIA	EXAMPLES
SUSTAINABILITY COMMUNITY-BASED TOURISM	ECONOMIC	1. Economic Benefits:	Capturing economic benefits; sustainability of tourism operations and services; economic monitoring; economic vitality; business performance/profitability; local economic development; economic well-being; local government income; rural development; national economic development; property values; local economic diversification; increased consumption of local products; supporting local entrepreneurs and fair trade; investments; employment; quality of employment; business motivation; revenue generation; business performance; income distribution/capital leakage and linkage; income and total sales; empowerment; local enterprise and ownership; sustainable livelihoods framework (SLF); local control.
		2.Local Jobs and Participation:	Local career opportunities/employment; public participation; local community opinion; local access; tourism awareness and education; support for community; labor/company and job conditions.
		3.Institutional Mechanism to Ensure Economic Benefits:	Institutional Mechanism to Ensure Economic Benefits: Fair wages; internal-external business operations; Income distribution; capital formation in the community/investment; nature of (visitors) demand; labor/company and job conditions; micro-credits; preventing exploitation; foreign exchange leakage and domestic linkages; demand and supply of local services; accommodation capacity; wages evaluation; tourism employment index; tourist expenditure pattern; index of foreign exchange revenue; integration of tourism with other activities.
		4.Visitor Management:	Seasonality; Length; Visitor expenditure
	ENVIRONMENTAL /ECOLOGICAL	1.Protection of Natural Environment:	Protection of valuable natural assets; managing scarce natural resources (water availability and conservation; drinking water quality); protection of sensitive environments; wildlife protection.
		2.Reducing Waste/Emissions:	Limiting impacts of tourism activity (sewage treatment;solid waste management; greenhouse gas emissions; energy conservation; wastewater; solid waste reduction; light and noise pollution; recycling and reuse; pollution effects management; visual pollution (conformity to local vernacular); respect environment; rate of ecosystem destruction/degradation.
		3.Innovating/ Adaptive Planning to Environment - friendly Plans:	Environment-friendly Plans: Green design, permaculture gardens; alternative energy; vegetation; conservation zone; fostering human environment relationships; low-impact transportation; ecosystem; atmosphere; energy; resilience and risk; environmental awareness and management; energy efficiency
		4.Assessment and Monitoring:	Environmental risks; assessment of environmental impacts of tourism activity; health of human population (residents/visitors); air; geology and soil; coastal and marine resources; environmental awareness; biodiversity and ecological health; natural capital; loss of renewable/non-renewable resources

SOCIAL-CULTURE	1.Community Well-being and Satisfaction:	Community well-being (local satisfaction with tourism; effects of tourism on communities); sustaining cultural assets; attraction protection; crime and harassment; cultural promotion; ownership patterns; resident views (satisfaction); host reactions to tourists; local culture/tradition; community development; social cohesion; sex tourism; community resource; distribution of resource/power; community health and safety; quality of life in general; building/architecture; socio-cultural fabric; recreational quality; address conflicts of interests
	2.Community Participation and Empowerment:	Community/resident involvement and participation in tourism; community assets/skills/involvement; uniqueness; community empowerment; cultural education; education and training; equitable changes inlocal lifestyle; site interpretation; intellectual property; distinction (visit to heritage sites); accessibility; resident access to tourism goods and benefits
	3.Visitor Satisfaction:	Tourist satisfaction; visitor management; visitor behavior; accessibility and convenience

2.4 Waste-Art, Creative Processes, and Their Societal Impact

While recycling in art is not new, its role in tourism and local development is underexplored. In Tidung Island, Indonesia, plastic makes up 83.86% of marine debris. Communities have turned to Waste-Art, converting waste into crafts as income-generating and awareness tools (Hayati et al., 2020). Similar initiatives in Manila (Borongan & NaRanong, 2022) and Taiwan (Hsia, 2020) show Waste-Art's potential to transform plastic into economic and educational value.

Taiwan's Bantou village, for example, used creative tourism to integrate art with sustainable practices. Waste became not only a material but a medium for storytelling and economic revitalisation. These cases show how Waste-Art serves both environmental and social goals However, challenges remain, including scaling, consistency, and balancing aesthetic value versus advocacy. Integrating HCD into these efforts ensures deeper community engagement and alignment with real needs. Waste-Art becomes more than decoration. It is positioned as a process of renewal rooted in culture, participation, and sustainability.

2.5 Addressing Gaps in Marine Waste Strategies with Human-Centred Design

While certain community-based marine waste projects are drawing upon elements of HCD, such as empathy or co-design, it's often in piecemeal ways. Without all parts of the whole, there's a limit on the extent to which we can capitalise on HCD's potential. Victor Papanek stated that if we are to "practice design responsibly, we must be willing to be 'radical'", to achieve ecological and social design that really matters. As an adaptive and iterative methodology, HCD cultivates locally driven innovation born from first-hand experience and local context (Wood et al., 2020). By embedding communities into every stage of the HCD process from empathy to implementation, HCD creates deeper ownership and long-term sustainability. However, for this change to be sustainable, HCD should not be seen as cosmetic 'tool kit' but systematically integrated as a strategy in SCBT process. It is this inclusive approach that is seen to be generating culturally sensitive solutions that have both environmental and socio- economic benefits.

3 DISCUSSION

3.1 Proposed Integrated Framework

This paper proposes an integrated framework situating Human-Centred Design (HCD) as the means for operationalising Sustainable Community-Based Tourism (SCBT) projects to address the marine waste challenge. Said differently, by injecting HCD's emphasis on empathy, co-creation, and iteration into SCBT's ability to ensure outcomes are rooted in and by community needs, sustainability can better be achieved across economic, environmental, and socio-cultural domains.

Drawing on Ryan's (2014) notion of design as the idea of intention and systemics as the idea of interdependence, and Fry's (as cited in Com, 2023) view of design as a process of constituting futures fundamental to everything that shapes life, these ideas sit at the heart of the framework. HCD brings intentionality(design) into community design, while SCBT mirrors reconstituting the ethos and culture of a community (systemics) (Tan, 2024). By coordinating these two approaches communities can design for aspirational futures rooted in their own lived experiences. The framework's airiness allows communities to prioritise or emphasise different pillars depending on their own intentions. For instance, some projects may prioritise socio-cultural goals such as heritage preservation and capacity building while still contributing to economic uplift and environmental stewardship. Others may be driven by ecological intentions (e.g. reducing marine debris), or economic ones (e.g. upcycling waste into sellable crafts) yet still reinforce local identity and well-being.

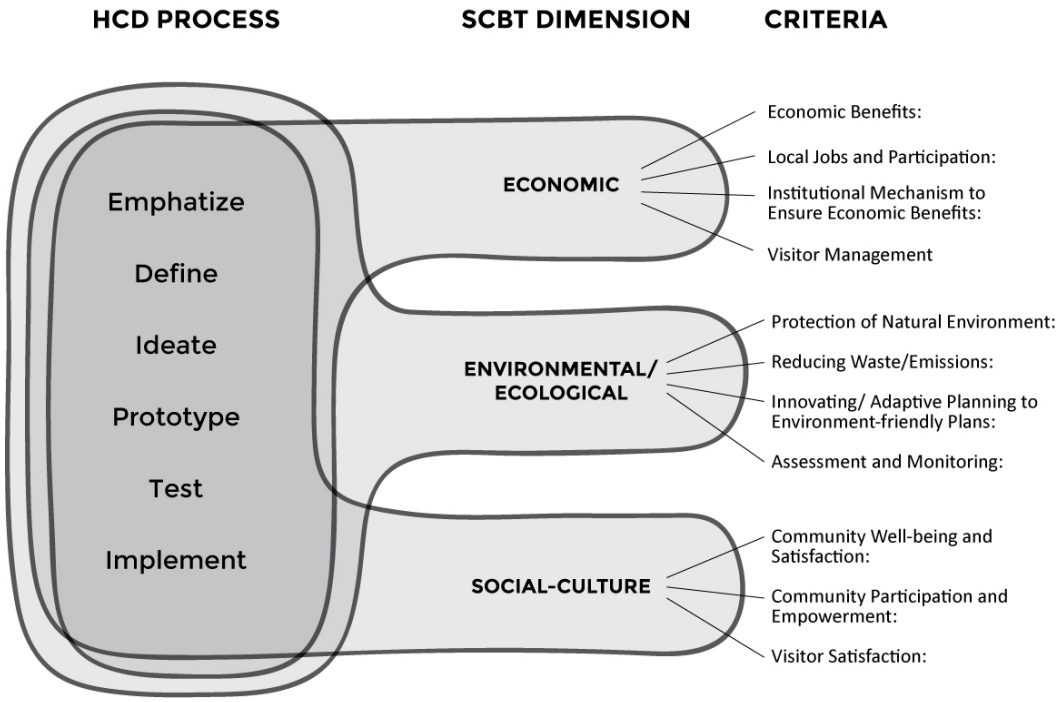

Figure 1 Illustration of the Synergy between HCD and SCBT

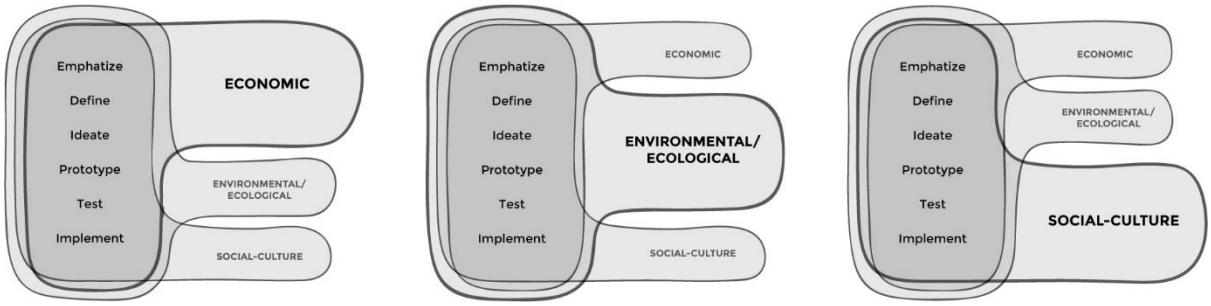

Figure 2 Three Variants of the HCD-SCBT Framework: Socio-Cultural, Economic, and Environmental Perspectives

This modular framework is illustrated in Figure 2, which depicts three possible variations of the framework, led by their respective principal pillar. However, the other pillars are still supported. Given the SCBT's focus on slow, deliberate growth, peak results across all pillars are often seen in an evolving process. The iterative nature of HCD especially lends itself to this type of adaptive progression. By integrating creativity, collaboration and the local context, this overall integrated framework can act as a clear practical guide for the type of community-led initiatives that transform marine waste into opportunities.

3.2 HCD + SCBT Synergy Working

This section presents a synergy working table between HCD phases and key dimensions of SCBT in marine Waste-Art. The working table (Table 6) is inspired on the framework of SCBT by Dangi, where HCD phases are put in concordance with the environmental, economic and socio-cultural dimensions that define a sustainable community-based development.

The table features four key columns:

1. Phase: Lists the six HCD phases: Empathise, Define, Ideate, Prototype, Test, Implement as the backbone of the creative process. Each phase marks a specific moment in project evolution, ensuring structured progression that remains community focused.
2. HCD Consideration: Highlights user-centred priorities at each phase, such as empathy, inclusivity, and iterative feedback. These considerations ensure that project outcomes are grounded in local values and material realities.
3. Marine Waste-Art Application: Offers examples of how each HCD phase can guide actions like engaging locals, creating art from marine debris, and gathering community feedback. These actions enhance both environmental goals and community development.
4. SCBT Dimension Criteria: Aligns the actions with Dangi's SCBT pillars: (1) Economic (e.g., local income, entrepreneurship), (2) Environmental (e.g., waste reduction, resource reuse) and (3) Socio-Cultural (e.g., cultural preservation, empowerment)

For example, in the first phase of Empathy, the need-solution pairs are about understanding community well-being or environmental challenges, whereas the last phase of Implement links more closely to economic diversification and cultural enrichment. Community partnerships can move in and out of each of the three phases as community needs change and emerge. As Fromm (1955) stated, "collective art is shared where it permits one to feel connected with others in a meaningful, rich, and productive way." The iterative methodology of HCD and its iterative nature facilitates partnerships between community stakeholders that are grounded in context, relevant, human centred, and responsive.

Overall, this table provides a replicable model that aligns creative processes to sustainability and provides a practical tool for researchers, designers and tourism planners to deliver interventions that are culturally relevant, environmentally appropriate and economically viable.

Table 2 Working Table for the Synergy of HCD and SCBT in Marine Waste-Art/Craft

Step (Phase)	HCD Consideration	Marine Waste-Art Application	SCBT Dimension - Criteria (Dangi)
Empathise	Conduct ethnographic research to understand community needs, values, and challenges.	- **Action**: Organise workshops and interviews with local fishermen, artisans, and residents to learn about their experiences and challenges related to marine waste. - **Example**: Collaborate with local environmental groups to conduct surveys and focus groups on how marine waste impacts their daily lives and community well-being.	**Economic**: Capturing economic benefits, supporting local entrepreneurs, employment. **Environmental**: Protection of natural assets, reducing waste/emissions, assessment and monitoring. **Social-Cultural**: Community well-being and satisfaction, community participation and empowerment.
Define	Synthesise research findings to identify key community issues related to marine waste.	- **Action**: Identify the most pressing issues such as economic opportunities tied to marine waste art and environmental impact. - **Example**: Prioritise challenges like lack of awareness or insufficient income from current crafts, and set goals for the project.	**Economic**: Local economic development, investments, local control. **Environmental**: Managing scarce resources, conservation efforts, environmental risk assessments. **Social-Cultural**: Cultural promotion, community resource management, social cohesion.
Ideate	Brainstorm with community members to generate ideas that address defined problems.	- **Action**: Facilitate creative sessions where community members suggest ways to transform marine waste into marketable art. - **Example**: Generate ideas for using fishing nets and other marine debris to create sculptures, home decor, or functional items.	**Economic**: Business motivation, income distribution, local enterprise. **Environmental**: Ecosystem protection, recycling and reuse, adaptive planning. **Social-Cultural**: Intellectual property, local access to tourism benefits, cultural education
Prototype	Develop prototypes that are low-cost, simple, and directly related to the community's capabilities and resources.	- **Action**: Create initial prototypes of marine waste-art products based on community input. - **Example**: Craft sample products like decorative items from plastic waste, and refine them based on feedback from the community and potential buyers.	**Economic**: Business performance, revenue generation, employment quality. **Environmental**: Waste management, energy conservation, low-impact transportation. **Social-Cultural**: Empowerment, skill development, community involvement.
Test	Test prototypes within the community, gathering feedback to refine and improve.	- **Action**: Present the prototypes at local events or markets for real-time feedback. - **Example**: Set up a booth at a community fair to showcase the art pieces and gather opinions on aesthetics, pricing, and practicality.	**Economic**: Market demand, consumer behavior, product viability. **Environmental**: Environmental impact monitoring, biodiversity protection, sustainable resource use. **Social-Cultural**: Visitor satisfaction, resident satisfaction, social benefits.
Implement	Finalise designs and plan for broader production and dissemination within the community.	- **Action**: Launch the production of selected marine waste-art products with a focus on sustainability and community benefit. - **Example**: Partner with local businesses and tourism operators to create a supply chain for these products, integrating them into the local tourism market.	**Economic**: Economic diversification, long-term profitability, community investment. **Environmental**: Environmental stewardship, waste reduction, resource management. **Social-Cultural**: Cultural heritage preservation, tourism integration, sustainable community development.

3.3 How Do Communities Participate in Waste-Art Development? Bridging Design, Wisdom, and Empowerment

According to the integration framework outlined in the synergy table above, community involvement and participation materialise in practice. Through the cyclical process of HCD, especially in the ideation phases, local knowledge and creativity are significant to co-shaping sustainable Waste-Art activities. During ideation community members offer ideas that are grounded in cultural practices, familiarity with materials and sensitivity to the environment. A sense of a collaborative process emerges where local knowledge intersects with potential creative ideas (Kirakosyan & Stephenson, 2019; Ngwu, 2019). The process involved in transforming waste from the marine environment into art objects is not

merely technical in nature rather, it becomes a shared process that builds social cohesion, capacities, and stronger community identities (Donkor et al., 2021; Hsia, 2020).

Furthermore, this engagement and social collaboration are consistent with the social cultural and economic dimensions of SCBT, as income is being created while cultural expression is maintained (Dangi & Jamal, 2016). The involvement of community members in the idea generation process and project activities assures that Waste-Art ideas will not be imported from the outside, but autochthonic, adaptable and based on rooted cultural practice. Thus, the integration of HCD and SCBT transforms marine waste from a burden into a communal asset, thereby generating sustainable livelihoods, environmental stewardship, and cultural revitalisation. In doing so, it demonstrates a practical pathway for other island and coastal communities facing similar challenges.

3 CONCLUSION

This integrated model leverages HCD's emphasis on empathy, iteration, and exploration of community needs with SCBT's emphasis on sustainability and community empowerment to both address current issues and concerns of deteriorating marine environments and insufficient income sources of local residents and design sustainable community-based interventions in the form of Waste-Art that are culturally sensitive and economically viable. The process of transforming marine waste into Waste-Art provides community members the opportunity to become producers of environmental and socio-economic change, rather than just passive receivers.

In addition to the aesthetics and artworks created through this process, the work offers a sustainable approach to help address the marine pollution challenges, reinvigorate community resilience, and reimagine cultural continuity. This can provide a model for other island and coastal regions wishing to combine creative practices with environmental and economic sustainability interventions. These approaches must be sustained by ongoing monitoring and evaluation to measure social, environmental and socio-economic impact of the work (Ngo & Creutz, 2022). Such assessment ensures that interventions continue to meet the evolving needs of the community whilst remaining aligned with sustainability objectives.

A quadruple helix approach involving universities, government, industry, and civil society (Nordberg et al., 2020), may further increase the scale and sustainability of such activities. As Norman (2022) notes, HCD is not a process, but a set of principles to creatively adapt to changing community needs. This combined approach provides a pathway for mobilising communities to participate in sustainable development through creative, community led interventions, which identify marine waste, not only as a source of environmental degradation, but as an asset to be leveraged for environmental benefit and economic potential.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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