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I am a research scholar in the Sustainability and Social Innovation Lab within the Department of Design at the prestigious Indian Institute of Technology Guwahati. My academic journey started with a Bachelor's degree in Design from IIITDM Jabalpur, where I honed my foundational skills and passion for product design. Building upon this foundation, I pursued a Master's degree in Design from Tezpur University in Assam, where I deepened my understanding of design principles and their applications and grew interest in research. Currently, my research focuses on product design for social innovation.

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Big Fish in Small Pond: Social Innovation in the Context of Fish Farming

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Abstract: Fishes have long been recognised as a vital source of nutrition, prompting the growth of fish farming, particularly in recent decades. However, despite technological advancements improving various aspects of the industry, there remains a notable gap in addressing the needs of the fishermen community, both internationally and within the Indian context. This paper highlights the challenges faced by fish farmers, ranging from disease management to environmental sustainability while emphasising the lack of attention given to the welfare and empowerment of fishermen. Drawing from existing literature and field study, the importance of social innovation in effectively addressing these unmet needs has been underscored. The article highlights different issues the fisherman community faces and presents a systems map of the fishery. The article informs that the social aspect has been overlooked. In this context, social innovation is characterised by novel and collaborative approaches to solving challenges faced by the fishing community, offering promising avenues for enhancing the sustainability and profitability of fish farming while prioritising the well-being of fishermen. By integrating social innovation into the fish farming sector, stakeholders can foster inclusive solutions that

leverage local knowledge and promote community empowerment. This paper advocates the need for a shift towards holistic approaches that prioritise social impact alongside economic gains in pursuing a more sustainable and equitable fish farming industry.

Keywords: ***Social Innovation, Sustainable production, aquaculture***

4.1. Introduction

Fishes are a good source of high-quality protein, essential fatty acids, vitamins, and minerals. It is also low in saturated fat, making it a nutritious food choice for maintaining a healthy diet. Hence, it has been a significant source of protein in many people's diets, and the practice of Fish farming can be dated back thousands of years (Nash, 2011). In the last few decades, it has been the fastest-growing sector in agriculture when seen at an international level. The industry is more diverse regarding feeds, produce, business models, diseases and issues (FAO, 2016). Fisheries have been the slowest adopters of the technology, but people have realised that the technology can help develop sustainable and profitable opportunities (Yue & Shen, 2022). Over time, Technological Advancements have been utilised to solve some of the issues tackled by the fish-farming industry, such as drones used for monitoring purposes of cages (Sousa et al., 2019), sensors to collect data for pollutant concentration, pH values, salinity, etc. (Su et al.)(xing et al.). Apart from these, it can be noted that significant work has been done in the field of disease control (Adams, 2019)(Fuji et al., 2007)(Gudding & Muiswinkel, 2013), production (Gratacap et al., 2019) while some researchers have some light on the equipment (Chu, 2020). These contributions to the fish farming industry have significantly improved the field, especially in the last 50

years. However, despite these improvements, prior research has also reported that there is still considerable scope for making the sector more sustainable and profitable (FAO, 2016) (Yue & Shen, 2022). While the research domain has focussed on the engineering and production of fish and the conservation of species, there has been a dearth of research addressing the issues of the fishermen community. Within the context of social innovation, the different issues of fishermen directly or indirectly impact society. The social aspect has been overlooked in the context of fish farming, and hence, addressing the issues faced by the fishermen would ultimately lead to sustainable production in this domain.

4.2. Literature

Several studies have highlighted the challenges fish farmers face, including the lack of information on fish diseases due to various factors, such as the absence of diagnostic infrastructure, the high cost of diagnosis, and the lack of well-equipped veterinary laboratories (Opiyo et al., 2018). Additionally, the lack of technical knowledge, poor quality fingerlings, and fish feed have been identified as significant issues affecting the fish industry (Subedi & Shrestha, 2020). Furthermore, infectious diseases have been recognised as significant constraints to aquaculture and a limiting factor for the economic and socioeconomic development of fish farmers in various countries (John et al., 2023). Moreover, the adoption of improved aquaculture technologies among fish farmers has been studied, revealing that the choice of farming as a secondary occupation, particularly crop production, presents a dynamic in adopting these technologies (Olaoye et al., 2016). The study also emphasises the importance of training and knowledge dissemination among fish

farmers, as a lack of training in aquaculture has been identified as a significant constraint (Mithun et al., 2021).

Furthermore, assistance and training services for fish farmers have been recognised as a strength in the organisation of the aquaculture sector in certain regions, indicating the potential for more rapid dissemination of scientific research results among fish producers (Kristanto et al., 2019). In addition to these challenges, the issue of sustainability and profitability of aquaculture has been addressed, with studies highlighting the susceptibility of the aquaculture sector to financial perils that favour the loss of investment among fish farmers (Mensah et al., 2021). Furthermore, the environmental problems associated with fish farming, such as pollution and genetic contamination of wild stocks, have been identified as severe issues that must be addressed (Honkanen & Olsen, 2009).

India has 1.95 lakh km of rivers and canals, 7.95 lakh hectares of floodplains and wetlands, 24.33 lakh hectares of freshwater ponds and tanks, 29.26 lakh hectares of reservoirs and 11.55 lakh hectares of brackish water ponds. After China, India is the second largest fish producer in the world (Lakra & Gopalakrishnan, 2021; Elkaradawy et al., 2021), making India an appropriate place for fish farming. However, the research in Indian aquaculture has focused chiefly on fish diseases, integrated farming, bacterial diseases, and fish production. Similar to the international scenario, in the Indian context, there is a dearth of data on the different stakeholders involved in the culture. This significant difference between the attention given to increasing fish production and the disregard for the needs of fishermen highlights an essential problem in discussions about fish farming. While it is crucial to maximise fish output for

economic reasons, focusing on the health and success of the fishermen who work hard to sustain the industry is just as important. It was observed in the literature that the context from the perspective of the fishermen's community has been explored less, hence providing scope for making the context of fish farming more sustainable. A field study was planned in and around Guwahati City to cross-check the issues found in the literature and explore further problems for the fishermen. In the further sections the article presents a systems map of the fishery and highlights few problems faced by the community.

4.3. Methodology

Through secondary research, it became evident that multiple stakeholders influence the workings of the fisheries, particularly when it comes to maintaining the fish farms. The double diamond design process (Figure 12) was utilised as the methodology (Council, 2016). It is a widely recognised design approach that consists of four stages: discover, define, develop, and deliver. The first diamond, discover and define, involves understanding the problem and its context, gathering relevant information, and defining the problem statement. The second diamond, develop and deliver, focuses on generating and developing solutions, prototyping, testing, and delivering the final product. This methodology was deemed appropriate for this project because it is a user-centred design process that prioritises understanding the users' and stakeholders' needs and wants. Additionally, it is a flexible methodology that allows for iteration and refinement throughout the design process to ensure that the final product meets the desired specifications and requirements.

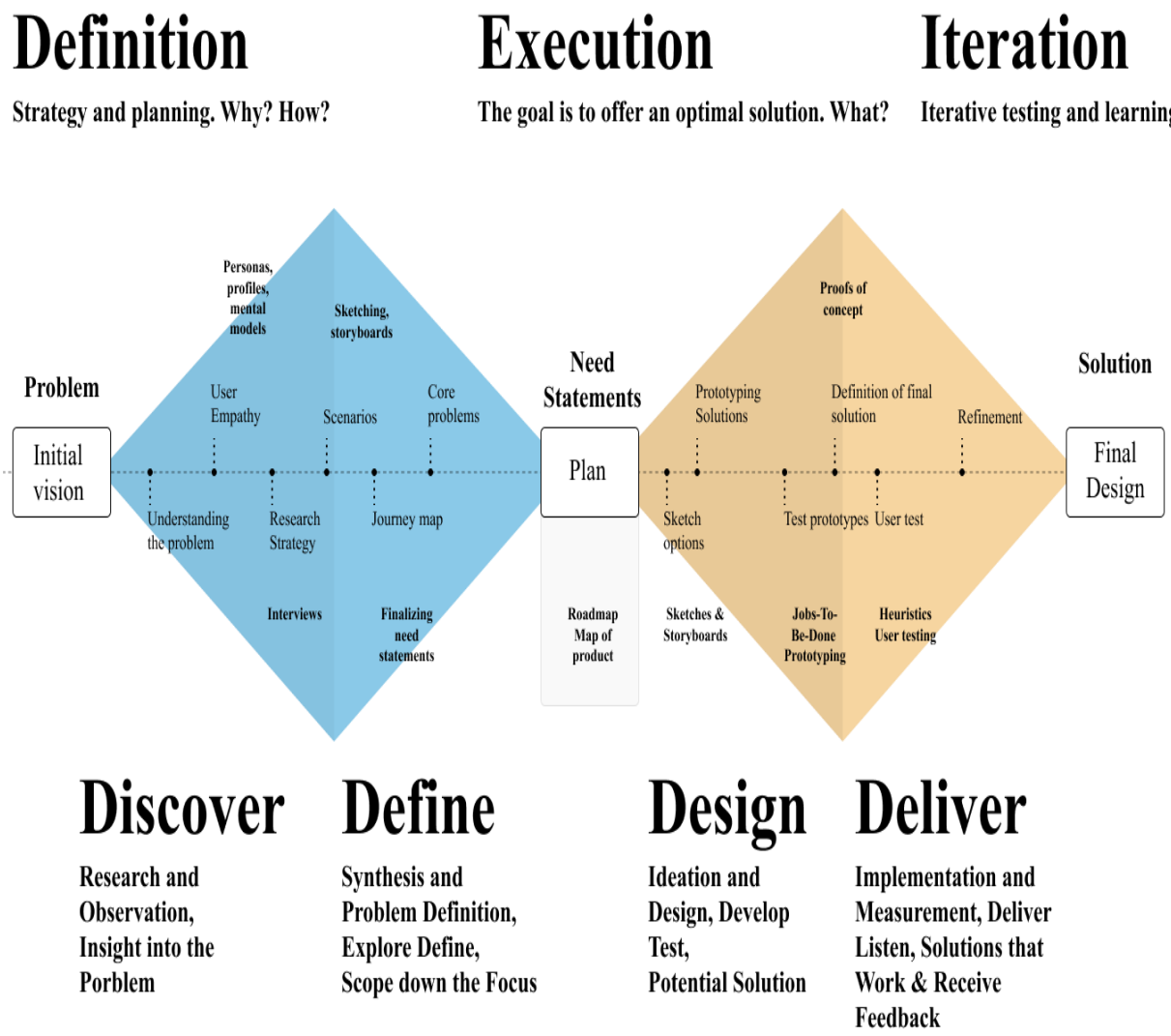

Fig. 12 Methodology

By thoroughly examining existing literature, industry practices, and expert insights, this research sought to provide valuable insights and recommendations for the context of Fisheries. The data for this research was collected from various fish farms and other related contexts located in and around Amingaon, Hajo and Panjabari. A

combination of data collection methods was employed to ensure a comprehensive understanding of the workings of fish farms.

4.3.1. Direct Observation for Design Research

Direct observation collected first-hand information about the live fish transportation process (Marshall & Rossman, 2014). Researchers visited the selected fish farms and closely observed the activities, including feeding, cleaning, use of tools, and testing practices. This approach allowed for an in-depth understanding of the existing transportation system, potential challenges, and areas for improvement. Observational data included transport container types, water quality management, stocking densities, and overall operational procedures.

4.3.2. Contextual Inquiry for Design Research

In addition to direct observation, Contextual inquiry was utilised to gain insights into the practical aspects of live fish transportation within the Guwahati context (Holtzblatt et al., 2004). Researchers engaged with various stakeholders involved in the process, including fish farm owners, transporters, and fishermen. These interactions involved in-depth discussions and interviews while they were performing the task, allowing for a deeper understanding of the stakeholders' challenges, requirements, and perspectives. Contextual inquiry provided valuable information regarding the local environmental conditions, logistical constraints, and specific issues related to fish fingerling transportation in Guwahati.

4.3.3. Interviews

Interviews were conducted with stakeholders to gather their expertise and opinions regarding live fish transportation (Kvale &

Brinkmann, 2009). Stakeholders included fish farm owners, transporters, government officials, and researchers with experience in aquaculture and fisheries. Structured interviews were designed to explore their knowledge, experiences, and insights on working in a fish farm, including required infrastructure, technology, best practices, and regulatory considerations.

4.4. Insights

It was identified that most of the work is done by the fishermen or labourers working in the fish farms while the final decision is taken by the owner, which is in line with the information found from the secondary data. The contextual enquiry also helped to understand the fishery system, the flow of information among the users, the flow of finances, the flow of matter, and where the stakeholders are providing physical effort.

Interviews were conducted with the different stakeholders gov, government officials, and scientists in Dispur. The interviews were then transcribed, and an affinity map was created. Once the affinity map was created, it was realised that a few other points were left unanswered, especially points concerning management and finance; hence, a second round of interviews was conducted to understand those points, and the affinity was updated with the new data.

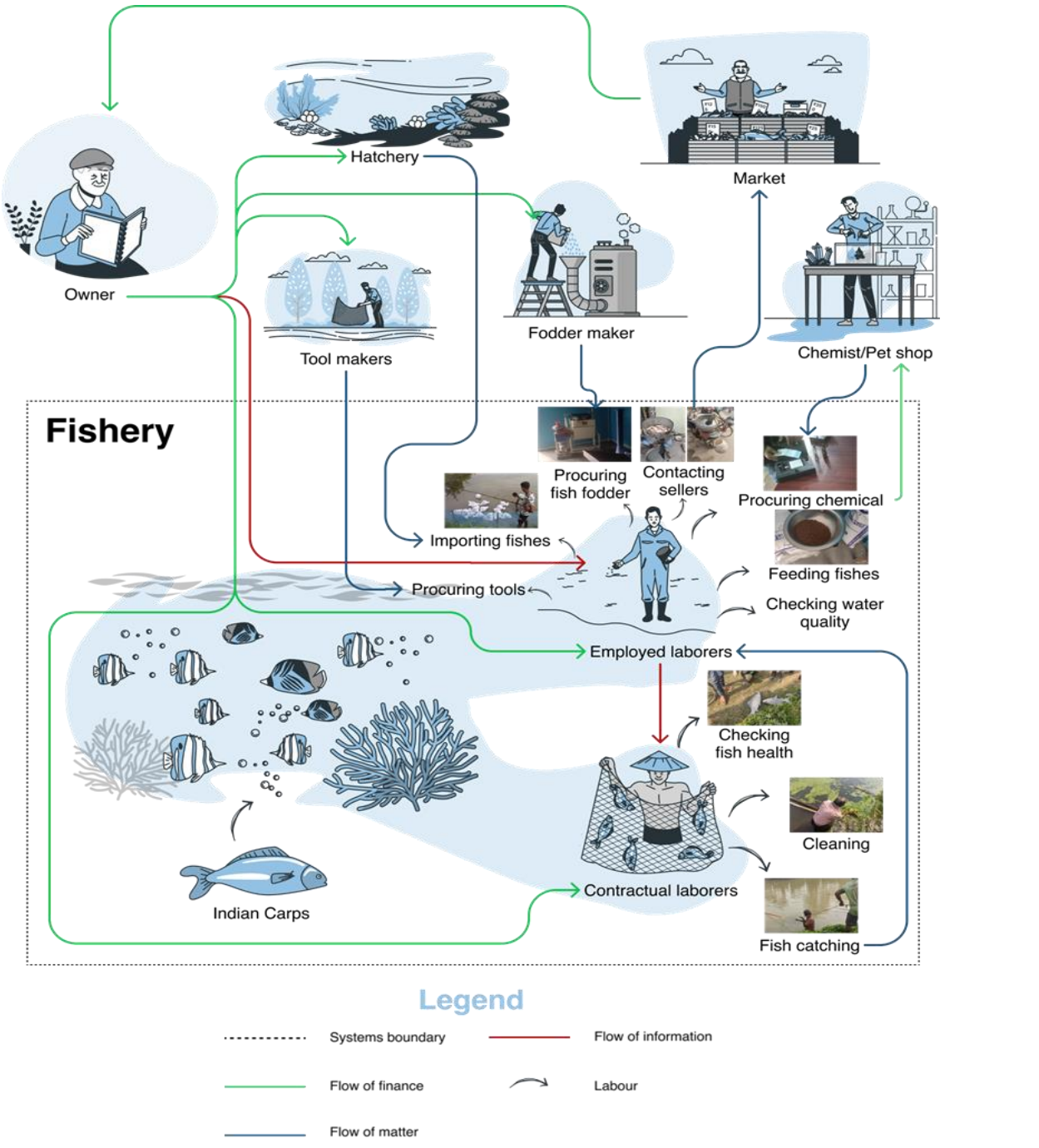

Fig. 13 System map of fisheries

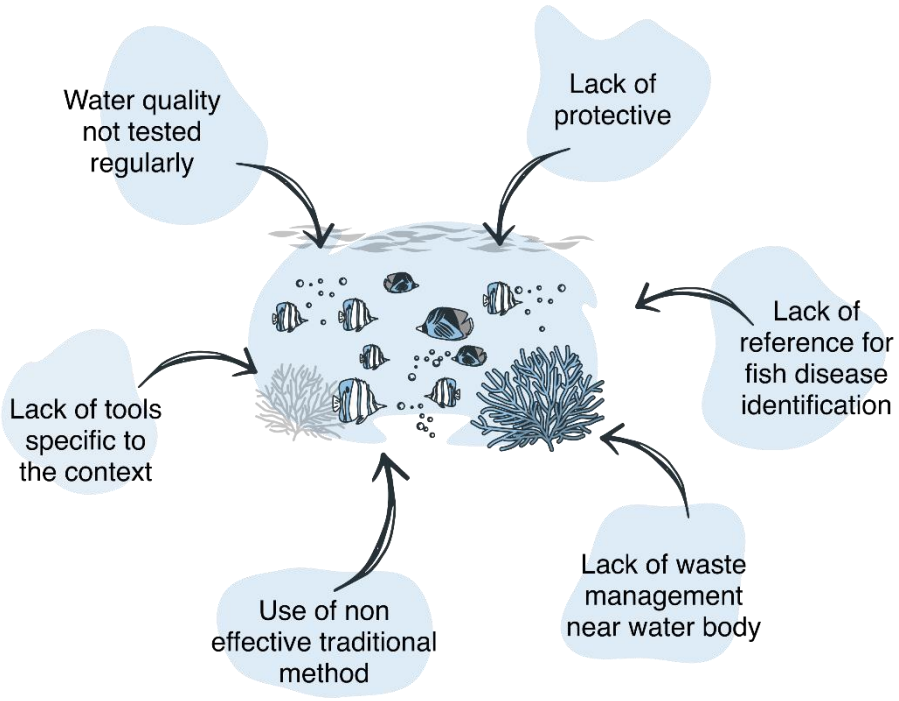

Fig. 14 Design opportunity in the domain fish-farming

4.5. Discussion and conclusion

It is evident from the problems found in the literature that the context is required to solve the unmet needs of the fishermen community. Hence, to solve the problems, social innovation would prove advantageous for society. In this context, social innovation from the design perspective will involve developing product design solutions that are economically viable and socially impactful and fostering positive change within communities. Social innovation here will emphasise collaboration, co-creation, and participatory approaches involving designers and community members.

Integrating social innovation into fish farming would not only meet the urgent requirements of fishermen but also cultivate a spirit of teamwork and empowerment among community members. When fishermen actively participate in crafting solutions, social innovators

tap into their local wisdom and skills, resulting in strategies that not only work well but also align with the community's values and endure over time.

This article advocates for a shift towards addressing fishermen's issues through the lenses of sociology and social innovation for sustainable production. This perspective would acknowledge the interconnectedness between social structures, cultural norms, and economic dynamics within fishing communities. By adopting a sociological approach, researchers and designers would gain insights into the underlying social factors influencing fishermen's livelihoods and well-being, thus enabling more holistic and sustainable interventions. Furthermore, by incorporating social innovation principles, interventions can be designed to empower fishermen, promote social cohesion, and enhance community resilience.

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