International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Post-Harvest Technology Needs Assessment among Small-Scale Fisherfolk in Barangay Tinabilan, Palompon, Leyte, Philippines

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International Journal of Science and Research Archive, 2026, 19(03), 932-940

Publication history: Received on 27 April 2026; revised on 21 June 2026; accepted on 24 June 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.19.3.1389

Abstract

Post-harvest losses remain a major challenge in small-scale fisheries, reducing product quality, food availability, and fisherfolk income. This study assessed the post-harvest technology needs of small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte, Philippines. Specifically, it identified existing post-harvest technologies, determined technological gaps and constraints, and established priority technology needs that could contribute to reducing post-harvest losses, improving product quality, enhancing fisherfolk livelihoods, and promoting sustainable fisheries development. A descriptive research design utilizing a Technology Needs Assessment (TNA) approach was employed. Data were collected from 60 randomly selected small-scale fisherfolk through a validated survey questionnaire and analyzed using frequency counts, percentages, weighted means, and ranking. Findings revealed that ice preservation, insulated containers, and traditional drying methods were the most commonly utilized post-harvest technologies. However, limited access to modern technologies such as cold-storage facilities, solar dryers, and vacuum packaging systems was observed. The major constraints identified were the lack of cold-storage facilities, high costs of post-harvest technologies, and limited access to ice supplies. Among the identified technology needs, community cold-storage facilities, ice-making facilities, and solar-powered fish dryers emerged as the highest priorities. The study highlights the importance of strengthening post-harvest infrastructure, technology transfer, and capacity-building initiatives to enhance fisheries value chains, improve food security, increase fisherfolk income, and support sustainable coastal community development.

Keywords: Small-scale fisheries; Post-harvest technologies; Technology needs assessment; Fisherfolk livelihoods; Fisheries value chain; Post-harvest losses; Sustainable fisheries development; Leyte; Philippines

1. Introduction

Small-scale fisheries play a vital role in global food security, nutrition, employment, and poverty alleviation, particularly in developing countries where coastal communities rely heavily on fishery resources for sustenance and income. The sector supports millions of people worldwide and contributes significantly to local economies through harvesting, processing, marketing, and other value-chain activities (FAO & WorldFish, 2023). Beyond their economic contributions, small-scale fisheries provide essential dietary protein and micronutrients that support the nutritional well-being of vulnerable populations (Akintola & Fatoya, 2017). As such, the sustainability and efficiency of small-scale fisheries are critical to achieving food security and livelihood development goals.

Despite their importance, small-scale fisheries continue to face significant post-harvest challenges that undermine productivity, profitability, and sustainability. Fish and fishery products are highly perishable commodities that require appropriate handling, preservation, processing, storage, and transportation technologies to maintain quality and market value. In many developing coastal communities, inadequate post-harvest infrastructure and limited access to modern technologies contribute to substantial physical, quality, and economic losses throughout the fisheries value

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chain (Maulu et al., 2020). These losses reduce food availability, decrease household income, and weaken the resilience of fishing-dependent communities.

Post-harvest fish losses remain a major concern globally. Food loss and waste in fisheries and aquaculture value chains continue to affect the efficiency and sustainability of aquatic food systems. Such losses often result from inadequate preservation facilities, poor handling practices, insufficient cold-chain infrastructure, limited processing technologies, and restricted market access. Kaminski et al. (2020) further emphasized that post-harvest losses disproportionately affect actors in small-scale fisheries and may vary across stakeholder groups, thereby influencing livelihood outcomes and economic opportunities within fishing communities.

Technological innovations have been recognized as critical interventions for reducing post-harvest losses and improving the quality and value of fishery products. Appropriate post-harvest technologies—including ice production and storage systems, insulated containers, solar dryers, smoking kilns, cold storage facilities, packaging technologies, and transportation systems—can enhance product shelf life, improve food safety, and increase market competitiveness (Abelti et al., 2024). The adoption of such technologies can contribute to increased income, reduced waste, improved food security, and enhanced resilience among small-scale fisherfolk.

The importance of post-harvest systems extends beyond loss reduction. Effective post-harvest technologies support fisheries value chains by improving product quality, facilitating market access, promoting value addition, and strengthening economic opportunities for fishing communities (Penca et al., 2021). Investments in post-harvest infrastructure and technological innovation have therefore become central components of fisheries development strategies aimed at promoting sustainable livelihoods and enhancing the contribution of small-scale fisheries to local and national economies (FAO & WorldFish, 2023). Likewise, strengthening fisheries value chains through technology adoption and capacity-building initiatives has been shown to enhance the resilience and sustainability of coastal livelihoods (Okafor-Yarwood et al., 2022).

A technology needs assessment is a systematic process used to identify technological gaps, determine priority interventions, and assess the resources required to address existing operational challenges. Such assessments provide evidence-based information for planning technology transfer programs, infrastructure investments, extension services, and capacity-building initiatives. In fisheries communities, technology needs assessments help ensure that interventions are responsive to local conditions and the actual requirements of fisherfolk, thereby increasing the likelihood of successful technology adoption and utilization.

In the Philippines, fisheries remain an important contributor to food security, employment, and rural livelihoods. The sector continues to support millions of Filipinos and contributes significantly to national fish production and coastal economic development (Bureau of Fisheries and Aquatic Resources [BFAR], 2024; Philippine Statistics Authority [PSA], 2024). However, many small-scale fisherfolk continue to rely on traditional post-harvest practices and have limited access to modern preservation, processing, storage, and transportation technologies. Coastal fishing communities frequently encounter challenges such as inadequate cold storage facilities, limited access to processing equipment, inefficient transportation systems, and insufficient training in improved post-harvest practices. These constraints contribute to product deterioration, reduced market value, and income losses among fisherfolk.

Although numerous studies have examined post-harvest fish losses and fisheries value chains in developing countries, limited empirical evidence is available regarding the specific post-harvest technology needs of small-scale fisherfolk in coastal communities of Eastern Visayas, particularly in Barangay Tinabilan, Palompon, Leyte. Existing fisheries interventions often focus on resource management, conservation, and production enhancement, while less attention is given to assessing the technological requirements necessary to reduce post-harvest losses and improve value addition at the community level. Consequently, localized assessments are needed to provide evidence-based information that can guide technology transfer initiatives, extension programs, and fisheries development interventions.

Barangay Tinabilan in Palompon, Leyte, is a coastal fishing community where fisheries remain a significant source of livelihood and food security. Despite ongoing initiatives related to marine resource conservation and sustainable fisheries management, information regarding the availability, adequacy, and utilization of post-harvest technologies among local fisherfolk remains limited. Consequently, local government units, development agencies, and academic institutions may lack the evidence necessary to design targeted technological interventions that effectively address post-harvest challenges within the community.

Objectives of the Study

Therefore, this study aimed to assess the post-harvest technology needs of small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte, Philippines. Specifically, it sought to:

- Identify existing post-harvest technologies;
- Determine technological gaps and constraints; and
- Establish priority technology needs that could contribute to:
  - Reducing post-harvest losses,
  - Improving product quality,
  - Enhancing fisherfolk livelihoods, and
  - Promoting sustainable fisheries development.

2. Methodology

This study employed a descriptive research design using a Technology Needs Assessment (TNA) approach to evaluate the post-harvest technology requirements of small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte, Philippines.

2.1. Study Area

The study was conducted in Barangay Tinabilan, Palompon, Leyte, Philippines, a coastal barangay where fishing serves as one of the primary sources of livelihood and food security. The community is characterized by the presence of small-scale fisherfolk engaged in fishing, fish handling, processing, and marketing activities. The selection of Barangay Tinabilan was based on its dependence on fisheries resources and the need to assess local post-harvest technological requirements to support sustainable fisheries development.

Furthermore, the Palompon Institute of Technology (PIT) has previously implemented various research and extension programs in the barangay, particularly in the areas of fisheries, marine resource conservation, coastal livelihood development, and community capacity building. These ongoing institutional engagements have established collaborative relationships with community stakeholders and highlighted the importance of generating evidence-based information to guide future technology transfer, extension initiatives, and sustainable fisheries development interventions in the locality.

2.2. Participants of the Study

The respondents of the study consisted of small-scale fisherfolk residing in Barangay Tinabilan, Palompon, Leyte. These included individuals directly involved in fishing operations and post-harvest activities such as fish handling, preservation, processing, storage, and marketing. A total of 60 small-scale fisherfolk participated in the study, representing approximately 80% of the fisherfolk population in the barangay. Respondents were selected through simple random sampling to ensure that each eligible fisherfolk had an equal opportunity to participate in the study. This sampling approach helped obtain representative information regarding existing post-harvest technologies, technological constraints, and priority technology needs within the community.

2.3. Research Instrument

Data were collected using a structured questionnaire developed based on relevant literature on fisheries post-harvest systems, technology needs assessment frameworks, and fisheries value-chain studies. The instrument utilized a combination of checklist, multiple-response, Likert-scale, and open-ended questions to capture both quantitative and qualitative information.

To ensure content validity, the questionnaire was reviewed by experts in fisheries technology, extension services, and research methodology. Revisions were incorporated based on their recommendations. A pilot test involving fisherfolk from a neighboring coastal barangay was conducted to assess the clarity, reliability, and comprehensibility of the instrument. Internal consistency reliability of the scaled items was evaluated using Cronbach's alpha coefficient, with a minimum value of 0.70 considered acceptable for research purposes. The instrument obtained a Cronbach's alpha coefficient of 0.71, indicating acceptable internal consistency and reliability for exploratory community-based research.

2.4. Statistical Treatment of Data

The statistical tools used in the study were selected based on the nature of the data gathered and the specific objectives of the research. Descriptive statistics were employed to summarize and interpret the responses of the fisherfolk regarding existing post-harvest technologies, technological constraints, and priority technology needs.

Table 1 Statistical Treatment of Data

Research Objective	Data Collected	Statistical Tool
Identify existing post-harvest technologies used by small-scale fisherfolk	Multiple-response data on post-harvest technologies	Frequency Count and Percentage
Determine technological gaps and constraints encountered in post-harvest activities	Multiple-response data on technological constraints	Frequency Count and Percentage
Establish priority technology needs that could contribute to reducing post-harvest losses, improving product quality, enhancing fisherfolk livelihoods, and promoting sustainable fisheries development	Five-point Likert-scale responses	Weighted Mean and Rank

The weighted mean was used to determine the level of perceived importance of each identified technology need, while ranking was employed to establish priority technological interventions based on their overall mean scores.

2.5. Ethical Considerations

The study adhered to established ethical standards for social and community-based research. Participation was voluntary, and respondents were informed of the objectives, procedures, potential benefits, and confidentiality provisions of the study. Informed consent was obtained prior to data collection. Respondents were assured that their identities and responses would remain confidential and would be used solely for research purposes. Participants were likewise informed of their right to withdraw from the study at any stage without penalty.

3. Results and Discussion

This section presents the findings of the study on the post-harvest technology needs of small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte. The results are discussed according to the study objectives, focusing on existing post-harvest technologies, technological gaps and constraints, and priority technology needs for improving post-harvest practices, reducing losses, and enhancing the livelihoods of fisherfolk in the community.

3.1. Existing Post-Harvest Technologies Utilized by Small-Scale Fisherfolk

This section presents the existing post-harvest technologies utilized by small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte. The findings provide an overview of the technologies and practices employed in fish handling, preservation, processing, storage, and marketing activities following harvest. Understanding the current level of technology utilization serves as a basis for identifying technological gaps and determining appropriate interventions to improve post-harvest operations.

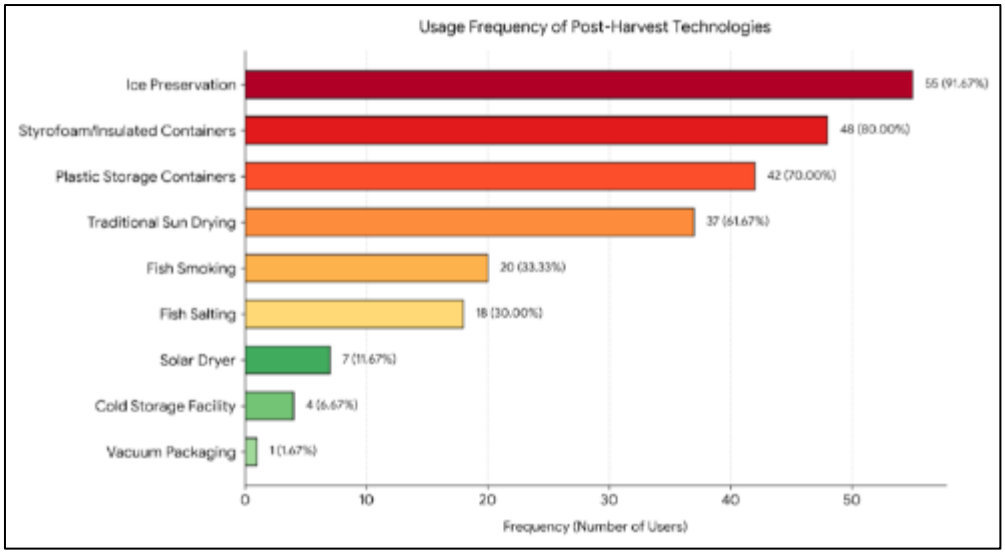

Figure 1 Percentage distribution of existing post-harvest technologies utilized by small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte

The findings indicate that ice preservation (91.67%) was the most commonly utilized post-harvest technology among fisherfolk, followed by insulated containers (80.00%) and plastic storage containers (70.00%). Traditional preservation methods such as sun drying (61.67%), smoking (33.33%), and salting (30.00%) remained prevalent. Conversely, modern technologies such as solar dryers (11.67%), cold storage facilities (6.67%), and vacuum packaging systems (1.67%) were rarely utilized. These results suggest that post-harvest operations in Barangay Tinabilan continue to rely predominantly on conventional preservation technologies, reflecting limited access to advanced post-harvest infrastructure.

The predominance of ice-based preservation is scientifically significant, as rapid cooling effectively retards microbial proliferation, enzymatic degradation, and oxidative spoilage, thereby maintaining fish quality and extending shelf life (FAO, 2022). Similarly, traditional processing methods such as drying, smoking, and salting reduce water activity, creating conditions that inhibit microbial growth and delay deterioration (Akintola & Fatoya, 2017). Despite their effectiveness, these methods are often associated with variability in product quality, exposure to environmental contaminants, and reduced processing efficiency compared with improved preservation technologies.

The limited adoption of solar dryers, cold storage facilities, and vacuum packaging systems suggests the presence of technological and infrastructural constraints that may hinder the capacity of fisherfolk to minimize post-harvest losses and maximize product value. Similar challenges have been reported in small-scale fisheries where inadequate infrastructure and limited access to improved technologies contribute to post-harvest losses, reduced product quality, and lower market competitiveness (FAO, 2022). From a fisheries post-harvest perspective, inadequate access to modern preservation technologies can contribute to quality deterioration, reduced marketability, and economic losses, particularly under conditions of high ambient temperature and extended marketing periods. These findings underscore the need for targeted interventions that enhance access to appropriate post-harvest technologies, strengthen technical capacity, and improve local infrastructure to support more efficient and sustainable fisheries value chains.

3.2. Technological Gaps and Constraints Encountered

This section presents the technological gaps and constraints encountered by small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte. The findings highlight the challenges affecting post-harvest handling, processing, storage, and marketing activities, providing insights into areas where technological improvements and support interventions are needed to enhance post-harvest efficiency and reduce losses.

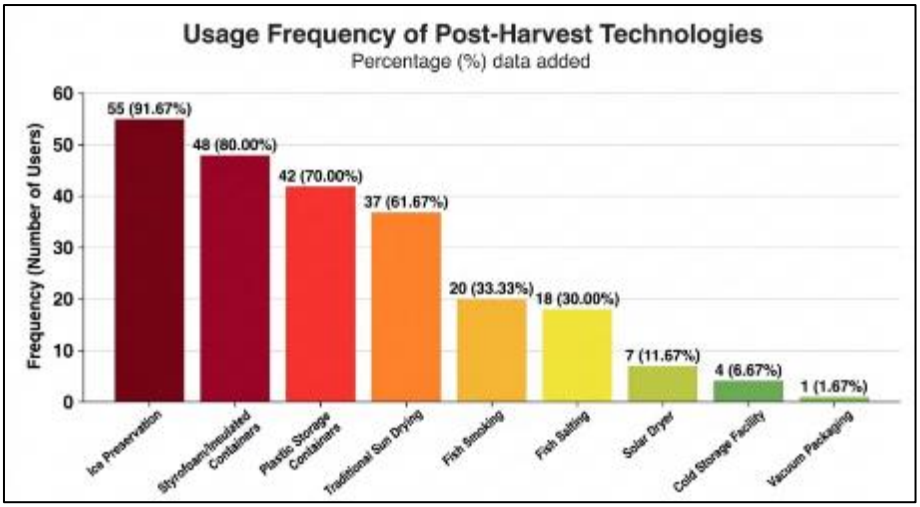

Figure 2 Technological gaps and constraints affecting post-harvest fisheries operations among small-scale fisherfolk

The most significant constraint identified by respondents was the lack of cold-storage facilities (90.00%), followed by the high cost of post-harvest technologies (85.00%) and limited access to ice supplies (78.33%). These findings indicate that preservation infrastructure remains insufficient to effectively maintain fish quality after harvesting. Furthermore, inadequate processing equipment and weather-related drying difficulties limit opportunities for value addition and increase vulnerability to spoilage. The results suggest that technological deficiencies contribute directly to post-harvest losses, reduced product quality, and lower economic returns among fisherfolk.

From a post-harvest systems perspective, the absence of reliable cold-chain infrastructure is particularly critical because fish is a highly perishable commodity that undergoes rapid microbial and biochemical deterioration when temperature control is inadequate (FAO, 2022). Limited access to affordable preservation technologies can shorten marketable shelf life, constrain market reach, and reduce the ability of fisherfolk to obtain higher prices for their products. Similarly, dependence on traditional drying methods exposes products to climatic variability, making post-harvest operations increasingly vulnerable to changing weather conditions. These constraints reflect broader challenges commonly observed in small-scale fisheries, where inadequate infrastructure, limited capital investment, and restricted access to technology hinder the efficiency and competitiveness of fisheries value chains (FAO, 2022; Akintola & Fatoya, 2017). Addressing these gaps through investments in cold storage, affordable preservation technologies, and climate-resilient processing systems could substantially reduce post-harvest losses, improve product quality and safety, and enhance the overall livelihood resilience of fishing communities.

3.3. Priority Post-Harvest Technology Needs According to Their Contribution to Post-Harvest Loss Reduction, Product Quality Improvement, Livelihood Enhancement, and Sustainable Fisheries Development

Table 2 Priority Post-Harvest Technology Needs of Small-Scale Fisherfolk Based on Their Perceived Contribution to Post-Harvest Loss Reduction, Product Quality Improvement, Livelihood Enhancement, and Sustainable Fisheries Development

Technology Needs	RPL	IPQ	EFL	PSD	Average Mean	Interpretation
Community Cold Storage Facility	4.87	4.85	4.63	4.60	4.74	Very Highly Needed
Ice-Making Facility	4.82	4.71	4.55	4.48	4.64	Very Highly Needed
Solar-Powered Fish Dryer	4.75	4.61	4.47	4.68	4.63	Very Highly Needed
Fish Processing Equipment	4.52	4.58	4.67	4.53	4.58	Very Highly Needed
Packaging Equipment	4.41	4.68	4.48	4.42	4.50	Very Highly Needed
Training on Post-Harvest Technologies	4.35	4.40	4.50	4.72	4.49	Very Highly Needed
Refrigerated Transportation	4.55	4.46	4.39	4.37	4.44	Very Highly Needed
Improved Smoking	4.23	4.42	4.28	4.35	4.32	Very Highly Needed

Note: Scoring based on a 5-point Likert Scale. All means are formatted to two decimal places; RPL - Reducing Post-Harvest Losses; IPQ - Improving Product Quality; EFL - Enhancing Fisherfolk Livelihoods; PSD - Promoting Sustainable Fisheries Development

This section presents the priority post-harvest technology needs identified by small-scale fisherfolk based on their perceived contribution to reducing post-harvest losses, improving product quality, enhancing livelihoods, and promoting sustainable fisheries development. The findings provide a basis for prioritizing technological interventions that address existing constraints and strengthen the overall efficiency and resilience of the fisheries sector.

The assessment revealed that all identified post-harvest technologies were perceived as very highly needed, indicating a strong demand for technological interventions among small-scale fisherfolk in Barangay Tinabilan. Among the technologies evaluated, the community cold-storage facility obtained the highest composite mean (M = 4.74), ranking first overall. Respondents considered cold storage as the most critical intervention for reducing post-harvest losses and maintaining fish quality. This finding underscores the central role of cold-chain infrastructure in fisheries post-harvest management, as temperature control is widely recognized as the most effective means of slowing microbial growth, enzymatic degradation, and biochemical spoilage in fish products (FAO, 2022). The high prioritization of cold storage reflects the respondents' awareness that inadequate preservation infrastructure not only compromises product quality and food safety but also limits market access and reduces potential income from fishery products.

The ice-making facility ranked second (M = 4.64), emphasizing the importance of ensuring a reliable and affordable supply of ice for immediate post-harvest handling. In small-scale fisheries, access to ice represents a practical and cost-effective preservation strategy that extends shelf life and preserves the sensory and nutritional quality of fish during transport and marketing (FAO, 2022). The high ranking of this technology suggests that improving access to basic cold-chain components may generate substantial reductions in post-harvest losses. Likewise, the solar-powered fish dryer ranked third (M = 4.63), highlighting the need for climate-resilient processing technologies. Unlike traditional open-air drying methods, solar dryers provide greater protection from environmental contaminants, improve drying efficiency, and reduce dependence on favorable weather conditions, thereby enhancing product quality, safety, and consistency.

Fish processing equipment ranked fourth (M = 4.58), indicating that respondents recognize value-adding technologies as important mechanisms for increasing profitability and strengthening livelihood opportunities. The adoption of appropriate processing technologies can support product diversification, enhance market competitiveness, and increase the economic value of fishery products, allowing fisherfolk to capture a greater share of the value chain (Akintola & Fatoya, 2017). In addition, training on post-harvest technologies received a high rating (M = 4.49), demonstrating that technological innovation alone may be insufficient without the corresponding development of human capital. Effective technology adoption requires knowledge, technical skills, and continuous extension support to ensure that technologies are utilized efficiently and sustainably.

Overall, the prioritization of these technologies reflects an integrated understanding among fisherfolk of the interrelated challenges affecting post-harvest fisheries systems. The identified needs address critical gaps in preservation, processing, and capacity development that directly influence post-harvest loss reduction, product quality enhancement, livelihood improvement, and sustainable fisheries development. From a broader development perspective, investments in these technologies could strengthen local fisheries value chains, improve food security, increase household income, and enhance the resilience of coastal communities to economic and environmental pressures. These findings suggest that future fisheries development programs should adopt a holistic approach that combines infrastructure development, technology provision, and capacity-building initiatives to achieve sustainable and long-term impacts in small-scale fishing communities.

4. Conclusion

This study assessed the post-harvest technology needs of small-scale fisherfolk in Barangay Tinabilan, Palompon, Leyte, with the aim of identifying existing post-harvest technologies, determining technological gaps and constraints, and establishing priority technology needs that could contribute to reducing post-harvest losses, improving product quality, enhancing fisherfolk livelihoods, and promoting sustainable fisheries development.

The findings revealed that post-harvest operations in the community remain largely dependent on conventional preservation and processing methods, particularly ice preservation, insulated containers, and traditional drying practices. While these technologies provide basic means of maintaining fish quality, the limited utilization of modern post-harvest technologies such as cold-storage facilities, solar dryers, and advanced packaging systems indicates significant technological limitations within the local fisheries sector.

The study further identified critical constraints affecting post-harvest activities, most notably the lack of cold-storage facilities, the high cost of post-harvest technologies, and limited access to ice supplies. These challenges hinder the ability of fisherfolk to effectively preserve fish quality, reduce spoilage, and maximize the economic value of their catch.

The persistence of these constraints suggests that existing post-harvest systems remain vulnerable to product deterioration, income losses, and market inefficiencies.

Among the priority technology needs, community cold-storage facilities emerged as the most important intervention, followed by ice-making facilities, solar-powered fish dryers, and fish processing equipment. These technologies were perceived to have substantial potential for reducing post-harvest losses, improving product quality, increasing household income, and strengthening the sustainability of local fisheries. The high ratings assigned to training and capacity-building initiatives further emphasize the importance of combining technological investments with knowledge and skills development to ensure effective technology adoption and long-term utilization.

The study demonstrates that strengthening post-harvest infrastructure, improving access to appropriate technologies, and enhancing technical capacities are essential strategies for improving the efficiency and resilience of fisheries value chains in Barangay Tinabilan. Addressing the identified technology needs can contribute to more sustainable post-harvest systems, improved livelihood outcomes, enhanced food security, and the long-term development of small-scale fisheries in coastal communities.

Recommendations

Based on the findings of the study, the following recommendations are proposed to address the identified post-harvest technology needs of small-scale fisherfolk in Barangay Tinabilan and to support sustainable fisheries development, improved product quality, and enhanced livelihood opportunities:

Establish a cold storage facility to reduce post-harvest losses, maintain fish quality, and extend the shelf life of fishery products during periods of low market demand or delayed marketing.

Develop an ice-making facility accessible to fisherfolk to ensure a reliable and affordable supply of ice for fish preservation, reducing spoilage and maintaining product quality during transport and marketing.

Promote the adoption of solar-powered fish drying technologies as a sustainable and weather-resilient alternative to traditional drying methods, enhancing processing efficiency and product quality.

Conduct regular training programs on post-harvest technologies, fish processing, and value-adding practices to strengthen the technical capabilities of fisherfolk and increase opportunities for income diversification.

Strengthen collaboration among the Palompon Institute of Technology (PIT), the Bureau of Fisheries and Aquatic Resources (BFAR), the Local Government Unit (LGU) of Palompon, and fisherfolk organizations to facilitate technology transfer, capacity-building initiatives, and resource mobilization for fisheries development.

Undertake further studies on the economic feasibility, adoption potential, and long-term impacts of the identified technologies to provide evidence-based guidance for investment decisions, policy formulation, and extension interventions.

Compliance with ethical standards

Informed consent was obtained from all individual participants included in the study.

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