

DEVELOPMENT OF A TRADITIONAL FISHERMEN EMPOWERMENT MODEL THROUGH TECHNOLOGY MODERNIZATION AND INSTITUTIONAL STRENGTHENING IN NORTH LOMBOK

Pengembangan Model Pemberdayaan Nelayan Tradisional Melalui Modernisasi Teknologi dan Penguatan Institusi di Lombok Utara

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ABSTRACT

Empowering coastal communities is an important strategy for improving the productivity and welfare of traditional fishermen. This study aims to formulate a model for empowering traditional fishermen that integrates technological modernization and institutional strengthening in North Lombok Regency. A Research and Development (R&D) approach was used, with data collected through surveys, interviews, focus group discussions, field observations, and documentation studies. The analysis was conducted descriptively for quantitative data and through data reduction techniques for qualitative data. The results show that modern technology is still rarely used, while fishermen's awareness and interest in adopting it are very high but hampered by capital constraints. On the institutional side, most fishermen are members of groups, but the functions of these organizations are not yet optimal in terms of capital, training, and collective marketing. Based on these findings, the study produced an empowerment model based on three pillars, namely technological modernization, institutional strengthening, and ecosystem support through access to capital, regulations, and multi-stakeholder partnerships. This model is expected to be a realistic and sustainable implementation framework to improve the productivity and welfare of traditional fishermen in the future.

Keywords: Empowerment Model, Fisherfolk Empowerment, Fishing Technology Modernization, Fisherfolk Institutions, Traditional Fishermen

ABSTRAK

Pemberdayaan masyarakat pesisir menjadi strategi penting untuk meningkatkan produktivitas dan kesejahteraan nelayan tradisional. Penelitian ini bertujuan merumuskan model pemberdayaan nelayan tradisional yang mengintegrasikan modernisasi teknologi dan penguatan institusi di Kabupaten Lombok Utara. Pendekatan Research and Development (R&D) digunakan dengan pengumpulan data melalui survei, wawancara, FGD, observasi lapangan, dan studi dokumentasi. Analisis dilakukan secara deskriptif untuk data kuantitatif dan melalui teknik reduksi data untuk data kualitatif. Hasil penelitian menunjukkan bahwa teknologi modern masih jarang digunakan, sementara kesadaran dan minat nelayan untuk mengadopsinya sangat tinggi tetapi terhambat oleh keterbatasan modal. Di sisi kelembagaan, sebagian besar nelayan tergabung dalam kelompok, namun fungsi organisasi belum optimal dalam hal permodalan, pelatihan, dan pemasaran kolektif. Berdasarkan temuan tersebut, penelitian menghasilkan model pemberdayaan berbasis tiga pilar yaitu modernisasi teknologi, penguatan kelembagaan, dan dukungan ekosistem melalui akses permodalan, regulasi, serta kemitraan multipihak. Model ini diharapkan menjadi kerangka implementatif yang realistis dan berkelanjutan untuk meningkatkan produktivitas dan kesejahteraan nelayan tradisional di masa mendatang.

Kata Kunci: Kelembagaan Nelayan, Model Pemberdayaan, Modernisasi Teknologi, Nelayan Tradisional, Pemberdayaan Nelayan

INTRODUCTION

Indonesia possesses very large marine and fisheries potential, with a coastline extending 99,093 km and a marine area of 5.8 million km² that holds an economic value of more than US\$ 1.2 trillion per year (Badan Informasi Geospasial, 2024; Badan Pusat Statistik, 2024). Nevertheless, the social conditions of coastal communities indicate the existence of disparities, as the majority of fishers remain in the low-income category and are vulnerable to poverty. In the Province of West Nusa Tenggara (NTB), the realization of fisheries production has only reached approximately 70% of the available potential, while North Lombok Regency produces only 7,325 tons out of a potential of 12,500 tons, or about 58.6% of production (Badan Pusat Statistik Kabupaten Lombok Utara, 2024). In addition, around 85% of the total fishers in North Lombok still have the status of traditional fishers who depend on simple equipment and limited market access. This condition indicates the need to optimize the utilization of marine resources in a productive and sustainable manner to improve the welfare of traditional fishers (Badan Pusat Statistik Provinsi Nusa Tenggara Barat, 2024).

Fisher empowerment is understood as a strategic effort to enhance the capacity, independence, and welfare of coastal communities through improving human resource capacity, access to information, and economic opportunities (Juaris *et al.*, 2023). Empowerment is not only oriented toward increasing income, but also toward fisher involvement in decision-making and participatory marine resource management. Traditional fisher groups that have long been marginalized require continuous assistance and support in order to adapt to economic development and market dynamics (Wibowo *et al.*, 2025). The empowerment process requires synergy among government, supporting institutions, and local communities to create an inclusive fisheries development ecosystem. Thus, fisher empowerment becomes a fundamental foundation in encouraging welfare improvement and strengthening coastal economic resilience (Setyawan *et al.*, 2025).

Modernization of fisheries technology refers to the use of innovations, such as environmentally friendly fishing gear, GPS-based navigation systems, cold storage facilities, and digital marketing platforms to improve the efficiency and productivity of fishers' enterprises (Efani *et al.*, 2024). The application of these technologies has the potential to reduce

fishing risks, lower operational costs, and expand market access for traditional fishers. However, the effectiveness of modernization is highly dependent on institutional support that provides capital, assistance, training, and business protection through cooperatives or fisher organizations (Efani *et al.*, 2024). Strong institutions enable fishers to build coordinated business systems and obtain better bargaining positions in the market. Synergy between technological modernization and institutional strengthening is viewed as an important strategy in transforming the traditional fisheries sector toward innovative, productive, and sustainable management (Arafah *et al.*, 2025).

To strengthen this conceptual foundation, several previous studies have evaluated the implementation of empowerment and technological modernization in fisher communities. Some earlier studies indicate that fisher empowerment is a key element in improving the welfare of coastal communities through capacity-building approaches, access to capital, and strengthening marketing networks. Research by Wibowo *et al.* (2025) found that empowerment programs based on continuous training and assistance are able to improve managerial capabilities and productivity of traditional fishers. The study by Rahmadani *et al.* (2025) emphasized that the success of empowerment is influenced by the level of fisher participation, local leadership, and the sustainability of government support. These findings show that fisher empowerment does not rely solely on economic aspects, but also on social and institutional aspects. These findings form the basis that strengthening fisher capacity must be carried out holistically and sustainably to produce significant change.

Other studies highlight the importance of technological modernization and institutional strengthening in driving the transformation of the traditional fisheries sector. Research by Arumsari *et al.* (2025) shows that the use of digital technologies such as GPS and weather information applications is able to identify fishing vessel positions with precision through a real-time ground sector interface, and can provide notifications in the event of accidents or hazardous conditions. In addition, Pahlevi *et al.* (2025) emphasize that the integration of fishing technology and institutional systems is able to improve distribution efficiency and income stability of fishers throughout the harvest season. This literature demonstrates that technology and institutions cannot be separated, as both complement each other in creating effective empowerment models. Overall, previous studies affirm the relevance of technological modernization strategies and institutional strengthening in improving small-scale fisheries business systems.

Although various marine sector development programs have been implemented in North Lombok Regency, the welfare of traditional fishers has not yet experienced significant improvement. Previous studies have not integrated technological modernization and institutional strengthening as a single integrated empowerment model, causing existing programs to be partial and unable to address root problems. As a result, there is no clear, measurable, and sustainable empowerment implementation strategy to enhance productivity and welfare of traditional fishers. This gap indicates the need for research that formulates a more relevant and effective fisher empowerment model for the context of North Lombok Regency.

This study aims to formulate a traditional fisher empowerment model that is relevant, effective, and applicable in the context of North Lombok Regency. Specifically, this study aims to: (1) formulate a traditional fisher empowerment model that integrates technological modernization and institutional strengthening and (2) produce empowerment implementation strategies that are realistic, measurable, and sustainability-oriented. Through the achievement of these objectives, this study is expected to provide theoretical contributions to coastal community empowerment studies, as well as practical benefits for local governments, fisher groups, and stakeholders in the marine and fisheries sector.

METHODS

Research Approach

This study uses a Research and Development (R&D) approach that focuses on developing a model for empowering traditional fishermen through technological modernization and institutional strengthening in North Lombok Regency. This approach was chosen to produce an empowerment model that is relevant, applicable, and in line with the socioeconomic conditions of fishermen. The model development process was carried out through the collection of empirical data on the actual conditions of fishermen, analysis of empowerment needs, preparation of model components, and formulation of implementation strategies. Data collection combined quantitative descriptive analysis to map socioeconomic characteristics, levels of technology utilization, and institutional effectiveness with qualitative analysis to explore fishermen's perceptions, aspirations, and experiences in the empowerment process. Furthermore, this research applies a participatory approach by involving fishermen, local institutions, and local governments in the process of validating and refining the model so that the resulting model is not only theoretical but can actually be applied and sustained in accordance with the needs of coastal communities.

Research Location and Time

This research was conducted in North Lombok Regency by taking samples from five subdistricts, namely Tanjung, Gangga, Kayangan, Bayan, and Pemenang, each covering two coastal villages selected based on the criteria of having a significant traditional fisher population (100 fishermen), having both formal and informal fisher institutions, having active traditional fishing activities, and showing variations in accessibility to markets and infrastructure. The study was conducted over a period of six months, including a preparation and literature review phase in the first month, field data collection in the second and third months, data analysis in the fourth month, formulation of an empowerment model and its implementation strategy in the fifth month, and finalization of the report and dissemination of results in the sixth month.

Population and Sample

The population in this study includes all traditional fishermen in North Lombok Regency, numbering approximately 2,763 people (based on data from the North Lombok Regency Marine and Fisheries Service in 2023). Quantitative sampling used stratified random sampling based on subdistrict and type of fishing gear, with the sample size determined using the Slovin formula at a 5% error rate, resulting in a minimum of 349 respondents distributed proportionally across the five subdistricts covered by the study. For the qualitative sample, purposive sampling and snowball sampling techniques were used with respondents consisting of 25 traditional fishermen, 10 fishermen group leaders, 5 fish traders, 5 fisheries extension workers, 5 relevant agency officials, 5 academics or fisheries experts, and 5 coastal community leaders. In addition, 10 Focus Group Discussion (FGD) sessions will be held, with two sessions in each sub-district, with 8-12 participants representing various stakeholders.

Data Collection Techniques

Data collection techniques in this study included surveys, in-depth interviews, focus group discussions (FGDs), field observations, and documentation studies. Surveys were conducted on 143 traditional fishermen using structured questionnaires to obtain data on socioeconomic characteristics, use of and interest in fishing technology, access to capital and marketing conditions, institutional roles, and empowerment needs. In-depth interviews were conducted with 15 key informants consisting of fishermen group leaders, coastal community

leaders, fisheries business actors, and local government representatives to explore perceptions, experiences, constraints, and views on the ideal empowerment model. Two FGD sessions were held to discuss in a more participatory manner the identification of the main problems faced by fishermen, the need for technological modernization, institutional strengthening, and the implementation mechanisms for potential empowerment models. Field observations were conducted to directly observe fishing activities, the condition of fishery facilities and infrastructure, the use of fishing gear, the marketing process, and the operational aspects of fishermen's institutions using a structured checklist. In addition, a documentation study was used to obtain secondary data through regional planning documents, fisheries statistics publications, empowerment program reports, marine and fisheries sector regulations, and fishermen's institutional documents as material for triangulation and analysis reinforcement.

Data Collection Instruments

The data collection instruments in this study included survey questionnaires, in-depth interview guides, FGD guides, observation checklists, and documentation matrices. The questionnaire was developed based on indicators of socioeconomic characteristics, use of fishing technology, access to capital and marketing, institutional roles, and empowerment needs, and has undergone validity and reliability testing. The interview guide is intended for key informants to explore their experiences, obstacles, and views on the integration of technological modernization and institutional strengthening. The FGD guide is used to identify problems, technological needs, institutional strengthening, and mechanisms for implementing the empowerment model. The observation checklist is used to record field conditions related to fishing gear, marketing facilities, fishing activities, and fisher groups' organizations. The documentation matrix is used to guide the collection of secondary data from statistical documents, empowerment program reports, and relevant institutional archives.

Data Analysis

The data analysis techniques in this study include quantitative and qualitative analysis. Quantitative analysis includes descriptive statistics to describe the characteristics of respondents and the socioeconomic conditions of fishermen, inferential analysis to test the relationship between variables such as technology adoption, productivity, income, and institutional participation through Chi-Square test, regression, correlation, or t-test, as well as multivariate analysis (PCA and Cluster Analysis) to identify data patterns and fisherman typologies. Qualitative analysis includes content analysis of interview transcripts, FGDs, and documents; narrative and phenomenological analysis to understand the subjective experiences and meanings of fishermen; SWOT to formulate empowerment strategies; stakeholders to map the roles and influences of stakeholders; and policy analysis to assess the alignment of relevant regulations. Data validity and reliability were maintained through instrument testing, surveyor training, field verification, and the application of credibility, transferability, dependability, and confirmability to ensure the trustworthiness of qualitative data.

RESULTS

Based on the results of a structured questionnaire distributed to 143 traditional fishermen in North Lombok Regency, which was compiled based on an analysis of five main components contained in the structured questionnaire, namely (1) Respondent Profile, (2) Fishing Technology, (3) Fishermen's Institutions, (4) Adoption and Empowerment Capabilities, and (5) Aspirations and Expectations. These five components provide a comprehensive picture of the socio-economic conditions of fishermen, the level of use and readiness for modern technology, the strengths and limitations of fishermen's group

organizations, the extent to which fishermen are able and willing to adopt empowerment programs, and their needs and goals for the future. Through analysis of these five aspects, the study obtained a strong empirical basis for formulating empowerment implementation strategies relevant to the field context. The results are shown in the figures and tables below.

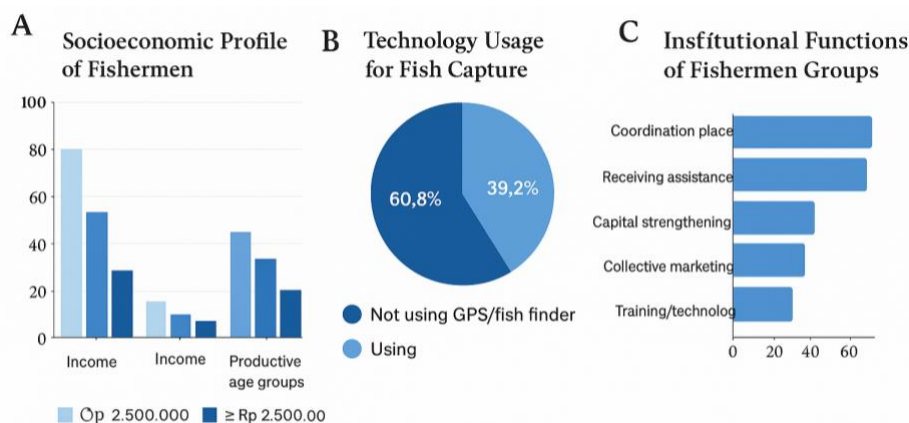


Figure 1. Composite Diagram of Socioeconomic Profile, Technology Usage, and Institutional Functions of Traditional Fishermen in North Lombok

To complement the visualization in Figure 1, the following table summarizes key findings related to main obstacles, priority needs, and the level of participation of service providers in the empowerment program.

Table 1. Key Findings on Constraints, Technology Adoption, and Participation of Traditional Fishermen

Variable	Percentage	Description
Major constraint: limited capital	60.1%	The most dominant barrier affecting fishing operations
Not using GPS/fish finder	60.8%	Indicates low levels of technological modernization
Perceive technology as very important	97.9%	High awareness of the need for technological improvement
Willingness to adopt modern technology	98.6%	Strong enthusiasm for capacity development
Willingness to actively participate in empowerment programs	97.2%	Supports the implementation of the developed empowerment model
Membership in fishermen groups	95.8%	Although participation is high, institutional functions remain limited

Empowerment Model for Traditional Fishermen Based on Technological Modernization and Institutional Strengthening

Based on the results presented previously, fishermen are highly prepared to adopt technology, but are still hampered by limited capital and low use of modern tools such as GPS and fish finders. Although most fishermen are members of groups, institutional functions remain weak in economic and managerial aspects. These findings form the basis for the formulation of an empowerment model that integrates technological modernization and institutional strengthening.

Model Formulation Process

Model formulation is carried out through several systematic stages. Consider Figure 2 below.

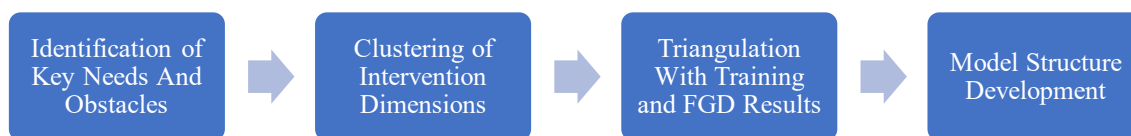


Figure 2. Formulation Process Model

Figure 2 illustrates the systematic flow in formulating an empowerment model, starting from the identification of needs and obstacles, the grouping of intervention dimensions, to the triangulation process that confirms the relationship between technological and institutional aspects. The final stage, which is the development of the model structure, shows that the integration of the two clusters, reinforced by the support of the financing and regulatory ecosystem, produces a model that is relevant and applicable to the context of traditional fishermen in North Lombok Regency.

Results of the Empowerment Model Formulation

The resulting empowerment model consists of the following three main pillars:

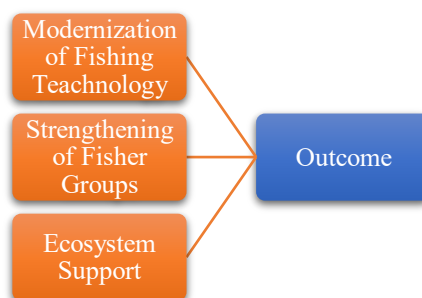


Figure 3. Model of Fisherfolk Empowerment

Figure 3 shows an empowerment model consisting of three main pillars, namely modernization of fishing technology, strengthening of fishermen's institutions, and ecosystem support covering financing, regulation, and multi-stakeholder partnerships. These three pillars function as complementary structural components that together support the achievement of outcomes in the form of increased productivity, efficiency, and economic independence for traditional fishermen.

Realistic, Measurable, and Sustainability-Oriented Empowerment Implementation Strategies

The results of the study formulated six groups of strategies for implementing fisher empowerment, which were compiled based on empirical findings, the level of readiness of fishers, and priority needs identified through surveys and training activities. All of these strategies were designed to be implemented in a phased, measurable, and sustainability-oriented manner. The series of strategies is summarized in Table 2 below.

Table 2. Summary of Empowerment Implementation Strategies

No.	Strategy Area	Key Implementation Strategies
1.	Modernization of Fishing Technology	<ul style="list-style-type: none"> • Tiered technical training on GPS, fish finders, and fishing-zone maps • Field-based mentoring to strengthen practical skills • Development of simple, applicable learning modules • Collective or partnership-based mechanisms for equipment procurement
2.	Strengthening Fisherfolk Institutions	<ul style="list-style-type: none"> • Training in administration and group management • Establishment of collaboration mechanisms across groups and stakeholders • Positioning groups as local learning hubs • Strengthening economic functions through joint procurement, collective marketing, and business planning
3.	Access to Financing and Supporting Facilities	<ul style="list-style-type: none"> • Facilitation of access to micro-financing schemes • Provision of information and guidance on available funding programs • Multi-stakeholder collaboration for technology and facility provision • Transparency and accountability mechanisms in the use of assistance
4.	Value Chain and Post-Harvest Development	<ul style="list-style-type: none"> • Training in fish processing and cold-storage techniques • Improved access to market information and marketing networks • Development of collective marketing schemes • Engagement of women in value-added activities to strengthen household economies
5.	Coastal and Resource Management	<ul style="list-style-type: none"> • Development and dissemination of rules for fishing-zone use • Mediation of conflicts over coastal space utilization • Strengthened coordination among fisher groups, government, and related sectors • Positioning fisher groups as partners in resource monitoring and management
6.	Program Sustainability Strategies	<ul style="list-style-type: none"> • Formation of core groups serving as peer tutors • Establishment of continuous learning systems at group level • Integration with government or institutional empowerment programs • Regular monitoring and evaluation to assess progress and effectiveness

DISCUSSION

Figure 1 illustrates the conditions of traditional fishermen from socioeconomic, technological, and institutional perspectives. Panel A shows that most fishermen are in a vulnerable economic condition, as indicated by the dominance of incomes below Rp2,500,000, which reaches around 80%, even though they are in the productive age group with a proportion of more than 50%, reflecting the existence of high but unmaximized work capacity potential. This finding is in line with the research by Pahlevi *et al.* (2025), which states that productive age is an important asset in increasing the working capacity of fishermen, but does not automatically improve welfare without technological support and market access. Panel B confirms the low level of modernization in fishing, where 60.8% of fishermen do not use GPS or fish finders, while only 39.2% have utilized them, indicating limited access to technology and the potential for increased efficiency if the technology were adopted more widely. This condition is in line with research by Pahlevi *et al.* (2025) and Patulak *et al.* (2024) showing that the adoption of modern technology among traditional fishermen is still low due to costs, skills, and access to training, even though technology has been proven to improve catch location accuracy and operational efficiency. Panel C shows that the institutional functions of fishermen are still limited to basic aspects such as coordination, which is the most dominant function with the highest percentage (close to 70%), while other important functions such as receiving assistance, capital strengthening, collective marketing, and technology training are at lower levels, mostly in the range of 20–50%. This condition is in line with the findings Suryani (2021) that fishermen's institutions in many regions still function as administrative forums, rather than as economic organizations capable of improving the bargaining position of fishermen. Overall, the three diagrams show that fishermen have basic capital in the form of productive age and group membership, but the biggest challenges lie in the low level of technological modernization and the suboptimal functioning of institutions, thus requiring empowerment interventions aimed at increasing access to technology and strengthening economic roles. This pattern was also found in the research by Juaris *et al.* (2023), which confirmed that increasing access to technology and strengthening institutions are key prerequisites in formulating an effective fisher empowerment model.

Table 2 shows that traditional fishermen face significant structural constraints, particularly capital constraints, which are the most dominant obstacle at 60.1%, limiting their ability to upgrade their fishing gear and adopt new technologies. This finding is in line with previous studies showing that capital constraints are a major factor hindering technological modernization in the traditional fisheries sector (Pahlevi *et al.*, 2025; Wibowo *et al.*, 2025). The low level of technological modernization is reflected in the fact that 60.8% of fishermen do not use GPS or fish finders, even though awareness of the importance of technology is very high, as indicated by 97.9% of respondents who consider technology to be a crucial aspect in improving fishing effectiveness. This is consistent with previous studies that found that although fishermen recognize the importance of technology, the adoption of innovation is often hampered by limited access and capacity (Simanjuntak *et al.*, 2025). The high level of interest in innovation is evident from the fact that 98.6% of fishermen expressed their willingness to adopt modern technology, and 97.2% were ready to actively participate in empowerment programs, indicating the existence of social energy and the readiness of the group to support transformation. In addition, 95.8% of fishermen are registered as members of groups, but institutional functions are still limited so that they cannot yet play an optimal role in access to capital, marketing, and capacity building. Previous studies have also shown that weak fishermen's institutions limit the group's ability to access capital, markets, and capacity building (Dwi *et al.*, 2025; Wibowo *et al.*, 2025). Overall, these data illustrate the gap between fishermen's high motivation to change and the limitations of facilities, capital, and inadequate

institutions to support a comprehensive modernization and empowerment process. These findings indicate the need for an empowerment model that focuses on technological modernization and group-based institutional strengthening with support for access to capital, technical training, and market strengthening as core components.

Figure 2 illustrates the process of formulating an empowerment model through four systematic stages. The first stage, identification of key needs and obstacles, was carried out by identifying the strategic needs of fishermen, which included access to fishing technology, institutional strengthening, and financial support, as well as the main obstacles in the form of limited capital and weak group governance. This approach is in line with previous studies that emphasize the importance of analyzing the strategic needs of fishermen as a first step in designing effective interventions (Nugraha *et al.*, 2024; Wibowo *et al.*, 2025). The second stage, clustering of intervention dimensions, grouped all field findings into two core clusters, namely technological needs, which include tools, training, and operational capabilities, and institutional needs related to organization, management, and partnerships. Previous studies have also shown that grouping interventions into technological and institutional dimensions facilitates focused and measurable empowerment program planning (Daniel LT *et al.*, 2025). The third stage, triangulation with training and FGD results, validated the relationship between the two clusters, showing that technological modernization requires strong institutional support and that institutional strengthening requires improving the technical capacity of its members. A similar triangulation method has been used in community empowerment research to ensure the relevance of interventions to the real needs of participants (Fatkhullah *et al.*, 2024). The final stage, model structure development, integrates the two clusters into an empowerment model framework based on two main pillars, namely technological modernization and institutional strengthening, complemented by financing and regulatory ecosystem support, resulting in a model that is realistic, contextual, and in line with the needs of traditional fishermen in North Lombok Regency. This integrative approach, which combines technological modernization and institutional strengthening, is in line with previous research findings showing that the combination of these two pillars is effective in increasing the capacity of traditional fishermen (Nusantara *et al.*, 2025).

Figure 3 shows a model for empowering fishermen based on three mutually reinforcing pillars: modernization of fishing technology, strengthening of fishermen's institutions, and ecosystem support. The pillar of technological modernization focuses on improving efficiency and productivity through the use of GPS, fish finders, fishing zone maps, technical training, and equipment procurement schemes tailored to fishermen's capacities. These findings are in line with previous studies showing that the use of modern fishing technology can significantly increase the efficiency and productivity of traditional fishermen (Efani *et al.*, 2024; Patulak *et al.*, 2024). The institutional strengthening pillar focuses on improving organizational structures, enhancing managerial capacity, strengthening planning and finance, and developing cooperation and collective action in procurement and marketing. This is consistent with previous studies showing that strong institutions, including group management and coordination, play an important role in improving market access and the sustainability of fishing businesses (Efani *et al.*, 2024; Wibowo *et al.*, 2025). Meanwhile, the ecosystem support pillar includes more affordable access to financing, regulations that support the management of fishing grounds, and multi-stakeholder partnerships in the provision of tools and training. The integration of these three pillars results in an empowerment framework that can support increased productivity, efficiency, and economic independence for traditional fishermen. Previous studies have also emphasized the importance of ecosystem support, such as access to capital, conducive regulations, and cross-sector partnerships, for the success of fisher empowerment programs (Arafah *et al.*, 2025). This integrated approach is in line with previous

research findings showing that a combination of technology, institutions, and ecosystem support can increase the economic independence and productive capacity of fishermen (Hajia *et al.*, 2024; Nusantara *et al.*, 2025; Wibowo *et al.*, 2025).

Table 2 shows that the strategy for implementing fisher empowerment was comprehensively developed through six main areas that reflect the actual conditions and needs in the field. The technology modernization strategy not only includes training in the use of GPS, fish finders, and fishing zone maps, but also field assistance, the development of practical learning modules, and mechanisms for collective or partnership-based equipment procurement. In terms of institutional aspects, the strategy is directed at strengthening group management, enhancing cooperation among stakeholders, positioning groups as learning centers, and strengthening economic functions through joint procurement and collective marketing. The overall strategy in these two areas shows that improving technological and institutional capacity is seen as the main foundation for empowerment. A similar approach has been applied in previous studies, which show that a combination of technological training and strengthening group institutions increases the effectiveness of fisher empowerment programs (Adisty *et al.*, 2024; Hernawan *et al.*, 2024).

The next strategy focuses on meeting the structural needs of fishermen, primarily through facilitating access to financing, providing funding information, and multi-stakeholder collaboration to provide tools and supporting facilities. Research Arafah *et al.* (2025) and Supriadi *et al.* (2024) emphasizes the importance of structural support, such as access to capital and multi-stakeholder collaboration, to strengthen the economic capacity of traditional fishermen. The development of value chains and post-harvest activities is aimed at improving product quality through processing training, access to market information, collective marketing, and the involvement of women in value-added activities. These findings are in line with previous studies showing that the involvement of women and improving product quality through post-harvest training can increase the added value and income of fishing households (Martono *et al.*, 2023). In coastal management, the strategies developed include the formulation of zoning regulations, conflict mediation, and strengthening cross-sectoral coordination. Meanwhile, the sustainability of the program is ensured through the formation of core groups as peer tutors, a continuous learning system, integration with government programs, and the implementation of periodic monitoring. Overall, this strategy demonstrates efforts to build empowerment that is not only responsive to current needs but also oriented towards long-term sustainability. Previous studies have also shown that the integration of coastal management, continuous learning, and collaboration with government programs supports the long-term sustainability of fisher empowerment (Nusantara *et al.*, 2025).

CONCLUSION

Based on the results of this study, it can be concluded that the empowerment of traditional fishermen in North Lombok Regency requires the integration of technological modernization and institutional strengthening to achieve increased productivity, efficiency, and welfare. Fishermen show high motivation to adopt modern technology and participate in empowerment programs, but limited capital and weak institutions are major obstacles. This study successfully formulated an empowerment model consisting of three main pillars: (1) modernization of fishing technology, (2) strengthening of fisher institutional capacity, and (3) ecosystem support covering financing, regulation, and multi-stakeholder partnerships. This model is complemented by realistic, measurable, and sustainability-oriented implementation strategies, covering six strategic areas that reflect real needs in the field. Thus, this study provides a theoretical contribution to the study of coastal community empowerment and offers

an applicable framework for local governments, fishing groups, and marine sector stakeholders to improve the welfare of traditional fishermen in a sustainable manner.

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