

Unlocking Innovative Climate Financing Tools to Empower the Marine Small-Scale Fisheries Sector of Sri Lanka in a Climate-Changing Future

MMSC Senevirathne^{1*} , DAM De Silva¹ , and M Esham¹ 

Received: 13th October 2025 / Accepted: 24th February 2026

ABSTRACT

Purpose: *The Marine Small-Scale Fisheries (MSSF) communities demand sustainable and innovative climate financing solutions as a highly vulnerable group to climate change. Hence, this study aims to map the existing climate finance landscape, assess the role of available climate financing instruments, identify the challenges MSSF communities face in accessing climate finance, and develop innovative climate financing tools tailored to the MSSF sector.*

Research Method: *The qualitative primary data were collected through a survey from purposively selected MSSF communities in Tangalle, Galle, and Negombo, as well as in Kalpitiya, Jaffna, and Trincomalee (384 respondents; 54 fishermen in each location and 20 fish processors in Galle, Negombo and Tangalle) and from expert consultations with 25 members, primarily in the fisheries and finance sectors. The climate finance landscape and the role of available financial instruments were descriptively analysed. Two-stage thematic analyses were applied: the first stage identified the prevailing challenges in accessing climate finance, and the second stage identified innovative climate financing solutions to address them.*

Findings and Values: *Government, private, and international/multilateral funds are the primary sources of climate financing, while the Ministry of Fisheries (MOF), multilateral organisations, public and private banks, NGOs, and informal moneylenders are the primary intermediaries. There are limited climate financing options, including insurance, grants, subsidies, financial aid, and formal and informal credit. The lack of locally governed, low-cost, flexible, inclusive and sustainable financial mechanisms is a key challenge identified. Overall, the study suggests six innovative climate-financing tools that provide the first context-specific models tailored to Sri Lanka's MSSF sector: Index-based insurance schemes, welfare schemes, Agency banking models, Savings clubs, Micro group loans, and Impact investment.*

Keywords: *Climate Finance, Marine Small-Scale Fisheries, Innovative Financing, Resilience, Sri Lanka.*

INTRODUCTION

In Sri Lanka, fishing has been a primary source of livelihood and income for coastal communities for centuries (Arulananthan 2016). The marine fisheries sector is vital, and has multifaceted significance in socio-economic development in Sri Lanka in terms of ensuring food security (with annual production of 280,610 MT), contributing to

the country's GDP (1.1% yearly contribution at current market price), contributing to the national export earnings (Rs. Million 99,118) and generating employment opportunities

¹Department of Agribusiness Management, Faculty of Agricultural Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya 70140, Sri Lanka.

*sulochana@agri.sab.ac.lk

(187,760 households) in year 2023 (Ministry of Fisheries, Aquatic and Ocean Resources 2024). The Small-Scale Fisheries (SSF) segment plays a crucial role within this broader marine fisheries sector in the Country. The majority of people involved in coastal fisheries in Sri Lanka are small-scale fishers (Ibrahim 2020).

Despite its contributions, the Marine Small-Scale Fisheries (MSSF) sector faces mounting challenges, including declining income, rising input costs, overexploitation of natural resources, and weak marketing linkages (Karmakar *et al.* 2010, De Alwis 2024). These socio-economic challenges are further exacerbated by climate change. Climate change poses a significant threat to the MSSF sector, as it is highly dependent on weather patterns. Moreover, Sri Lanka, being a small tropical island in the north Indian Ocean and positioned at the centre of the monsoon regime, makes it prone to almost every identified impact of climate change, such as sea level rise, change in precipitation, rainfall patterns, storms, and warning of the sea (Eriyagama 2010, De Zoysa & Inoue 2014, Arulananthan 2016).

Due to these climate change vulnerabilities, the MSSF sector faces various risks, such as life risks, reduced fish harvests, damages to boats, fishing gear, vessels, landing sites, public and private infrastructures, post-harvest losses, increased production costs, reduced fishing days, loss of fisheries resources, and habitat destruction (Arulananthan 2016, Sandaruwan & De Silva 2022).

According to Upare (2024), when the MSSF livelihoods face additional challenges, such as climate change, the income from the fisheries sector is insufficient to lift them above the poverty line. One of the main challenges faced by MSSF is limited access to climate finance, which refers to funds directed towards mitigating and adapting to climate change. The study by Kibona *et al.* (2021) also highlighted that fisheries are among the leading sectors that should receive climate finance and the importance of the fair and effective distribution of such finance.

On the other hand, adapting to climate change poses a significant challenge, especially in developing countries. According to a study by Lars (2022), covering more than 50 countries, most of which are middle-income, are experiencing debt stress and tend to face high climate vulnerability. A study by Grafton *et al.* (2008) also supports the fact that the effective implementation of sustainable fisheries management is challenging due to insufficient financing and inadequate institutional support, especially in developing countries. At the national and international levels, Sri Lanka underscored the urgency of allocating additional climate finance to the country. At COP28, Sri Lanka emphasised the need to become a net-zero emitter, requiring an investment of \$100 billion, equivalent to roughly \$4 billion per year from now until 2050, or approximately 5% of the country's 2022 GDP. Furthermore, public finance is constrained by Sri Lanka's dual crisis, namely the COVID-19 pandemic and the economic crisis (Central Bank of Sri Lanka 2025). Hence, countries such as Sri Lanka should find innovative ways to bridge these financing gaps and create fiscal space for climate-resilient investments while also managing increasingly unsustainable debt burdens (United Nations Development Programme (UNDP) 2024).

In this context, innovative financial instruments could play a crucial role in managing environmental risks and reducing exposure to these risks through climate adaptation (Hobday *et al.* 2025). Innovating financing is also a key factor in scaling up climate finance to support climate-resilient development (Omukuti 2024). The study by Upare (2024) highlighted the significance of such innovative financial tools, particularly in meeting unmet financial needs, and underscored their importance for those highly vulnerable to climate change, such as MSSFs. As such, it is of paramount importance to introduce innovative financial solutions that supersede traditional financing to unlock private and public funding for Sri Lanka's fisheries sector (United Nations Development Programme (UNDP) and Lakshman Kadirgamar Institute of International Relations and Strategic Studies 2023). Despite these pressing issues,

the climate change Impacts on Sri Lanka's fisheries sector have received relatively little attention (Ministry of Environment Sri Lanka 2022). On the other hand, Sri Lanka requires more research and awareness regarding the financing for the blue economy (Niluka & Dushyantha 2023). Most of the previous studies only focused on the climate change impact on fishing communities and none of the studies focused on financing for climate mitigation or adaptation (Jayasinghe & Niroshana 2016, Sandaruwan & De Silva 2022). Sri Lanka has yet to develop a robust blue economy capable of attracting climate finance. Therefore, it is assumed that the Sri Lankan fisheries sector may face numerous challenges related to climate change and financing, underscoring the need for robust financial investments to support MSSF communities.

This highlights the urgent need to understand the existing landscape of climate finance tools, their roles, and the challenges facing current climate financing options, as well as to develop innovative financing tools to ensure sustainable and resilient value chains in small-scale marine fisheries amid ongoing climate change. Accordingly, this study aims to map the existing climate finance landscape, identify its roles, examine the challenges inherent in accessing current climate financing options, and propose context-specific, innovative climate finance tools for the MSSF communities. This study is particularly relevant for policymakers, development finance institutions, and researchers focused on climate adaptation in the blue economy.

MATERIALS AND METHODS

Study locations and sample profile

The study was conducted across six major coastal regions: Galle, Tangalle, Negombo, Kalpitiya, Jaffna, and Trincomalee (Fig. 1). These regions were purposively selected to capture regional diversity and based on their prominence in small-scale fishing activities. Figure 1 shows each location with the marine fish catch, the number of active fishers, the total number of active boats, and the mean monthly rainfall (2018–2025). Ethical practices

were followed in collecting data.

Data collection

The study employed a two-stage qualitative data collection approach. The data for this study were collected through focus group discussions, primary field surveys, expert consultations, and secondary data sources. Data were collected from 384 respondents, comprising 324 small-scale fishers representing all six study locations (Galle, Tangalle, Negombo, Kalpitiya, Trincomalee, and Jaffna), and 60 small-scale fish processors from major small-scale fish processing hubs: Galle, Tangalle and Negombo. Table 1 indicates the socio-economic profile of the respondents.

The average age of fishers was 49 years, and the average household size was four members. Fishers have completed an average of 9 years of formal education and 27 years of fishing experience. Among fish processors, all were female, with an average age of 60 years. They had completed an average of 11 years of formal education and 17 years of fish-processing experience.

Stage 01 of the data collection focused on collecting primary data through individual and Focus Group Discussions (FGDs) from small-scale fishers and fish processors, while stage 02 involved expert consultations.

Stage 01: Six FGDs were conducted with the participation of fishers across six study locations, and three FGDs were held with fish processors in Negombo, Galle, and Tangalle. Participants were selected purposively to ensure diverse representation in terms of practices, knowledge, experience, and community roles. They were contacted through community leaders and local institutions and engaged using a semi-structured discussion guide that covered existing climate finance support, financial challenges, and opportunities.

The FGD with small-scale fishers and Fish Processors focused on mapping the climate finance landscape and identifying the roles of available financing instruments from the

Table 1. Socio-economic-demographic profile of the surveyed individuals.

Group and sample size	Variable	Average Value	Trincomalee	Tangalle	Galle	Negombo	Kalpitiya	Jaffna
Fishers	Average Age (years)	49 years	50 years	47 years	48 years	50 years	45 years	53 years
Sample size: Total: 324	Seasonality of Work (active days/month)	18 days	22 days	21 days	19 days	17 days	15 days	16 days
54 fishers from each location	Average household members	5 members	4 members	3 members	4 members	5 members	6 members	5 members
	School-aged children	2 members	3 members	2 members	2 members	2 members	3 members	2 members
	Average monthly expenditure (Rs)	LKR 59,630	LKR 53,250	LKR 63,125	LKR 62,100	LKR 74,500	LKR 56,400	LKR 48,400
	Average formal education	9 years	9 years	11 years	10 years	8 years	10 years	7 years
	Fishing experience (years)	27 years	35 years	17 years	23 years	26 years	33 years	29 years
	Boat owners (%)	90%	88%	91%	82%	90%	92%	94%
	Crew members (%)	10%	12%	9%	18%	10%	8%	6%
Fish Processors	Average Age	60 years	-	53 years	65 years	63 years	-	-
Total: 60	Seasonality of Work (days/month)	25 days	-	23 days	26 days	25 days	-	-
20 from Tangalle, Ambalangoda and Negombo	Average household members	4 members	-	4 members	4 members	5 members	-	-
	School-aged children	2 members	-	1 member	2 members	3 members	-	-
	Average monthly expenditure (Rs)	LKR 47,867	-	LKR 54,000	LKR 43,500	LKR 46,100	-	-
	Average formal education	11 years	-	11 years	11 years	10 years	-	-
	Experience in fish processing (years)	17 years	-	21 years	17 years	14 years	-	-
	Gender	100% female	-	100% female	100% female	100% female	-	-

Source: Field survey 2024

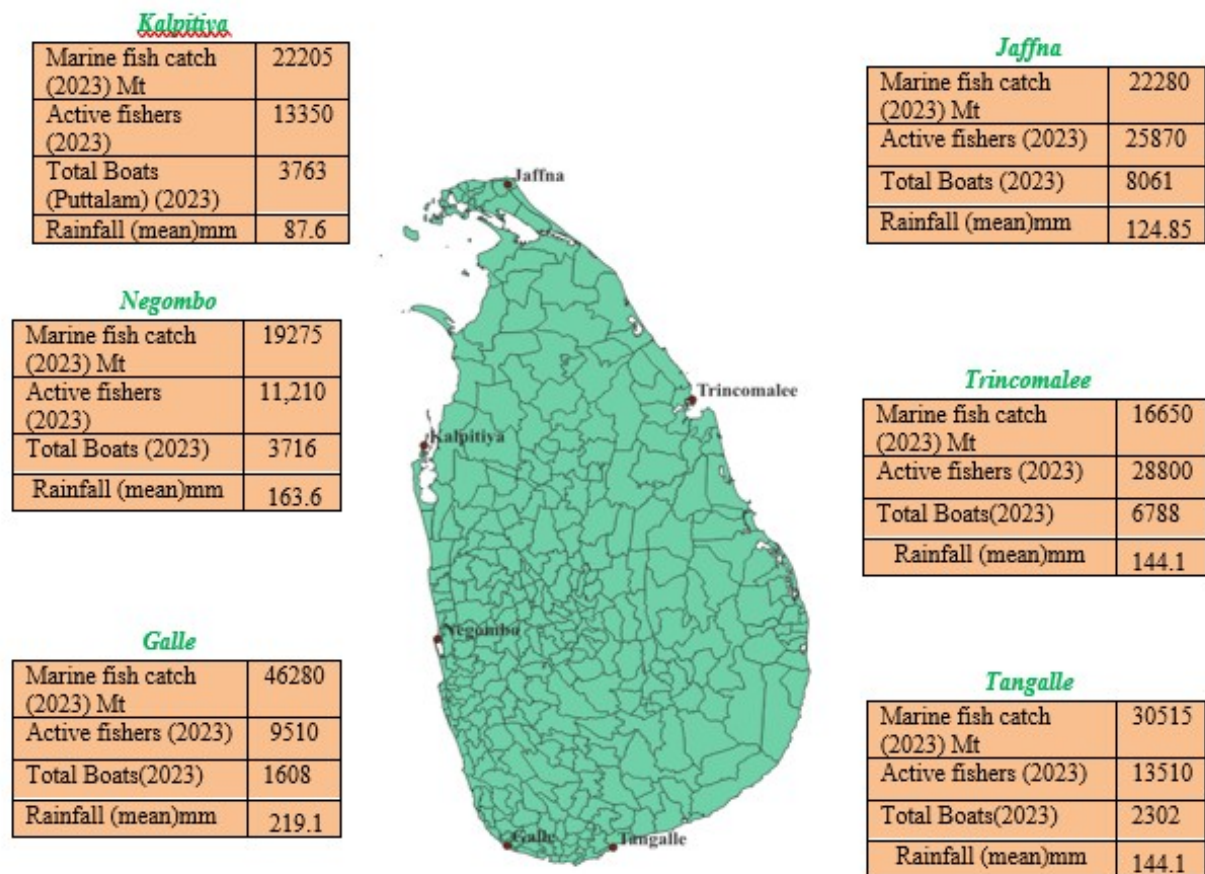


Figure 1. Study locations of data collection (Source: Climatic data based on Department of Meteorology, Sri Lanka and fisheries data from the Ministry of Fisheries, 2024).

perspective of MSSF communities, and identifying the challenges they face with the climate finance options.

Stage 02: To further develop the existing climate finance landscape and design innovative climate financing tools for the fisheries sector, expert consultations were conducted. Twenty-five experts with more than 20 years of experience were interviewed, representing government, non-government, and international organisations, including the Central Bank of Sri Lanka, Public and Private banks, microfinance institutions, Universities, and various ministries/ departments such as Finance, Fisheries, Environment, Meteorology, and the Disaster Management Centre.

They were selected based on their experience in fisheries, finance, and climate change, and were engaged through semi-structured interviews. Based on the themes or gaps identified in the focus group discussion, the experts were

personally contacted and interviewed.

Data analysis

The landscape of climate financing is mapped, and the role of existing financial instruments is identified based on primary data collection and focused group discussions (involving both MSSF communities and experts).

Stage 01: Based on FGDs, a thematic analysis is conducted to identify the challenges inherent in the existing climate financing options from the MSSF communities' perspective. To identify recurring topics, the FGD transcripts were categorised and transcribed. Socioeconomic limitations, institutional inefficiencies, and obstacles to financial access were the main topics of the coding. The main economic and governance shortcomings in the MSSF industry were represented by the larger categories into which these issues were divided.

Stage 02: Thematic Analysis 02 was conducted

in accordance with the Expert consultation. Transcripts of expert interviews were coded for recurring themes related to the development of innovation opportunities. Each solution theme was matched with the gaps identified in Focus Group Discussion 01. The findings from each focus group discussion are then integrated to develop innovative financial tools. This integrating nature of the tool ensures that the developed tools are community-driven and policy-aligned. For each innovative financing strategy, a corresponding financial inclusion framework was developed, integrating qualitative and quantitative findings to guide its application.

RESULTS AND DISCUSSION

Climate change impacts on the marine small-scale fisheries sector

Almost every respondent in the sample indicated that both the frequency and severity of climate change and extreme weather events (e.g., rainfall, storms/cyclones and temperature) have increased over the past 5-10 years, thereby significantly disrupting their fishing operations. Storms/Cyclones are identified as the main climate-induced hazard faced by small-scale fishers. Most fishers (61%) have more than 30 years of fishing experience. Although mobile alerts, such as “Sayura”, inform fishermen about climate conditions and guide their fishing decisions, 43% of them continue fishing even during adverse weather conditions due to financial necessity.

The impacts of the storms/cyclones include the disruption of fishing activities due to lost fishing days (94%), damage to fishing infrastructure, vessels, or gear (74%), and injuries or loss of life (9%). Compared with fishing, fish processing in Sri Lanka relies heavily on traditional, weather-dependent methods. Heavy and unpredictable rainfall was identified as a significant issue, with all respondents in the study reporting that sudden and intense rainfall severely disrupts fish processing activities. Moreover, all fish processors in the sample reported a noticeable shift toward more variable rainfall patterns in recent years, making adaptation more difficult.

95% of fish processors reported that, due to insufficient storage facilities, they face spoilage and reduced profitability. Small-scale retailers and wholesalers are less affected by climate change than fishermen and fish processors, as their sales do not depend solely on MSSF yields. However, they also encountered several challenges, including high price volatility, the unavailability of certain fish species, reduced fish quality, and business interruptions.

Climate finance landscape and role in supporting small-scale fisheries

Experts note that tracking and quantifying climate finance flows remain complex due to data limitations. Therefore, in this study, cash flows are qualitatively determined rather than precisely quantified (Fig. 2). The sources of climate finance for the MSSF value chain can be broadly classified into three categories: government funds, private funds, and international/multilateral funds. The local government allocates funds through treasury funds for the MSSF mainly via key government institutions, including the Ministry of Fisheries (MOF), the National Aquatic Resources Research and Development Agency (NARA), the Department of Fisheries and Aquatic Resources (DFAR), Ceylon Fisheries Corporation (CFC), Ceylon Fishery Harbours Corporation (CFHC), and the Marine Environment Protection Authority (MEPA).

These institutions play a central role in securing funds for climate change mitigation and adaptation, including through technology and infrastructure development, marine conservation, capacity building, and other development activities. However, among these financial supports, most current aid is provided immediately after the disaster to address immediate needs, such as cash transfers, food rations, infrastructure development, and vessel restoration.

Furthermore, post-event cash transfers provided by the government immediately after hazardous events are typically unconditional. For example, special compensation is provided to fishermen who die from a natural hazard while engaged

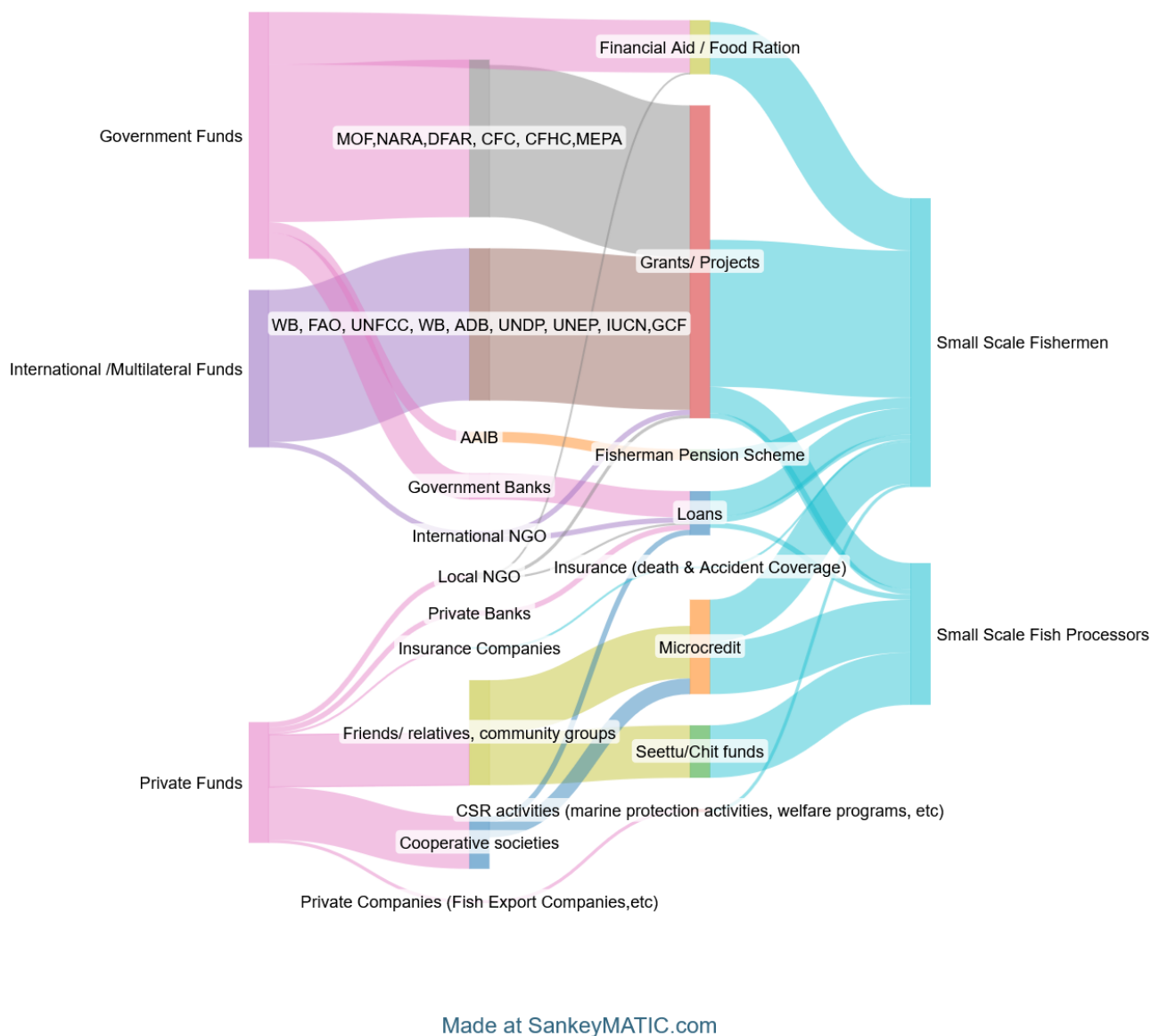


Figure 2. Climate finance flows for Sri Lanka's Marine Small-Scale Fisheries Sector.

Table 2. Operationalisation table of the study.

Objective	Sample and Data Source	Key Variables/Themes	Analysis	Output
Map the existing climate finance landscape	384 respondents (324 fishermen and 60 fish processors; field survey, purposive sampling) 9 FGDs 25 experts Secondary sources (policy documents, reports, financial databases)	Types of climate finance instruments available for MSSF	Descriptive mapping of tools (thematic categorisation based on fund source, intermediary, and target group)	Comprehensive explanation of available climate financing tools; visual representation through a Sankey diagram
Identify the roles of existing financing instruments	384 respondents 9 FGDs 25 experts Secondary sources	Functions of existing climate finance tools	Descriptive analysis	Role of each climate financing option
Examine challenges in current climate financing options	9 FGDs with MSSF communities	Challenges related to climate financing options	Thematic analysis 01	Categorisation of challenges into main themes
Design context-specific innovative climate finance tools	Synthesised datasets (expert consultation + MSSF insights)	Community-driven innovative and feasible financing instruments	Thematic Analysis 02 (experts) + framework building	Conceptual framework for innovative financing tools

in fishing. A compensation of 01 million is provided for a family, and the DFAR and the Ministry of Finance implement this program.

The insurance schemes available to the SSF communities are minimal. The MOF (through DFAR), in collaboration with Sri Lanka Insurance, offers an insurance scheme for the fishermen, providing coverage mainly for deaths, accidents, and disappearances. According to the Department of Fisheries & Aquatic Resources 2024, out of the total active fishers, approximately only 1.73% contributed to the insurance scheme that has been in operation so far, and the coverage is only mandatory for

multiday boats.

In addition, fishermen can obtain private life insurance. Moreover, very recently, the Sri Lanka Agricultural and Agrarian Insurance Board (AAIB) announced an insurance scheme for fishers, citing the “hazardous nature of their work”. Further, the “Fishermen’s Pension and Social Security Benefit Scheme” was also introduced by AAIB.

International/multilateral funds can be considered as another primary source of climate finance. The empirical literature identified multilateral organisations as one of the most

important financial instruments for fisheries, (Guggisberg 2019, Hoegh-Guldberg *et al.* 2019). Green Climate Fund, World Bank (WB), Food and Agriculture Organization (FAO), United Nations Framework Convention on Climate Change (UNFCCC), World Bank (WB), Asian Development Bank (ADB), United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN) and Green Climate Fund (GCF) are primarily focusing on activities such as mangrove cultivation, coral reef protection, tree planting, and rehabilitation activities, which could be identified as the main actions currently funded as long-term resilience-building activities.

Within the formal banking system, there is no specifically tailored loan scheme for small-scale fisheries communities to adopt to mitigate the effects of climate change. However, a “Diyawara Diriya” loan scheme has been introduced by the Department of Fisheries and Aquatic Resources in collaboration with the Bank of Ceylon, available to fishermen and supports them in adapting to new technologies, such as enhancements, vessel construction, and upgrading the standards of their crafts.

However, no scheme is available for fish processors, retailers, or wholesalers. According to our study’s survey results, 98% of MSSF communities in the sample rely on informal methods to meet immediate cash needs, such as borrowing from private lenders, friends, and relatives. Moreover, local and international Non-Governmental Organisations (NGOs) also play a massive role in facilitating lending and savings facilities for fisheries communities and other infrastructure development projects.

Moreover, fisheries cooperative societies and fisheries organisations (Eg; Anna fisheries association in Trincomalee, Kudawella fisheries cooperative society, Ambalangoda fisheries society, Aniwasal fishing society, Kudawella West fish processors society, Negombo Sri Vimukthi fish processors society) also play a significant role in providing financial

services, including lending money for immediate cash needs and offering savings accounts. Furthermore, female fish-processing community-level organisations, led by women, are more active and engaged than fisheries communities, predominantly male.

Challenges facing in accessing the existing financing options available for the small-Scale fisheries sector

Fig. 3 illustrates how MSSF communities perceive each financial instrument under the impact of climate change, with respect to availability, accessibility, and affordability. The most readily available financial instruments for coping with climate-related impacts are informal methods, such as borrowing from friends, relatives, and moneylenders. Forty per cent of the fishers and 96% of the fish processors indicated that friends and relatives were a highly available source of support. In comparison, 80% of the fishers and 93% of the fish processors identified moneylenders as a highly available option. In terms of accessibility, the majority (74% of fishers & 78% of fish processors) reported that money from friends/relatives was a highly accessible option. Additionally, 88% of the fishers and 50% of the fish processors indicated that moneylenders have high access. In comparison, 62% of the fishers and 47% of the fish processors reported having high access to microcredit. Though informal sources, such as “loans from friends/relatives, money lenders, and microcredit” are less affordable instruments due to their high interest rates of around 10–15%, the fishers and fish processors widely use those informal instruments as their widespread availability and accessibility.

Themes / gaps in accessing climate financing instruments as identified in FGD

Weak social protection coverage:

Social protection coverage against climate change risks for MSSF communities is weak and fragmented. An insurance scheme can be regarded as a risk-transfer tool and a financial instrument crucial for climate change adaptation and mitigation, but it presents several challenges during the design and implementation phases.

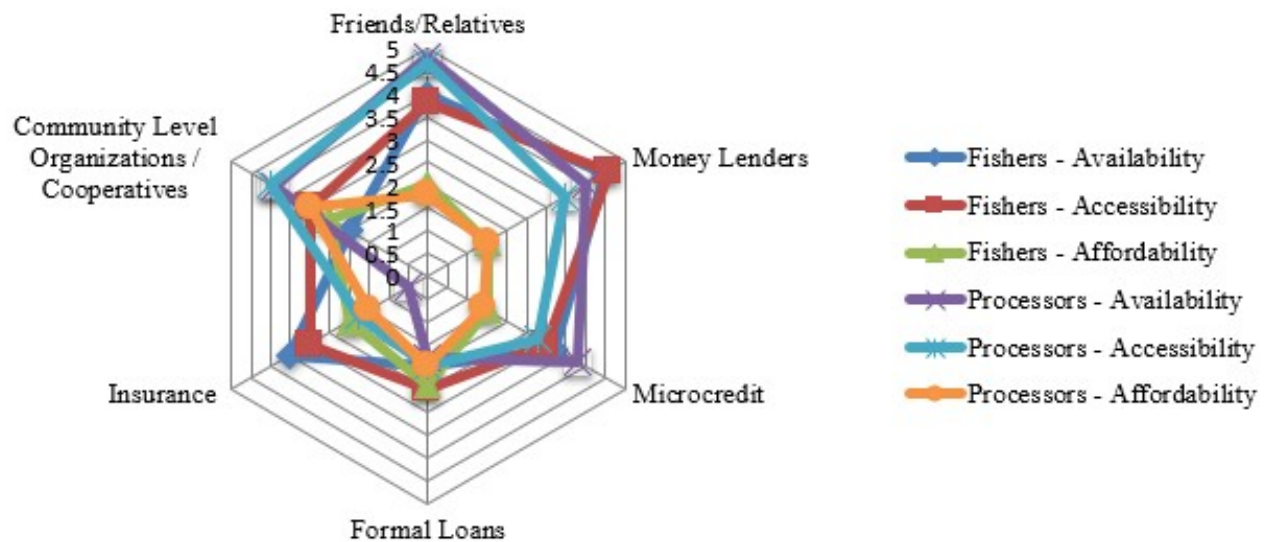


Figure 3. Perceptions of Financial Instruments.

There is limited participation in indemnity-based insurance schemes in areas such as *Kudawella*, *Trincomalee* and *Kalpitiya*, and the fishermen who are already involved in the scheme are not satisfied with the product, mainly due to a lack of mutual trust between them and insurance providers, the lengthy loss assessment process, leading to non-payment or delays in paying indemnities, and the unaffordable premiums. A fisherman considers it an additional burden without a return on investment.

Furthermore, many fishers lack understanding of how the insurance scheme works, and there is a notable lack of transparency in its implementation. Notably, current insurance schemes do not cover critical aspects, such as loss of dates for fishing activities and partial damage to boats or gear, both of which are common.

“There is no clear process for the insurance compensations. The insurance companies ask several questions and follow long procedures to make the payments” (Fisher, FGD 1)

Among the Small-Scale Fisheries communities, awareness about the existing “pension and social benefit scheme” is very low. Although all fishers are aware of the insurance scheme, only 9% are aware of the pension scheme. In this scheme, affordability remains an issue. Moreover, this

welfare scheme does not address broader risks, such as climate shocks, prevalent in the fisheries sector.

Currently, fish processors, who are primarily women, lack access to insurance or pension schemes explicitly designed for them. The schemes often exclude female fish processors from participation, primarily because existing insurance schemes have limited coverage and eligibility requirements that typically exclude active fishers.

Their role, especially in post-harvest processing, is crucial and cannot be overstated. 91% of female fish processors are forced to pawn their jewellery during the off-season to meet their urgent and short-term financial needs. This process traps them in a vicious cycle of debt and asset depletion, hindering their long-term economic resilience.

Not only are small-scale fishers and fish processors vulnerable to the impacts of climate change, but their families are also affected. Most of the sample (89%) depend entirely on fisheries-related activities for their household livelihoods. Education, nutritional level, and well-being are all dependent on the income from fisheries. About 74% of the small-scale fishers in the sample have school-aged children.

During the off-season, they face considerable financial difficulties in funding their children's education. There is no fixed financial support scheme in place for the children of fisheries families. Hence, children miss school days due to an inability to afford the costs. This will create short-term and long-term effects on their livelihoods.

Limited financial inclusion:

Small-scale fisheries value chain actors face several challenges that hinder their access to loan schemes, including insufficient collateral to secure credit, limited financial literacy, and limited understanding of loan-granting procedures. Additionally, they face high transaction costs in obtaining loans and protracted loan-processing timelines. The previous literature consistently highlights the significance of informal financing sources for fisheries communities in the face of climate change, as formal credit instruments available to the fisheries sector are not flexible enough to meet the financial needs arising from unpredictable changes (Ruddle 2011, Pomeroy *et al.* 2020); and informal money lenders fill this gap, primarily the buyers of fish or the owners of boats (Pomeroy *et al.* 2020).

Lack of a locally governed, flexible financial mechanism for fish processors:

According to the study, only a few savings options are currently available for the small-scale fisheries. Among SSFs, savings are notably higher among women engaged in fisheries activities, such as fish processing, than among fishermen. However, they lack a well-structured safe mechanism for accumulating and growing their savings.

Lack of working capital for fish processors:

Compared to small-scale fishermen, fish processors have less access to the formal banking system (particularly the female fish processors), particularly in terms of credit facilities. Hence, the inability to maintain production during adverse weather forces reliance on costly informal loans. Moreover, for small-scale fish processors, a critical impediment to obtaining a loan from a formal institution is the lack of

business registration. Fish processors are unable to obtain business registration because they lack an adequate wastewater management system.

No Alternative Livelihoods during Off-Season:

Fisheries livelihoods are seasonal and affected by many factors beyond their control. Absence of alternative livelihood options resulted in unstable incomes during the off-season. 87% of the Small-Scale Fishermen and 100% of the fish processors in the sample reported that they did not receive any financial support during the off-season or weather-related disruptions that led to a prolonged period without an income. Despite the risks, off-season fishing (May to September/October for the South-West Coast and November to April for the North-East Coast) persists because there are no other viable options for generating revenue. Due to households' complete reliance on fishing, communities are forced to resort to informal methods, such as borrowing from moneylenders, friends/relatives, and microcredit, often unaffordable. This reliance keeps communities trapped in cycles of poverty, thereby increasing their vulnerability to climate-related shocks.

High Post-Harvest Waste and Low Value Capture:

According to the study, 20%–40% of fish is wasted, particularly during processing. 11% of the fish processors in the sample sell their fish waste for use in animal feed production at very low rates.

Absence of Long-Term Financing for Climate-Resilient Infrastructures:

Fishing boats, nets, and drying yards currently in use are not climate-resilient and lack modern fishing methods, making them highly vulnerable to storms, floods, and sea-level rise. During the winter season, when fishermen keep their boats in the boatyards, waves and strong winds drag small boats onto land, causing damage to the vessels. Communities lack access to long-term, adequate financing for upgrading to weather-resilient infrastructure.

Innovative financial solutions for the MSSF communities

Table 3. Evidence tool matrix for the innovative financial solutions for the MSSF.

Theme / Gap identified in the 1st FGD	Evidence from FGD	Corresponding strategy from expert consultation	Innovative financing and its role
Weak social protection and security coverage	• The insurance scheme does not cover loss of fishing/processing days and damage to vessels or gear • Unaffordable premiums • Lengthy and time-consuming paybacks • Lack of mutual trust between insurer and fisheries communities • No insurance scheme for women processors	• Coverage: loss of fishing/processing days, damage to boats, gear, nets (indirect), emergency food support, supply chain disruptions • Government and donor premium subsidy • Flexible payments • Community-based fund pooling • Grievance redressal mechanism, gender-sensitive approach (priority service/premium)	Index-Based Parametric (Weather Insurance Scheme) – • Protects against climate-related losses • Covers partial damages • Enables quick payouts • Improves affordability • Ensures gender inclusion • Reduces income volatility
No pension or welfare scheme for fish processors		Expand existing pension scheme for fish processors	Pension Scheme – provides long-term social security
Off-season income loss disrupts children's education		Secondary and higher education scholarships for fishing families	Education scholarships – ensures continuity of education despite income volatility
Lack of income support during off-seasons		Introducing seasonal grants	Seasonal grants – provides short-term income support for essential needs

Exclusion from formal banking	• Lengthy procedures • High documentation requirements • Lack of trust in banks • Low financial literacy	Partner banks with community-level cooperatives; agent-led transactions	Agency Banking Model – • Simplified banking access • Builds trust with MSSF communities • Enhances financial inclusion
Lack of locally governed, flexible, and sustainable financial mechanisms	• Women have better savings habits via cooperatives • Lack of access to formal financial services	Develop women-led savings clubs with governance and transparency training	Savings Clubs – • Community-driven savings mechanism • Empowers women's decision-making
Lack of working capital for fish processors (especially females)	• Limited access to affordable credit • Lack of working capital for female processors	Link savings clubs with micro-group loans and mobile banking access	Micro Group Loans – • Affordable and flexible working capital • Supports business continuity and startup activities
No alternative income during off-season	Off-season fishing continues despite no alternative livelihood	Impact investment in blue tourism and alternative income sources	Impact Investment – Blue Tourism • Reduces dependency on fisheries sector • Promotes livelihood diversification

High post-harvest waste	20–40% fish waste; women sell waste at low prices for feed production	Finance waste-to-value SMEs for women processors	Impact Investment – Waste Value	• Reduces post-harvest losses • Converts waste into value-added products • Supports women-led enterprises
Climate-vulnerable infrastructure	Vessels, nets, drying yards, and cold storage are not climate-resilient	Finance solar-powered drying yards and renewable cold storage	Impact Investment – Climate-Resilient Infrastructure	• Ensures production continuity • Reduces asset loss

The following financial instruments developed based on the expert consultations.

Index-Based / parametric (Weather Index) Insurance scheme: A rapid recovery immediately after a disaster is crucial for enhancing resilience to climate change-related disasters. The study identified the weather-index-based or parametric insurance scheme as a more effective instrument for fisheries communities vulnerable to rapidly changing weather patterns. Fig. 4 presents the conceptual framework developed for the insurance scheme in this study. To produce a viable financial instrument, the model considers the socio-economic characteristics and the challenges faced by the MSSF communities.

Affordability is always a fundamental issue for MSSF communities. Hence, based on expert consultations, this model adopts a partially subsidised insurance scheme with a government contribution of 40% and an additional 30% from donor agencies, which can be provided through private companies, NGOs, or international or local projects. This is feasible for Sri Lankan fisheries communities because the Government can contribute to subsidising the poorer fishers

by covering their insurance premiums. To avoid the free rider problem, we suggest that the remaining 40% be paid by the insurance buyer (Fisher/Fish Processor).

This would encourage fishers to avoid fishing during hazardous weather, thereby minimising the risk of loss and injury. Moreover, the product is designed with adjustable payment schedules to be flexible for the borrower. The premium can be arranged as an annual or semi-annual to allow for flexibility. AAIB will serve as the central regulatory body for this insurance scheme, providing the technical foundation for the scheme by managing the national-level fund pool and collecting meteorological data, among other tasks. Then, collecting premiums, holding funds, and creating a fund pool will be facilitated by the community-level organisations, such as fisheries cooperatives, which will manage them. It will strengthen existing cooperatives and implement community- or cooperative-based insurance schemes. This is totally under the control and the monitoring of the Ministry of Fisheries. Moreover, the government or the Ministry of Fisheries should organise the capacity-building training programs for the selected fisherfolk organisations on insurance

matters. At the same time, real-time weather data (Wind Speed, Rainfall, Wave height) should be collected at each location to detect threshold breaches.

It can measure business losses resulting from extreme or catastrophic weather events. Payouts should be triggered by levels of rainfall, wind speed, or cyclone events. The index-based triggers and payouts design for each coverage is given in Table 4. Threshold levels were determined from historical climate and disaster records, and subsequently discussed and refined by sectoral experts. In this case, the insurer need not file a separate claim. Moreover, this insurance scheme will compensate both fishermen and fish processors for losses incurred due to fishing/processing dates, including income loss, Damage to Boats, Gear, and Nets (Indirectly), and emergency food support. Most small-scale fishermen complain that insurers require inspection of the damage before releasing funds. In this method, the fund release is faster because it does not require a complex damage assessment. Moreover, the government should also strengthen insurance education to educate both fishermen and insurance providers.

Furthermore, the insurance scheme will provide a sustainable approach, particularly benefiting female fish processors. Sri Lankan female fisheries communities are strong and work well as a well-organised entity. Given the high social control and low transaction costs, this can be particularly beneficial for fish processors. Moreover, this model proposes a Grievance Redressal Mechanism (GRM) in conjunction with the insurance scheme to ensure fairness, accountability, and trust.

Welfare scheme for small-scale fisheries Communities: Welfare schemes available to both small- and large-scale fisheries sectors are very limited. Moreover, no social protection or pension schemes are available for fish processors or women involved in the fisheries sector. Here, the study introduces three instruments within the welfare scheme: a pension scheme, an educational grant, and a seasonal grant for the MSSF communities.

Pension Scheme: The Fishermen's Pension Scheme is introduced by the Agriculture and Agrarian Insurance Board (AAIB), which provides disability, retirement, and other benefits to fishing families. By 2022, only 215 fishers contributed to the pension scheme (Ministry of Fisheries 2023). However, the funds available appear to be insolvent, which represents a significant gap in the social safety net for fishing families (World Bank 2021).

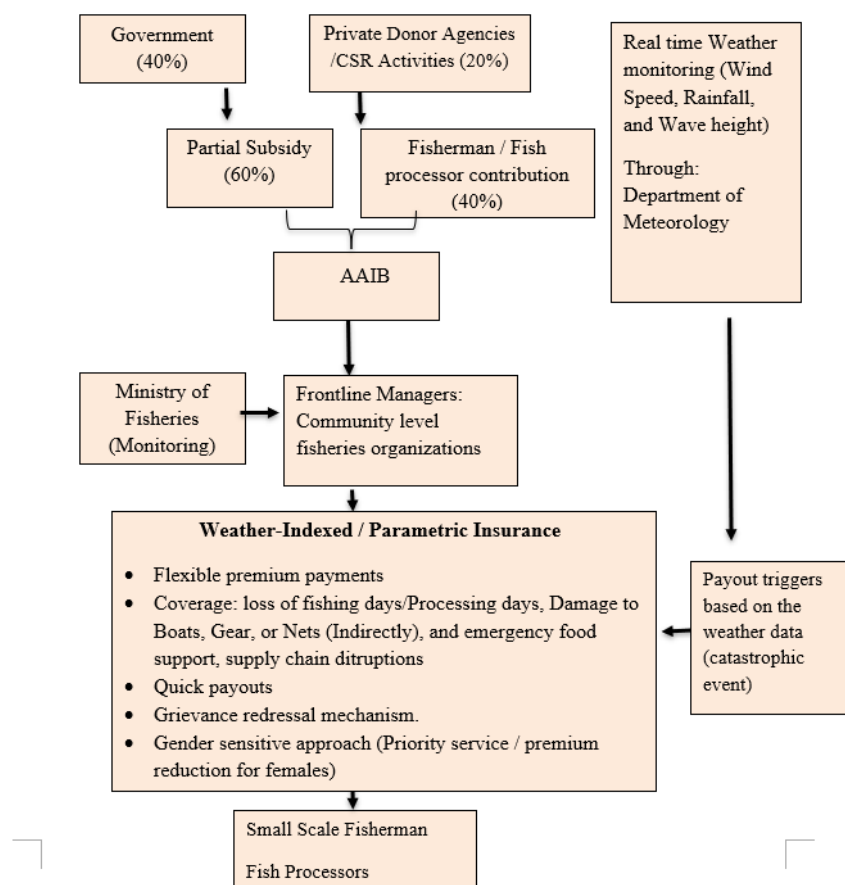
Therefore, through this model, the study suggests expanding the existing pension scheme to include the fish processors. Moreover, a tiered pension scheme could be offered, allowing fishers/ fish processors to choose their contribution based on their income level. It will be more flexible for the users. Furthermore, the pension scheme can be linked to climate-resilient initiatives. If the recipient engages in such initiatives, including sustainable projects like mangrove or reef restoration, the credit can be topped up.

Seasonal Grant : During closed or climate bans, compensation or a grant can be introduced to alleviate the hardship faced by small-scale fishers and small-scale fish processors. Compensation or grants can be introduced to improve the food security and well-being of coastal communities and households. Seasonal grants are also crucial for reducing overfishing and illegal fishing and for implementing sustainable fishery management practices. This seasonal grant should have a clear, transparent, and non-partisan process to select the "right" people for the funding. Furthermore, individuals who receive compensation may also engage in illegal fishing. Therefore, there should be an effective monitoring scheme that can be closely monitored by the AAIB. The scheme can be directly linked to the savings account, thereby promoting long-term resilience building.

Education Grants and Scholarships for the Children of Fisheries Families: This study suggests both long-term and short-term support. As immediate support, the study proposes a grant for primary and secondary school students to meet their cash needs during the off-season.

Table 4. Index-based triggers and payout design for the proposed insurance scheme based on expert consultations.

Group	Coverage	Index-based trigger	Payout design
Fisherman	Loss of fishing days	Dept. of Meteorology issues “No-Fishing advisory or warning” for ≥ 5 consecutive days.	LKR 2,000–2,500 per fisher per day missed (maximum 10 days/month).
Fisherman	Boat/ vessel or gear damage	Cyclone/tropical storm with sustained winds ≥ 55 km/h within 50 km of the landing site	For a boat: LKR 25,000
Fisherman	Emergency food	Fishing ban ≥ 10 consecutive days	Household essential food and survival needs worth LKR 7,500 for 10 days
Fish Processors	Loss of processing days	Continuous rainfall ≥ 100 mm/day for 5+ days; OR cloudy/rainy conditions making sun drying impossible.	LKR 1,000 per day of disruption per registered processor.
Fish Processors	Supply chain disruptions	Official fishing bans ≥ 7 days $\rightarrow$ no raw fish for processing.	Flat LKR 7,500–10,000 per processor household.

**Figure 4. Framework for weather index-based parametric insurance.**

As a long-term solution, the study recommends a scholarship scheme for students to attend fisheries-specialised universities or faculties in Sri Lanka, such as the University of Sri Lanka's Faculty of Fisheries and Aquatic Sciences. Most respondents noted that fisheries are no longer a job passed down through generations. Hence, this would also be an effective method for passing on the fisheries to future generations.

Agency Banking Model: The Small-Scale Fisher communities are currently reluctant to engage in transactions with formal banking institutions due to lengthy procedures and high documentation requirements, which create barriers to access. This fosters a partnership between licensed and Small-Scale Fisheries Communities through an agent representing fisheries cooperatives or associations for banking transactions. The leadership of well-organised fisheries cooperatives could play a key role in facilitating transactions between the bank and the borrower. This will increase access for small-scale fisheries communities to formal banking services.

Savings Clubs: Female fish processors have a well-established culture of collective savings within their fish-processing cooperatives and other organisations. Building upon this existing practice, the study develops a financial tool in the form of savings clubs for female fish processors, which will serve as an effective resilience-building strategy. Savings clubs are local, community-led groups that empower members to manage their resources (both financial and environmental). Although the expected cash support from these sources may be small, there are substantial human resources available through this channel. These funding opportunities are ideal for adaptation measures targeting community-level actions.

In this savings club model, fish processors must contribute a fixed, small amount on a regular basis (e.g., weekly or monthly). At the end of a cycle, one member may receive the lump sum, and the process rotates until all members have received their share. The elected group leaders will manage funds. Savings clubs are required to

maintain accountability to gain more benefits from other lenders. The financial discipline should be promoted within the savings group. Moreover, savings clubs could serve as an organised channel to link financial resources to the most vulnerable households in the MSSF sector. To ensure transparency and maintain accountability among the groups, the study recommends public display of financial records, rotating leadership, and the use of digital bookkeeping applications.

Micro Group Loan: The savings clubs can be directly linked to the Micro group loan; hence, the savings groups have active account operations for the previous period. A precondition for acquiring a group loan is an active membership or transaction history in the savings club. This can be introduced as a short-term loan that can be linked through mobile banking. The loan scheme can be granted for the development of community-level drying yards or storage facilities. Through improved storage and drying facilities, they could continue production even during adverse weather conditions, thereby enhancing their business resilience. Well-organised and active savings clubs can also link to larger-scale funding from local and international donor agencies. Fig. 5 shows the conceptual framework developed for savings clubs and micro-group loans.

Impact investment: Impact investment is a form of investing that aims to generate both positive environmental/ social impacts, as well as financial returns (Food and Agriculture Organization of the United Nations, 2020). In our study, we propose an impact investment model tailored to the Sri Lankan context that benefits both MSSF communities and society (Fig. 6).

In this model, it is proposed that the Sri Lankan Government, together with multilateral development institutes such as the Asian Development Bank and World Bank-like institutions, act as the Anchor Investor. The anchor investors will provide concessional capital and guarantee returns to private investors. Because anchor investors' intentions are not

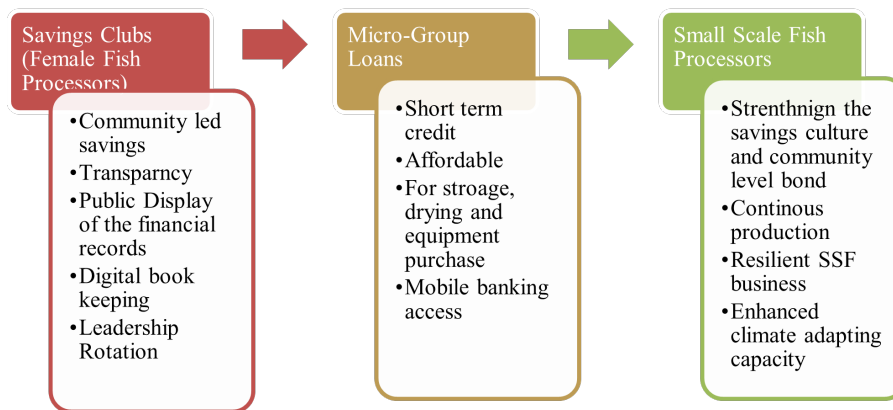


Figure 5. Framework for savings clubs and microcredit.

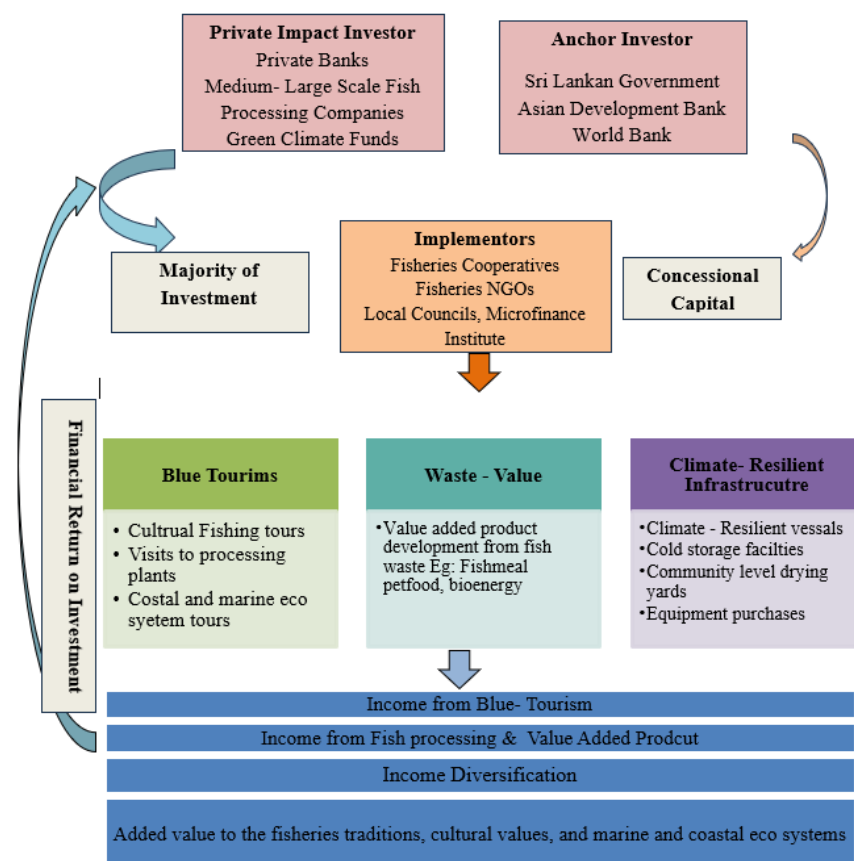


Figure 6. Framework for Impact Investment.

solely to generate profit, they can serve as a guarantee for private investors. This will reduce the burden for the private investors. The anchor investors will also cover the first loss if the businesses face any losses. Then the local commercial banks, seafood-processing companies, and the Green Climate Fund in Sri Lanka could identify as private impact investors who will provide most of the investments. They will receive financial returns based on their investment, as a portion of the income generated from the activities. Implementation will be carried out by fisheries cooperatives/ NGOs supporting fisheries activities, microfinance institutions, or through local authorities. The study suggests three possible activities to be financed under impact investing as follows.

Blue Tourism: During the off-season, even in adverse weather conditions, small-scale fishermen continue to fish, disregarding the risks, as they lack alternative livelihood opportunities. If alternative job opportunities are available, this risk will be mitigated. Microloans could be introduced to the commercially led blue eco-tourism ventures. The borrowers should be the small-scale fishermen. During the off-season, the fishermen could undertake trips that emphasised the natural and cultural heritage of the coastal areas. Furthermore, coastal and marine ecosystems could be further promoted. This will diversify their income sources during the off-seasons, characterised by heavy rainfall and winds. Furthermore, it will also reduce fishing pressure. Microloans range from Rs. 200,000 to Rs. 500,000. Flexible repayment periods can be set according to seasonal earnings. The loan may be used to purchase safety equipment, repair boats or vessels, cover branding and marketing costs, and purchase tour-guide tools. Eco tourism activities such as fishing demonstrations, mangrove tours, visits to fish processing areas, local seafood cooking classes, etc.

Waste – Value: 11% of the fish processors in the sample are sending their fish waste to the animal feed production at very low rates. However, we can provide them with the necessary knowledge and funding to develop products such as fishmeal, pet food, fertiliser, and bioenergy.

Currently, fish processors are reluctant to initiate production due to limited knowledge and capital. Hence, the impact investment could be directed towards initiating women-led SMEs in fish waste-based value-added production.

Climate- Resilient Infrastructure: Advances in technology are another means of enhancing resilience. The study identified the importance of investing in climate resilience infrastructure (such as fishing vessels, cold storage facilities, and drying yards) development to withstand harsh sea conditions, as well as renewable energy-sourced cold storage facilities, weather-proof drying yards, and eco-friendly processing facilities. This will lead to minimising environmental footprints. Impact investment could fund solar-powered drying facilities for fishermen, thereby enhancing their living standards by providing an alternative income source, reducing fish spoilage, and minimising fish waste.

CONCLUSIONS

This study mapped the existing climate finance landscape, assessed the role of available climate financing instruments, identified the challenges in accessing climate financing, and developed innovative climate financing tools tailored to the MSSF sector. The findings revealed that climate-related storms/ cyclones affect Small-scale fishers, resulting in lost fishing days, damage to fishing infrastructure, vessels, and gear, habitat destruction, and injuries or loss of life. Fish processors are highly vulnerable to frequent and intensive rainfall due to insufficient drying and storage facilities. The sources of climate finance for the MSSF value chain can be broadly classified into three categories: government, private, and international/multilateral funds, with government institutions playing a central role through cash and fund transfers, infrastructure development, marine conservation, and other development activities.

The study highlights a critical gap: significantly, fewer financial tools are specifically tailored to the unique needs of the small-scale fisheries sector, and even fewer are designed to facilitate

adaptation to climate change and mitigate its impacts. According to the FDG with the MSSF communities, the main challenges faced by the MSSF communities are weak social protection coverage, limited financial inclusion, a lack of a locally governed, flexible financial mechanism for female fish processors, a lack of working capital for fish processors, absence of alternative livelihoods during off-season, high post-harvest waste and low value capture, absence of long-term financing for climate-resilient assets. Moreover, Sri Lanka lacks a reliable data source on the MSSF sector, a gap that is crucial for policy development.

Expert consultations validated these challenges and guided the design of more context-specific solutions through innovative climate finance instruments, including the Weather Index Insurance model, Welfare Scheme, Agency Banking systems, Community Savings Clubs, and Climate-resilient Impact Investment opportunities. Collectively, these instruments

aim to enhance financial inclusion, facilitate faster recovery from climate shocks, and support both short-term mitigation and long-term resilience across the MSSF sector.

In conclusion, this study makes two significant key contributions: it bridges the gap between community-identified needs and expert-driven solutions, ensuring financial innovations are not only technically feasible but also socially acceptable; and it expands the climate finance discourse by highlighting the importance of localised, small-scale financial mechanisms in safeguarding livelihoods within Sri Lanka's blue economy.

Based on the study's results, future studies should focus on piloting the proposed financing instruments to assess their effectiveness, accessibility, long-term sustainability, and scalability across different MSSF contexts. Moreover, it is essential to strengthen public-private partnerships.

REFERENCES

- Arulananthan K (2016) Climate Change Impact on Coastal Fisheries and Aquaculture in Sri Lanka. In: Climate Change Impact on Coastal Fisheries and Aquaculture in South Asia (Giri SS Ed.). SAARC Agriculture Centre, Dhaka, Bangladesh, 144–165.
- Central Bank of Sri Lanka (2025) Sustainable Finance Roadmap 2.0. Central Bank of Sri Lanka, Colombo, Sri Lanka, 85 pp. https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/sustainable_finance_roadmap_2.0.pdf.
- De Alwis H (2024) Facing the Tides. Centre for Poverty Analysis, Sri Lanka, 57–61. <http://icsfarchives.net/20231/1/920.ICSF1393.pdf>.
- De Zoysa M, Inoue M (2014) Climate Change Impacts, Agroforestry Adaptation and Policy Environment in Sri Lanka. *Open Journal of Forestry*, 4(5), 439–456. <https://doi.org/10.4236/ojf.2014.45049>.
- Department of Fisheries and Aquatic Resources (2024) Annual Performance Report 2024. Colombo, Sri Lanka, 77 pp. https://fisheriesdept.gov.lk/wp-content/uploads/2025/07/D_of-Fisheries_E_PR_2024.pdf.
- Eriyagama N (2010) Impacts of climate change on water resources and agriculture in Sri Lanka: a review and preliminary vulnerability mapping. International Water Management Institute, Colombo, Sri Lanka, 125 pp.
- Food and Agriculture Organization of the United Nations (2020) Blue Growth Initiative: Blue finance guidance notes – Impact investment. FAO, Rome. <https://openknowledge.fao.org/server/api/core/bitstreams/691cadfa-5b16-4a6b-8c29-3e71d61a0528/content>.

- Grafton RQ, Hilborn R, Ridgeway L, Squires D, Williams M, Garcia S, Groves T, Joseph J, Kelleher K, Kompas T, Libecap G, Lundin CG, Makino M, Matthiasson T, McLoughlin R, Parma A, Martin GS, Satia B, Schmidt CC, Tait M, Zhang LX (2008) Positioning fisheries in a changing world. *Marine Policy*, 32(4), 630–634. <https://doi.org/10.1016/j.marpol.2007.11.003>.
- Guggisberg S (2019) Funding coastal and marine fisheries projects under the climate change regime. *Marine Policy*, 107, 103352. <https://doi.org/10.1016/j.marpol.2018.11.015>.
- Hobday AJ, Little LR, Watson JR, Spillman CM (2025) Parametric insurance for climate adaptation in fisheries and aquaculture. *Reviews in Fish Biology and Fisheries*, 35(1), 175–185. <https://doi.org/10.1007/s11160-025-09920-3>.
- Hoegh-Guldberg O, Northrop E, Ashford OS, Chopin T, Cross J, Duarte C, Geers T, Gössling S, Haugan P, Hemer M, Huang C, Humpe A, Kitch G, Kowek D, Krause-Jensen D, Lovelock CE, Matthews K, Nielsen FG, Parker R, Tyedmers P (2019) The Ocean as a Solution to Climate Change: Updated Opportunities for Action. World Resources Institute. <https://oceanpanel.org/publication/ocean-solutions-to-climate-change>.
- Ibrahim FA (2020) Between the sea and the land: small-scale fishers and multiple vulnerabilities in Sri Lanka. *Sri Lanka Journal of Social Sciences*, 43(1), 5–12. <https://doi.org/10.4038/sljss.v43i1.7641>.
- Jayasinghe AD, Niroshana KHH (2016) Potential Impacts of Climate Change on Fisheries and Aquaculture in Sri Lanka. *Journal of Fisheries Science and Technology*.
- Karmakar KG, Mehta GS, Ghosh SK, Selvaraj P (2010) Review of the development of micro-finance services for coastal small-scale fisheries and aquaculture for South Asian countries with special attention to women. FAO, Rome, 75 pp.
- Kibona SE, Pauline NM, Hepelwa AS (2021) Distribution of Adaptation Climate Finance in Africa Region. *Tanzania Journal of Development Studies*. [Preprint].
- Lars J (2022) Avoiding “Too Little Too Late” on International Debt Relief. United Nations Development Programme (UNDP), New York, USA.
- Ministry of Environment Sri Lanka (2022) Third National Communication of Climate Change in Sri Lanka. Climate Change Secretariat, Colombo, Sri Lanka. <https://unfccc.int/sites/default/files/resource/Third%20National%20Communication%20of%20Sri%20Lanka.pdf>.
- Ministry of Fisheries (2023) Progress Report 2022. Colombo, Sri Lanka. <https://fisheries.gov.lk/web/images/downloads/pdfs/2023/Progress-Report-2022>.
- Ministry of Fisheries, Aquatic and Ocean Resources (2024) Annual Fisheries Statistical Bulletin 2024. https://www.fisheries.gov.lk/web/images/statistics/annual_report/Annual_Fisheries_Statistical_Bulletin_2024_compressed.pdf.
- Niluka G, Dushyantha N (2023) Unlocking the blue economy: financing a sustainable ocean future. *Bolgoda Plains*, 3(2), 55–58. [https://doi.org/10.31705/BPRM.v3\(2\).2023.12](https://doi.org/10.31705/BPRM.v3(2).2023.12).
- Omukuti J (2024) The need for a climate-resilient development-aligned framing of innovative climate finance. *Current Opinion in Environmental Sustainability*, 66, 101400. <https://doi.org/10.1016/j.cosust.2023.101400>.
- Pomeroy R, Arango C, Lomboy CG, Box S (2020) Financial inclusion to build economic resilience in small-scale fisheries. *Marine Policy*, 118, 103982. <https://doi.org/10.1016/j.marpol.2020.103982>.

- Ruddle K (2011) “Informal” Credit Systems in Fishing Communities: Issues and Examples from Vietnam. *Human Organization*, 70(3), 224–232. <https://doi.org/10.17730/humo.70.3.v4810k37717h9g01>.
- Sandaruwan KPGL, De Silva DWLU (2022) Assessing climate change vulnerability in Sri Lankan coastal fishing communities. (Unpublished). <https://doi.org/10.13140/RG.2.2.34503.57766>.
- United Nations Development Programme (UNDP) (2024) 2024 UNDP Trends Report. UNDP, New York, USA, 92 pp. https://www.undp.org/sites/g/files/zskgke326/files/2024-02/undp_trends_report_2024_1.pdf.
- United Nations Development Programme (UNDP) and Lakshman Kadirgamar Institute of International Relations and Strategic Studies (2023) Sri Lanka’s Blue Economy: A Position Paper. UNDP, Colombo, Sri Lanka, 45 pp.
- Upare S (2024) Financing innovations for sustainable small-scale fisheries. *INFOFISH International*, 5/2024, 47–48. <https://infofish.org/v4/media/attachments/2024/09/04/financing-innovations-for-sustainable-small-scale-fisheries.pdf>.
- World Bank (2021) Priorities for Sustainably Managing Sri Lanka’s Fisheries, Coastal Aquaculture, and the Ecosystems That Support Them. Washington, DC. <https://documents1.worldbank.org/curated/en/308261634198704809/pdf/Priorities-for-Sustainably-Managing-Sri-Lanka-s-Marine-Fisheries-Coastal-Aquaculture-and-the-Ecosystems-that-Support-Them.pdf>.