

Sustaining livelihoods and building resilience: Policy implications for the Lower Mekong Basin

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ABSTRACT

The diverse agricultural landscape in the Lower Mekong Basin (LMB) encompasses vulnerable smallholder farmers, whose livelihoods are exposed to the impacts of natural hazards, environmental degradation and climate change. This paper aims to understand the vulnerability and risk drivers to agricultural livelihoods in the LMB and the existing capacities, policies and strategies to strengthen livelihoods. The inherent capacities (capitals) of these communities have helped them withstand and cope with the impacts of natural and anthropogenic stressors on their livelihoods. Skills, training and indigenous knowledge complemented by social networks and co-operatives are crucial to human and social capital. Similarly, water management, irrigation infrastructure, and demarcation and protection of natural resources have helped reduce potential impacts on agricultural activities and outputs. These are supported through financial instruments such as grants, subsidies and loans. On the other hand, while extant policies and strategies in LMB countries acknowledge the vital role of agriculture in socioeconomic development, the utilisation of robust assessment frameworks pertaining to livelihood resilience is limited. This paper discusses the potential advantages of incorporating integrated livelihood resilience assessments in current policies, which can help in designing context-specific strategies and optimise resource allocation for sustainable livelihood development in the LMB. However, to ensure robust assessments, stakeholders must harmonise assessment frameworks, promote community engagement, enhance data availability and strengthen institutional collaboration.

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KEYWORDS LOWER MEKONG BASIN, LIVELIHOOD, RESILIENCE, TOOL FRAMEWORK

HIGHLIGHTS

- Natural and anthropogenic stressors impact agricultural activities in the Lower Mekong Basin (LMB) and diminish livelihood security and resilience.
- Communities in LMB have developed several capacities (capitals) to cope with the stressors, which are complemented by several government policies and strategies.
- LMB policies prominently emphasise the promotion and protection of agriculture; however, there is a significant gap in specific and integrated assessment frameworks.
- Integrated resilience assessment frameworks and tools enable policymakers to prioritise resources and design interventions that address risks and strengthen livelihoods.
- A standardised and common assessment approach will be helpful at the regional and national levels operative through institutional collaboration and coordination for effective communication across different agencies and communities.

1. INTRODUCTION

Over the past decade, there has been a significant shift in the disaster risk management paradigm, transforming the response-centric approach to a mitigation-centric approach (Pal et al., 2022). On the other hand, supplemented by scientific research, real-world evidence and the realisation and acceptance among scientists, policymakers and the general public, the climate change debate has evolved from its ‘reality’ to a focus on mitigation and adaptation strategies (Gramberger et al., 2015; Hoang et al., 2018; Pilli-Sihvola & Väättäin-Chimpuku, 2016; Tanner et al., 2015). The increasing impacts of climate-induced natural hazards are a testament to the need for global action for disaster resilience and sustainable development.

The Lower Mekong Basin (LMB) is located in Southeast Asia, covering parts of Cambodia, Lao PDR, Thailand and Vietnam. The river basin plays a significant role in the region’s social, cultural, bio-physical and environmental nexus (Morton & Olson, 2018). More than sixty-five million people residing within the basin region depend on the river, its ecosystem, and natural resources for livelihood and economic activities, particularly in agriculture, transportation and energy production (Pal et al.,

2023). However, the region faces numerous challenges, which create stress and cause changes in the Mekong River basin hydrology. Natural hazards such as floods and drought, and anthropogenic activities such as infrastructure development, urbanisation and environmental degradation exert multiple stresses on the river ecosystem and directly impact livelihood security and disaster resilience among the communities. Because of these challenges, the LMB countries and regional agencies such as the Mekong River Commission have formulated various policies and strategies to mitigate risks, cope with impacts and build resilience.

In this backdrop, the objectives of this study were as follows:

1. Identify the drivers of vulnerability and risk, existing capacities and the challenges faced in strengthening agricultural livelihoods in the LMB.
2. Synthesise existing policies and strategies implemented in the LMB for livelihood protection and resilience and identify gaps.
3. Provide recommendations to strengthen the existing policies for effective actions in enhancing the resilience of local livelihoods.

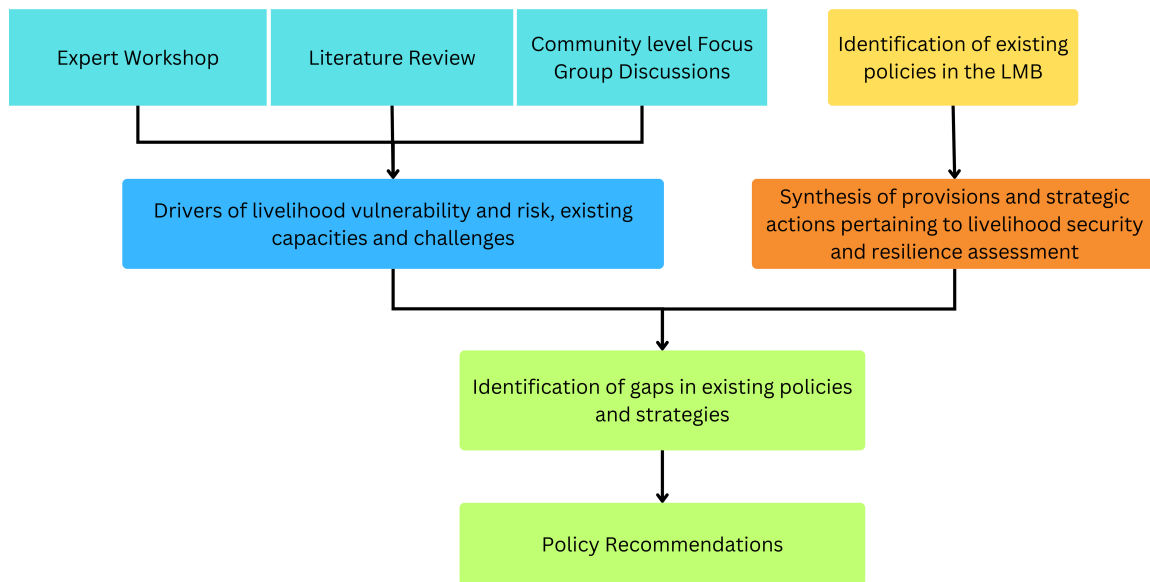


FIGURE 1. Methodological flowchart of the study for this paper.

2. METHODOLOGY

Figure 1 shows the methodological flowchart of the study.

In the first stage, discussions were conducted with experts and community people living in the LMB who depended on agricultural livelihoods. An expert workshop was conducted in Thailand with twelve researchers and practitioners in natural resource management, climate change, disaster risk reduction, risk governance and agriculture from three LMB countries, viz. Thailand, Vietnam and Cambodia. In addition, workshops were conducted with community people, local authorities and researchers as participants in the three LMB countries (approximately 20 people from each country), where focus group discussions were carried out. Five key questions guided the discussions,

1. What are the primary livelihood activities in the LMB communities?
2. What factors pose threat to livelihood activities?
3. What capacities do communities possess that reduce impacts on livelihood activities?
4. What must be done to enhance the resilience of local livelihoods?
5. What are the desired outcomes of livelihood activities?

The purpose of these workshops was to identify the major drivers of risk and vulnerability to agricultural livelihoods, understand their impacts and identify existing capacities of the local communities and stakeholders in risk reduction. The information generated through the review and workshops has

been discussed through the lens of the Sustainable Livelihoods Framework (SLF) (DFID, 1999).

The information generated was further validated through a review of existing literature. A semi-systematic review process was utilised to identify, synthesise and analyse the literature on livelihood resilience in the LMB. Literature was searched on Scopus and Web of Science with the keywords: ‘livelihood’, ‘lower mekong’, ‘livelihood+impacts’, ‘livelihood+vulnerability’, ‘livelihood+resilience’, and ‘agriculture+vulnerability’. Similarly, in the second stage, existing policies in all four countries in the LMB region were reviewed to understand how these policies addressed the issues surrounding livelihoods and resilience. The synthesis of the data collected through the two stages is used to identify gaps in existing policies and strategies and develop recommendations.

3. RESULTS AND DISCUSSION

Table 1 demonstrates the outcomes of the expert workshop and focus group discussions based on the five key questions. Similarly, Figure 2 shows the outcomes of the expert workshop and focus group discussions through the lens of the Sustainable Livelihood Framework (SLF). The figure depicts the linkages between factors that induce vulnerability in agricultural livelihoods in the LMB, the capacity of the communities across five livelihood capitals, strategies and instruments that may enhance resilience and the desired livelihood outcomes.

Livelihood systems in the LMB communities predominantly exhibit an agrarian character,

TABLE 1. Outcomes of expert workshop and community-focus group discussions on livelihood resilience aspects in the LMB.

Questions	Cambodia	Thailand	Vietnam
What are the primary livelihood activities?	<ul style="list-style-type: none"> — Farming (Paddy) — Horticulture (Vegetables) — Textile industry 	<ul style="list-style-type: none"> — Farming (Paddy) — Livestock — Aquaculture 	<ul style="list-style-type: none"> — Farming (Paddy) — Small-scale food industries — Aquaculture
What factors pose threat to livelihood activities?	<ul style="list-style-type: none"> — Floods — Drought — Wind storms 	<ul style="list-style-type: none"> — Drought — Floods — Tropical storms 	<ul style="list-style-type: none"> — Riverbank erosion — Floods — Changes in river flow
What are the desired livelihood outcomes?	<ul style="list-style-type: none"> — The ability of farmers to increase farm production and income — Proper use of natural resources 	<ul style="list-style-type: none"> — Household food security — Increased income and financial status 	<ul style="list-style-type: none"> — Ensure continuous operation of farming and small-scale business activities — Improved psycho-social well being
What capacities do communities possess that reduce impacts on livelihood activities?	<ul style="list-style-type: none"> — Flood Control Structures — Early Warning & Agro-advisory — Irrigation infrastructure — Hazard-resilient crop varieties — Agricultural storage structures 	<ul style="list-style-type: none"> — Drought/flood-tolerant plant species — Crop diversification — Precision farming (technological interventions) — Early warning system, information and advisory 	<ul style="list-style-type: none"> — Water resource planning — Land-use planning and zoning — Structural mitigation measures (embankments, dykes, dams) — Early warning system — Community co-operatives and networks
What must be done to enhance the resilience of local livelihoods?	<ul style="list-style-type: none"> — Strengthen market and supply chain — Financial security (insurance) for farmers — Capacity building and technological advancement in agriculture — Increase the capacity of local authorities 	<ul style="list-style-type: none"> — Comprehensive stakeholder engagement in planning and decision-making — Inter-agency collaboration and knowledge sharing — Targeted policies for farmers/agricultural communities 	<ul style="list-style-type: none"> — Strategies for livelihood diversification, relocation and resettlement — Implement skill development training and education activities. — Provide technical and financial support for housing and agricultural assets.

relying significantly on paddy farming, livestock rearing, aquaculture or associated small-scale businesses. Agriculture, fisheries and forest products contribute significantly to household and national income, making up more than 10% of the GDP of the countries (World Bank, 2022). More than 6.8 million people in the region are directly engaged in farming, while an additional 18 million work in the agricultural sector as farm labour. However, without intensive farming systems and techno-

logical advancements, the communities heavily rely on the ecosystem and natural resources for agricultural practices (such as irrigation, grazing, forest products, etc.) (Morton & Olson, 2018). This reliance increases their exposure and vulnerability to the increased frequency and intensity of natural hazards, including floods and drought, as well as the adverse impacts of riverbank infrastructure development and environmental degradation (Pal et al., 2023).

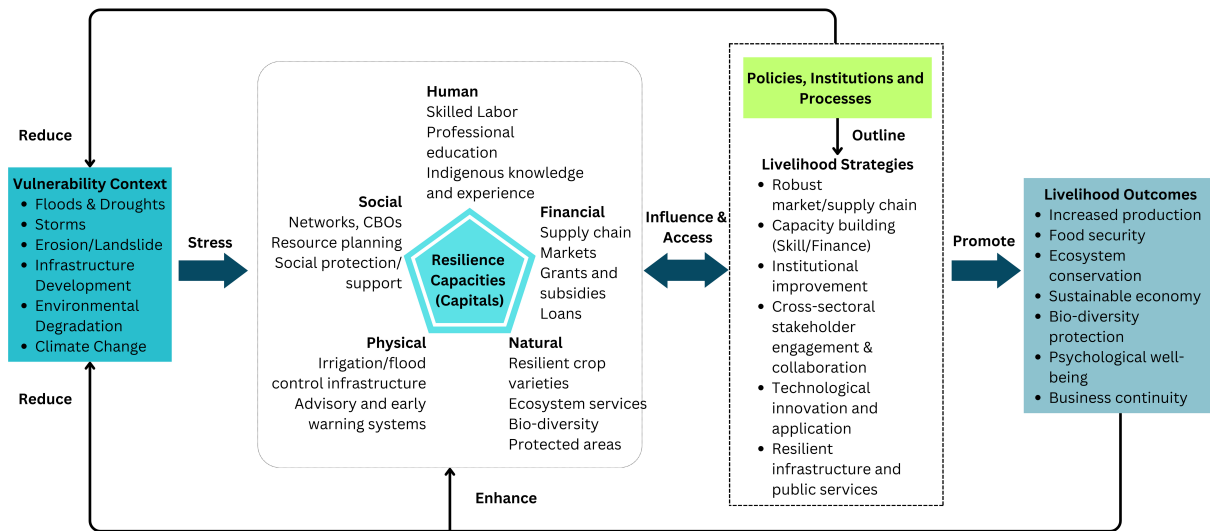


FIGURE 2. Understanding livelihood resilience perspective for the LMB region through the Sustainable Livelihoods Framework.

3.1. Factors impacting resilience of livelihoods in the LMB

LMB’s agrarian livelihoods are highly dependent on natural resources and the environment. Hence, changes and variations in ecosystem services due to natural and anthropogenic factors have a direct impact on livelihood activities and outcomes, as discussed below.

3.1.1. Natural hazards

The LMB region is prone to both flooding and drought. While the regular flood cycle is a vital component of the local livelihoods, the increasing frequency and severity of floods in recent years have the potential to impact human and economic activities adversely. Floods destroy crops, livestock, and infrastructure, leading to substantial economic losses and food insecurity (Arias et al., 2019; Hoang et al., 2018; K. V. Nguyen & James, 2013). The average annual cost of floods in the LMB is estimated to range between US\$ 60–70 million, with Cambodia and Vietnam suffering a higher proportion of losses (Christopher, 2012).

The LMB has also been experiencing frequent drought; the likelihood of annual meteorological drought is 0.40 to 0.45 per year in Lao PDR and Thailand and 0.30 to 0.35 per year in Cambodia and Vietnam (Christopher, 2012). Drought and low river flow have widespread impacts, including diminished agricultural productivity, environmental degradation, and reduced energy production, among others that have a direct impact on the local livelihoods (Abhishek et al., 2021; Thilakarathne & Sridhar,

2017). Although the exact cost estimates are not available, the MRC estimates drought impacts to be more significant than floods, and appropriately so, with individual drought such as the 2004–05 drought in Cuu Long Delta in Vietnam costing about US\$ 45 million.

3.1.2. Riverbank infrastructure development

The construction of dams, embankments and other riverbank infrastructure projects in the LMB region has significantly altered the natural flow of rivers (Pokhrel et al., 2018). As of 2023, more than 90 hydropower projects have been constructed in the LMB region, along with other synergistic infrastructure and services such as irrigation, transportation and disaster management (MRC, 2014). However, while there are several economic gains, such infrastructure development disrupts the ecosystem and natural resources such as a decline in fisheries, forests, wetlands and mangroves that are estimated to cost up to US\$168 billion by 2040 (MRC, 2014). Disrupted river ecosystems and altered river flow negatively impact the livelihoods of communities dependent on fishing, agriculture and other water-based activities.

3.1.3. Environmental degradation

The pressure exerted by population growth and socio-economic development in the LMB has posed considerable challenges for the river basin, ecosystem and communities. The increasing population (expected to rise to about 83 million in 2060) coupled with rapid industrialisation and urbanisation will lead to environmental degradation, including

deforestation, soil erosion and water pollution, which further compounds the challenges faced by agricultural communities in the LMB (Thu Trang & Loc, 2021). Unsustainable land and water management practices, as well as the use of agrochemicals, have led to a decline in agricultural productivity and biodiversity loss, threatening the long-term livelihood security of these communities (T. D. Dang et al., 2018; Pokhrel et al., 2018; Spruce et al., 2020). Studies show that dam construction has severely disrupted the sediment flow in the LMB rivers, reducing the volume of sediment by more than half between 1994 and 2014 (WWF, 2018), further exacerbated by unsustainable sand mining to fulfill the increasing demand in the construction industry. Similarly, the LMB has also experienced dramatic changes in land use and land cover (LULC); one study found that between 1988 and 2017, about 21% of the area in the Mekong Basin had undergone LULC changes, attributed mainly to changes in forests into shrimp farms, cultivable lands and built-up area (Li & Hong, 2022).

3.1.4. Vulnerability to climate change

The LMB ecosystem is highly complex, dynamic and fragile and is recognised as one of the region's most vulnerable to the impacts of climate change. These impacts have gradually become evident, affecting the livelihoods of millions relying on the river's natural resources. According to research conducted by the MRC, the average annual basin-wide increase in temperature could be between 0.4 °C to 3.3 °C by 2060, while average annual rainfall may vary between 16% reduction (in dry climate scenario) or 17% increase (in wet climate scenario) (MRC, 2017). Similarly, Talberth and Reytar (2014) estimate an annual net economic cost of nearly US\$ 364 billion due to climate change by 2030 in the LMB countries; losses in labour productivity are expected to be the most significant, followed by impacts of sea level rise and reduction of agriculture and fisheries production.

The cumulative effect of floods, droughts, river-bank infrastructure development, and environmental degradation and climate change have significant impacts on the traditional livelihood activities of agricultural communities in the region (Kura et al., 2017; Myint, 2014; Thu Trang & Loc, 2021). Many farmers and fishers struggle to sustain their livelihoods, experiencing reduced income, limited market access and increased vulnerability to poverty (Nguyen & Sean, 2021). The loss of livelihood activi-

ties also has broader socioeconomic implications, as it undermines the region's food security, exacerbates inequality and perpetuates rural-urban migration.

3.2. Livelihood resilience capacities

The livelihood resilience concept introduces five major capitals (assets): Human, Financial, Natural, Physical and Social as shown in Figure 1 above. In agricultural communities such as the LMB, the human capital, determined by the size of the household and its labour force has significant implications on livelihoods, especially given the challenges of labour shortages resulting from migration and a shift towards more formal sectors of trade (Huy & Khoi, 2011). Human capital in the LMB is enhanced by the availability of skilled labour in the agricultural sector, and the proficiency and expertise of the community's workforce. This is achieved by introducing professional and formal education and specialised training to community members (Tran et al., 2023). In addition, using indigenous knowledge and experience can facilitate in enhancing sustainability of livelihoods (Phu, 2023).

Similarly, LMB communities also rely on financial capacities to secure livelihoods. Communities rely on access to markets and supply chains (Wong, 2006) and broader economic and financial instruments to strengthen their capacity to invest in agriculture and generate income. This is supported through accessibility to grants, subsidies and loans, which, in many cases, are explicitly targeted to the agricultural sector. Considering the LMB communities' heavy reliance on natural resources for their livelihoods, natural capital plays a significant role. To combat the impacts of natural hazards, climate change and anthropogenic factors, farming communities have been using improved and resilient crop varieties (Ho et al., 2021), implementing crop diversification strategies (Tung, 2017), polyculture and composite farming to reduce risks. Similarly, the demarcation of protected areas including community-based conservation activities has helped safeguard biodiversity and ecosystem services, ultimately improving agricultural outputs.

The LMB countries have also mainly invested on physical infrastructures to control and mitigate risks. Infrastructure such as flood control structures designed to mitigate the impact of flooding events, early warning and advisory systems for timely communication of potential threats,

irrigation infrastructure supporting agricultural activities, and strategies for optimal land allocation and use through land-use planning and zonation has helped control hazards, reduce exposure of agricultural land and activities towards hazards and increase security. Finally, social capital, including the strength and extent of community networks and collaborative ventures through co-operatives, is essential to enhancing economic and social outcomes by reducing and transferring risks across a wider group of people. Similarly, LMB communities rely on cultural and religious activities to foster cohesion, unity and collaboration to withstand and cope with the impacts of natural hazards. This is complemented by social protection and security schemes implemented by the government and other organisations.

3.3. Policies and strategies on livelihood security and resilience in LMB

Lower Mekong Basin countries have developed and implemented several policies and strategies aimed at multi-dimensional socioeconomic development. They focus on sustainable agriculture, water resource management, climate change adaptation and community-based approaches. These efforts aim to improve food production, enhance income generation, and build resilience to climate and environmental challenges, benefiting local communities in the region. A brief synopsis of major policies and strategies, their strategic objectives or goals directed towards agricultural livelihoods and the provisions regarding vulnerability, risk or resilience assessment is given in [Table 2](#).

3.3.1. *Emphasis on promoting agricultural livelihoods*

In Thailand, the National Strategy (2018–2037) is oriented towards augmenting societal resilience and addressing agricultural and food security concerns by integrating agricultural management practices. This includes initiatives to increase agricultural productivity, foster employment within the agricultural sector and elevate farmers' per capita income. Additionally, the 20-year Agriculture and Co-operatives Strategy (2017–2036) is directed towards fortifying the resilience and competencies of individual farmers and farmer institutions, concurrently advancing the productivity and quality benchmarks of agricultural commodities. Similarly, the Agricultural Development Strategy outlined in the Twelfth National Economic and Social Development Plan (2017–2021) focuses on strengthening agricultural production. It emphasises developing

and maintaining water storage systems, strategically planning crop planting aligned with water availability and safeguarding potential agricultural land. The strategy seeks to broaden opportunities for farmers to access land, thereby supporting their livelihoods. Concurrently, the Climate Change Master Plan (2015–2030) is designed to guide agencies and organizations in formulating mechanisms, tools and action plans dedicated to climate change adaptation across multiple sectors, including agriculture, rural development and livelihoods.

The Agriculture Restructuring Plan 2021–2025 of Vietnam aims to enhance agricultural products' quality, added value, and competitiveness while prioritising environmental and ecological protection. By doing this, the plan seeks to elevate rural populations' income, ensuring food and livelihood security. Similarly, the Sustainable Agriculture and Rural Development Strategies for the Period 2021–2030 with a Vision Toward 2050 outlines strategies to improve socio-economic and environmental dimensions of agriculture with an emphasis on increasing farmer's incomes and quality of life. Moreover, it also aims to enhance the resilience of agricultural livelihoods through diversification, poverty alleviation programs and equitable development across all regions. Resilience building of agricultural livelihoods is also outlined in Vietnam's 5-Year Socio-Economic Development Plan (2016–2020), which concentrates on agricultural restructuring, increasing the efficiency of agricultural production to enhance the lives of farmers and overall rural development. Finally, the National Strategy for Climate Change Until 2050 prioritizes urgent solutions to reduce vulnerability and enhance resilience against climate change impacts. The strategy emphasises sustainable livelihood models, incorporating training, profession transition, technology assistance, and funding sources to support residents in areas vulnerable to climate change and its associated impacts.

In Cambodia, the National Strategic Development Plan 2019–2023 acknowledges the pivotal role of agriculture in contributing to multiple dimensions of national development. It aims to fortify the role of the agriculture sector in overall socio-economic development through employment, food security, poverty reduction and rural development. In concordance, the National Environment Strategy and Action Plan 2016–2023 envisions promoting the agriculture sector as a critical driver of economic development and aims to foster

TABLE 2. Policies and strategies developed by LMB countries for enhancing livelihood security and resilience in the region.

SN	Policy/Strategy	Goals/objectives on resilience of agricultural livelihoods	Provisions regarding vulnerability, risk and resilience assessment
Thailand			
1	National Strategy (2018–2037)	Developing agricultural and food security by integrating agricultural management, increasing agricultural productivity, increasing employment in the agricultural sector, and improving farmers' per capita income.	None
2	20-year Agriculture and Co-operatives Strategy (2017–2036)	Strengthening the farmers and farmer institutions. Increasing the productivity and quality standards of agricultural commodities.	None
3	Agricultural Development Strategy in the Twelfth National Economic and Social Development Plan (2017–2021)	Strengthening agricultural production by developing and maintaining water storage systems, planning the crop planting systems to match the availability of water, protecting potential agricultural land and expanding opportunities for farmers to access land for their livelihood.	Preparing maps on the risks from climate change that show the agricultural areas affected by the climate change for the community to jointly solve the problems, that show the vulnerable areas to floods, drought, landslides, problems from saltwater intrusion, transmission of plant and animal diseases, etc. Vulnerability assessments of agricultural land and coastal areas are needed to update their risks and vulnerability for use in the preparation of the adaptation plan for the agriculture sector.
4	Climate Change Master Plan (2015–2050)	Action planning for resilience and adaptation to climate in high-priority sectors (including agriculture) Develop effective and comprehensive early warning measures such as pest and meteorological forecasting for the agricultural sector. Establish a climate-based agricultural insurance scheme.	Assess the impact of climate change on food security at national and local levels, considering the effects that future domestic and international demand for food will have on the food security, livelihood and nutritional quality of food available. Develop agricultural risk maps that will aid in forecasting the occurrence of disasters such as outbreaks of plant and animal diseases, flooding, drought, landslides, saltwater intrusion, and other extreme weather events.

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TABLE 2. Continued.

SN	Policy/Strategy	Goals/objectives on resilience of agricultural livelihoods	Provisions regarding vulnerability, risk and resilience assessment
Vietnam			
1	Agriculture Restructuring Plan 2021–2025.	Continue to restructure the agricultural sector towards sustainable agricultural development, improve quality, added value and competitiveness of agricultural products; environmental and ecological protection; improve income for people in rural areas; ensure food security and national defence.	None
2	Sustainable Agriculture And Rural Development Strategies For The Period 2021–2030 With A Vision Toward 2050	Develop agriculture effectively and sustainably in terms of economy, society and environment. Improving income, life quality, role and position of people involved in agricultural production; creating non-agricultural careers to develop diversified livelihoods, reduce poverty sustainably for rural people and ensure equal development opportunities among regions.	Build a system of warning, forecasting and determining risks as the basis of synchronous solutions, and proactively protect production against risks of epidemics, natural disasters, environmental pollution, etc.
3	5-Year Socio-Economic Development Plan 2016–2020	Concentrate on agricultural restructuring, improving the efficiency of agricultural production and new rural development associated with improving farmers' lives.	None
4	National Strategy for Climate Change Until 2050	Implement urgent solutions for reducing vulnerability and increasing resistance against climate change impact; at its highest priority, ensure safety and livelihood for inhabitants in regions that are potentially heavily affected. Develop sustainable livelihood models, prioritise training, profession transition, technology assistance, and funding source approach for inhabitants of areas prone to climate change and its impacts.	Assess impact, vulnerability, risk, loss, and damage caused by climate change in the planning and investment in infrastructure development of coastal and island industrial parks, urban areas, residential areas, and relocation areas on the basis of classifying areas with disaster risks and climate change scenarios. Assess and classify areas based on climate change risks and natural disasters; produce natural disaster warning maps; develop and build a national database on climate change.

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TABLE 2. Continued.

SN	Policy/Strategy	Goals/objectives on resilience of agricultural livelihoods	Provisions regarding vulnerability, risk and resilience assessment
Cambodia			
1	National Strategic Development Plan 2019–2023.	Promote the agriculture sector and rural development, the strategic goal is to strengthen the role of the agriculture sector in generating jobs, ensuring food security, reducing poverty and developing rural areas.	Formulating guidelines for local risk assessments and their use in local development planning, with a complement of traditional, indigenous and local knowledge and practices, and science and technology.
2	National Environment Strategy and Action Plan 2016–2023	Promotion of the agriculture sector in supporting economic growth, ensuring equity, reducing poverty, securing food security, and promoting the development of the rural economy.	Promote the application of informed environmental decision-making processes and tools, and proper assessment and monitoring based on scientific evidence and knowledge.
3	Cambodia Climate Change Strategic Plan 2014–2023	Increase capacity to address climate-induced opportunities in agricultural production systems, ecosystems and protected areas such as (i) Agricultural diversification (e.g. crops, livestock etc.), (ii) Increase in productivity (e.g. crops, fisheries, livestock, forestry etc.), (iii) Opportunity for new cropping, (iv) Watershed and ecosystem management.	Use existing vulnerability and risk assessments and conduct new ones where necessary to prioritise adaptation measures for key regions of Cambodia, such as coastal zones, highlands, rural and urban areas.
4	Plan of Action for Disaster Risk Reduction in Agriculture 2014–2018	To enhance the capacities and resilience of farmers and communities to threats and disasters affecting agriculture and rural livelihood.	Improve, in coordination with other relevant stakeholders, the existing risks and vulnerability assessment methodologies from an agricultural perspective.
Lao PDR			
1	9 th Five-Year National Socio-Economic Development Plan. (2021–2025)	Enhanced well-being of the people, including poverty alleviated in rural and remote areas, and people's livelihoods, cultural values, and media work improved; equal access to socio-economic development opportunities promoted and the rights of women and children protected.	Update disaster risk information at the central level and encourage localities to assess risks and create disaster risk maps; and support the development of provincial disaster risk reduction strategies and disaster preparedness plans for ten provinces, 20 districts and 80 villages.

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TABLE 2. *Continued.*

SN	Policy/Strategy	Goals/objectives on resilience of agricultural livelihoods	Provisions regarding vulnerability, risk and resilience assessment
2	Agriculture Development Strategy to 2025 and Vision to 2030.	To enable more inclusive and efficient agricultural and food systems by the creation of employment, income generation for people, environmental protection and contribute to stability and balance of ecological system.	Carry out the study and collection of information to identify and map out risky areas where natural disasters often occur and may occur, such as downstream areas along the rivers that are at risk on flooding, areas that are at risk on drought, areas that often affected by the outbreak of animal and plant diseases, areas that are at risk on soil erosion and other risks by applying modern techniques or technologies in the determination and assessment of events such as the use of satellite image, aerial photos/maps, applying modern warning systems and others.
3	Natural Resources and Environment Strategy 2016–2025.	Development and management of natural resources and environment, and to ensure sustainable social economic development, and build capacity for climate change adaptation and mitigate the risks of natural disaster. Reduce the risk and impact of natural disasters to livelihood, agricultural products, public and private investment.	Implement research programs to study and disseminate the updated climate change scientific data and develop maps of vulnerable and high-risk disaster areas to support in policy and strategy planning, national socio-economic development plans of line sectors at central and local levels and for people's livelihood.
4	National Strategy on Climate Change 2010	Develop the capacity of the country in mitigating and adapting to changing climatic conditions in a way that promotes sustainable economic development, reduces poverty, protects public health and safety, enhances the quality of Lao PDR's natural environment, and advances the quality of life for all Lao people.	Undertaking a country-specific, sector-based research on the vulnerability, impacts and adaptation options of the agricultural sector in Lao PDR at the macro-scale as well as the village level.
5	Plan of Action for Disaster Risk Reduction and Management in Agriculture 2014–2016	Prevent and reduce the impacts of natural disasters and climate change on farming communities and the agricultural sectors, and contribute to enhanced resilience of livelihoods for sustainable and fair food and nutrition security in Lao PDR.	Upgrade climatic risk and vulnerability assessment tools and methods, provide agro-climate information products along agricultural cropping cycles and ensure timely delivery of hazard-specific early warnings targeted to the needs of farmers and other agriculture-dependent communities.

sustainable agricultural practices in the country. Similarly, the Cambodia Climate Change Strategic Plan 2014–2023 aims to address climate-induced challenges in agricultural production systems, ecosystems and protected areas. It outlines strategies such as agricultural diversification, improving agricultural practices for increased productivity, exploration of new cropping opportunities, and ecosystem management. Complementing these initiatives, the Plan of Action for Disaster Risk Reduction in Agriculture 2014–2018 seeks to enhance the capacities and resilience of farmers and communities. The focus is on mitigating threats and disasters affecting agriculture and rural livelihoods, aligning with broader national strategies for sustainable development.

The well-being of rural and remote populations in Lao PDR is emphasised in the 9th Five-Year National Socio-Economic Development Plan (2021–2025), focussing on poverty reduction, improvement of livelihoods and enhancement of cultural values. A more specific policy document, the Agriculture Development Strategy to 2025 and Vision to 2030 aims to establish more inclusive and efficient agricultural and food systems. The strategy emphasises strengthening the agricultural sector to increase employment opportunities and household income in rural communities and foster environmental protection and ecosystem conservation. Sustainable livelihoods are also embedded within the Natural Resources and Environment Strategy (2016–2025), which is centred on developing and managing natural resources and the environment. The strategy emphasises reducing risks and impacts from natural disasters on livelihoods, agricultural products, and public and private investments. Concurrently, the National Strategy on Climate Change 2010 also has specific provisions directed towards promoting sustainable economic development and livelihoods in the country by enhancing capacity to mitigate and adapt to climate change. Finally, the Plan of Action for Disaster Risk Reduction and Management in Agriculture 2014–2016 provides a much more concentrated action on preventing and reducing the impacts of natural disasters and climate change on farming communities and the agricultural sector to contribute to enhanced resilience for sustainable and equitable food and nutrition security in the country.

3.3.2. Evidence of livelihood vulnerability, risk and resilience assessment actions

Although existing policies have emphasised strengthening agricultural livelihoods in the LMB countries, there is limited evidence of robust assessment frameworks and approaches to understand the current levels of livelihood resilience.

Thailand's National Strategy and the 20-Year Agriculture and Co-operatives Strategy lack explicit consideration of vulnerability, risk, and resilience assessment. At the same time, the Twelfth National Economic and Social Development Plan and Climate Change Master Plan emphasise integrating vulnerability assessments, specifically in mapping and assessing impacts on national and local food security. These plans outline developing risk maps to assess the potential impact of climate change on agricultural regions to natural hazards such as floods, drought, landslides, saltwater intrusion, and the transmission of plant and animal diseases.

In Vietnam, the Agriculture Restructuring Plan and the 5-Year Socio-Economic Development Plan do not explicitly address vulnerability, risk or resilience assessments. On the other hand, the Sustainable Agriculture and Rural Development Strategy prioritizes risk determination as the foundation for comprehensive solutions. This includes proactive measures to safeguard water production against epidemics, natural disasters and environmental pollution. The National Strategy for Climate Change has a much more comprehensive provision for assessing impacts, vulnerability, risk, loss, and damage, including integrating disaster risk classifications into infrastructure development planning for coastal and island industrial parks, urban areas, residential areas and relocation zones. The strategy also emphasises developing natural disaster warning maps and the establishment of a national database on climate change.

Cambodia's National Strategic Development Plan incorporates explicit provisions and guidelines for localised risk assessments to inform local development planning through scientific and technological interventions and with traditional, indigenous and local knowledge. The National Environment Strategy and Action Plan advocates utilizing evidence-based assessment and monitoring tools for informed environmental decision-making, including sustainable agricultural practices. Similarly, the Cambodia Climate Change Strategic Plan prioritises both existing vulnerability and risk assessments and supplemental information through

new evaluations to assess, identify and prioritise adaptation measures across different sectors and regions, including agriculture. The Plan of Action for Disaster Risk Reduction in Agriculture is much more targeted towards agricultural risk mitigation and aims to enhance existing agricultural risk and vulnerability assessment methodologies through collaboration with relevant stakeholders.

In contrast to previous countries, the Socio-Economic Development Plan of Lao PDR has specific provisions for developing central-level disaster risk information, encouraging localities to assess risks, and crafting disaster risk maps. The Agriculture Development Strategy also involves applying modern techniques like satellite imagery, aerial photos, and advanced warning systems to study and map high-risk agricultural areas prone to natural disasters. Similarly, the Natural Resources and Environment Strategy and the National Strategy on Climate Change have specific provisions regarding sector-specific research on climate change data and developing vulnerability maps to identify disaster-prone areas. These strategies also outline several adaptation options for the agricultural sector at both macro and village levels. Finally, Lao PDR's Plan of Action for Disaster Risk Reduction and Management in Agriculture has specific provisions on using climate risk and vulnerability assessment tools to generate agro-climate information products and deliver hazard-specific warnings and advisories tailored to the needs of farming and agriculture-dependent communities.

A synthesis of the extant policies within the Lower Mekong Basin (LMB) countries, namely Thailand, Cambodia, Lao PDR, and Vietnam shows the importance of agricultural livelihoods in the region, demonstrated by the diverse array of strategic objectives, provisions and guidelines embedded within their sectoral development plans (agriculture, environment) and the disaster risk management and climate change strategies. Similarly, in line with the paradigm shift in risk management in global frameworks such as the SDGs, SFDRR and IPCC, the current policies also incorporate several actions on vulnerability, risk and resilience assessments, albeit in different sectors and scales. However, a disjoint can be seen in assessing the vulnerability, risk, and resilience of livelihoods from a multi-dimensional perspective. Present assessment guidelines and initiatives predominantly concentrate on physical assessments, neglecting the identification of underlying attributes

and interlinkages within livelihoods within intricate socio-economic and ecological systems of the LMB region.

The current policies exhibit a gap in comprehensive strategies and action plans for the integrated assessment of vulnerabilities and resilience concerning agricultural livelihoods. It seems imperative to broaden the comprehension and understanding of livelihoods by exploring multi-faceted aspects. The role of five capitals (human, social, natural, financial and physical) on livelihood outcomes and the influence and impact of policies, institutions and support mechanisms in building livelihood resilience can only be adequately measured through a robust assessment framework that integrates these factors, within the specific local paradigm of the LMB. Such a framework can be a benchmark for planning, developing, and implementing targeted strategies and actions conducive to fortifying and enhancing resilience within the agricultural sector.

3.4. Importance of resilience assessment, framework and tools

Addressing the complex challenges faced by agricultural communities living in the LMB requires a comprehensive and multi-dimensional approach (Pal et al., 2023). Efforts must be made to enhance livelihood security and disaster resilience through sustainable land and water management practices, improved infrastructure planning, strengthened early warning systems, and the promotion of alternative income-generating activities (Gunawardana et al., 2021; Myint, 2014; Phoumin & Minh Thu, 2020).

Considering the widespread impacts of natural and anthropogenic hazards across multiple sectors in the LMB, there has been an increasing recognition of assessment to measure the vulnerabilities and capacities of communities. An interdisciplinary approach to address the grounded solutions can provide the basis for integrated multi-hazard resilience assessment frameworks. The results obtained through these frameworks will provide valuable information for decision-making by capturing the unique challenges these communities face and identifying opportunities for intervention.

3.4.1. Implications for disaster management

Assessment frameworks integrating livelihood and resilience can significantly affect effective disaster management in the LMB (Cimellaro et al., 2010; Hansson et al., 2020; Lecegui et al., 2022; Tariq et al., 2021). By providing a comprehensive under-

standing of vulnerabilities in the existing livelihood systems, these frameworks enable policymakers and practitioners to prioritise resources, design targeted interventions and develop robust strategies that can promote sustainable livelihoods, thereby enhancing the resilience of the communities. For instance, identifying livelihood and economic activities prone to failure during floods and drought can inform investments in strengthening these activities (McCallum et al., 2016; K. V. Nguyen & James, 2013). Integrating the established theoretical principles of sustainable development, resilience and climate change into these frameworks, policymakers and development agencies can anticipate and address emerging risks and uncertainties associated with future hazards.

3.4.2. Promoting sustainable development

Resilience assessment frameworks also contribute to sustainable development in the LMB. By considering multiple dimensions of resilience, these frameworks help recognise the interlinkages between disaster risk reduction, poverty alleviation and environmental sustainability. For instance, by evaluating the impacts of riverbank infrastructure development on communities' livelihoods and ecosystems, these frameworks can guide infrastructure planning and design that promote sustainable development (Hishan et al., 2021; Phoumin & Minh Thu, 2020). Additionally, by assessing the social and economic factors that influence resilience, such as access to education, healthcare and markets, these frameworks can inform policies that address systemic vulnerabilities and promote inclusive development.

4. CONCLUSION & POLICY RECOMMENDATIONS

The livelihoods of LMB communities face considerable exposure to environmental and anthropogenic hazards and stressors. Events such as floods and droughts have a profound impact on their way of life, mainly since a substantial portion of the population depends directly on the river's ecosystem and basin hydrology for their economic activities. To effectively manage risks and enhance disaster resilience in the LMB, it becomes crucial to recognise the intricate interlinkages and interactions between livelihoods and resilience perspectives. By understanding and addressing these connections, efficient actions can be taken to mitigate the impact of disasters and safeguard the well-being of the communities in the region.

Enhancing the disaster mitigation process is best achieved by empowering local communities to build their inherent capabilities for handling impacts effectively. This necessitates appropriate policy interventions to address disparities, which can be identified through a comprehensive study utilising critical dimensions and indices. Such studies enable a thorough understanding of the community's adaptation behaviour, livelihood risks, and potential sustainable approaches. However, ensuring these policies, strategies, and interventions are firmly rooted in scientific evidence is equally crucial. This requires robust assessment processes to gather reliable data, providing a solid foundation for guiding decision-making and enhancing the overall effectiveness of disaster management efforts.

The following key recommendations have been made to enhance resilience assessments in the LMB region, to aid development and risk management planning for sustainable livelihoods and disaster resilience.

- **Incorporate specific actions on agricultural livelihood resilience assessment in the LMB:** While agricultural production and associated livelihoods have been prioritised in several policies and strategies in the LMB countries, this paper identifies that a comprehensive assessment of livelihood resilience has not been prioritised yet. Considering the ever-increasing need and acknowledgment of the role of livelihood security in attaining overall disaster and climate resilience, specific actions must be included within the policies to act as a formal pathway.
- **Harmonise resilience assessment frameworks and toolkits:** It is crucial to establish a standardised and harmonised approach to resilience assessment across LMB communities. This can be achieved by developing a comprehensive tool that incorporates the various dimensions across multiple disciplines into a singular framework. By harmonising these tools, policymakers can ensure consistency, comparability, and effective communication of resilience information between different communities and stakeholders.
- **Promote community participation and ownership:** Resilience assessment frameworks and toolkits should prioritise community participation and ownership. Communities in the LMB are the ones most affected by disasters, and their local knowledge and perspectives are invaluable in understanding their vulnerabilities and designing appropriate resilience strategies.

Policymakers should actively engage communities throughout the assessment process, involving them in data collection, analysis, and decision-making. This participatory approach will foster a sense of ownership and empower communities to take proactive measures for disaster risk reduction.

- **Enhance data availability and accessibility:** Reliable and up-to-date data is essential for effective resilience assessment and planning. Policymakers should invest in data collection systems, including early warning systems, hazard monitoring networks and socio-economic databases. Furthermore, efforts should be made to ensure the accessibility and usability of data for stakeholders involved in resilience planning. This can be achieved through data-sharing platforms, user-friendly interfaces and capacity-building programmes that enable communities to interpret and utilise the data effectively.
- **Integrate climate change adaptation into resilience assessments:** Climate change poses significant challenges to disaster risk management in the Lower Mekong Basin. Resilience assessment frameworks and toolkits should incorporate climate change adaptation measures to address future risks. This includes considering projected climate scenarios, assessing climate-related vulnerabilities and identifying appropriate adaptation strategies. By integrating climate change considerations into resilience assessments, policymakers can enhance the long-term effectiveness of disaster risk management and planning efforts.
- **Strengthen institutional coordination and collaboration:** Effective resilience assessment and planning require close coordination and collaboration among various stakeholders, including government agencies, non-governmental organisations, community-based organisations and international partners. Policymakers should establish mechanisms for interagency coordination, ensuring that different sectors and levels of government work together seamlessly. Additionally, fostering collaboration between researchers, practitioners and policymakers can facilitate knowledge exchange, innovation and the adoption of best practices in resilience assessment and planning.

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