CAPACITY BUILDING FOR MEASURING MULTI-HAZARD LIVELIHOOD SECURITY AND RESILIENCE IN LOWER MEKONG BASIN

Livelihood Security and Resilience Assessment (LiSeRA) Toolkit

USER HANDBOOK

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1 ABOUT THE PROJECT

Managing hazards and building back better is every government's top priority across the world. Located in one of the most hazard-prone areas, the Mekong River basin countries are frequently exposed to hydro meteorological hazards. However, managing these hazards is becoming more challenging during the COVID-19 pandemic. Hence a multi-hazard disaster risk management perspective should be adopted to strengthen disaster preparedness, response, and recovery. To strengthen livelihood security and resilience, it is essential to quantify them in the form of indices. The project "Capacity building for measuring multi-hazard livelihood security and resilience in the Lower Mekong Basin" funded by the Asia Pacific Network for Global Change Research (APN-Japan) aimed at enhancing the capacities of the stakeholders for evidence-based decision-making and interventions by creating a tool for measuring livelihood security and resilience to multi-hazards. The project was jointly implemented by the Asian Institute of Technology, Thailand; Kasetsart University, Thailand; An Giang University, Vietna; Royal University of Phnom Penh, Cambodia and the Indian Institute of Technology – Bombay, India.

In the first phase, the project developed the Livelihood Security and Resilience Assessment (LiSeRA) tool for measuring multi-hazards perspectives of the selected communities in selected LMB countries by conducting comprehensive literature review and workshops with experts in the region. Following this, capacity building training workshops were conducted in the project countries, to introduce the concept of livelihoods security and resilience to the stakeholder, enhance their understanding and develop their capacity for adopting the tool in the multi-hazard risk management context.

2 INTRODUCTION

The Lower Mekong Basin (LMB) is a subsidiary region of the Mekong River, with approximately 10 million people directly dependent on the river for livelihood and economic activities. However, communities in the region are increasingly exposed to multiple hazards that have significant direct and indirect impacts on their livelihoods. In absence of robust assessment mechanisms, government agencies, development partners and local communities have not been able to design, plan and implement effective actions and strategies for livelihood security and resilience.

The Livelihood Security and Resilience Assessment (LiSeRA) toolkit has been developed to enhance the quality of livelihood resilience assessment in the Lower Mekong Basin

communities. The toolkit has been developed through comprehensive review of literature, and inputs from stakeholders including experts, government officials and local community members who are directly involved in planning and implementing risk reduction strategies and actions. The toolkit has been developed in a participatory approach, and consists of a comprehensive indicator library for the measurement of livelihood resilience in the LMB communities.

The toolkit is intended for researchers, development planners and policy makers to understand the linkages between livelihood and resilience and conduct quantitative assessments to generate livelihood and resilience indices for different levels (communities, local governments, state governments). Additionally, the toolkit also serves as a reference for researchers and practitioners in identifying critical indicators that can be used to plan and evaluate risk assessment and management actions within the LMB communities.

3 LIVELIHOOD SECURITY AND RESILIENCE ASSESSMENT (LISERA) FRAMEWORK

The concept of resilience has different facets, and has gained popularity among scientific and humanitarian community. In environmental and ecological spectrum, resilience is often linked with the sustainable use and management of resources, aiding human development and well-being while preserving the ecosystem functions. In disaster management, however, resilience is often defined as the capacity to bounce back to their pre-crisis condition, or even improve upon it. Community disaster resilience is also defined as its ability to anticipate, prepare for, respond to, and recover quickly from disasters and assesses the speed of recovery from disasters and the community's ability to learn, cope, and adapt. Hence, in broader terms, resilience is the capacity of a community to absorb, respond to, and recover from the potential negative impacts of disasters on their lives, assets and livelihoods.

Resilience concepts encompass a wide variety of fields, and have been further classified into ecological, social, economic and livelihood resilience among others, and are often interlinked with one another. Some scholars define social resilience as the ability of groups or communities to adapt to social, political, and environmental change. On the other hand, livelihood resilience is generally defined as "the capacity of all people throughout generations to maintain and improve their livelihood opportunities and well-being in the face of environmental, economic, social, and political disruptions.".

Livelihood sustainability and resilience are closely linked with one another. Livelihood security encompasses the people's ability to cope with natural and anthropogenic hazards and threats such as irregular weather patterns, resource constraints, epidemics and diseases and market fluctuations that contribute to the sustainability of their livelihoods. However, the perspectives of livelihood security and resilience greatly differs among the various stakeholders; while general public may consider their short-term changes and stressors, policy makers may look into longer-term and holistic approaches in resilience. Hence, a clear conceptualization of what constitutes livelihood resilience is important for communities, local governments and development partners to link livelihood security with resilience components including capacity, adaptability, assets and accessibility.

The findings of the expert workshop and literature review were used to develop the Livelihood Security and Resilience Assessment (LiSeRA) framework shown in figure 1. The integrated framework consists of two segments, livelihood dimension and resilience dimension. Livelihood dimensions include five capitals derived from the theoretical principles of sustainable livelihood capitals; Human, Physical, Natural, Financial and Social. These capitals are determined by a specific vulnerability context; the insecurity of one's livelihood activities and well-being in the face of ecological and environmental changes in the LMB communities. Furthermore, each livelihood capital has been divided into sub-dimensions.

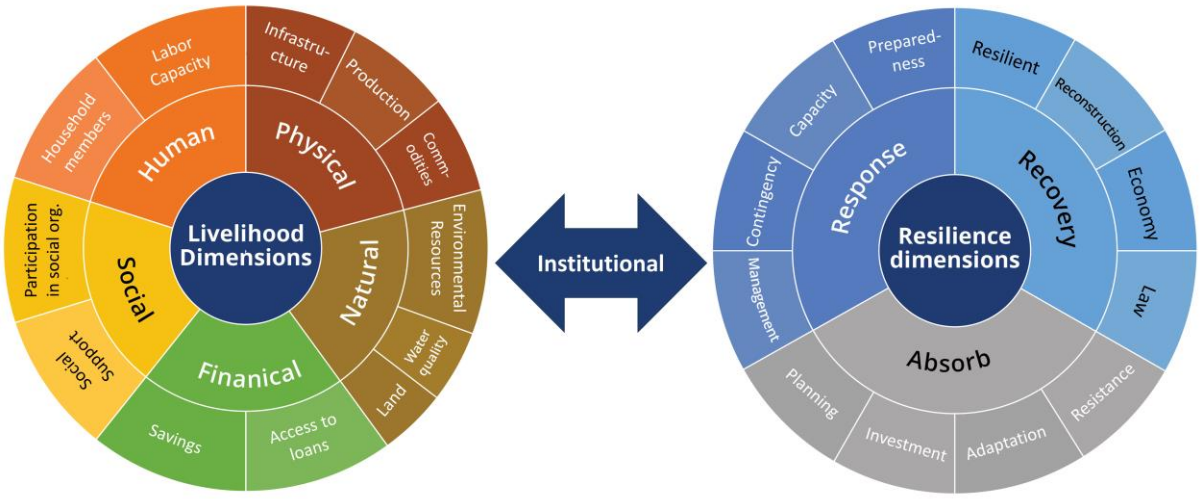


Figure 1: The Livelihood Security and Resilience Assessment (LiSeRA) framework depicting the dimensions and sub-dimensions.

For the current study area, these sub-dimensions were identified based on the synthesis of existing literature on livelihood security in the LMB region and findings from the expert

workshop. Human capital is measured in terms of household members and labor capacity, especially in the face of shortages of labor in the LMB due to migration and change of trade. Similarly, physical capacity of LMB communities is measured in terms of the status of infrastructure development and health, measures implemented to increase food production and storage, and availability, accessibility and quality of commodities and basic services. The natural capitals of the communities include quality of ecosystem services, such as land and water and the stock of bio-diversity and environmental resources within the community, which form essential components for the LMB communities considering their significant reliance on their environment for livelihood activities. Household savings and accessibility to loans and financial support make up the financial capitals, providing reserves and buffers in preparation for potential impacts of hazards and stressors. Finally, the social capital for the community includes formation, participation and active engagement in community-based organizations, self-help groups, networks and social support.

On the other hand, community-based vulnerability principles provided the foundations for resilience dimensions, further categorized into three sub-dimensions; Absorb, Response and Recovery. The LMB communities' capacity to absorb the impacts and stressors primarily rely on their planning and risk reduction strategies, such as flood and water management infrastructures, advisories and early warning systems and innovative practices, tools and technologies in agriculture. Similarly, response capacity of communities reflects their ability to manage the impacts from threats and stressors, and rely on the capability of the community to reach to the changes within their environment. Social bonds and support generated through community partnership and engagement programs, and collaboration with government, organizations and institutions, availability of contingent resources and knowledge and capacity are key response capacities of the communities. Finally, the recovery capacity of the LMB communities is measured by their ability to withstand and recover from the impacts of hazards, measured in terms of their institutional functions and capacities, policies, strategies, and technical and financial support for sustainable and disaster-resilient housing and settlements.

Using these theoretical principles and local contexts, the LiSeRA toolkit library has been developed (Annex 1). In total, 48 indicators for Resilience and 59 indicators for Liveihood Security have been identified and selected to develop the toolkit. The Resilience indicators are categorized into three dimensions; Absorb, Manage/Respond and Recover, each with four sub-

dimensions. Similarly, the Livelihood Security indicators are categorized into five dimensions; Human, Physical, Natural, Social and Financial.

4 LISERA TOOLKIT

This section gives a brief introduction to the features and the different sections of the LiSeRA Toolkit. It also describes the step-by-step procedure for using the LiSeRA Excel and 'R' Toolkit to conduct livelihood security and resilience assessment for a study area.

4.1 Features of the Excel Toolkit

The following section briefly describes the features and sheets of the LiSeRA Excel Toolkit.

4.1.1 Dashboard

The LiSeRA Excel Toolkit has a dashboard that shows the real-time update of the calculations for livelihood and resilience dimensions indices for the study area based on the inputs given in the toolkit. Two separate dashboards have been prepared

- Dashboard_Livelihood (figure 2) shows the total value of livelihood dimensions (Human, Social, Natural, Physical and Financial). The dashboard shows the integration of the livelihood and resilience dimension as well. At the bottom, the total sum of each livelihood dimensions is displayed.
- Dashboard_Resilience (figure 3) shows the individual values of resilience sub-dimensions (investment, resistance, adaptation, planning, preparedness, capacity, contingency, management, legislature, economy, reconstruction & resilient). In the right-hand side, the sum value of each of the resilience sub-dimension indicators are also displayed.

Dimension		L1 : Human		L2: Social		L3: Natural		L4:Physical		L5: Financial	
P1 : Absorb	R1: Investment	L1R1	0.37	L2R1	0.42	L3R1	0.84	L4R1	0.78	L5R1	0.50
	R2: Resistance	L1R2	0.95	L2R2	0.98	L3R2	0.72	L4R2	0.66	L5R2	0.67
	R3: Adaptation	L1R3	0.22	L2R3	0.39	L3R3	0.48	L4R3	0.66	L5R3	0.64
	R4: Planning	L1R4	0.56	L2R4	0.60	L3R4	0.72	L4R4	0.67	L5R4	0.33
P2: Manage/ Respond	R5: Preparedness	L1R5	2.13	L2R5	1.04	L3R5	1.44	L4R5	1.11	L5R5	0.89
	R6: Capacity	L1R6	0.40	L2R6	1.01	L3R6	1.56	L4R6	0.70	L5R6	1.00
	R7: Contingency	L1R7	1.29	L2R7	0.50	L3R7	0.48	L4R7	0.49	L5R7	1.14
	R8: Management	L1R8	0.26	L2R8	0.47	L3R8	1.92	L4R8	0.74	L5R8	1.01
P3: Recover	R9: Legislature	L1R9	0.40	L2R9	0.69	L3R9	0.00	L4R9	1.43	L5R9	1.21
	R10: Economy	L1R10	0.60	L2R10	0.62	L3R10	1.80	L4R10	0.57	L5R10	2.37
	R11: Reconstruction	L1R11	0.59	L2R11	1.19	L3R11	0.60	L4R11	0.89	L5R11	0.94
	R12: Resilient	L1R12	0.75	L2R12	0.59	L3R12	1.44	L4R12	1.31	L5R12	0.33
SUM		**8.5**		**8.5**		**12.0**		**10.0**		**11.0**	

Figure 2: Dashboard for Livelihood Dimension Index

Dimension		L1 : Human		L2: Social		L3: Natural		L4:Physical		L5: Financial		SUM
P1 : Absorb	R1: Investment	R1L1	0.34	R1L2	0.43	R1L3	0.51	R1L4	0.43	R1L5	0.00	**1.70**
	R2: Resistance	R2L1	0.21	R2L2	0.29	R2L3	0.24	R2L4	0.33	R2L5	0.44	**1.50**
	R3: Adaptation	R3L1	0.65	R3L2	0.54	R3L3	0.57	R3L4	0.54	R3L5	0.41	**2.70**
	R4: Planning	R4L1	0.86	R4L2	0.86	R4L3	0.90	R4L4	0.90	R4L5	0.57	**4.10**
P2: Manage/ Respond	R5: Preparedness	R5L1	0.60	R5L2	0.92	R5L3	0.87	R5L4	1.01	R5L5	1.24	**4.64**
	R6: Capacity	R6L1	1.06	R6L2	1.19	R6L3	1.46	R6L4	0.93	R6L5	1.99	**6.63**
	R7: Contingency	R7L1	0.92	R7L2	1.90	R7L3	1.59	R7L4	0.00	R7L5	1.65	**6.06**
	R8: Management	R8L1	1.88	R8L2	3.02	R8L3	0.00	R8L4	0.00	R8L5	3.35	**8.24**
P3: Recover	R9: Legislature	R9L1	0.63	R9L2	0.66	R9L3	1.29	R9L4	0.00	R9L5	0.90	**3.48**
	R10: Economy	R10L1	0.00	R10L2	1.95	R10L3	0.00	R10L4	1.53	R10L5	0.00	**3.48**
	R11: Reconstruction	R11L1	0.00	R11L2	0.00	R11L3	1.33	R11L4	1.28	R11L5	0.00	**2.61**
	R12: Resilient	R12L1	0.00	R12L2	1.08	R12L3	0.94	R12L4	1.28	R12L5	1.63	**4.93**

Figure 3: Dashboard for Resilience Dimension Index

4.1.2 Indicator Library

The indicator library provides a brief overview of the dimensions, sub-dimensions and indicators in the livelihood and resilience indices. Along with this, it also displays the weightages assigned to each of the dimensions, sub-dimensions and indicators and allows for modification (if required) during the assessment process.

- **Dimension/Sub Dimension Weightage (D Wt./SD Wt.):** The weightage for the dimension and/or sub-dimension within the livelihood or resilience index.

- **Code:** The unique code representation for the indicator. For livelihood indicators, coding is done with the sequence LxRx (ranging from L1R1 to L5R12), where Lx denotes the livelihood dimension, and Rx denotes the resilience sub-dimension. For resilience indicators, the coding is done with the sequence RxLx (ranging from R1L1 to R12L5).
- **Indicator:** The indicators within each dimension and sub-dimension
- **Indicator Description (Measurement):** A detailed description of the indicator including the most suitable index of measurement (qualitative or quantitative).
- **Indicator Wt.:** The weightage assigned to the indicators.
- **Adjusted Indicator Wt:** The adjusted value of indicator weightage computed automatically by multiplying the dimension, sub-dimension weightages and the indicator weightages.
- **References:** Sources of journal articles, publications and documents for the respective indicators.

Dimension	Dim Weight	Code	Indicators	Indicator Description (Measurement)	Indicator Wt	Adjusted Indicator Wt = Gobal Wt * Indicator Wt	References
Human	0.17	L1R1	Home ownership	Proportion of households that have full ownership of their houses	0.04	0.007	(Sina et al., 2019)
		L1R2	Physical and mental health	Proportion of population with physical or mental health issues (disabilities)	0.11	0.019	(Sina et al., 2019)
		L1R3	Innovation potential	Potential of the communities to innovate and develop new ideas and skills for livelihood	0.03	0.004	(Oxfam, 2013)
		L1R4	Level of expertise and skills	Proportion of working population with accredited expertise and skills for livelihood	0.07	0.011	(Sina et al., 2019)
		L1R5	Ability and health of labor	Proportion of working age population with physical and mental health issues (disabilities)	0.25	0.043	(Scoones, 1998)
		L1R6	Farmer education	Proportion of farmer households with secondary or tertiary education	0.05	0.008	(Lecegui et al., 2022)
		L1R7	Financial circumstance	Proportion of households with financial issues such as poverty, debts, lack of ownership etc.	0.15	0.026	(Sina et al., 2019)
		L1R8	Traditional ecological knowledge	Adoption and implementation of traditional ecological knowledge & skills in livelihood activities	0.03	0.005	(Lecegui et al., 2022)
		L1R9	Land ownership and secure land rights	Proportion of households with secure land ownership and rights	0.05	0.008	(SDG, 2017)
		L1R10	Income	Average income level of households	0.07	0.012	(Ainuddin & Routray, 2012)
		L1R11	Access to basic services	Proportion of population living in households with access to basic services (healthcare, education, transportation, WASH etc.)	0.07	0.012	(SDG, 2017)
		L1R12	Stability of income	Proportion of working-age population with stable jobs (salary) and income sources	0.09	0.015	(Sina et al., 2019)

Figure 4: Excerpt of Indicator Library for Livelihood Dimensions

Dimension	Dim Weight.	Sub - Dimension	Sub Dim Wt	Code	Indicators	Indicator Description (Measurement)	Indicator Wt	Adjusted Indicator Wt = Dim Wt*Sub-dim Wt*Ind Wt	References
Absorb	0.2	Investment	0.17	R1L1	Comprehensive partnership with external agencies on DRR	Actions undertaken for enhancing partnerships with external agencies for disaster risk management	0.20	0.007	(Orencio & Fujii, 2013)
				R1L2	Investment in management and conservation of natural resources.	Proportion of investment from community and local governments to sustain natural resources	0.25	0.009	(Courtney et al., 2008)
				R1L3	Developers and communities incorporate risk reduction into the location and design of structures.	Risk reduction measures incorporated into the location and design of structures	0.30	0.010	(Courtney et al., 2008)
				R1L4	Ownership of farming equipment (own, rent, borrow pieces of equipment)	Proportion of agricultural households who have ownership of farming equipment	0.25	0.009	(Quandt, 2018)
		Resistance	0.15	R2L1	Social support and network systems on DRR activities	Presence of social support and systems for implementation of disaster risk reduction activities to reduce hazard impacts	0.14	0.004	(Orencio & Fujii, 2013)
				R2L2	Protection and enhancement of ecosystem and bio-diversity	Sensitive habitats, ecosystems, and natural features protect and maintained to reduce risk from hazards	0.19	0.006	(Courtney et al., 2008)
				R2L3	Irrigation for productive agriculture	Proportion of agricultural land area equipped with irrigation facilities for productive agriculture	0.16	0.005	(Quandt, 2018)
				R2L4	Access to public services	Proportion of population with easy access to public facilities (schools, hospitals)	0.22	0.007	(Quandt, 2018)
				R2L5	Income stability	Proportion of population with stable income (salaried jobs)	0.29	0.009	(Quandt, 2018)
		Adaptation	0.27	R3L1	Education Level	Proportion of population with secondary and tertiary level of education	0.24	0.013	(Ainuddin & Routray, 2012)
				R3L2	Social protection and safety of vulnerable groups	Proportion of vulnerable population covered by social protection systems (insurances, benefits, support system etc.)	0.20	0.011	(Orencio & Fujii, 2013)
				R3L3	Indigenous knowledge and technologies	Application of indigeneous knowledge and technologies in farming and other livelihood activities	0.21	0.011	(Orencio & Fujii, 2013)
				R3L4	Availability of robust road network	Proportion of 'all-season' roads in comparison to total road network within community/local government	0.20	0.011	(Quandt, 2018)
				R3L5	Remittance	Proportion of remittance and income from external sources as a source of income for the community	0.15	0.008	(Quandt, 2018)
		Planning	0.41	R4L1	Education Level	Proportion of population with secondary and tertiary level of education	0.21	0.017	(Ifejika Speranza et al., 2014)
				R4L2	Community-Based Planning	Presence of community based approaches in planning of DRM and development activities	0.21	0.017	Department of Homeland Security, 2
				R4L3	Protected areas and ecosystems	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	0.22	0.018	(SDG, 2017)
				R4L4	Investment in early warning and evacuation system	Financial resources available to maintain and improve warning and evacuation systems	0.22	0.018	(Courtney et al., 2008)
				R4L5	Access to a bank account	Proportion of population with ownership of accounts in financial institutions (banks)	0.14	0.011	(Quandt, 2018b)

Figure 5: Excerpt of indicator Library for Resilience Dimensions

4.1.3 Input Values

This sheet will be used to input the values for the individual indicators based on the subjective or objective assessment of the study area by the user. Separate sheets have been designed for livelihood and resilience indices. The instructions for placing the input values are shown in the top row of the sheet and described in the following sections. In addition to the fields already described earlier in the indicator library, the input values has the following fields,

- **Type of Indicator:** Displays the type of indicator and measurement index (subjective or objective)
- **Effect on livelihood/resilience:** The effect of the indicator on the livelihood or resilience indices (positive indicators will increase livelihood or resilience, and negative will decrease)
- **Input Value:** The input value for the particular indicator computed based on the subjective or objective assessment of the study area by the researcher. The input value ranges from 0 (Absent/Very Low) to 5 (Very High).
- **Value:** The total value of the indicator in the livelihood or resilience index computed by multiplying the input value with the indicator weightage.

INSTRUCTIONS			Check the measurement index (description of indicator including the metric of measurement)	Check the type of indicator (subjectiive or objective)	Check the effect of the indicator on the Livelihood Resilience (positive or negative)	Input the assessment value for the indicator	The indicator weightage is automatically copied from previous sheet	Adjusted value of the indicator will be automatically calculated
A	B	C	D	E	F	G	I	H
Dimension	Code	Indicators	Indicator Description (Measurement)	Type of Indicator	Effects on Livelihood Resilience	Input Value	Indicator Wts	Value = Input * Indicator Weightage * 10
Human	L1R1	Home ownership	Proportion of households that have full ownership of their houses	Objective	Positive	1	0.007	0.074
	L1R2	Physical and mental health	Proportion of population with physical or mental health issues (disabilities)	Objective	Negative	2	0.019	0.568
	L1R3	Innovation potential	Potential of the communities to innovate and develop new ideas and skills for livelihood	Subjective	Positive	5	0.004	0.218
	L1R4	Level of expertise and skills	Proportion of working population with accredited expertise and skills for livelihood	Objective	Positive	4	0.011	0.447
	L1R5	Ability and health of labor	Proportion of working age population with physical and mental health issues (disabilities)	Objective	Negative	3	0.043	0.851
	L1R6	Farmer education	Proportion of farmer households with secondary or tertiary education	Objective	Positive	0	0.008	0.000
	L1R7	Financial circumstance	Proportion of households with financial issues such as poverty, debts, lack of ownership etc.	Objective	Negative	0	0.026	1.294
	L1R8	Traditional ecological knowledge	Adoption and implementation of traditional ecological knowledge & skills in livelihood activities	Subjective	Positive	2	0.005	0.102
	L1R9	Land ownership and secure land rights	Proportion of households with secure land ownership and rights	Objective	Positive	4	0.008	0.319
	L1R10	Income	Average income level of households	Objective	Positive	3	0.012	0.359
	L1R11	Access to basic services	Proportion of population living in households with access to basic services (healthcare, education, transportation, WASH etc.)	Objective	Positive	4	0.012	0.470
	L1R12	Stability of income	Proportion of working-age population with stable jobs (salary) and income sources	Objective	Positive	5	0.015	0.748
Social	L2R1	Conservation and protection of cultural and natural heritage and resource	Proportion of municipal or central government budget for preservation, protection and conservation of cultural and natural heritage and	Objective	Positive	5	0.008	0.422
	L2R2	Social resources and support	Proportion of households/population who are engaged in social activities such as networks, groups, affiliations etc.	Objective	Positive	5	0.020	0.981
	L2R3	Pro-poor public social spending	Proportion of total municipal or government budget designated to support the poor and vulnerable populations	Objective	Positive	5	0.008	0.390
	L2R4	Application of Local Disaster Risk Reduction strategies	Development, adoption and implementation of local disaster risk reduction strategies in line with national disaster risk reduction strategies	Subjective	Positive	5	0.012	0.599
	L2R5	Social protection for vulnerable groups	Proportion of population covered by social protection systems such as insurance, subsistence allowances, facilities etc.	Objective	Positive	5	0.021	1.040
	L2R6	Exchange and reciprocity of social capital	Availability of mechanisms and systems to facilitate the transfer of social and cultural values, norms, knowledge and skills	Subjective	Positive	5	0.020	1.013
	L2R7	Cooperative societies, self-help groups	Availability and access of the population to cooperative societies and self help groups for social support	Subjective	Positive	5	0.010	0.502
	L2R8	Social Networking	Proportion of households involved in social networks, organizations and groups	Objective	Positive	5	0.009	0.470
	L2R9	Access to state	Proportion of population with ease of access to public facilities, markets, government agencies etc.	Objective	Positive	5	0.014	0.689
	L2R10	Skills, knowledge and abillity of labor	Proportion of working-age population with accredited skills & knowledge	Objective	Positive	5	0.012	0.617
	L2R11	Participatory collaboration mechanisms	Inclusion of participatory approaches and mechanisms in development planning an disaster risk management	Subjective	Positive	5	0.024	1.190
	L2R12	Gender equity	Adoption of gender equity and inclusion within community including immunization, access to facilities, income generation etc.	Subjective	Positive	5	0.012	0.586

Figure 6: Excerpt of 'Input Values_Livelihood' of the LiSeRA Toolkit

INSTRUCTIONS				Check the measurement index (description of indicator including the metric of measurement)	Check the type of indicator (subjectiive or objective)	Check the effect of the indicator on the Livelihood Resilience (positive or negative)	Input the value of indicator	The indicator weightage is automatically copied from previous sheet	Adjusted value of the indicator will be automatically calculated
A	B	C	D	E	F	G	H	I	J
Dimension	Sub -Dimension	Code	Indicators	Indicator Description (Measurement)	Type of indicator	Effects on Resilience	Input Value	Indicator Weightage	Value = Input * Indicator Weightage * 10
Absorb	Investment	R1L1	Comprehensive partnership with external agencies on DRR	Actions undertaken for enhancing partnerships with external agencies for disaster risk management	Subjective	Positive	5	0.007	0.34
		R1L2	Communities and local governments invest in management and conservation to sustain their natural resources.	Proportion of investment from community and local governments to sustain natural resources	Objective	Positive	5	0.009	0.43
		R1L3	Developers and communities incorporate risk reduction into the location and design of structures.	Risk reduction measures incorporated into the location and design of structures	Subjective	Positive	5	0.010	0.51
		R1L4	Ownership of farming equipment (own, rent, borrow pieces of equipment)	Proportion of agricultural households who have ownership of farming equipment	Objective	Positive	5	0.009	0.43
	Resistance	R2L1	Social support and network systems on DRR activities	Presence of social support and systems for implementation of disaster risk reduction activities to reduce hazard impacts	Subjective	Positive	5	0.004	0.21
		R2L2	Protection and enhancement of ecosystem and bio-diversity	Sensitive habitats, ecosystems, and natural features protect and maintained to reduce risk from hazards	Subjective	Positive	5	0.006	0.29
		R2L3	Irrigation for productive agriculture	Proportion of agricultural land area equipped with irrigation facilities for productive agriculture	Objective	Positive	5	0.005	0.24
		R2L4	Access to public services	Proportion of population with easy access to public facilities (schools, hospitals)	Objective	Positive	5	0.007	0.33
		R2L5	Income stability	Proportion of population with stable income (salaried jobs)	Objective	Positive	5	0.009	0.44
	Adaptation	R3L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	5	0.013	0.65
		R3L2	Social protection and safety of vulnerable groups	Proportion of vulnerable population covered by social protection systems (insurances, benefits, support system etc.)	Objective	Positive	5	0.011	0.54
		R3L3	Indigenous knowledge and technologies	Application of indigeneous knowledge and technologies in farming and other livelihood activities	Subjective	Positive	5	0.011	0.57
		R3L4	Availability of robust road network	Proportion of 'all-season' roads in comparison to total road network within community/local government	Objective	Positive	5	0.011	0.54
		R3L5	Remittance	Proportion of remittance and income from external sources as a source of income for the community	Objective	Positive	5	0.008	0.41
	Planning	R4L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	5	0.017	0.86
		R4L2	Community-Based Planning	Presence of community based approaches in planning of DRM and development activities	Subjective	Positive	5	0.017	0.86
		R4L3	Protected areas and ecosystems	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Objective	Positive	5	0.018	0.90
		R4L4	Investment in early warning and evacuation system	Financial resources available to maintain and improve warning and evacuation systems	Objective	Positive	5	0.018	0.90
		R4L5	Access to a bank account	Proportion of population with ownership of accounts in financial institutions (banks)	Objective	Positive	5	0.011	0.57

Figure 7: Excerpt of the 'Input Values_Resilience' of the LiSeRA Toolkit

4.2 How to use the LiSeRA Excel Toolkit

Step 1: Select and input the dimension, sub-dimension and indicator weightage for the assessment

1. The general instructions for inserting the values in the sheet is placed in the first row.

2. The current weightages of the indicators in the LiSeRA toolkit have been generated from pairwise comparison and Analytical Hierarchical Process (AHP) based on opinions of experts and stakeholders in the Lower Mekong Basin communities.

3. You can choose to continue your assessment with the same weightages, or generate and enter new weightages based on your own indicator weightage assessment process.

4. Input the weightages of the respective dimensions and indicators in the ***'Indicator Libryar_Livelihood'*** and ***'Indicator Library_Resilience'*** sheets.

5. In the 'Indicator Library_Livelihood' sheet, enter the global weightage for five Livelihood dimensions (Human, Social, Natural, Physical and Financial) in the column marked **'Dim Wt.'**. For each of the dimensions, enter the indicator weightage in the column marked **'Ind. Wt.'**. Ensure that the sum of weightages for five dimensions and 12 indicators in each dimension equals to 1 (One).

6. In the 'Indicator Library_Resilience', enter the dimension, sub-dimension and indicator weightages in respective columns (Dim Wt., Sub Dim Wt. and Ind Wt.). Ensure that the sum of each of these equals to 1.

INSTRUCTIONS	Enter the weightage of Livelihood Dimensions in this Column				Enter the weightage of each indicator in this column	The adjusted indicator weightage will be calculated automatically from the entered dimension and indicator weightage	
Dimension	**Dim Wt.**	**Code**	**Indicators**	**Indicator Description (Measurement)**	**Ind Wt.**	**Adjusted Indicator Wt = Gobal Wt * Indicator Wt**	**References**
Human	**0.17**	L1R1	Home ownership	Proportion of households that have full ownership of their houses	0.04	0.007	(Sina et al., 2019)
		L1R2	Physical and mental health	Proportion of population with physical or mental health issues (disabilities)	0.11	0.019	(Sina et al., 2019)
		L1R3	Innovation potential	Potential of the communities to innovate and develop new ideas and skills for livelihood	0.03	0.004	(Oxfam, 2013)
		L1R4	Level of expertise and skills	Proportion of working population with accredited expertise and skills for livelihood	0.07	0.011	(Sina et al., 2019)
		L1R5	Ability and health of labor	Proportion of working age population with physical and mental health issues (disabilities)	0.25	0.043	(Scoones, 1998)
		L1R6	Farmer education	Proportion of farmer households with secondary or tertiary education	0.05	0.008	(Lecegui et al., 2022)
		L1R7	Financial circumstance	Proportion of households with financial issues such as poverty, debts, lack of ownership etc.	0.15	0.026	(Sina et al., 2019)
		L1R8	Traditional ecological knowledge	Adoption and implementation of traditional ecological knowledge & skills in livelihood activities	0.03	0.005	(Lecegui et al., 2022)
		L1R9	Land ownership and secure land rights	Proportion of households with secure land ownership and rights	0.05	0.008	(SDG, 2017)
		L1R10	Income	Average income level of households	0.07	0.012	(Ainuddin & Routray, 2012)
		L1R11	Access to basic services	Proportion of population living in households with access to basic services (healthcare, education, transportation, WASH etc.)	0.07	0.012	(SDG, 2017)
		L1R12	Stability of income	Proportion of working-age population with stable jobs (salary) and income sources	0.09	0.015	(Sina et al., 2019)

INSTRUCTIONS	Enter the Global Weightage of Resilience Dimensions here		Enter the weightages of the Sub-dimensions in each dimension here					Enter the weightages of indicators within each of the sub-dimension here	The adjusted indicator weightage will be calculated automatically from the entered dimension and indicator weightage	
Dimension	**Dim Wt.**	**Sub - Dimension**	**Sub Dim Wt.**	**Code**	**Indicators**	**Indicator Description (Measurement)**		**Ind. Wt**	**Adjusted Indicator Wt = D Wt. * SD Wt.*Ind Wt.**	**References**
Absorb	**0.2**	**Investment**	**0.17**	R1L1	Comprehensive partnership with external agencies on DRR	Actions undertaken for enhancing partnerships with external agencies for disaster risk management		0.20	0.007	(Orencio & Fujii, 2013)
				R1L2	Investment in management and conservation of natural resources.	Proportion of investment from community and local governments to sustain natural resources		0.25	0.009	(Courtney et al., 2008)
				R1L3	Developers and communities incorporate risk reduction into the location and design of structures.	Risk reduction measures incorporated into the location and design of structures		0.30	0.010	(Courtney et al., 2008)
				R1L4	Ownership of farming equipment (own, rent, borrow pieces of equipment)	Proportion of agricultural households who have ownership of farming equipment		0.25	0.009	(Quandt, 2018)
		Resistance	**0.15**	R2L1	Social support and network systems on DRR activities	Presence of social support and systems for implementation of disaster risk reduction activities to reduce hazard impacts		0.14	0.004	(Orencio & Fujii, 2013)
				R2L2	Protection and enhancement of ecosystem and bio-diversity	Sensitive habitats, ecosystems, and natural features protect and maintained to reduce risk from hazards		0.19	0.006	(Courtney et al., 2008)
				R2L3	Irrigation for productive agriculture	Proportion of agricultural land area equipped with irrigation facilities for productive agriculture		0.16	0.005	(Quandt, 2018)
				R2L4	Access to public services	Proportion of population with easy access to public facilities (schools, hospitals)		0.22	0.007	(Quandt, 2018)
				R2L5	Income stability	Proportion of population with stable income (salaried jobs)		0.29	0.009	(Quandt, 2018)
		Adaptation	**0.27**	R3L1	Education Level	Proportion of population with secondary and tertiary level of education		0.24	0.013	(Ainuddin & Routray, 2012)
				R3L2	Social protection and safety of vulnerable groups	Proportion of vulnerable population covered by social protection systems (insurances, benefits, support system etc.)		0.20	0.011	(Orencio & Fujii, 2013)
				R3L3	Indigenous knowledge and technologies	Application of indigeneous knowledge and technologies in farming and other livelihood activities		0.21	0.011	(Orencio & Fujii, 2013)
				R3L4	Availability of robust road network	Proportion of 'all-season' roads in comparison to total road network within community/local government		0.20	0.011	(Quandt, 2018)
				R3L5	Remittance	Proportion of remittance and income from external sources as a source of income for the community		0.15	0.008	(Quandt, 2018)
		Planning	**0.41**	R4L1	Education Level	Proportion of population with secondary and tertiary level of education		0.21	0.017	(Ifejika Speranza et al., 2014)
				R4L2	Community-Based Planning	Presence of community based approaches in planning of DRM and development activities		0.21	0.017	Department of Homeland Security, 2
				R4L3	Protected areas and ecosystems	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type		0.22	0.018	(SDG, 2017)
				R4L4	Investment in early warning and evacuation system	Financial resources available to maintain and improve warning and evacuation systems		0.22	0.018	(Courtney et al., 2008)
				R4L5	Access to a bank account	Proportion of population with ownership of accounts in financial institutions (banks)		0.14	0.011	(Quandt, 2018b)

Figure 8: Indicator library and weightage inputs for Livelihood (top) and Resilience (bottom) indices

Step 2: Input values for Livelihood and Resilience Dimension indicators

1. The values for indicators within the Livelihood and Resilience Dimension must be done in the 'Input Values_Livelihood' and 'Input Values_Resilience' sheets respectively.
2. The general instructions for inserting the values in the sheet is placed in the first row.
3. Before inserting the values for the indicators, check the measurement index *(description of indicator including the metric of measurement)*, the type of indicator *(subjective or objective*) and the effect on Livelihood or Resilience *(positive or negative)* carefully.
4. Input values must be accurately chosen based on the type of indicator and the effect of the indicator on the Livelihood and Resilience dimensions as follows,
    1. For **Objective Indicators**, a normalization scale must be developed to categorize data obtained for the study area into six levels: 0 – Lowest, 5 – Highest.
    2. For **Subjective Indicators**, subjective assessment must be conducted in the study area. The information collected must be categorized into six categories and respective input values as shown in the table below.

Status	*Benchmark*	*Input Value*
Absent	Absent Condition	0
Poor	1 -20 % fulfilled	1
Fair	21- 40 % Fulfilled	2
Good	41 -60 % Fulfilled	3
Very Good	61 – 80 % Fulfilled	4
Excellent	80 -100% fulfilled	5

3. In case of both Positive and Negative indicators, the input data will follow the same scaling. For both indicators, input the whole number only, without any signs (-/+). The toolkit has been calibrated to automatically assign negative values to the negative indicators.

5. After determining the values for the indicators, place the Input Values in the respective columns; ***Column G*** in 'Input Values_Livelihood' sheet and ***Column H*** in the 'Input Values_Resilience' sheet.

6. Once the values for the indicators are placed in the respective fields, the adjusted values are automatically calculated by multiplying the input value with the indicator weightage.

INSTRUCTIONS			Check the measurement index (description of indicator including the metric of measurement)	Check the type of indicator (subjectiive or objective)	Check the effect of the indicator on the Livelihood Resilience (positive or negative)	Input the assessment value for the indicator	The indicator weightage is automatically copied from previous sheet	Adjusted value of the indicator will be automatically calculated
A	B	C	D	E	F	G	I	H
Dimension	Code	Indicators	Indicator Description (Measurement)	Type of Indicator	Effects on Livelihood Resilience	Input Value	Indicator Wts	Value = Input * Indicator Weightage * 10
Human	L1R1	Home ownership	Proportion of households that have full ownership of their houses	Objective	Positive	1	0.007	0.074
	L1R2	Physical and mental health	Proportion of population with physical or mental health issues (disabilities)	Objective	Negative	2	0.019	0.568
	L1R3	Innovation potential	Potential of the communities to innovate and develop new ideas and skills for livelihood	Subjective	Positive	5	0.004	0.218
	L1R4	Level of expertise and skills	Proportion of working population with accredited expertise and skills for livelihood	Objective	Positive	4	0.011	0.447
	L1R5	Ability and health of labor	Proportion of working age population with physical and mental health issues (disabilities)	Objective	Negative	3	0.043	0.851
	L1R6	Farmer education	Proportion of farmer households with secondary or tertiary education	Objective	Positive	0	0.008	0.000
	L1R7	Financial circumstance	Proportion of households with financial issues such as poverty, debts, lack of ownership etc.	Objective	Negative	0	0.026	1.294
	L1R8	Traditional ecological knowledge	Adoption and implementation of traditional ecological knowledge & skills in livelihood activities	Subjective	Positive	2	0.005	0.102
	L1R9	Land ownership and secure land rights	Proportion of households with secure land ownership and rights	Objective	Positive	4	0.008	0.319
	L1R10	Income	Average income level of households	Objective	Positive	3	0.012	0.359
	L1R11	Access to basic services	Proportion of population living in households with access to basic services (healthcare, education, transportation, WASH etc.)	Objective	Positive	4	0.012	0.470
	L1R12	Stability of income	Proportion of working-age population with stable jobs (salary) and income sources	Objective	Positive	5	0.015	0.748

INSTRUCTIONS				Check the measurement index (description of indicator including the metric of measurement)	Check the type of indicator (subjectiive or objective)	Check the effect of the indicator on the Livelihood Resilience (positive or negative)	Input the value of indicator	The indicator weightage is automatically copied from previous sheet	Adjusted value of the indicator will be automatically calculated
A	B	C	D	E	F	G	H	I	J
Dimension	Sub -Dimension	Code	Indicators	Indicator Description (Measurement)	Type of indicator	Effects on Resilience	Input Value	Indicator Weightage	Value = Input * Indicator Weightage * 10
Absorb	Investment	R1L1	Comprehensive partnership with external agencies on DRR	Actions undertaken for enhancing partnerships with external agencies for disaster risk management	Subjective	Positive	5	0.007	0.34
		R1L2	Communities and local governments invest in management and conservation to sustain their natural resources.	Proportion of investment from community and local governments to sustain natural resources	Objective	Positive	2	0.009	0.17
		R1L3	Developers and communities incorporate risk reduction into the location and design of structures.	Risk reduction measures incorporated into the location and design of structures	Subjective	Positive	3	0.010	0.31
		R1L4	Ownership of farming equipment (own, rent, borrow pieces of equipment)	Proportion of agricultural households who have ownership of farming equipment	Objective	Positive	5	0.009	0.43
	Resistance	R2L1	Social support and network systems on DRR activities	Presence of social support and systems for implementation of disaster risk reduction activities to reduce hazard impacts	Subjective	Positive	4	0.004	0.17
		R2L2	Protection and enhancement of ecosystem and bio-diversity	Sensitive habitats, ecosystems, and natural features protect and maintained to reduce risk from hazards	Subjective	Positive	1	0.006	0.06
		R2L3	Irrigation for productive agriculture	Proportion of agricultural land area equipped with irrigation facilities for productive agriculture	Objective	Positive	2	0.005	0.10
		R2L4	Access to public services	Proportion of population with easy access to public facilities (schools, hospitals)	Objective	Positive	1	0.007	0.07
		R2L5	Income stability	Proportion of population with stable income (salaried jobs)	Objective	Positive	2	0.009	0.17
	Adaptation	R3L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	1	0.013	0.13
		R3L2	Social protection and safety of vulnerable groups	Proportion of vulnerable population covered by social protection systems (insurances, benefits, support system etc.)	Objective	Positive	2	0.011	0.22
		R3L3	Indigenous knowledge and technologies	Application of indigeneous knowledge and technologies in farming and other livelihood activities	Subjective	Positive	1	0.011	0.11
		R3L4	Availability of robust road network	Proportion of 'all-season' roads in comparison to total road network within community/local government	Objective	Positive	0	0.011	0.00
		R3L5	Remittance	Proportion of remittance and income from external sources as a source of income for the community	Objective	Positive	2	0.008	0.16
	Planning	R4L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	3	0.017	0.52
		R4L2	Community-Based Planning	Presence of community based approaches in planning of DRM and development activities	Subjective	Positive	2	0.017	0.34
		R4L3	Protected areas and ecosystems	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Objective	Positive	3	0.018	0.54
		R4L4	Investment in early warning and evacuation system	Financial resources available to maintain and improve warning and evacuation systems	Objective	Positive	2	0.018	0.36
		R4L5	Access to a bank account	Proportion of population with ownership of accounts in financial institutions (banks)	Objective	Positive	4	0.011	0.46

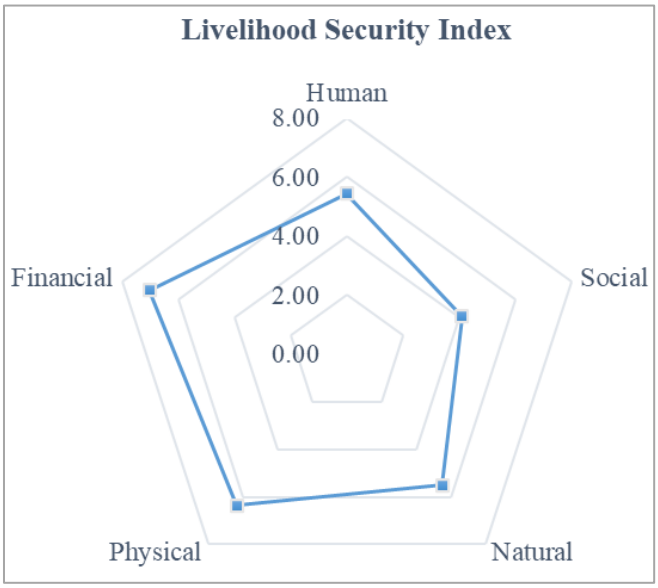
Figure 9: Input values sheets for livelihood (top) and resilience (bottom) indices

Step 3: Check matriculated and graphical outputs

1. The outputs of the livelihood security and resilience will be generated in the LiSeRA dashboard.
2. The outputs will be generated in tabular (matrix) and graphical form through radar plots,

- **Indicator values:** The matrix displays the values of each indicator computed through the calculation of indicator weightage and input value.
- **Sum:** The total sum for dimension (or sub dimension) for livelihood and resilience is shown.
- **% of ideal value:** The percentage of sum of livelihood or resilience dimensions and sub-dimensions with respect to the ideal value (generated through ideal inputs)

Dimension		L1 : Human		L2: Social		L3: Natural		L4:Physical		L5: Financial	
P1 : Absorb	R1: Investment	L1R1	0.07	L2R1	0.17	L3R1	0.84	L4R1	0.31	L5R1	0.50
	R2: Resistance	L1R2	0.57	L2R2	0.79	L3R2	0.58	L4R2	0.00	L5R2	0.27
	R3: Adaptation	L1R3	0.22	L2R3	0.23	L3R3	0.00	L4R3	0.40	L5R3	0.64
	R4: Planning	L1R4	0.45	L2R4	0.12	L3R4	0.72	L4R4	0.27	L5R4	0.33
P2: Manage/ Respond	R5: Preparedness	L1R5	0.85	L2R5	0.00	L3R5	0.58	L4R5	1.11	L5R5	0.18
	R6: Capacity	L1R6	0.00	L2R6	0.41	L3R6	0.62	L4R6	0.56	L5R6	0.40
	R7: Contingency	L1R7	1.29	L2R7	0.30	L3R7	0.29	L4R7	0.10	L5R7	0.68
	R8: Management	L1R8	0.10	L2R8	0.38	L3R8	0.77	L4R8	0.29	L5R8	1.01
P3: Recover	R9: Legislature	L1R9	0.32	L2R9	0.28	L3R9	0.00	L4R9	1.43	L5R9	0.48
	R10: Economy	L1R10	0.36	L2R10	0.37	L3R10	0.36	L4R10	0.23	L5R10	1.90
	R11: Reconstruction	L1R11	0.47	L2R11	0.71	L3R11	0.48	L4R11	0.35	L5R11	0.38
	R12: Resilient	L1R12	0.75	L2R12	0.35	L3R12	0.29	L4R12	1.31	L5R12	0.26
SUM		5.5		4.1		5.5		6.4		7.0	



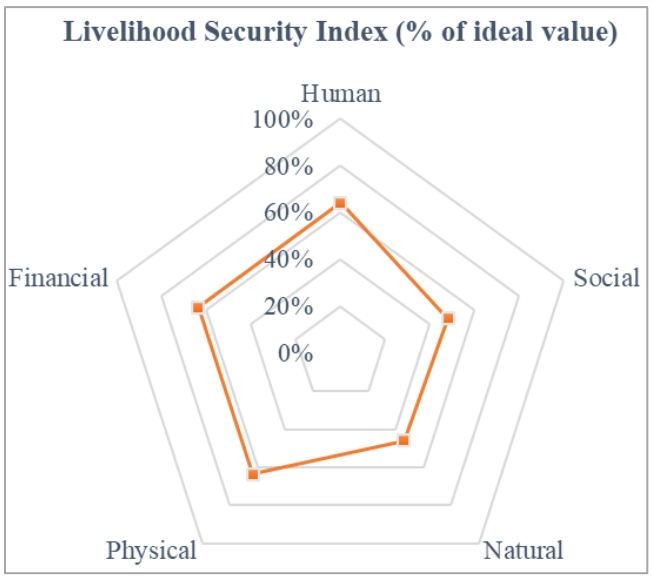
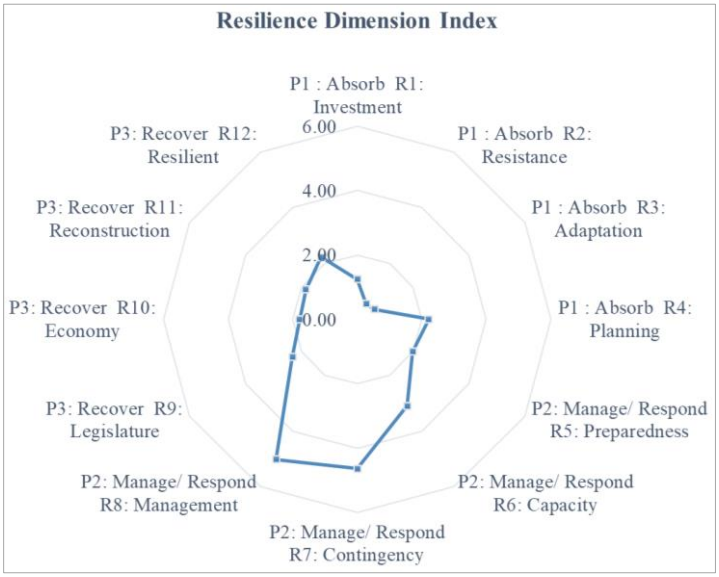


Figure 10: Outputs for Livelihood Security indices displayed in the LiSeRA Toolkit Dashboard

Dimension		L1 : Human		L2: Social		L3: Natural		L4:Physical		L5: Financial		SUM
P1 : Absorb	R1: Investment	R1L1	0.34	R1L2	0.17	R1L3	0.31	R1L4	0.43	R1L5	0.00	**1.24**
	R2: Resistance	R2L1	0.17	R2L2	0.06	R2L3	0.10	R2L4	0.07	R2L5	0.17	**0.56**
	R3: Adaptation	R3L1	0.13	R3L2	0.22	R3L3	0.11	R3L4	0.00	R3L5	0.16	**0.62**
	R4: Planning	R4L1	0.52	R4L2	0.34	R4L3	0.54	R4L4	0.36	R4L5	0.46	**2.22**
P2: Manage/ Respond	R5: Preparedness	R5L1	0.36	R5L2	0.37	R5L3	0.52	R5L4	0.00	R5L5	0.74	**1.99**
	R6: Capacity	R6L1	0.42	R6L2	0.24	R6L3	0.88	R6L4	0.37	R6L5	1.19	**3.10**
	R7: Contingency	R7L1	0.92	R7L2	1.14	R7L3	1.59	R7L4	0.00	R7L5	0.99	**4.64**
	R8: Management	R8L1	1.88	R8L2	1.81	R8L3	0.00	R8L4	0.00	R8L5	1.34	**5.03**
P3: Recover	R9: Legislature	R9L1	0.38	R9L2	0.26	R9L3	0.77	R9L4	0.00	R9L5	0.90	**2.32**
	R10: Economy	R10L1	0.00	R10L2	1.17	R10L3	0.00	R10L4	0.61	R10L5	0.00	**1.78**
	R11: Reconstruction	R11L1	0.00	R11L2	0.00	R11L3	1.33	R11L4	0.51	R11L5	0.00	**1.84**
	R12: Resilient	R12L1	0.00	R12L2	0.43	R12L3	0.37	R12L4	0.77	R12L5	0.65	**2.23**



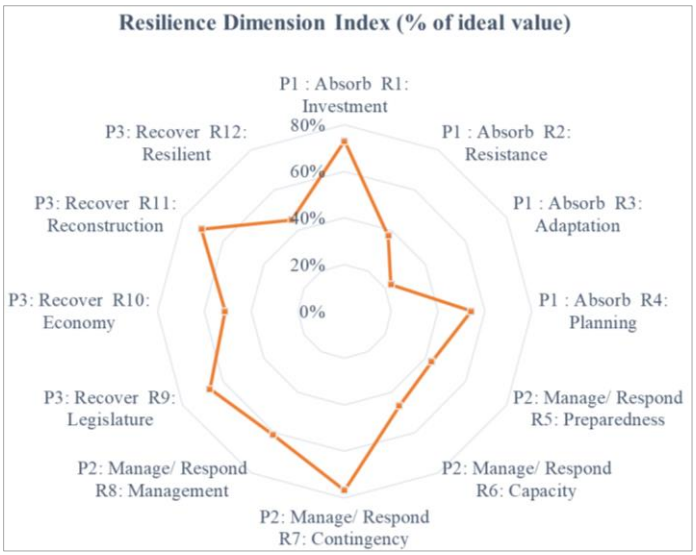


Figure 11: Outputs for Resilience Dimension Index displayed in the LiSeRA Toolkit Dashboard

4.3 How to use the LiSeRA 'R' Toolkit

The LiSeRA 'R' Toolkit is provided as a .RData file named "LiSeRA Toolkit" along with an associated 'LiSeRA_Inputs' excel file. The .RData file consists of the codes used for the calculation of the Livelihood Security and Resilience Dimension indices similar to the excel toolkit. The codes are also available in a word document.

Step 1: Place the inputs for the livelihood and resilience security indicator weightages (if needed)

1. The 'LiSeRA_Inputs' excel file consists of excel sheets to be used to enter the dimension and indicator weightages and input values for the different indicators.
2. Two separate sheets 'Livelihood_Input' and 'Resilience_Input' are provided consisting of the indicators, description, weightage and input fields.
3. The current weightages of the indicators in the LiSeRA toolkit have been generated from pairwise comparison and Analytical Hierarchical Process (AHP) based on opinions of experts and stakeholders in the Lower Mekong Basin communities.
4. You can choose to continue your assessment with the same weightages, or generate and enter new weightages based on your own indicator weightage assessment process.
5. You can enter the revised weightages of the dimensions, subdimensions and indicators in the respective columns. For Livelihood_Input sheet, enter dimension weightage in Column B and indicator weightage in Column G. For Resilience_Input sheet, enter dimension weightage in Column B, sub-dimension weightage in Column D and indicator weightage in Column I.
6. The cumulative weightage for each indicator will be automatically computed (Column H and J in Livelihood and Resilience input sheets respectively).

Step 2: Input the values for the indicators based on your assessment

1. Before inserting the values for the indicators, check the measurement index *(description of indicator including the metric of measurement)*, the type of indicator *(subjective or objective)* and the effect on Livelihood or Resilience *(positive or negative)* carefully.
2. Input values must be accurately chosen based on the type of indicator and the effect of the indicator on the Livelihood and Resilience dimensions as follows,

a. For Objective Indicators, a normalization scale must be developed to categorize data obtained for the study area into six levels: 0 – Lowest, 5 – Highest.

b. For Subjective Indicators, subjective assessment must be conducted in the study area. The information collected must be categorized into six categories and respective input values as shown in the table below.

Status	*Benchmark*	*Input Value*
Absent	Absent Condition	0
Poor	1 -20 % fulfilled	1
Fair	21- 40 % Fulfilled	2
Good	41 -60 % Fulfilled	3
Very Good	61 – 80 % Fulfilled	4
Excellent	80 -100% fulfilled	5

c. In case of both Positive and Negative indicators, the input data will follow the same scaling. For both indicators, input the whole number only, without any signs (-/+). The toolkit has been calibrated to automatically assign negative values to the negative indicators.

3. After determining the values for the indicators, place the Input Values in the respective columns; *Column I* in 'Livelihood_Input' sheet and *Column K* in the 'Resilience_Input' sheet.

4. Once the values for the indicators are placed in the respective fields, the adjusted values are automatically calculated by multiplying the input value with the indicator weightage.

Step 3: Open and edit the 'R' codes

1. The codes for the toolkit can be used with any of the following two methods,

   a. Open the .RData file named "LiSeRA Toolkit" which contains the codes in RStudio, or,

   b. Copying the codes from the word document 'LiSeRA_R Code' onto a new RStudio window.

2. Change the folder path in setwd () command in Line 5 to the folder containing the LiSeRA_Inputs excel file that includes the weightages and input values.

Step 4: Run the 'R' codes and use/interpret the results

1. Select the entire code and click 'Run' or press Ctrl+Enter.
2. The results of the computation will be displayed in the form of Radar Plots in the 'Plots' window on the right-hand side as follows.

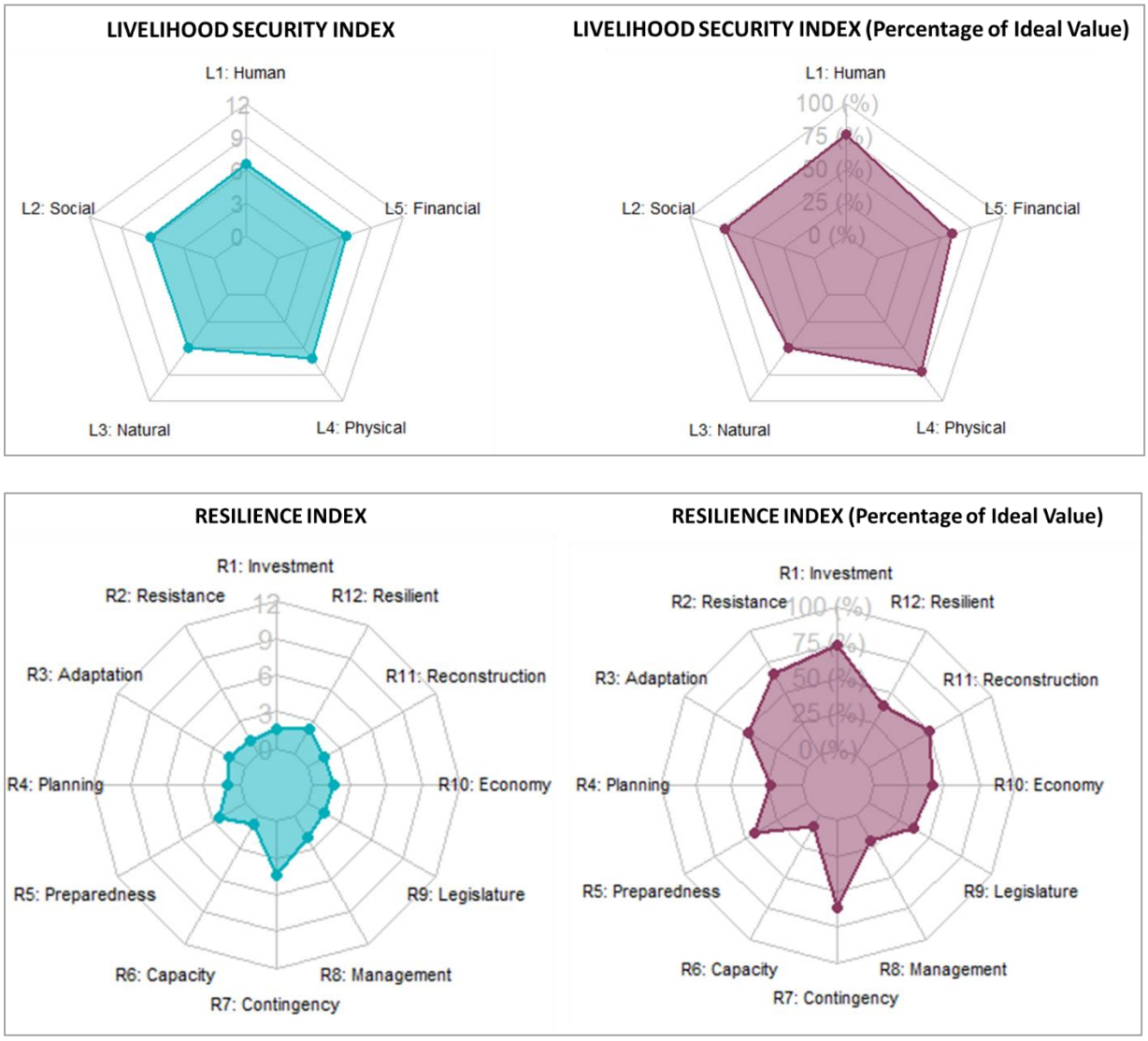


Figure 12: Outputs for livelihood security (top) and resilience (bottom) indices from the LiSeRA 'R' Toolkit

5 ANNEXES

Annex 1: Livelihood Security and Resilience Assessment (LiSeRA) Indicator Library

Table 1: Resilience Dimensions, Sub Dimensions and Indicators in the LiSeRA Framework

Dimension	Sub - Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
Absorb	Investment	R1L1	Comprehensive partnership with external agencies on DRR	Actions undertaken for enhancing partnerships with external agencies for disaster risk management	Subjective	Positive	(Orencio & Fujii, 2013)
		R1L2	Communities and local governments invest in management and conservation to sustain their natural resources.	Proportion of investment from community and local governments to sustain natural resources	Objective	Positive	(Courtney et al., 2008)
		R1L3	Developers and communities incorporate risk reduction into the location and design of structures.	Risk reduction measures incorporated into the location and design of structures	Subjective	Positive	(Courtney et al., 2008)
		R1L4	Ownership of farming equipment (own, rent, borrow pieces of equipment)	Proportion of agricultural households who have ownership of farming equipment	Objective	Positive	(Quandt, 2018)
	Resistance	R2L1	Social support and network systems on DRR activities	Presence of social support and systems for implementation of disaster risk reduction activities to reduce hazard impacts	Subjective	Positive	(Orencio & Fujii, 2013)
		R2L2	Protection and enhancement of ecosystem and bio-diversity	Sensitive habitats, ecosystems, and natural features protect and maintained to reduce risk from hazards	Subjective	Positive	(Courtney et al., 2008)
		R2L3	Irrigation for productive agriculture	Proportion of agricultural land area equipped with irrigation facilities for productive agriculture	Objective	Positive	(Quandt, 2018)

Dimension	Sub - Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
		R2L4	Access to public services	Proportion of population with easy access to public facilities (schools, hospitals)	Objective	Positive	(Quandt, 2018)
		R2L5	Income stability	Proportion of population with stable income (salaried jobs)	Objective	Positive	(Quandt, 2018)
	Adaptation	R3L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	(Ainuddin & Routray, 2012)
		R3L2	Social protection and safety of vulnerable groups	Proportion of vulnerable population covered by social protection systems (insurances, benefits, support system etc.)	Objective	Positive	(Orencio & Fujii, 2013)
		R3L3	Indigenous knowledge and technologies	Application of indigeneous knowledge and technologies in farming and other livelihood activities	Subjective	Positive	(Orencio & Fujii, 2013)
		R3L4	Availability of robust road network	Proportion of 'all-season' roads in comparison to total road network within community/local government	Objective	Positive	(Quandt, 2018)
		R3L5	Remittance	Proportion of remittance and income from external sources as a source of income for the community	Objective	Positive	(Quandt, 2018)
	Planning	R4L1	Education Level	Proportion of population with secondary and tertiary level of education	Objective	Positive	(Ifejika Speranza et al., 2014)
		R4L2	Community-Based Planning	Presence of community-based approaches in planning of DRM and development activities	Subjective	Positive	(US Department of Homeland Security, 2016)
		R4L3	Protected areas and ecosystems	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Objective	Positive	(SDG, 2017)
		R4L4	Investment in early warning and evacuation system	Financial resources available to maintain and improve warning and evacuation systems	Objective	Positive	(Courtney et al., 2008)
		R4L5	Access to a bank account	Proportion of population with ownership of accounts in financial institutions (banks)	Objective	Positive	(Quandt, 2018b)

Dimension	Sub - Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
Manage/ Response	Preparedness	R5L1	Dedicated, trained and equipped human re-sources for emergencies	Number of dedicated, trained and equipped human resources (per 1000 households) for emergencies	Objective	Positive	(World Health Organization, 2017)
		R5L2	Public Information and Warning	Proportion of population covered and quality of public information and warning services	Objective	Positive	(US Department of Homeland Security, 2016)
		R5L3	Understanding of functioning environment and ecosystems	Documentation and understanding of the functioning, linkages and interrelationships between environment, ecosystem and livelihood activities	Subjective	Positive	(Orencio & Fujii, 2013)
		R5L4	Community warning and evacuation infrastructure	Availability of community warning and evacuation infrastructure for emergencies	Subjective	Positive	(Courtney et al., 2008)
		R5L5	Financial resources for emergency preparedness	Proportion of financial resources of local government/community allocated for emergency preparedness	Objective	Positive	(World Health Organization, 2017)
	Capacity	R6L1	Basic emergency and relief services	Provision of basic emergency and relief services for the local communities (number of emergency responders & emergency relief facilities per 1000 people)	Objective	Positive	(Courtney et al., 2008)
		R6L2	Social Institutional Capability	Capacity of the social institutions within the community to respond to emergencies	Subjective	Positive	(Oxfam, 2013)
		R6L3	Threats and Hazards Identification	Activities undertaken to identify, categorize and monitor threats and hazards	Subjective	Positive	(US Department of Homeland Security, 2016)
		R6L4	Ownership of farming equipment	Proportion of agricultural households who have ownership of and access to (own, rent, borrow pieces of equipment) farming equipment	Objective	Positive	(Quandt, 2018)
		R6L5	Support for emergency response	Availability of organizations, volunteers and adequate resources to support emergency response activities	Subjective	Positive	(Courtney et al., 2008)
	Contingency	R7L1	Non-farm skills	Agricultural communities have gained and practice non-farming skills	Subjective	Positive	(Ifejika Speranza et al., 2014)
		R7L2	Health and Social Services	Proportion of population with access to proper health and social services (hospitals, ambulance etc)	Objective	Positive	(US Department of Homeland Security, 2016)

Dimension	Sub - Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
		R7L3	Crop Yields	Amount of storage of crops yield in the previous years (per 1000 households)	Objective	Positive	(Ifejika Speranza et al., 2014)
		R7L5	Contingency Resources	Availaibility of contingency resources (foods, equipments, personnel) to respond to emergencies	Subjective	Positive	(Oxfam, 2013)
	Management	R8L1	Labor Availability	Proportion of working-age population who are available as labor for agricultural and livelihood activities within the community	Objective	Positive	(Quandt, 2018)
		R8L2	Cooperation with local community for DRR activities	Cooperation, involvement and prioritization of local communities for planning, implementation and monitoring of DRR activities	Subjective	Positive	(Orencio & Fujii, 2013)
		R8L5	Financial support for community actions	Financial support mechanism are transparent, accountable, and available to support planned community actions.	Subjective	Positive	(Courtney et al., 2008)
Recovery	Legislature	R9L1	Adoption and implementation of DRR strategies	Local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies	Subjective	Positive	(SDG, 2017)
		R9L2	Local to national coordinating Structure	Availaibilty of coordinating structure and mechanism from local to national level for emergency response	Subjective	Positive	(US Department of Homeland Security, 2016)
		R9L3	Environmental practices in risk reduction	Implementation of environmental practices and nature-based solutions to mitigate hazards and risks	Subjective	Positive	(Orencio & Fujii, 2013)
		R9L5	Protection of small-scale farmers	Degree of application of a legal/regulatory/ policy/institutional framework which recognizes and protects access rights for small-scale farmers and fisheries	Subjective	Positive	(SDG, 2017)
	Economy	R10L2	Income gained through membership in groups	Proportion of household income generated and gained through group memberships	Objective	Positive	(Ifejika Speranza et al., 2014)
		R10L4	Financial resources to support the recovery	Financial resources available to local governments and communities to support recovery	Objective	Positive	Courtney et al., 2008)
	Reconstruction	R11L3	Supportive policy and institutional structure	Policy and institutional structure developed to support effective recovery process	Subjective	Positive	(Orencio & Fujii, 2013b)

Dimension	Sub - Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
		R11L4	Use of community resources for recovery	Availability of local tools, equipments, infrastructure and manpower for recovery	Subjective	Positive	(Ifejika Speranza et al., 2014)
	Resilient	R12L2	Community access to basic social services	Proportion of population in the community with access to basic social services (healthcare, education, WASH etc.)	Objective	Positive	(Orencio & Fujii, 2013)
		R12L3	Integrity of natural and built environment	Actions undertaken for the sustainabel integration of natural and built environment	Subjective	Positive	(Oxfam, 2013)
		R12L4	Infrastructure System	Availability and quality of infrastructure systems and services	Subjective	Positive	(US Department of Homeland Security, 2016)
		R12L5	Promotion of stable and robust economies	Financial resources available to promote stable and robust economies, reduce vulnerability to hazards, and aid in disaster recovery.	Subjective	Positive	(Courtney et al., 2008)

Table 2: Livelihood Security dimensions and indicators in the LiSeRA Framework

Dimension	Code	Indicators	Measurement Index	Type	Effect	Reference
Human	L1R1	Home ownership	Proportion of households that have full ownership of their houses	Objective	Positive	(Sina et al., 2019)
	L1R2	Physical and mental health	Proportion of population with physical or mental health issues (disabilities)	Objective	Negative	(Sina et al., 2019)
	L1R3	Innovation potential	Potential of the communities to innovate and develop new ideas and skills for livelihood	Subjective	Positive	(Oxfam, 2013)
	L1R4	Level of expertise and skills	Proportion of working population with accredited expertise and skills for livelihood	Objective	Positive	(Sina et al., 2019)
	L1R5	Ability and health of labor	Proportion of working age population with physical and mental health issues (disabilities)	Objective	Negative	(Scoones, 1998)
	L1R6	Farmer education	Proportion of farmer households with secondary or tertiary education	Objective	Positive	(Lecegui et al., 2022)
	L1R7	Financial circumstance	Proportion of households with financial issues such as poverty, debts, lack of ownership etc.	Objective	Negative	(Sina et al., 2019)
	L1R8	Traditional ecological knowledge	Adoption and implementation of traditional ecological knowledge & skills in livelihood activities	Subjective	Positive	(Lecegui et al., 2022)
	L1R9	Land ownership and secure land rights	Proportion of households with secure land ownership and rights	Objective	Positive	(SDG, 2017)
	L1R10	Income	Average income level of households	Objective	Positive	(Ainuddin & Routray, 2012)
	L1R11	Access to basic services	Proportion of population living in households with access to basic services (healthcare, education, transportation, WASH etc.)	Objective	Positive	(SDG, 2017)
	L1R12	Stability of income	Proportion of working-age population with stable jobs (salary) and income sources	Objective	Positive	(Sina et al., 2019)
Social	L2R1	Conservation and protection of cultural and natural heritage and resource	Proportion of municipal or central government budget for preservation, protection and conservation of cultural and natural heritage and resources	Objective	Positive	(SDG, 2017)
	L2R2	Social resources and support	Proportion of households/population who are engaged in social activities such as networks, groups, affiliations etc.	Objective	Positive	(Scoones, 1998)
	L2R3	Pro-poor public social spending	Proportion of total municipal or government budget designated to support the poor and vulnerable populations	Objective	Positive	(SDG, 2017)

	L2R4	Application of Local Disaster Risk Reduction strategies	Development, adoption and implementation of local disaster risk reduction strategies in line with national disaster risk reduction strategies	Subjective	Positive	(SDG, 2017)
	L2R5	Social protection for vulnerable groups	Proportion of population covered by social protection systems such as insurance, subsistence allowances, facilities etc.	Objective	Positive	(SDG, 2017)
	L2R6	Exchange and reciprocity of social capital	Availability of mechanisms and systems to facilitate the transfer of social and cultural values, norms, knowledge and skills	Subjective	Positive	(Lecegui et al., 2022)
	L2R7	Cooperative societies, self-help groups	Availability and access of the population to cooperative societies and self help groups for social support	Subjective	Positive	Erenstein et al. (2010)
	L2R8	Social Networking	Proportion of households involved in social networks, organizations and groups	Objective	Positive	Adato and Meizen-Dick (2002)
	L2R9	Access to state	Proportion of population with ease of access to public facilities, markets, government agencies etc.	Objective	Positive	Tacoli (1999)
	L2R10	Skills, knowledge and abillity of labor	Proportion of working-age population with accredited skills & knowledge	Objective	Positive	Tacoli (1999)
	L2R11	Participatory collaboration mechanisms	Inclusion of participatory approaches and mechanisms in development planning an disaster risk management	Subjective	Positive	(Courtney et al., 2008)
	L2R12	Gender equity	Adoption of gender equity and inclusion within community including immunization, access to facilities, income generation etc.	Subjective	Positive	Erenstein et al. (2010)
Natural	L3R1	Quality of bio-diversity and natural resources	Actions undertaken to maintain and enhance the quality, health and status of bio-diversity & natural resources including flora & fauna, land, air, water etc.	Objective	Positive	Adato and Meizen-Dick (2002)
	L3R2	Productive agriculture	Proportion of agricultural area with irrigation and agricultural system facilities	Objective	Positive	(SDG, 2017)
	L3R3	Development of adaptive resources for agricultural sustainability	Actions undertaken to develop and enhance agricultural resources for sustainable agriculture	Subjective	Positive	(SDG, 2017)
	L3R4	Agricultural sustainability	Research and development for innovation in agricultural systems and mechanisms	Subjective	Positive	(SDG, 2017)
	L3R5	Agricultural capacity	The capacity of agricultural land computed through soil capability index	Objective	Positive	Erenstein et al. (2010)
	L3R6	Access to natural resources	Access of the community/households to natural resources for their livelihood activities	Subjective	Positive	(Lecegui et al., 2022)

	L3R7	Genetic conservation for food and agricultural sustainability	Number of plant and animal genetic resources conserved and enhanced for food and agricultural sustainability	Objective	Positive	(SDG, 2017)
	L3R8	Sustainable land use	Proportion of land consumption rate compared to population growth rate	Objective	Positive	(SDG, 2017)
	L3R10	Location of community	Distance of community from economic activity centers to allow adequate economic opportunities	Objective	Positive	(Sina et al., 2019)
	L3R11	Environmental services	Incorporation of sustainable environmental practices for livelihood activities	Subjective	Positive	Scoones (1998)
	L3R12	Soil capacity	Classification of soil capacity in terms of soil fertility, moisture, organic content etc.	Objective	Positive	(Ifejika Speranza et al., 2014)
Physical	L4R1	Household assets	Proportion of household with required assets for livelihood sustainability and stability	Objective	Positive	Campbell et al. (2001)
	L4R2	Quality and status of critical infrastructure	(a) Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters	Subjective	Negative	(SDG, 2017)
	L4R3	Infrastructure and facilities to enhance productive agriculture	Proportion of agricultural land equipped with a) irrigation, b) farm mechanization, c) accessibility from nearest markets	Objective	Positive	Erenstein et al. (2010)
	L4R4	Accessibility to transportation	Proportion of population that has convenient access to public transport	Objective	Positive	(SDG, 2017)
	L4R5	Sustainable transportation and road networks	Proportion of the rural population who live within 2 km of an all-season road	Objective	Positive	(SDG, 2017)
	L4R6	Expenditure on essential and critical services	Proportion of total government spending on essential services (education, health and social protection)	Objective	Positive	(SDG, 2017)
	L4R7	Development aid and support	Total official international support (official development assistance plus other official flows) to infrastructure	Objective	Positive	(SDG, 2017)
	L4R8	Environmental practices that reduce hazard risk	Adoption and implementation of environmental practices and nature based solutions to reduce hazards and risk	Subjective	Positive	(Orencio & Fujii, 2013)
	L4R9	Prevention of unsustainable land use	Policies and instruments to prevent unsustainable use of land and resources	Subjective	Positive	Orencio & Fujii, 2013)
	L4R10	Slum and informal settlements and vulnerable population	Proportion of urban population living in slums, informal settlements or inadequate housing	Objective	Negative	(SDG, 2017)

	L4R11	Availability of WASH services	Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water	Objective	Positive	(SDG, 2017)
	L4R12	Telecommunication and network coverage	Proportion of population covered by a mobile network, by technology	Objective	Positive	(SDG, 2017)
Financial	L5R1	Availability of housing capital	Proportion of household funds comprised of housing and shelter services	Objective	Positive	(Ainuddin & Routray, 2012)
	L5R2	Diverse and environmentally sustainable livelihoods	Proportion of local economic and livelihood activities that are characterized as diversified and environmentally sustainable	Objective	Positive	
	L5R3	Livelihood Viability	Presence of positive environment (social, cultural, financial) that supports the development and expansion of livelihood activities	Subjective	Positive	(Oxfam, 2013)
	L5R4	Support for poor households	Policies and strategies to enhance the financial capacity of population living below the national poverty line.	Subjective	Positive	(SDG, 2017)
	L5R5	Assistance for vulnerable population and groups	Total official development assistance grants from all donors that focus on poverty reduction as a share of the recipient country's gross national income	Objective	Positive	(SDG, 2017)
	L5R6	Employment	Proportion of working-age population engaged in sustainable income generating activities	Objective	Positive	(Ainuddin & Routray, 2012)
	L5R7	Income and economy of small-scale farmers	Monthly average income of small-scale farmers	Objective	Positive	(SDG, 2017)
	L5R8	Availability of social capital	Presence of social support mechanisms, institutions and services to enhance financial status of the communities	Subjective	Positive	Sina et al., 2019
	L5R9	Recovery policies and decisions	Presence of policies, instruments, institutions and mechanisms for effective recovery of economy	Subjective	Positive	Sina et al., 2019
	L5R10	Diversified economic activities	Proportion of households with multiple sources of income	Objective	Positive	(Ainuddin & Routray, 2012)
	L5R11	Access to livelihood support	Proportion of households with access to financial support for livelihood	Objective	Positive	Sina et al., 2019
	L5R12	Poverty and economic status	Proportion of the population living below the international/national poverty line	Objective	Negative	(SDG, 2017)

Annex 2: LiSeRA Toolkit 'R' Code

 # This code has been developed under the project 'Capacity building for measuring multi-hazard livelihood security and resilience in the Lower Mekong Basin'

#first version: 04/02/2023

#Last update: 24/03/2023

```
setwd("D:/Study@AIT/Assistantship Work/APN Project/LiSeRA Excel Toolkt/LiSeRA_R Toolkit") #to change the working directory to the input file location

getwd()


##~~~Install/load all required packages

install.packages("read_excel")

library(readxl)

install.packages("dplyr")

library(dplyr)


## checking the number of sheets it contains

#Sheet_counts<- excel_sheets("LiSeRA Excel Toolkit_FINAL.xlsx")

#Sheet_counts


# Importing specific sheets into R using the read_excel()

#importing input values

Livelihood_MasterSheet <- read_excel("LiSeRA_Inputs.xlsx",

                                     sheet = "Livelihood_Input")

Livelihood_MasterSheet$`Effects on Livelihood Resilience`[is.na(Livelihood_MasterSheet$`Effects on Livelihood Resilience`)]=0
```

```
#Output calculation for livelihood
for (i in 1:nrow(Livelihood_MasterSheet)) {
  if (Livelihood_MasterSheet$`Effects on Livelihood Resilience`[i]=="Positive") {
    Livelihood_MasterSheet$output[i] <- (Livelihood_MasterSheet$`Livelihood Input`[i] * Livelihood_MasterSheet$`Livelihood Weightage`[i]*10)
  } else if (Livelihood_MasterSheet$`Effects on Livelihood Resilience`[i]=="Negative"){
    Livelihood_MasterSheet$output[i] <- ((5 - Livelihood_MasterSheet$`Livelihood Input`[i])* Livelihood_MasterSheet$`Livelihood Weightage`[i]*10)
  } else{
    Livelihood_MasterSheet$output[i] <- 0
  }
}

##~~~~~~~~~~~~~~~~~~~ Sort the dataframe based on Code
library(stringr)
install.packages('ramify')
library(ramify)

Tool_dashboard<-resize(Livelihood_MasterSheet$output, 5, 12, across=c("rows", "columns"), byrow = TRUE)

#convert to dataframe and renaming the columns and rows
Livelihood_Dashboard<-as.data.frame.matrix(Tool_dashboard)
rownames(Livelihood_Dashboard)<-c('L1: Human','L2: Social','L3: Natural','L4: Physical','L5: Financial')
```

```
colnames(Livelihood_Dashboard)<-c('R1: Investment','R2: Resistance','R3: Adaptation','R4: Planning','R5: Preparedness','R6: Capacity','R7: Contingency','R8: Management','R9: Legislature','R10: Economy','R11: Reconstruction','R12: Resilient')


Livelihood_Dashboard$Ideal_value <- c(8.5, 8.5, 12.00, 10.00, 11.00)

Livelihood_Dashboard$maximum <- c(12.00, 12.00, 12.00, 12.00, 12.00)

Livelihood_Dashboard$Sum<-rowSums(Livelihood_Dashboard[, 1:12])

Livelihood_Dashboard$'Percentage of Ideal Value'<-((Livelihood_Dashboard$Sum/Livelihood_Dashboard$Ideal_value)*100)

## L I V E L I H O O D  D A S H B O A R D


# Define the variable ranges: maximum and minimum

max_min <- data.frame(

  K1 = c(Livelihood_Dashboard$Ideal_value),0,100)

colnames(max_min) <- c("Max", "Min", "Max_p")

max_min <- as.data.frame(max_min)



# Rename columns in max_min to match Livelihood_Dashboard

rownames(max_min) <- rownames(Livelihood_Dashboard)

# Bind the variable ranges to the data (LiSERA_DASHBOARD)

Livelihood_Dashboard <- cbind( Livelihood_Dashboard, max_min)

Livelihood_Dashboard<- t(Livelihood_Dashboard)

Livelihood_Dashboard<- as.data.frame(Livelihood_Dashboard)
```

```
##~~~~~~~~~~~~~~~~~~~~~~~~data visualization (Radar Plots)
install.packages('fmsb')
library(fmsb)
??radarchart


# Create the radar chart
data <- Livelihood_Dashboard[c("maximum", "Min","Sum"), ]
data2 <- Livelihood_Dashboard[c("Max_p", "Min", "Percentage of Ideal Value"), ]


create_beautiful_radarchart <- function(data, color = "#00AFBB",
                                        vlabels = colnames(data), vlcex = 0.7,
                                        caxislabels = NULL, title = NULL, ...){
  radarchart(
    data, axistype = 1,
    # Customize the polygon
    pcol = color, pfcol = scales::alpha(color, 0.5), plwd = 2, plty = 1,
    # Customize the grid
    cglcol = "grey", cglty = 1, cglwd = 0.8,
    # Customize the axis
    axislabcol = "grey",
    # Variable labels
    vlcex = vlcex, vlabels = vlabels,
    caxislabels = caxislabels, title = title, ...
  )
}
```

```
# Define colors and titles
colors <- c("#00AFBB",'#8B3A62')
op <- par(mfrow=c(1,2))
create_beautiful_radarchart(data,
                            color = colors[1],caxislabels = c(0, 3, 6, 9, 12), title = "Livelihood Security Index")
create_beautiful_radarchart(data2,
                            color = colors[2], title = "Livelihood Security Index (% of ideal value)")
par (op)


### ~~~~~~~~~~~ ~~~~~~~~ R E S I L I E N C E
#importing input values
Livelihood_MasterSheet <- read_excel("LiSeRA_Inputs.xlsx",
                                     sheet = "Livelihood_Input")
Livelihood_MasterSheet$`Effects on Livelihood Resilience`[is.na(Livelihood_MasterSheet$`Effects on Livelihood Resilience`)]=0


#Output calculation for livelihood
for (i in 1:nrow(Livelihood_MasterSheet)) {
  if (Livelihood_MasterSheet$`Effects on Livelihood Resilience`[i]=="Positive") {
    Livelihood_MasterSheet$output[i] <- (Livelihood_MasterSheet$`Livelihood Input`[i] * Livelihood_MasterSheet$`Livelihood Weightage`[i]*10)
  } else if (Livelihood_MasterSheet$`Effects on Livelihood Resilience`[i]=="Negative"){
    Livelihood_MasterSheet$output[i] <- ((5 - Livelihood_MasterSheet$`Livelihood Input`[i])* Livelihood_MasterSheet$`Livelihood Weightage`[i]*10)
  } else{
```

```
    Livelihood_MasterSheet$output[i] <- 0
  }
}

##~~~~~~~~~~~~~~~~~~~ Sort the dataframe based on Code
library(stringr)
install.packages('ramify')
library(ramify)

Tool_dashboard<-resize(Livelihood_MasterSheet$output, 5, 12, across=c("rows", "columns"), byrow = TRUE)

#convert to dataframe and renaming the columns and rows
Livelihood_Dashboard<-as.data.frame.matrix(Tool_dashboard)
rownames(Livelihood_Dashboard)<-c('L1: Human','L2: Social','L3: Natural','L4: Physical','L5: Financial')
colnames(Livelihood_Dashboard)<-c('R1: Investment','R2: Resistance','R3: Adaptation','R4: Planning','R5: Preparedness','R6: Capacity','R7: Contingency','R8: Management','R9: Legislature','R10: Economy','R11: Reconstruction','R12: Resilient')

Livelihood_Dashboard$Ideal_value <- c(8.5, 8.5, 12.00, 10.00, 11.00)
Livelihood_Dashboard$maximum <- c(12.00, 12.00, 12.00, 12.00, 12.00)
Livelihood_Dashboard$Sum<-rowSums(Livelihood_Dashboard[, 1:12])
Livelihood_Dashboard$'Percentage of Ideal Value'<-((Livelihood_Dashboard$Sum/Livelihood_Dashboard$Ideal_value)*100)
```

```
## LIVELIHOOD DASHBOARD


# Define the variable ranges: maximum and minimum
max_min <- data.frame(
  K1 = c(Livelihood_Dashboard$Ideal_value),0,100)
colnames(max_min) <- c("Max", "Min", "Max_p")
max_min <- as.data.frame(max_min)



# Rename columns in max_min to match Livelihood_Dashboard
rownames(max_min) <- rownames(Livelihood_Dashboard)
# Bind the variable ranges to the data (LiSERA_DASHBOARD)
Livelihood_Dashboard <- cbind( Livelihood_Dashboard, max_min)
Livelihood_Dashboard<- t(Livelihood_Dashboard)
Livelihood_Dashboard<- as.data.frame(Livelihood_Dashboard)



##~~~~~~~~~~~~~~~~~~~~~~data visualization (Radar Plots)
install.packages('fmsb')
library(fmsb)
??radarchart
# Create the radar chart
L_data <- Livelihood_Dashboard[c("maximum", "Min","Sum"), ]
L_data2 <- Livelihood_Dashboard[c("Max_p", "Min", "Percentage of Ideal Value"), ]


create_beautiful_radarchart <- function(data, color = "#00AFBB",
```

```
                        vlabels = colnames(data), vlcex = 0.7,
                        caxislabels = NULL, title = NULL, ...){
  radarchart(
    data, axistype = 1,
    # Customize the polygon
    pcol = color, pfcol = scales::alpha(color, 0.5), plwd = 2, plty = 1,
    # Customize the grid
    cglcol = "grey", cglty = 1, cglwd = 0.8,
    # Customize the axis
    axislabcol = "grey",
    # Variable labels
    vlcex = vlcex, vlabels = vlabels,
    caxislabels = caxislabels, title = title, ...
  )
}

# Define colors and titles
colors <- c("#00AFBB",'#8B3A62')
op <- par(mfrow=c(1,2))
create_beautiful_radarchart(L_data,
                            color = colors[1],caxislabels = c(0, 3, 6, 9, 12), title = "Livelihood Security
Index")
create_beautiful_radarchart(L_data2,
                            color = colors[2], title = "Livelihood Security Index (% of ideal value)")
par (op)
```

```
#%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

### ~~~~~~~~~~~ ~~~~~~~ R E S I L I E N C E
Resilience_MasterSheet <- read_excel("LiSeRA_Inputs.xlsx",
                                     sheet = "Resilience_Input")
Resilience_MasterSheet$`Effects on Resilience`[is.na(Resilience_MasterSheet$`Effects on Resilience`)]=0

#Output calculation for resilience
for (i in 1:nrow(Resilience_MasterSheet)) {
  if (Resilience_MasterSheet$`Effects on Resilience`[i]=="Positive") {
    Resilience_MasterSheet$output[i] <- (Resilience_MasterSheet$`Resilience Input`[i] * Resilience_MasterSheet$`Resilience Weightage`[i]*10)
  } else if (Resilience_MasterSheet$`Effects on Resilience`[i]=="Negative"){
    Resilience_MasterSheet$output[i] <- ((5 - Resilience_MasterSheet$`Resilience Input`[i])* Resilience_MasterSheet$`Resilience Weightage`[i]*10)
  } else{
    Resilience_MasterSheet$output[i] <- 0
  }
 }

Resilience_dashboard<-resize(Resilience_MasterSheet$output, 12, 5, across=c("rows", "columns"), byrow = TRUE)
```

```
#convert to dataframe and renaming the columns and rows

Resilience_Dashboard<-as.data.frame.matrix(Resilience_dashboard)

colnames(Resilience_Dashboard)<-c('L1: Human','L2: Social','L3: Natural','L4: Physical','L5: Financial')

rownames(Resilience_Dashboard)<-c('R1: Investment','R2: Resistance','R3: Adaptation','R4: Planning','R5: Preparedness','R6: Capacity','R7: Contingency','R8: Management','R9: Legislature','R10: Economy','R11: Reconstruction','R12: Resilient')


Resilience_Dashboard$Ideal_value <- c(1.70, 1.50, 2.70, 4.10, 4.64, 6.63, 6.06, 8.24, 3.48, 3.48, 2.61, 4.93)


Resilience_Dashboard$maximum <- c(10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00)

Resilience_Dashboard$Sum<-rowSums(Resilience_Dashboard[, 1:5])

Resilience_Dashboard$'Percentage of Ideal Value' <- round((Resilience_Dashboard$Sum/Resilience_Dashboard$Ideal_value)*100)



# RESILIENCE DASHBOARD


# Define the variable ranges: maximum and minimum

max_min <- data.frame(

  K1 = c(Resilience_Dashboard$Ideal_value),0,100)

colnames(max_min) <- c("Max", "Min", "Max_p")

max_min <- as.data.frame(max_min)
```

```
# Rename columns in max_min to match Resilience_Dashboard
rownames(max_min) <- rownames(Resilience_Dashboard)
# Bind the variable ranges to the data (Resilience_Dashboard)
Resilience_Dashboard <- cbind( Resilience_Dashboard, max_min)
Resilience_Dashboard<- t(Resilience_Dashboard)
Resilience_Dashboard<- as.data.frame(Resilience_Dashboard)
# Create the radar chart
R_data <- Resilience_Dashboard[c("maximum", "Min","Sum"), ]
R_data2 <- Resilience_Dashboard[c("Max_p", "Min", "Percentage of Ideal Value"), ]
# Define colors and titles
colors <- c("#00AFBB",'#8B3A62')
op <- par(mfrow=c(1,2))
create_beautiful_radarchart(R_data,
                            color = colors[1],caxislabels = c(0, 3, 6, 9, 12), title = "Resilience Index")
create_beautiful_radarchart(R_data2,
                            color = colors[2], title = "Resilience Index (% of ideal value)")
par (op)
```