

Table 1: Three dimensions and indicators of sustainability to assess adaptation in Indigenous and local contexts (adopted from [29])

Sustainability dimensions	Indicators	Questions asked with adaptation indicators	References
Social	Social benefits	Does the option offer health and education benefits? Does the option minimize negative trade-offs with other development policy goals and identify positive synergies with other policy goals?	[30]
	Sociocultural acceptability	Is there public resistance to the option? Does the option typically find acceptance within existing sociocultural norms and utilize diverse knowledge systems including Indigenous and local knowledge?	[31–33]
	Social and regional inclusiveness	Does the option include different social groups and remote regions? Does the adaptation option adversely affect vulnerable groups or other areas?	[34–36]
Economic	Microeconomic and macroeconomic viability, including employment and productivity enhancement potential	What are the economic costs and trade-offs of the option? (high costs correspond to low feasibility) Would the option lead to higher economic productivity? Does the option employ many people or does the system's productivity increase under the option?	[37,38]
Environmental	Adaptive capacity/resilience-building potential	Does the option enhance the ability of ecosystems or relevant decision-makers to adjust to potential damage to the environment, take advantage of opportunities, or respond to consequences, or does the option contribute to building resilience (the environment's ability to cope with stressors and reorganize to maintain structures and functions and retain the capacity to transform)?	[39]
	Ecological capacity	Does the option enhance supporting, regulating, or provisioning ecosystem services in any way?	[39]

Table 2: Examples of Indigenous and local knowledge-based adaptation responses and their impacts on sustainability

Adaptive responses	Examples	(+/-) Impacts on sustainability	Sustainability dimensions	References
Community-based adaptation	Participatory adaptation planning (Langalanga people from the Solomon Islands)	(+) Support community cohesion, local resource management (forest, water, and fisheries), and disaster risk reduction (-) Increased settlement along the coast leads to conflicts over access to fishing grounds	Social, Environmental	[40,41*]
	Inclusion of women in fisheries (Alaskan native people, United States)	(+) Inclusion of women's knowledge in fisheries decision-making (Alaskan native people, United States) (-) Limited research considering the knowledge and perspectives of fisherwomen in Alaska (Alaskan native people, United States)	Social	[77**]
Diversification	Livelihood diversification (Indigenous peoples in the Asia Pacific region)	(+) Diverse skills give them opportunities to maximize the flexible use of all available capital to sustain their livelihood and reduce climate risks and vulnerability (-) Limited specialization in one livelihood activity (expert knowledge and learning)	Economic, Social	[3,44]

	Crop diversification (Bangladesh; Milpa farmers in Mexico; various ethnic groups in northern Vietnam; Yi people in China)	(+) Contribution to agrobiodiversity, improved soil quality, reduced pest infestation, health and nutritional intake diversity (-) Although mixed cropping increases yield, indigenous crops generally display lower yields and lower market prices, resulting in generally lower income generation potential compared to improved varieties	Environmental, Economic, Social	[51,54,55,67]
Local governance and conflict resolutions schemes	Co-management (small-scale fishers in Timor-Leste and Bangladesh)	(+) Empowered communities are more likely to meet both socio-economic and biological goals being involved in decision-making (-) Inequities reinforced by the customary power hierarchies reduce incomes and access rights of poor fishers	Social, Economic, Environmental	[78,79]
	Community-based management (Laos PDR, Resex Pirajubaé fishers of Brazil)	(+) Foster capacity building (-) Degradation of coastal-marine ecosystems and a severe impact on traditional fishery did not prevent due to urban growth over the reserve	Social, Environmental	[80,81]
Land, soil, and water management	Soil management (Thai farmers in Vietnam; smallholder farmers in Northern Ghana; Khasi and Jaintia people in Northern India)	(+) Improves soil quality, including soil fertility and water retention potential (-) Labor work-intensive, which is addressed through collective actions and a culture of reciprocity	Environmental, Economic, Social	[82,83]

	Water management (Sri Lanka; Peruvian Andean Indigenous pastoralists; Northern Pakistan)	(+) a good water management systems guarantees sustainable and fair water use among community members (-) Excessive water usage in the dry season might exhaust natural water sources	Social, Economic, Environmental	[62–64]
Traditional weather observation and forecast	Traditional weather forecast (Alfa pastoralists in Ethiopia; Mayan milpa farmers in Mexico)	(+) High cultural acceptance, Information sharing to inform all community members (-) The higher unpredictability especially of rainfall, makes traditional weather forecast less reliable and decision-making more difficult	Social, Economic	[57,61]