Academic Project

Assessing Gaps and Needs in Impact, Vulnerability, Risk Assessment (IVRA) and Adaptive Capacity Assessments (ACA)

Acknowledgements

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Acronyms

AC	Adaptation Committee
ACA	Adaptive Capacity Assessment
CBEA	Community-Based Extension Agents
GIZ	German Society for International Cooperation
HDI	Human Development Index
IPCC	Intergovernmental Panel on Climate Change
LEG	Least Developed Countries Expert Group
LDC	Least Developed Countries
MEL	Monitoring, Evaluation, Learning
NAP	National Adaptation Plans
NELD	Non-Economic Loss and Damage
RCCR	Rural Coastal Communities Resilience Framework
SB62	62nd Session of the UNFCCC Subsidiary Bodies
SIDS	Small Island Developing States
SSPs	Shared Socioeconomic Pathways
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
IVRA	Impact, Vulnerability, and Risk Assessment

Executive summary

Different forms of assessments have been developed and conducted to understand how climate change affects both nature and society. These assessments serve as tools for capturing the complex interactions between climate-related hazards, environmental conditions and socioeconomic factors. For the present study, we have taken into consideration two different types of such assessments: Impact, Vulnerability and Risk Assessments (IVRA) and Adaptative Capacity Assessments (ACA). Together, these approaches provide a foundation for evidence-based planning and decision-making on climate change across different scales.

Impact, Vulnerability and Risk Assessments have been successful in supporting planning processes and offering critical insights into hazards, vulnerability, impact and climate-related risks. These assessments play an important role in guiding national adaptation strategies and climate action, by informing decision-makers identify who and what is at risk, and why they are at risk. In doing so, Impact, Vulnerability, and Risk Assessments contributes to a more effective and equitable interventions. However, despite being a well-established field of practice with significant advancements, gaps and needs in multiple categories and dimensions remain recurring, leading to limitations to full potential and applicability of these assessments across different contexts.

Such is also the case for the field of Adaptive Capacity Assessments, the main objective of which is to gain a thorough understanding of whether a system can adapt to and cope with climate variability and change, and use this knowledge to guide the development of effective, sustainable, and fair adaptation strategies that minimize vulnerability and enhance resilience. With the impeding necessity of having to adapt to a world dangerously close to surpassing tipping points, it becomes important to assess all possible ways in which adaptation actions can be mobilised, of which adaptive capacity assessments form a major part.

The United Nations Framework Convention on Climate Change (UNFCCC), as the primary international treaty addressing climate change, has established constituted bodies to support the implementation of adaptation action. One of them, the Adaptation Committee (AC) provides technical guidance, synthesising information on the state of adaptation and issues recommendations to Parties. Through its workstreams, the Adaptation Committee (AC) seeks to provide support to those Parties, particularly to those in need.

Impact, Vulnerability, and Risk Assessment

The recurring gaps identified within the semi-structure literature review conducted

- Conceptual Gaps
- Methodological Gaps
- Data Gaps
- Institutional/Operational Gaps
- Policy integration Gaps
- Inclusivity Gaps

Building on the identified gaps, key needs in Impact, Vulnerability, and Risk Assessments were also identified from the literature review, to inform more effective, inclusive and context-responsive assessment practices. Key needs include:

- Comprehensive Data and Monitoring Needs
- Advancing Conceptual Clarity and Risk-Sensitive Approaches
- Methodological Improvements and Advanced Modelling Approaches
- Policy and Decision-Making support
- Local Participation and Knowledge Integration

In response to the gaps and needs found across both academic and grey literature, targeted entry points were developed to guide improvements in assessment design, implementation and policy integration:

- Data and Monitoring
- Conceptual and Methodological Coherence
- Participation and Inclusivity
- Policy and Alignment

Reflecting on the synthesis and analysis made, and based upon the entry points listed, the recommendations made were:

- Technical Guidance, aiming to development regional training modules with more in-depth technical guidance on building inclusive, interoperable national data ecosystems.
- Establish stakeholders-informed normative thresholds, where technical experts engage in inclusive consultations with communities, Indigenous Peoples, and civil society to define context-specific thresholds that reflect local realities, values, and acceptable risk levels.

Adaptive Capacity Assessment

The challenges which persist in the ACAs mainly pertain to how well the assessments are structured, designed and implemented, of which some also pertain to how well the assessments are able to incorporate dimensions of equity.

Structural Challenges:

General Challenges	• Lack of conceptual consensus • Inconsistent methodologies, indicators and assessment types • Fragmentation in indicators • Capacity-action gaps • Lack of MEL mechanisms • Data unavailability and lack of coordination among stakeholders
Inequity	• Lack of consideration of participatory approaches • Lack of incorporation of Traditional, Indigenous, and Local Knowledge • Lack of gender considerations • Lack of consideration of vulnerable groups

To tackle these challenges and establish pathways to realise the full potential of the opportunities which ACAs present, seven entry points have been formulated as follows:

- Mainstreaming Participatory and Inclusive Methodologies
- Integrating Traditional, Indigenous and Local Knowledge
- Centring Gender Considerations and Intersectionality
- Diversifying Data
- Applying a Social-Ecological Systems (SES) Perspective
- Establishing Adaptive Monitoring, Evaluation, and Learning (MEL)
- Shifting from Static Assessment to Capacity Mobilisation

These entry points can realise the potential of Adaptive Capacity Assessments and work towards adaptation action. This version of ACAs is future-oriented, drives actionable outcomes and solutions, captures interconnected risks, and is coordinated across scales.

Furthermore, to divert research towards establishing these pathways and realising the opportunities, we recommend:

- Expert Workshops, aiming to supplement the literature review in this report, allowing for exchange between researchers, practitioners, and policymakers.
- Creation of a toolkit of Adaptive Capacity Assessments, recommending methods with appropriate indicators and data types to practitioners, based the specific context and scale of the research.

This report thus aspires to provide actionable insights that support more coordinated, inclusive, and forward-looking adaptation strategies across various scales. By identifying recurring gaps and challenges in both Impact, Vulnerability and Risk, and Adaptive Capacity Assessments, as well as being able to translate them into more tangible and practical recommendations, the findings in this report aim to inform the development of improved technical guides and training materials on climate adaptation.

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Chapter 1.
Introduction

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1. Background

Adaptation plays a vital role in the global, long-term strategy to address climate change, offering essential protection for human populations, livelihoods, and natural ecosystems. While recognition of the urgency for adaptation action and the need for robust assessment frameworks is increasing, the current landscape continues to face challenges such as inconsistencies, implementation difficulties, and a general perception of limited effectiveness (Hirschfeld et al., 2020). Assessing adaptive capacity is viewed as a critical component of the adaptation process itself (Chepkoech et al., 2020), as it offers insights into the ability of communities and systems to cope with stressors, adjust to changing conditions, and capitalize on emerging opportunities. These assessments play a key role in informing policy decisions and guiding strategic management priorities (Jurjonas et al., 2020).

In response to these challenges, the UNFCCC has established constituted bodies and workstreams to advance adaptation responses. Among them, the Adaptation Committee (AC) was formed to promote the implementation of enhanced adaptation action in a coherent manner. The AC provides technical support, guidance, and information on the state of adaptation, along with recommendations to all countries that are Parties to the Convention and the Paris Agreement.

The present project aligns with Workstream 1 ‘Providing technical support and guidance to the Parties on adaptation, including on means of implementation’ of the AC's 2025–2027 workplan and Decision 2/CMA.5, which outlines the UAE Framework for Global Climate Resilience. This framework guides the achievement of the Global Goal on Adaptation (GGA) and supports drafting proposals for activities related to impact, vulnerability, and risk assessments, as well as adaptive capacity assessment. To prioritize these activities, the AC seeks to identify gaps and needs where technical support and guidance are most required by Parties to reduce the increasing adverse impacts, risks, and vulnerabilities associated with climate change and to enhance adaptation action and support.

Through this project, we aim to identify gaps and needs in impact, vulnerability, and risk assessments (IVRA), as well as the challenges and opportunities for adaptive capacity assessments (ACA), across both academic and grey literature. These are particularly relevant to the work of the UNFCCC, which relies on accurate information and timely guidance to assist Parties especially those from developing countries in identifying climate risks, prioritizing funding, and designing inclusive and effective assessments and adaptation strategies. The main deliverables include: 1) A detailed report, 2) Mapping existing technical guidance and training materials.

Many traditional approaches to risk management have leaned heavily on technical and reactive solutions, often neglecting the importance of collective governance and inter-institutional collaboration (dos Santos & Pessoa, 2025). This highlights the need for a more nuanced understanding of adaptive capacity and its underlying dynamics. Studying adaptive capacity reflects a shift away from purely vulnerability- or impact-focused assessments toward more actor and action-centered approaches. This shift can be supported through the development of technical guidance documents that inform multi-criteria frameworks and composite indices (Huddleston et al., 2023) to measure adaptive capacity across multiple scales (Dressel et al., 2020).

The motivation for this research stems from a central gap: the persistent misalignment between existing assessments and the evolving realities and demands faced by countries on the frontlines of climate change. This disconnection hampers how effectively adaptation actions can be planned, resourced, and monitored. To help address this pressing issue, the report synthesizes findings on how IVRA and ACA are currently understood and assessed.

Chapter 2.
Methodology

River Swat, Pakistan © Asim

2. CONTEXT

This report has the purpose to address two different areas of expertise, the **gaps and needs** prevalent in **IVRA** and the **challenges and opportunities** within **ACA**; the terminology used to assess "gaps and needs" and "challenges and opportunities" for the different workstreams comes from the mandate assigned by the commissioners, so that the AC may address them via technical guidance and training materials. While these two workstreams will be discussed separately within this report, their assessment was structured similarly.

2.1. Literature Review

Both workstreams conducted a Semi-structured Literature Review of about 50 sources each. These sources are comprised of peer reviewed academic papers and grey literature reports published by reputable organizations such as the UNFCCC, GIZ or the World Bank.
Grey literature was compiled by Google searches, snowball sampling, and through recommendations by the course facilitator, the supervisor and the AC. For the IVRA workstream, 30 grey literature sources were analysed, while ACA analysed 20 sources.
The academic papers were compiled through a Scopus search conducted in May 2025 and then vetted through a four-eye process to ensure the relevancy and legitimacy of the papers. This selection was supplemented with other relevant papers selected through snowball sampling. In total the IVRA workstream selected 26 papers to analyse through this process, while the ACA workstream selected 28 papers. These are the search strings used in Scopus:

IVRA – "Risk AND Impact AND Vulnerability AND Gaps AND Assessment AND Needs AND Climate Change"- searched within Article Titles, Abstracts and Key terms, from 2015-2025 – 87 documents found

ACA – "Adaptive Capacity Assessment" – search within Article Title – 86 documents found

To ensure a manageable and focused literature review, we selected search terms that would narrow the scope of results to a workable extent. For the IVRA search, the initial results yielded just over a hundred documents; this was further refined by applying a date filter for publications between 2015 and 2025, reducing the number to 87 and ensuring that the literature analysed was both recent and relevant. For ACA, the search term "adaptive capacity assessment" initially resulted in over 6,000 papers when applied under the "Article Titles, Abstracts and Key Terms" field. To significantly narrow down the results and maintain relevance, the same term was applied under the more restrictive "Article Title" field, which yielded 86 documents.

It is important to note here that the resources used are limited to English. This restriction is due to the shared language proficiency within the research team and the accessibility of English sources. However, this language constraint may have excluded relevant insights or findings available in non-English publications, potentially limiting the global comprehensiveness and cultural diversity of our review.

The analysis of the literature in the two research fields was tailored towards the specific needs of IVRA and ACA. The detailed analysis approach and the findings of each workstream will be presented in the following chapters. Both workstreams created coding frameworks that are included in Appendix C.

2.1.1 Literature Analysis in Impact, Vulnerability, and Risk Assessments

This section outlines the continuation of the methodology used to conduct and process the literature review, including both academic and grey literature, for the analysis on Impact, Vulnerability and Risk Assessments. The primary goal was to analyse and synthesize the knowledge gaps highlighted by authors and practitioners, as well as needs identified by them, and to also provide an overview of the current state of the field. The process here conducted was essential to inform the development of more targeted recommendations, which will be presented later, for strengthening technical guidance and training materials.

Coding and Data Extraction Process IVRA

To systematically extract and process information in the existing and reviewed documents, a coding framework was developed. By stablishing this coding framework, it was possible to structure an analysis across different sources. Based on preliminary readings conducted prior to the semi-systematic literature review, a coding framework was established to guide de identification and analysis of the key gaps and needs in the current Impact, Vulnerability, and Risk Assessment practices.
This framework structured our review of the academic and grey literature review around the following:

- **Conceptual Gaps**
- **Methodological Gaps**
- **Data Gaps**
- **Institutional/Operational Gaps**
- **Policy integration Gaps**
- **Inclusivity Gaps**
- **Gaps in Guidance/Training**
- **Interconnected Risk**

These categories served as the foundation for mapping the literature, and later for establishing entry points and formulation of recommendations in this report.
Those categories were chosen to capture critical, and the most recurring barriers identified in Impact, Vulnerability, and Risk Assessments. With those, the analysis was not only on technical aspects but also including social, institutional and other gaps that directly impact the effectiveness of IVRA processes.
For the grey literature (which includes technical guides, training materials and reports from international organizations), all the categories above were also included with the addition of: Digital and Tool Access, regarding the accessibility of digital technologies and tools.

Thematic Analysis IVRA

The coding framework was established to ensure a structured approach and served as the foundation for the semi-systematic review of the literature. Following the development of this framework, both academic and grey literature sources were reviewed and coded according to the predefined gap categories listed above, allowing the identification of gaps across the readings. The coding process provided relevant information across the range of sources, including the frequency and distribution of the gaps within the academic and grey literature.
The results were then analysed to define, synthesise and map the key gaps, going beyond the initial frequency findings to examine the nature of the gaps in greater depth. This analysis, presented in this report, revealed patterns and cross-cutting themes, that emerged consistently throughout the literature.
These findings are visually compiled and summarised in the Mind Map (Figure 2) elaborated by the authors. It was designed to highlight the gaps and their interconnections, aiming to illustrate their complexity and emphasizing how they can reinforce and influence one another.

2.1.2 Literature Analysis in Adaptive Capacity Assessments

The primary goal for the ACA literature review is to identify challenges and opportunities within assessments, through our own thought process upon analysis and also through those already identified by researchers and practitioners, thus providing a comprehensive overview of the current state of the field of study. Upon identification of the challenges, entry points were formulated to establish pathways to realise the full potential of the identified opportunities, and recommendations for future research were made accordingly.

Coding and Data Extraction Process ACA

The ACA literature review primarily aims to uncover both challenges and opportunities within the current adaptation landscape. To ensure a systematic and comprehensive analysis, a tailored coding framework was developed. This framework was designed in alignment with Decision 2/CMA.5 under the UAE framework, ensuring consistency with the current adaptation agenda (UNFCCC, 2024).
The initial phase of the review assessed how well the literature aligned with the targets outlined in paragraphs 9 – 10 of Decision 2/CMA.5. This was followed by further examination of the literature using specific analytical fields, shaped by the cross-cutting considerations set out in paragraphs 13–14 of the same decision. The resulting categories for analysis, used for both academic and grey literature, are as follows:

- **Participatory and community-based approaches**
- **Traditional, Indigenous and Local Knowledge**
- **Gender Considerations**
- **Vulnerable Groups**

- **Interconnected Risk**
- **Mobilisation of Adaptive Capacity**
- **Policy integration and synergies**
- **Socio-ecological-systems**

Additionally, assessment types, indicators and general gaps were noted in the coding framework.

Thematic Analysis ACA

Through the analysis, common themes emerged within these categories which could be interrelated between different categories. For instance, when reviewing the category of ‘Traditional, Indigenous and Local Knowledge’ 56% of the assessments had not mentioned it. While 5% acknowledged the importance of different types of knowledge but did not include it in their own research, only 39% assessments had actively included different knowledge systems. Combining the findings from different categories uncovered relationships between key factors influencing ACAs. For example, we observed that research papers which overlooked participatory approaches often also neglected considerations such as gender, vulnerable groups, and local knowledge.
This approach revealed how comprehensively these factors are incorporated in existing literature and also highlighted prevailing challenges and helped formulate opportunities within the Adaptive Capacity concept. Such a method of analysis provided a clearer landscape of the current state of adaptive capacity assessments.

2.2 Mapping of Existing Technical Guidance Materials and Assessments

To complement the results of the Literature Analysis, Mapping of Existing Technical Guidance Materials and Assessments in an Excel sheet will provide an overview of the existing assessment methods for IVRA and ACA (Appendix E). Each resource will be briefly profiled, detailing its assessment type, the methodology, its target audience, the geographical scope, and an evaluation of the applicability of the method. This will create a database, which can help guide the implementation of assessments by showing the relevance of different approaches.

Scale of Assessment	No. of IVRAs	No. of ACAs
Local / community scale	9	11
Regional scale	9	4
National scale	12	2
International scale	7	2
Total Assessments	18	18
	(Some Assessments can be conducted on several scales)	

Table 1 Scale of Impact, Vulnerability, and Risk Assessments and of Adaptive Capacity Assessments

In total, we mapped 18 assessment methodologies for IVRA and ACA each. The scale at which these assessments were conducted (local/community, regional, national, and international) is presented in Table 1. Of these assessments, 7 IVRA sources and 15 ACA sources carried out assessments themselves. An overview of the geographical location of where they were conducted is given in Table 2.

As shown in Table 1, the majority of assessments, particularly ACAs, were carried out at the local/community scale, which indicates a strong focus on the localised nature of ACAs. IVRAs, though fewer in number overall, show a relatively even distribution across scales, including one at the international level. Table 2 provides a regional breakdown, highlighting that Africa accounted for the highest number of IVRAs, while ACAs were more widely distributed, with notable concentrations in Asia and the Pacific Islands.

Major Regions where Assessments were Conducted	No. of IVRAs	No. of ACAs
Asia	1	3
North America	0	1
Latin America	0	1
Europe	0	1
Africa	3	2
Pacific Islands	0	2
Caribbean Islands	1	2
Middle East	0	1
Global (encompassing several countries)	2	2
Total Assessments	7	15

Table 2 Geographical Focus of Impact, Vulnerability, and Risk Assessments and of Adaptive Capacity Assessments

2.3 Insights from SB62

The desk research was supplemented by insights drawn from the 62nd Session of the UNFCCC Subsidiary Bodies (SB62) in Bonn, Germany (June 2025). Negotiation sessions, particularly those focused on the Global Goal on Adaptation (GGA), along with associated side events, provided important contextualisation for the workstreams presented here, offering insight into current political and technical debates. These insights helped situate the findings within broader policy frameworks and reinforced the relevance of the UAE Framework, which places strong emphasis on inclusive, scalable and forward-looking approaches to adaptation planning and monitoring. The main conference insights are listed in Infobox 1.

Infobox1. Insights - SB62, June 2025, Bonn

Lack of coherent methodologies	➢ Indicators for the Global Goal on Adaptation (GGA) often lack accompanying metadata or clear methodologies. ➢ Indicator approaches cannot represent all facets of adaptation, risking stagnation. ➢ Focus on capacity building to advance GGA.
Call for participatory processes for more inclusive adaptation	➢ A recurring theme was the call for stronger involvement of local stakeholders to ensure that adaptation actions reflect local interests and protect the most vulnerable. ➢ Ethical and equitable inclusion of Indigenous Peoples and Indigenous Knowledge in adaptation decision-making.
Disaggregation of social parameters to foster representation	➢ Disaggregated data is essential to accurately reflect intersectionality. ➢ This enables more precisely targeted and therefore more effective adaptation policies.
Tension between national and local scales of adaptation	➢ While adaptation primarily takes place at the local level, it is frequently shaped by national or international policies. ➢ Challenges in reconciling global priorities with local or subnational specificities. ➢ Highlights the need to better align and integrate policy frameworks across scales.
Call for long-term and continuous assessments	➢ Emphasis on ongoing, rather than sporadic, assessments to track the evolution of adaptation efforts. ➢ Focus on evaluating the quality of adaptation processes, not just outcomes.

Flood 2022, Pakistan © Asim

Chapter 3.

Impact, Vulnerability, and Risk Assessment (IVRA)

3.1 Conceptual Framing

The terms impact, vulnerability and risk are used across multiple disciplines and frameworks while addressing climate change adaptation and disaster risk reduction. However, a lack of a shared understanding and conceptual foundation has led to significant variations in how these terms are defined and applied in assessments. In some cases (Asare-Kyei et al., 2017) they are used interchangeably, while in others they are treated as distinct or even contradictory concepts (Colette, 2016). A clear and consistent understanding of those concepts here is fundamental to both guide the structure of this analysis and to interpret the findings.

In the literature across the Intergovernmental Panel on Climate Change's Assessment Reports (IPCC ARs), for example, vulnerability has been defined as a combination of different elements. In earlier reports, as in AR4 (2007), vulnerability was understood as outcome of exposure to stress, sensitivity to perturbations and adaptive capacity (IPCC AR4, 2007). The concept shifted in AR5 (2015), resonating with the integration of Disaster Risk Reduction and Climate Change Adaptation, towards a more risk-centred approach, as an interaction between hazard, exposure and vulnerability, which continued in AR6. Similarly, earlier models had a static approach (Higuera Roa et al., 2025; Tabari & Willems, 2023) and lacked clarity on whether vulnerability should be considered a context, a process or an outcome (Colette, 2016). This variety of definitions and understandings further complicates the application of those concepts in assessments (Menk et al., 2022).

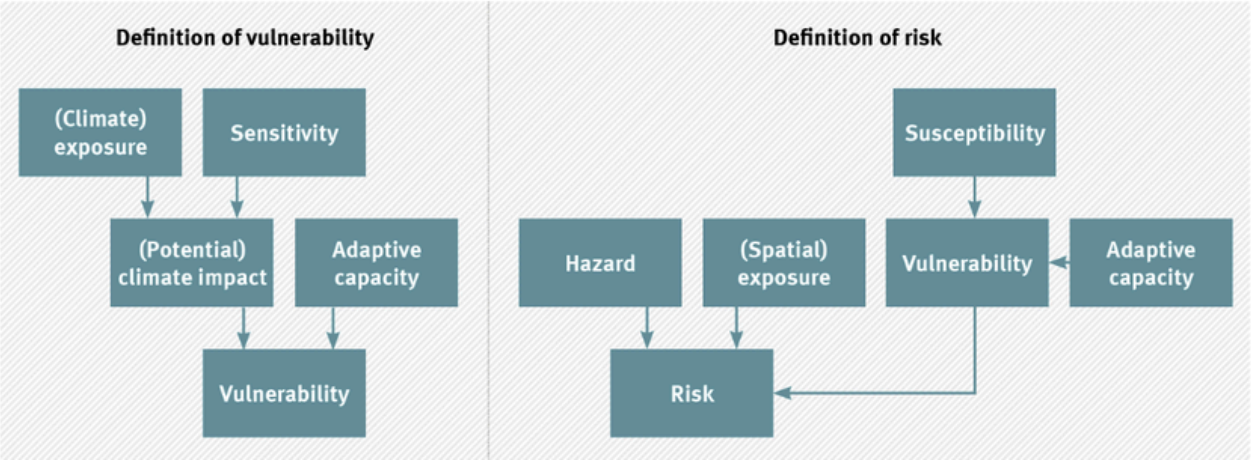


Figure 1 Vulnerability to Risk – a shift in IPCC 2007 to 2014 (Buth et al., 2017, p. 42)

Definitions Based on IPCC AR6 (IPCC, 2023)

The approach adopted in this study is based on the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC), which provides the coherent basis for the analysis made later on. The IPCC AR6 defines the key concepts used in this report as:

Vulnerability: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.
Risk: In accordance with IPCC-AR6, Risk is the potential for adverse consequences for human or ecological systems, resulting from the interaction of climate-related hazards with the vulnerability and exposure of affected systems.
Exposure: The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected.
Impacts: The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather/climate events), exposure, and vulnerability.

3.2 Gaps in Impact, Vulnerability and Risk Assessments

In this section, we present the gaps found in the literature, their interactions and summarize the key findings using a visual representation.
As detailed in the methodology of this report, the gaps were categorized into different groups to better structure the analysis. After the coding process, several patterns began to emerge, not only within the individual gaps but also across them. The analysis process brought to light that these gaps do not occur in isolation and, instead, they intersect, overlap and reinforce others. This leads to the perception of their interconnections and cross-cutting themes. The causal and reinforcing links between different types of gaps along the literature indicates its interconnections, while recurrent issues that emerges across the different gaps demonstrates the cross-cutting themes.
These linkages, to be explored below, reflect the systemic and interdependent nature of Impact, Vulnerability and Risk Assessments. This suggests that addressing one gap in isolation may not be sufficient while conducting an assessment, and, to improve its design and implementation, a more holistic and multi-dimensional strategy is required.

Data Gap

One of the most recurrent gaps identified across both academic and grey literature is the prevalence of data gaps. Nearly all sources pointed to this issue, as 22 out of the 28 academic papers and 21 out of 30 grey literature sources reported data gaps, often leading to gaps in other areas. In this report, data gaps are understood as the absence of granular data, meaning with insufficient detail to capture local realities, as well as the lack of disaggregated data (by gender, age, income, for example) and high-resolution spatial data, all needed to reflect specific vulnerabilities. As a direct result, the use of broad or even generalized datasets can fail to identify nuances of local risks, impacts and vulnerabilities, limiting the efficiency of assessments.

This can be illustrated by the case of Nepal (Ministry of Forests and Environment [MoFE, Government of Nepal], 2021), in which a vulnerability and risk assessment conducted was unable to evaluate variables at a municipal scale. The available data lacked the granularity and specificity needed to provide a more context-sensitive assessment. The limitation is further exacerbated as the source points out that while landslide susceptibility data was available at a finer level, general vulnerability data for Nepal was only reported at a district level. This disconnection and differences in data resolution hinder the comprehension of local vulnerabilities, failing to capture communities' perspectives and can result in assessments that fail to reflect community-specific realities.

Infobox 2. Addressing Data Gaps and Gender Vulnerabilities through the Women Climate Vulnerability (WCV) Index Quang, N. M. (2022)

Climate adaptation efforts can fail to account the intersecting risks faced by vulnerable populations, such as rural women in developing countries. The absence of and fragmented sectoral data of gender indicators can limit the ability to design gender-sensitive policies.

Aiming to address these gaps, the Women Climate Vulnerability (WCV) Index was developed as an interdisciplinary and adaptable tool for measuring and comparing risks to rural women.

Methodology	➢ Combines physical, economic and political indicators ➢ Across 51 specific risk factors ➢ Uses empirical data, surveys and structured experts consultancy to fill data gaps
Application	➢ In Ben Tre Province, Vietnam, the WCV Index reveled high vulnerability in water access and rural livelihoods, exposing the absence of gender-specific policy responses.
Insights	➢ The WCV Index is an example of how evidence-based information for decision-makers are better to allocate climate resources ➢ The need to develop gender-sensitive adaptation strategies ➢ Integrating local realities with more granular data supports more inclusive and equitable action.

Conceptual Gaps

The second most frequent identified gap across the reviewed literature relates to conceptualization, found in over half of the literature, as in 14 academic papers and 15 grey documents. These conceptual gaps primarily concern the inconsistent definition and operationalization of terms we deemed essential for Impact, Vulnerability and Risk Assessments, particularly vulnerability.

In Suleimany & Sulaimani (2025), the absence of a comprehensive country-scale assessment of vulnerability to extreme heat was noted. Many assessments focused solely on the impact of extreme heat on specific communities, leading to a limited understanding of the spatial patterns and levels of a country's vulnerability, as well as its trends over time. Further, Tabari & Willems (2023) emphasized the need for a comprehensive, cross-disciplinary risk outlook, in this case, on drought. On the research, it was noted that drought risk assessments tend to assume exposure and vulnerability are static.

In cases such as the ones described in Suleimany & Sulaimani (2025) and Tabari & Willems (2023), assessments also perceive risk as a static or isolated phenomenon. This conceptualization of risk fails to account how risks can evolve over time, and how they are shaped by socio-economic interactions, manifesting differently across scales and contexts. A comprehensive risk perspective integrates multiple dimensions, moving beyond the sole focus on "risks from hazards", prioritising the potential adverse consequences to human and ecological systems. By having a dynamic and multi-dimensional understanding of risk, as they can be influenced by external factors such as inequalities and historical marginalization, assessments are able to grasp complex realities, avoiding ineffective or even maladaptive policy responses (UNDRR, 2022).

Institutional/Operational and Policy Integration Gaps

Additional gaps appear when examining the design and implementation processes of these assessments. Some of these were categorized as institutional/operational and others as policy integration gaps.

Infobox 3. Policy Integration and Institutional Gaps in Brazil's National Adaptation Plan (NAP)

The Brazilian National Adaptation Plan (NAP) provides an example of self-identified gaps in policy integration and institutional arrangements, specifically, within its Strategy for Disaster Risk Management.

Key Gaps	➢ Deficiencies in institutional management structures, reflecting gaps in governance and clear institutional arrangements. ➢ Lack of continuity in actions due to disparities between agencies at different governance levels, indicating a lack of sub-national integration in adaptation planning, representing a major barrier to implementation.
Implications	➢ By identifying these gaps, Brazil's NAP highlights how deficiencies in institutional frameworks can hinder the implementation of adaptation at the national and sub-national level.
Insights	➢ Policy integration gaps and weak institutional arrangements directly affect the effectiveness of adaptation plans. ➢ Brazil's NAP is transparent in identifying internal shortcomings, emphasizing that addressing these structural barriers is crucial for adaptation planning.

Institutional and operational gaps include weak coordination and collaboration, fragile institutional frameworks to sustain assessments, as well as poor communication and alignment between scientists and policymakers. This was highlighted by UNDRR (2022, p. 18) which states "...DRR and CCA are usually managed by separate institutions and instruments on the national to subnational scales. This makes comprehensive approaches difficult to implement." , as seen in the case analysis of the Brazil's NAP (Info Box 3).

Another challenge, which strongly correlates with data gaps, is the lack of accessible, operational instructions for conducting IVRA assessments that are comparable. There are also persistent barriers to data sharing across ministries, agencies and stakeholders due to restrictive policies and institutional silos, as well as a lack of centralized or open-access databases. This can be seen in Arora (2023), which emphasizes the non-availability of updated datasets, that lead and impacted the ability of decision-makers to make evidence-based decisions.

Within policy integration gaps, a key issue is the disconnect between assessments and their policy implementation. For example, Asare-Kyei et al. (2017) found that in rural communities in West Africa, prior vulnerability and risk indices lacked applicability because they used standardized indicators across countries, which failed to capture the realities and priorities of the most affective populations. Market and policy constrain that restrict adaptation measures, especially when integrating assessments into decision making, were also noted. Escarcha et al. (2018) emphasized that limited capacities and financial constrains in developing countries restrict the depth and costs of assessments.

Inclusivity Gap

Although it was not the most frequently coded gap throughout the literature review process, inclusivity emerged as a critical and cross-cutting issue that leads to other gaps identified in this report. Its relative absence in the literature does not necessarily suggest its irrelevance, rather it highlights a blind spot that can compromise the effectiveness and equity of Impact, Vulnerability and Risk Assessments. When perspectives are excluded, such assessments can reinforce existing inequalities and overlook critical vulnerabilities.

Vulnerable groups can have limited opportunities to participate and co-produce assessments, often being reduced to roles where they are merely providing information, without having a genuine influence on the process. This issue is especially pronounced in top-down approaches with minimal community involvement. When evaluating this through a gender lens, those assessments ignore instances of intra-household dynamics such as gender-based violence and care burdens, not challenging the unequal social structures and even risking reinforcing existing vulnerabilities. The gaps are raised in Quang (2022), as seen in the Info Box 1 , which highlighted the underrepresentation of women in climate assessments in Mekong Delta, although experiencing disproportionate impacts.

Inclusivity gaps were also evident in the poor integration of indigenous and traditional knowledge. Asare-Kyei et al. (2017) noted that prior risk assessments in West Africa ignored indicators relevant to local communities. Through a participatory approach to selecting indicators, their study introduced new variables that had not previously been used in risk assessments for the region. This highlights the importance of incorporating local knowledge held by communities, which can bring new perspectives that are often absent in conventional, top-down scientific approaches.

Moreover, the lack of inclusivity often contributes to other observed gaps, including limited data granularity, weak institutional coordination, inadequate local ownership and failure to integrate traditional and local knowledge systems. In this sense, lack of inclusivity in Impact, Vulnerability and Risk Assessments is not a singular gap but a cross-cutting issue, as “[inclusivity] enables identifying solutions that can target or be sequenced as needed across age and population type. At the local level, when revising or designing new projects or plans, it would mean (...) ensuring that the different population groups including minorities are also represented and can effectively take part in the planning process” (UNDRR, 2022, p.78).

Visual Representation

As pointed in the previous section, one key takeaway from the literature review is that the identified gaps are interconnected and can influence each other. To better illustrate these relationships and the way the gaps interact and consequentially understand the needs for their resolution, a mind map was developed as a visual tool to clearly display these connections.

The mind map was designed to provide a concise visual summary of all the categories and the key findings of the literature review. The map allows a better understanding of how the gaps overlap and reinforce each other, emphasizing the need for integrated, multi-dimensional solutions.

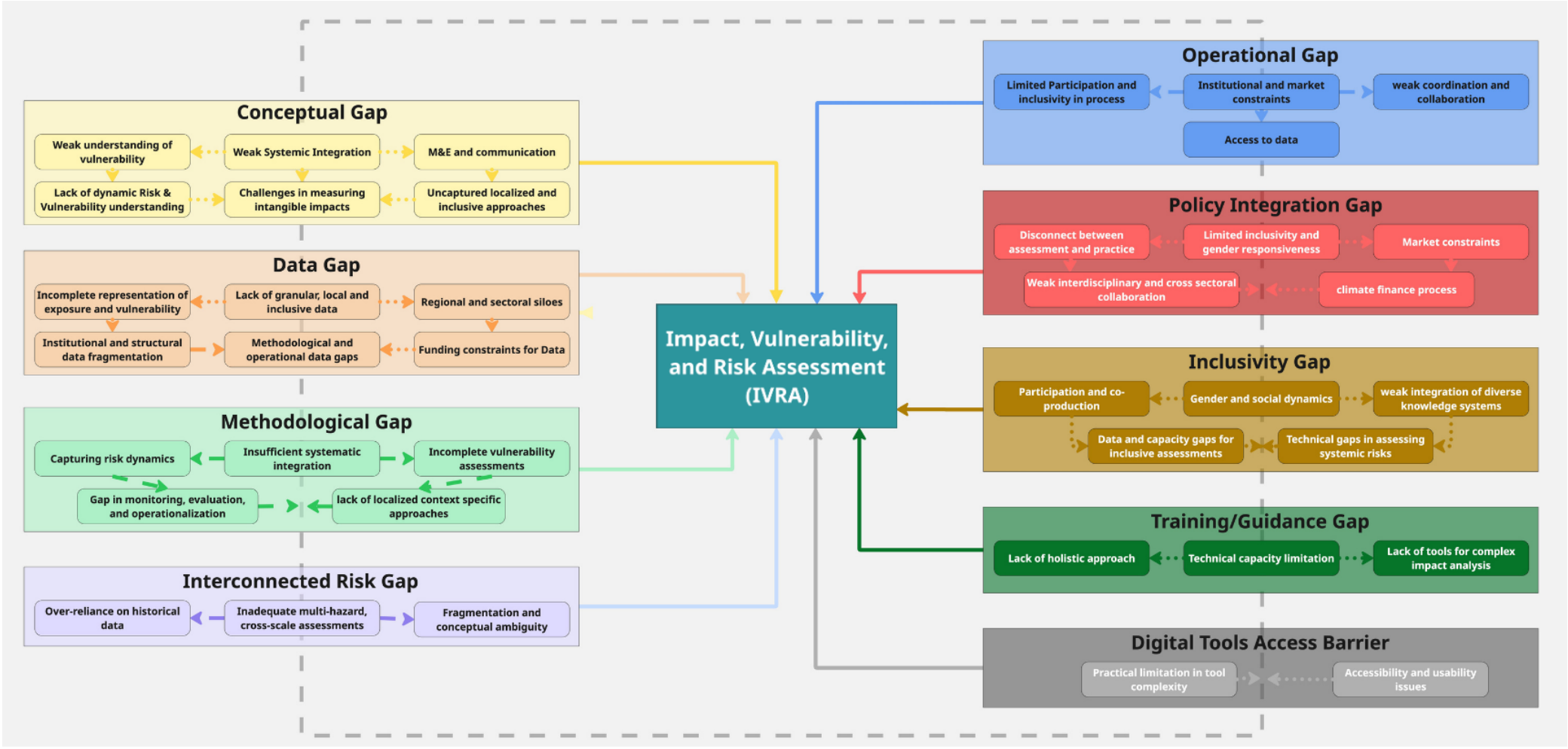


Figure 2 Mind Map of Gaps in IVRA (Original Graphic) – larger Version in Appendix C

3.3 Needs Identified in Impact, Vulnerability and Risk Assessments

This section focuses on a set of needs identified according to the gaps with the coding framework for the literature review process of Impact, Vulnerability and Risk Assessment (IVRA). The needs are based on thematic areas under Target 9 of the Baku to Belém work aligned with the gaps outlined in the previous section for Target 10a i.e. Impact, Vulnerability and Risk Assessment. The section is organised by incorporating 5 main needs drawn from academic and grey literature.
The summarised key needs highlighted in the literature around the first need of iterative adaptation cycle are food for thought for enhanced assessments by UN agencies and development cooperations.

Comprehensive Data and Monitoring Needs

A need for robust data strategy (collection, management, integration, and accessibility) across all levels of climate risk and vulnerability assessments. This includes addressing persistent difficulties with data resolution, particularly for slow-onset processes, which require long-term datasets that are often missing in many countries (GIZ, 2022).

A mixed-method strategy that integrates qualitative and quantitative tools, such as remote sensing, mapping, perception surveys, key informant interviews, and group discussions, is required to capture the entire complexity of climate impacts and understand why they occur. The obtained data must be stored in a coordinated system and made accessible for future use, including transfer to relevant local agencies (Urban Flood Risk Handbook: Assessing Risk and Identifying Interventions world bank, 2023).

Tabari & Willems (2023) state that, assessments must increasingly be informed by localized, high-resolution, and disaggregated vulnerability indicators that account for differential impacts across gender, age, socioeconomic status, and specific local conditions, rather than relying on broad national-level averages like Human Development Index (HDI). The authors also suggest that there is also a need to move beyond single indicator frameworks, acknowledging that no single perfect tool exists, and instead utilize a diverse range of data sources to address measurement challenges.

A robust, standardized, and regularly updated databases of both historical and current climate data are required to ensure consistency and reliability (Umweltbundesamt, 2021). Moreover, integrating empirical data with surveys, expert judgment, and reducing heterogeneity between countries and sectors is essential with the development of dynamic monitoring systems to enable continuous tracking of climate risks and vulnerabilities in real (Zebisch et al., 2021).

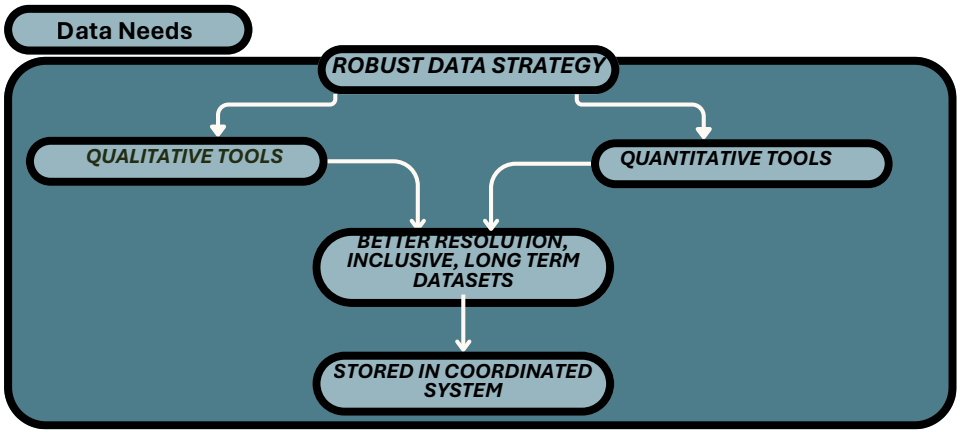


Figure 3 Conceptual Understanding of Needs Identified in IVRA (Original Graphic)

Advancing Conceptual Clarity Needs

Given the methodological complexity of vulnerability assessments, sufficient time is required not only conducting assessments but also to a common understanding and shared language among stakeholders (Umweltbundesamt, 2017). There is a strong need to adopt common and updated conceptual frameworks, such as those promoted by the IPCC, which define risk as a function of hazard, exposure, and vulnerability. Future assessments and planning processes need to incorporate careful consideration of normative thresholds, such as determining what levels of risk are deemed tolerable and to understand how adaptation measures, despite being well-intentioned, may result in maladaptation (Umweltbundesamt, 2021).

Methodological Improvements Needs

There is a pressing need for development and application of indirect methods such as migration flow analysis or spatiotemporal climate datasets identified by Zickgraf (2021) and complementary climate data to reduce distortions in participatory approaches as slow onset process unfold gradually without visible impacts and accumulated over time. Comprehensive and multidimensional frameworks are urgently needed to assess risks from under-addressed hazards, such as extreme heat, and to replace single-hazard approaches with methods that account for multi-hazard, cross-scalar, systemic, and cascading risks. Additionally, there is a critical need to develop methodologies that integrate the highly relevant dimension of Non-Economic Loss and Damage (NELD) (GIZ, 2022). To improve future-oriented assessments, models may incorporate Shared Socioeconomic Pathways (SSPs) and other forward-looking projections such as gentrification, industrialization, and demographic transitions, to more accurately capture evolving risk patterns (Menk et al., 2022).

Policy and Decision-Making Needs

Policies need to ensure that assessments are not conducted in isolation but are systematically embedded into planning processes, funding applications, and local decision-making frameworks to ensure relevance and impact (Suleimany & Sulaimani, 2025). Context-specific policy interventions are necessary to address the unique vulnerabilities faced by different countries, regions, and communities, recognizing that one-size-fits-all approaches are insufficient (Weathering Risk, 2023).

Local Participation and Knowledge Integration Needs

Participatory, community-based assessments are essential for capturing local knowledge, understanding social realities, and identifying drivers of vulnerability, which formal top-down assessments often overlook. Engaging local experts and stakeholders will not only improves the validity of results but also enhances access to localized data and reduces uncertainty. Indigenous knowledge systems and local adaptation practices need to be systematically integrated into assessments to ensure cultural relevance and practicality. In addition, gender-responsive assessments require moving beyond basic representation to actively address intra-household dynamics, gender-specific vulnerabilities, and non-economic losses.

The importance of localized data infrastructure is also emphasized, with a need to ensure that all data, both collected and generated, are stored properly and made transferable to relevant local agencies. Mechanisms such as the Community-Based Extension Agents (CBEA) model in rural agricultural extension in Ghana highlight the value of training local service providers in climate data collection, analysis, and dissemination, enabling communities to generate and act on relevant information (World Bank, 2023).

Detailed documentation of local adaptation practices is needed to support knowledge exchange and evidence-based policymaking. Conducting regional and district-level research to identify highly vulnerable sub-populations is critical for sub-national adaptation strategies. Additionally, there is a recognized need to improve the information and services provided by national meteorological and hydrological institutions, ensuring they support localized adaptation planning and align with National Adaptation Plans (NAPs) (PCCB, 2023).

When seen together, the needs presented above reveal not only technical gaps in assessment design and its implementation, as data and conceptual, but also deeper structural and governance-related issues that hinder the development of effective and inclusive strategies. Addressing these needs requires a systemic approach that

aligns conceptual clarity, data systems, methodological tools, and participatory mechanisms with not only international institutions, but especially with local policy frameworks.

The entry points that will be presented in the following section will lay the foundation for actionable recommendation. These entry points seek to continue with the insights raised within the literature review for improving guidance, tools, and practices related to IVRA assessments.

3.4 Entry Points for Impact, Vulnerability and Risk Assessments

Based on the coding framework previously stablished, besides the review and analysis made of academic and grey literature, this section reflects upon the identified gaps and needs delimited in previous sections and formulates entry points. These four entry points aim to translate the identified needs into a more practical and policy-relevant actions. They are conceptualized and later on organized following the categories stablished earlier within the analysis of the gaps, them being data and monitoring, conceptual and methodological coherence, participation and inclusivity, and policy alignment. These intend to guide future efforts by technical bodies seeking to strengthen the design, implementation, and utility of IVRA, as well as to direct the recommendations proposed in this report.

1.Data and Monitoring

Comprehensive national data strategies for climate risk and vulnerability assessment, including mechanisms for regular collection, integration, and sharing of disaggregated and localized data.
Promote mixed-method data collection approaches, integrating remote sensing, participatory methods, and perception-based tools to capture both quantitative and qualitative dimensions of risk.
Data repositories with open access, such as the State of Adaptation Action (SOA) Platform (Info box 4), to ensure consistent, long-term, and cross-sectoral use, especially for slow-onset processes.
Improve data resolution and inclusivity by investing in high-resolution, gender- and age-disaggregated indicators that better reflect local realities and differential vulnerabilities.
Institutionalize dynamic monitoring systems to enable real-time risk tracking and feedback loops for policy adjustment.

2. Conceptual and Methodological Coherence

Adopt common conceptual frameworks, such as the IPCC model of risk as a function of hazard, exposure, and vulnerability, across assessments and capacity-building efforts.
Encourage stakeholder alignment on key definitions and terms early in the assessment process to ensure a shared language and consistent understanding.
Support continued research on dynamic vulnerability, particularly those that account for feedback loops, nonlinearities, and cross-scale interactions.
Invest in multi-hazard and systemic risk methodologies that go beyond sector-specific or hazard-specific tools, especially in under-assessed areas like extreme heat.

3. Participation and Inclusivity

Participatory approaches in local and sub-national assessments to ensure that voices, knowledge, and experiences shape both the diagnosis and the solutions of assessments.
Systematically integrate Indigenous and traditional knowledge systems into the planning process of the assessment frameworks to improve cultural relevance and effectiveness.
Gender-responsive assessments that go beyond representation to address intra-household dynamics, unpaid care burdens, and gender-based vulnerabilities.
Strengthen local data infrastructure and ownership, including through training and deployment of local extension agents, to sustain knowledge generation and enable community-led action.
Improve local and regional research to identify vulnerable groups for tailored sub-national adaptation strategies.

4. Policy Alignment

Promote coordination across ministries and sectors, embedding cross-agency partnerships in both assessment design and implementation.
Ensure policies reflect context-specific risks and priorities, particularly in underrepresented regions and among socially vulnerable populations.
Require assessments to be integrated into key planning documents, including NAPs, NDCs, and climate finance proposals, to ensure their relevance and practical utility.

Infobox 4. State of Adaptation Portal

The State of Adaptation Action (SoA) platform is the Adaptation Committee's new portal of interactive country profiles to showcase the state of adaptation arrangements and action in each country that is a Party to the UNFCCC

What it offers	➢ Country-specific profiles for all UNFCCC Parties ➢ Information on adaptation planning, implementation, and governance ➢ Data sourced from national reports and communications
Purpose	➢ Enhance transparency and understanding of adaptation efforts ➢ Support global tracking of adaptation progress ➢ Stimulate learning and inform future action across countries

Access to the portal:
https://unfccc.int/topics/adaptation-and-resilience/state-of-adaptation

3.5 Recommendations for Impact, Vulnerability and Risk Assessments

The recommendations presented within this section reflect the synthesis and analysis made on the recurring gaps and needs identified in the literature. Aligned with paragraph 10(a) of Decision 2/CMA.5 and the AC's mandate to provide technical guidance and capacity-building support for the implementation of the UAE Framework, these recommendations are structured around the four entry points delimited in the previous section. By addressing these entry points, we foresee not only to improve the quality and usability of assessments on impact, vulnerability and risk, but also to contribute strengthening adaptation planning and implementation processes, particularly in vulnerable contexts.

These recommendations can serve as a basis for further dialogue, development, collaboration and cooperation in the international setting, by the alignment with country-specific capacities and institutional settings. Each of the recommendations focuses on enabling more coherent, responsive, and equitable practices.

Technical Guidance:

The literature review conducted in this report highlights how recurring gaps in data collection, monitoring and interpretation significantly affects the effectiveness of Impact, Vulnerability and Risk Assessments, leading to gaps in other critical dimensions of this process. To address these gaps and strengthen technical capacities, we recommend the development of regional training modules with more in-depth technical guidance on building inclusive, interoperable national data ecosystems. By improving the collection of disaggregated data, by standardizing across institutions to enable comparability, seeking to integrate both scientific and traditional and indigenous knowledge systems, these efforts can create more robust foundations for assessments.

Online learning platforms, such as **Coursera** , **UNFCC:e-Learn**, and **UNITAR** could offer the opportunity to launch targeted training programs focused on linking more localized data to Impact, Vulnerability and Risk Assessments processes. Given the data limitations faced and identified in this review in Latin America and Small Island Developing Countries (SIDS), particularly in the Pacific and Caribbean Islands, we recommend piloting this initiative in these regions as the starting point, focusing in developing inclusive training in regards to language accessibility, cultural appropriateness, and regional data realities, for later on broader global scale application.

Establish stakeholder-informed normative thresholds:

For operationalizing more effective Impact, Vulnerability and Risk Assessments, as recognized in Institutional/Operational and Policy Integration gaps, strengthening institutional capacities at national and subnational levels are required. Following up the limitations on the data availability and quality, there is a need for building technical and governance capabilities of authorities to design, interpret and apply assessment findings.

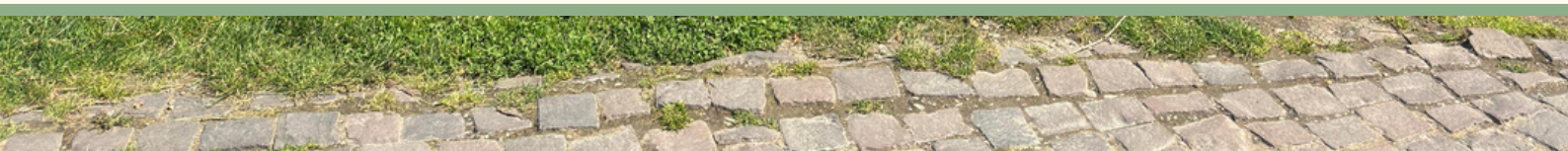
Currently, assessments lack clearly defined thresholds, which results in ambiguity around planning, priorities, and timing of response. Those thresholds help to translate assessment data into actionable decisions, for example by identifying when climate exposure becomes unacceptable for a community or when social vulnerability exceeds what a system can manage.

To address this, authorities responsible for adaptation with support of technical experts should engage in inclusive consultations with communities, Indigenous Peoples, and civil society to define context-specific thresholds that reflect local realities, values, and acceptable risk levels. The development of context-specific normative thresholds defines when levels of risk or vulnerability are deemed tolerable, intolerable or require urgent action. These thresholds should then be formally integrated into climate risk and vulnerability assessment frameworks, guiding prioritization, early warning systems, and trigger-based responses. Documentation of these thresholds should be transparent, regularly reviewed, and aligned with international frameworks to ensure they remain relevant and equitable.

People taking tree shed in scorching heat in Bonn Hofgarten © Asim

Chapter 4.

Adaptive Capacity Assessments (ACA)



4.1 Conceptual Framing

Adaptive Capacity has been defined as, "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences" (IPCC, 2023). Sometimes also referred to as adaptability, adaptive capacity is a central concept that integrates the literatures on vulnerability and resilience. Academicians have also compared or related the concept to other prevailing theories such as organization theory (Engle, 2011) and Sen and Nussbaum's capabilities approach (Andrijevic et al., 2023; Jurjonas et al., 2020).

Since the release of the IPCC 4th Assessment Report in 2007, the scholarship surrounding adaptive capacity has increased exponentially, and the prevailing conceptual understanding of adaptive capacity, rightly so, is the fact that is bridges vulnerability and resilience research fields (Elrick-Barr et al., 2023; Engle, 2011). Adaptive capacity and vulnerability are considered to be inversely proportional, implying that an increase in adaptive capacity will decrease vulnerability. On the other hand, within resilience studies, adaptive capacity is simply understood as the capacity of actors within a system to manage and influence resilience. It facilitates interactions between human and environmental components to either maintain the system's current state or to transform it to a new, more desirable state when the current one is untenable (Datta & Behera, 2022; Engle, 2011; Warrick et al., 2017; Williges et al., 2017). Such an understanding in academia is also reflected in the IPCC AR5 WG II Risk Framework. The IPCC AR5 is the first to consider how vulnerability, which forms a central part of the framework along with hazard and exposure, is in itself determined by sensitivity and adaptive capacity. AR6 WG II builds on the conceptual understanding in AR5 and treats adaptive capacity with more complexity and nuance – aside from considering how adaptive capacity is a determinant of vulnerability, it also looks into how broader social, political, and economic systems influence whether people or communities can adapt to climate change effectively (IPCC WGII, 2023a, 2023b).

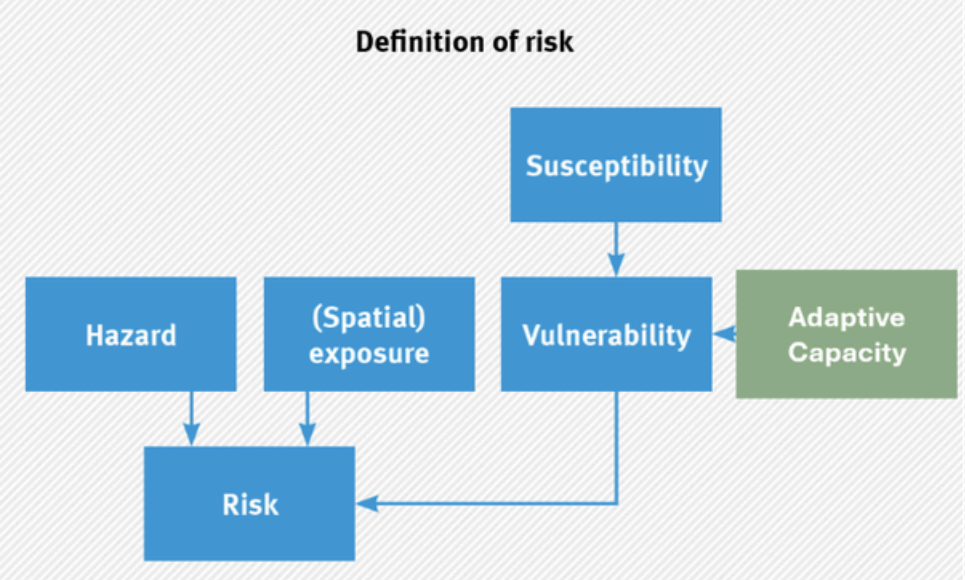


Figure 4 Vulnerability to Risk – a shift in IPCC 2007 to 2014 (Adapted from Buth et al., 2017, p. 42)

According to the IPCC AR6, research 'for adaptation' results in knowledge that can facilitate the planning and implementation of adaptation, of which adaptive capacity building processes are a major part (IPCC WGII, 2023a). This leads to the necessity of adaptive capacity assessments (ACA). Adaptive capacity is considered to be a "universally positive system property" (Engle, 2011) and ACAs have the positive objective and dimension of reducing vulnerability and increasing resilience. The nature of ACA is multifaceted, given the context-specific nature of adaptive capacity and adaptation itself, yet the common overarching goal of all ACA is to identify a system's capacity to minimize vulnerability and increase its resilience in the face of climate shocks and stresses.

Regional assessments can enable data collection and application of information into decision-making and policy (Hogarth & Wójcik, 2016), and create an asset base from which adaptation actions and investments can be carried out, making it a "political necessity" (Juhola & Kruse, 2015).

The evolution and current scenario of ACA are well described by (Elrick-Barr et al., 2023). The initial development of ACAs took the approach of identifying asset deficits and improving existing stocks of capital. Second-generation assessments shifted focus to factors that help mobilising capacities and recognised multiple domains of capacity. However, both the first and second generations failed to sufficiently tackle the issue of scale, and they also overlooked how interactions between individuals and groups can build up or reduce capacity. In response to such a scenario, they call for a third-generation of assessments which bring issues of equity and agency in access and mobilisation to the forefront. However, there is currently no available standardised or generalised toolkit available for ACA at any level of governance, which influences how they are designed and implemented, often leading to several challenges and gaps.

Since vulnerability is influenced by adaptive capacity, it becomes important to distinguish between the more mainstream vulnerability assessments and ACA. The former are designed to identify vulnerable populations and understand the root causes that put places and people at risk, making them more actor-centric and easily translatable into policy outcomes (Hernández-Cruz & Dávila, 2020). ACAs, on the other hand, focus on the attributes and resources available to an entire system to be able to prepare, respond, and recover (Choden et al., 2020). They look into what would build adaptive capacity and/or what the barriers or limitations to adaptation are (Hernández-Cruz & Dávila, 2020). In essence, while vulnerability assessments identify where and why a system is susceptible to harm, ACAs explain how that system can adjust, cope, and transform, and provide pathways for enhancing those abilities to reduce overall vulnerability. This brings to light the unique quality of ACAs being more future-oriented due to its proactiveness in promoting moving beyond reacting to past events to focus instead on planned adaptation towards climate resilience (Juhola & Kruse, 2015; Jurjonas et al., 2020).

Despite understanding the importance of adaptive capacity, it is often overlooked. When using the ideas of vulnerability and resilience in isolation, the practical implications of adaptive capacity fail to be considered to their full potential. Adaptive capacity is a shared, positive feature of a system, and it's strongly influenced by policy, governance, and management. Building up adaptive capacity helps systems deal with various climate challenges and gives them the flexibility to change course if needed. Instead of keeping vulnerability and resilience separate adaptive capacity could offer a bridge in the two concepts and lead to more effective, actionable outcomes (Engle, 2011).

4.2 Challenges in Adaptive Capacity Assessments

Through the review of academic and grey literature, the prevalent gaps and challenges in the way ACAs are designed and implemented became evident. Upon analysis of the coding framework, it was found that the challenges which persist in current ACAs pertain to the structure of the assessments – how the assessments themselves are designed and implemented. Within these challenges, a sub-category of challenges also emerged, which pertain to the issue of limited integration of dimensions of equity. The next sections elaborate on these challenges.

4.2.1. Adaptive Capacity Assessments – General Structural Challenges

Lack of conceptual consensus

One of the most evident challenges that came to light was the reality that despite an agreed-upon definition of adaptive capacity mentioned in the IPCC glossary, there is a stark lack of conceptual understanding and consensus among researchers, particularly in academic literature (Siders, 2019). While many studies reference the IPCC definitions, others apply or build upon alternative frameworks, such as the capabilities approach by Nussbaum and Sen, or the Turner framework emphasizing response, mitigation, and recovery. Adaptive capacity is also described by some as a stock of capital (e.g., financial, human, institutional) that enables adaptation actions, or the performance of urban infrastructures in the face of environmental stress, such as rising temperatures. Some understandings treat it as static, linked to assets like human capital and infrastructure, (Andrijevic et al., 2023; Datta & Behera, 2022; Naji & Gwilliam, 2016; Tinch et al., 2015) while others emphasize its dynamic, socially constructed nature shaped by institutional rules, social norms, and access to technology (Parsons et al., 2018; Warrick et al., 2017). While this can be attributed to the context-specific nature of adaptive capacity and adaptation in general, the differences in understandings were very wide (Whitney et al., 2017).

Despite recurring references to its role in influencing vulnerability, adaptive capacity remains an abstract and often ambiguous concept, dependent on the specific context, scale, and disciplinary lens through which it is examined. This fragmentation raises the question of how one can rigorously assess or build adaptive capacity without first clearly defining it. Moreover, It is worth noting that while grey literature tends to demonstrate a sound conceptual understanding of adaptive capacity, it rarely involves direct implementation of assessments or guidelines on how to design the assessments.

Variation in the methodology and assessment types

There is great variation in the methodology and assessment types for evaluating adaptive capacity, ranging from quantitative index-based models to deeply qualitative, community-centred methods (Siders, 2019; Whitney et al., 2017). A common approach involves indicator-based frameworks, such as the Climate Adaptive Design Index for the Built Environment (CADI-BE) (e.g. Bassolino & Cerreta, 2021), the Sustainable Livelihoods Framework (SLF) (e.g. Choden et al., 2020; Datta & Behera, 2022), and large-scale social and ecological models (e.g. Epule et al., 2023), all of which aim to capture various dimensions of adaptive capacity using aggregated or fuzzy logic systems. However, critiques of these first- and second-generation assessments have emerged, pointing out limitations such as an overreliance on increasing the number of indicators without addressing deeper systemic issues, including institutional coordination and power dynamics (Elrick-Barr et al., 2023).

Fragmentation in Indicators Used

Currently no general framework or toolkit for ACA exists, and so there is a diverse set of various indicators used by researchers and practitioners. This is supported by the literature analysed, wherein it was observed that there is significant fragmentation (and low consensus) regarding the indicators used to assess adaptive capacity, reflecting the concept's high degree of contextual sensitivity. Indicators span multiple domains, from socioeconomic metrics (e.g., GDP per capita, income inequality, poverty rates, educational attainment) (Araya-Muñoz et al., 2016) to institutional dimensions (e.g., governance effectiveness, rule of law), to physical and environmental characteristics like permeable surfaces, building albedo, shading systems, and infrastructure. More advanced frameworks, such as the Shared Socioeconomic Pathways (SSPs) (Andrijevic et al., 2023) and the Rural Coastal Communities (RCCR) model (Jurjonas et al., 2020), operationalize indicators across thematic spectra (e.g., livelihood dependency vs. diversity, or rigidity vs. agency), linking them to community resilience and vulnerability. Despite their widespread use, traditional indicators are increasingly critiqued for their inability to capture dynamic, cross-level interactions, temporal variation, and feedback loops (Mortreux & Barnett, 2017).

While indicators serve important functions in prioritization, coordination, and risk reduction, their utility depends heavily on careful tailoring to purpose, context, and scale, reinforcing that no single universal set of indicators is adequate for all adaptation assessments (Whitney et al., 2017).

Capacity-Action Gap

The diverse methodologies available and the heavy reliance on quantitative indicators compound to a capacity-action gap, despite the efforts that have been made to understand the concept of adaptive capacity. Scholars mention that there is insufficient evidence that an increase in adaptive capacity leads to increased levels of adaptation or effective implementation (Mortreux & Barnett, 2017). This disconnect arguably represents the most pressing obstacle in operationalizing ACA. Comparable insights about the limitations of generic capacity have emerged across both high-income and low-income contexts (Green et al., 2021; Mesfin et al., 2020; Mortreux et al., 2020). For example, a study based on community-level surveys identified a non-linear relationship between generic capacity and adaptation behaviour, drawing parallels to the principle of diminishing marginal utility – whereby individuals with the highest incomes were, in some cases, even less likely to adopt adaptive strategies than those with the lowest incomes (Schubert et al., 2025). In other words, there is often limited actionable outcomes from ACAs (Mortreux & Barnett, 2017).

Lack of Mechanisms for Monitoring, Evaluation and Learning (MEL)

This, along with the lack of a clear definition for what constitutes "successful adaptation" and the absence of a universal framework for evaluating adaptive capacity, complicates efforts to develop systematic assessment methods and impedes scholarly consensus (Adaptation Committee, 2023; Adaptation Committee & LEG, 2023; UNFCCC, 2022). One of the challenges that follows the implementation of any ACA is the fact that they often lack a mechanism for Monitoring, Evaluation and Learning (MEL) which can ensure that the resulting policy is sustainable (Whitney et al., 2017). The indicators currently used in MEL are predominantly output-oriented, such as counting the number of implemented policies or personnel trained. However, these metrics often fail to capture whether such actions truly reduce vulnerability or strengthen resilience, thus making it difficult to determine the real effectiveness of ACAs. In fact, some reports caution that relying on these indicators may even result in unintended negative impacts (Adaptation Committee, 2023; NAP Global Network, 2024). Moreover, the evolving dynamics that influence the strengthening or weakening of collective capacity are frequently overlooked. As a result, interventions derived from these ACAs tend to be top-down, short-lived, and reactive in nature, limiting their overall effectiveness (Elrick-Barr et al., 2023).

Data unavailability and Lack of Coordination Among Stakeholders

All described challenges and gaps are exacerbated by the fact that limitations persist in data availability and coordination among stakeholders. Through analysis of the literature, it was noted that there is a severe lack of data across several key areas, especially insufficient disaggregated data, which hinders holistic planning (NAP Global Network & UNFCCC, 2019). There is also a lack of high-resolution socio-economic and climate data, and inadequate observational and projected climate data coverage (Adaptation Committee, 2020; Adaptation Committee & LEG, 2023). Challenges further stem from poor international coordination affecting the quality and continuity of socio-economic data, low publication and disclosure rates, and a general lack of good quality data (Adaptation Committee, 2020, 2023; Adaptation Committee & LEG, 2023). Additionally, limited documentation of methodologies used by countries hampers transparency and comparability in assessing adaptation needs (UNFCCC, 2022). Sharing and overall coherence is compounded by coordination across governance levels and key actors and stakeholders (Adaptation Committee & LEG, 2023; UNFCCC, 2025).

4.2.2. Adaptive Capacity Assessments – Specific Inequity Challenges

In addition to structural challenges inherent in the design and implementation of ACA, the literature review highlights several gaps related to inequity – specifically, the insufficient consideration of key factors that would

promote justice within ACA processes. As previously noted, the qualitative dimensions of ACA are fundamental to ensuring meaningful inclusivity of key actors and stakeholders. However, ACA practices often overlook one or more of these critical qualitative elements, undermining their potential to foster equitable outcomes.

Lack of Integration of Participatory Approaches

Community resilience which warrants transformational changes requires collective action, due to the fact that individuals rarely act in isolation (Elrick-Barr et al., 2023), especially considering diverse socio-cultural factors which influence community behaviour and perceptions. Taking a top-down approach by not incorporating the perspectives of individuals and communities risks not being able to create a comprehensive understanding of the factors that determine adaptive capacity at local levels (Whitney et al., 2017).

Despite the acknowledgement of its importance, some ACAs fail to holistically apply a participatory approach to their research (~28% of the academic literature analyzed), and most fail to consider it as an integral part of their assessment altogether (~46% of the academic literature analysed). One paper by (Williges et al., 2017), while acknowledging the importance of stakeholder involvement, omits it entirely due to the scale of assessment and the difficulty of facilitating participatory approaches at that level. Such a lack of resources to include participation is also reflected in other assessments (e.g. Larson et al., 2013), wherein they have not omitted the approach entirely, but have instead only included high-level key stakeholders in their study (such as, community leaders), which would still fail to fully capture the voices of diverse local communities and vulnerable populations.

Lack of Consideration of Traditional, Indigenous and Local Knowledge

The IPCC acknowledges that Indigenous Knowledge "is an enabling condition that enhances the feasibility of adaptation options" (Andrijevic et al., 2023). Another study mentions that 'traditional ecological knowledge' is a form of diversity that increases the resilience of human systems (Hogarth & Wójcik, 2016). Additionally, local knowledge which manifests from lived experiences is an essential source of qualitative data which also supports the understanding of adaptive capacity perceptions (Jurjonas et al., 2020). This being said, the integration of local and indigenous knowledge across ACA has been severely limited (UNFCCC, 2025). Of the literature reviewed, only 17% of the academic literature had good consideration of traditional, Indigenous, or local knowledge. This can be attributed to several reasons. Misalignment with mainstream climate science, language barriers that lead to the oversimplification of nuanced knowledge, and a general lack of recognition of the diversity within traditional knowledge systems complicate their inclusion (UNFCCC, 2023). This also brings the discussion back to the challenge of generalizing ACAs: it is essential to incorporate local and indigenous knowledge in a culturally sensitive manner (Adaptation Committee, 2023), something that can only be effectively achieved through highly localized ACAs that actively involve community members.

Lack of Gender Considerations

Integrating gender considerations into adaptive capacity assessments is essential for ensuring equitable and effective adaptation. Gender intersects with other socioeconomic factors to shape vulnerability and adaptive capacity, resulting in differing needs and capabilities across social groups (NAP Global Network & UNFCCC, 2019). Without gender-responsive approaches, adaptation actions risk reinforcing or exacerbating existing inequalities (Adaptation Committee, 2022). Moreover, women often hold valuable knowledge, such as sustainable farming techniques or the use of local plants, that can significantly enhance climate resilience but are still overlooked (UNFCCC, 2023).

Unfortunately, much like integration of diverse knowledge systems and participatory approaches, gender considerations have not yet taken forefront in ACAs; only 18% of the academic literature analysed had holistic or narrow gender considerations, the rest of the literature overlooked it entirely. The considerations have largely been through quantitative dimensions, such as gender ratio or percentage of female population engaged in work (Araya-Muñoz et al., 2016). Often, women have simply been clubbed under the general 'vulnerable groups' without considering how gender informs and shapes vulnerabilities in communities (Choden et al., 2020; NAP Global Network & UNFCCC, 2019). The ACAs which have holistically ensured the inclusion of gender from both

quantitative and qualitative perspectives and through participation of women have come to the common conclusion of how women tend to have lower levels of adaptive capacity across several measures (Yaro et al., 2016), and how men on the other hand have higher ordinal adaptive capacity values (Choden et al., 2020).

Lack of consideration of vulnerable groups

Across the reviewed literature, a general lack of meaningful consideration for vulnerable groups in ACA is evident – only about 40% of the analysed academic literature incorporates vulnerable groups. Many studies acknowledge that constraints to adaptation are deeply intertwined with broader structural issues such as poverty, limited access to education and healthcare, and historical marginalization (Andrijevic et al., 2023; Choden et al., 2020; Datta & Behera, 2022; Jurjonas et al., 2020). Vulnerability was occasionally discussed in terms of specific demographic characteristics, including age (Hogarth & Wójcik, 2016), ability (Hernández-Cruz & Dávila, 2020), and poverty levels (Epule et al., 2023), though these factors were often noted but not systematically included in the assessments. Education, particularly literacy rates and tertiary education, was noted as a determinant of knowledge and thus adaptive capacity, yet considerations like social capital were sometimes excluded for not aligning with sectoral priorities. Children were considered to be an especially vulnerable group, with institutional and knowledge barriers to youth participation, lack of access to education (UNFCCC, 2021) and the lack of "child sensitive" adaptation policies (Adaptation Committee, 2024) emerging as some of the key challenges. While some forward-looking frameworks advocate for third-generation assessments that emphasize equity in access and the mobilisation of capacity, overall, the literature suggests that vulnerability remains an underexplored yet critical dimension of adaptive capacity.

Figure 5 gives an overview of the ACA workstream analysis findings. The challenges have been discussed above, the opportunities and entry points that were identified in ACAs throughout the Literature Review will be further elaborated in the coming chapters.

4.3. Opportunities within Adaptive Capacity Assessments

While several challenges pertain with the structure of the analysed ACAs, the concept of Adaptive Capacity itself offers a distinct lens for Climate Change Adaptation, emphasising future development and people's capabilities (Siders, 2019). In a context where the interconnected and intensifying nature of climate risk is becoming more apparent as climate change progresses, it is imperative that Adaptation research does not only rely on rigid, hazard-specific assessments that provide static snapshots, but concentrates on future action to combat climate risk impacts. Therefore, it is crucial to address current challenges within the assessment structure and work towards a version of ACAs that make use of the conceptual opportunities.

This version of ACAs is **future-oriented, drives actionable outcomes** and **solutions, captures interconnected risks**, and is **coordinated across scales**. The concrete opportunities offered by a revised ACA approach will be discussed in detail below:

Forward-thinking and Future-oriented Assessments

The concept of Adaptive Capacity is inherently forward-thinking as it aims to improve the future climate adaptation of a system (Tinch et al., 2015). Adaptive Capacity Assessments can help to understand the baseline and give a stocktake, however the true strength of the approach lies within its potential to initiate future change (Araya-Muñoz et al., 2016).

When assessing people's capacity, the focus lies on what they are able to achieve in the future. This stands in contrast to emphasising vulnerabilities of climate affected societies, overlooking the potential and agency withing in the assessed groups. A forward thinking and capacity centred approach helps to shift from a reactive

Visualisation of Challenges and Opportunities in Adaptive Capacity Assessments

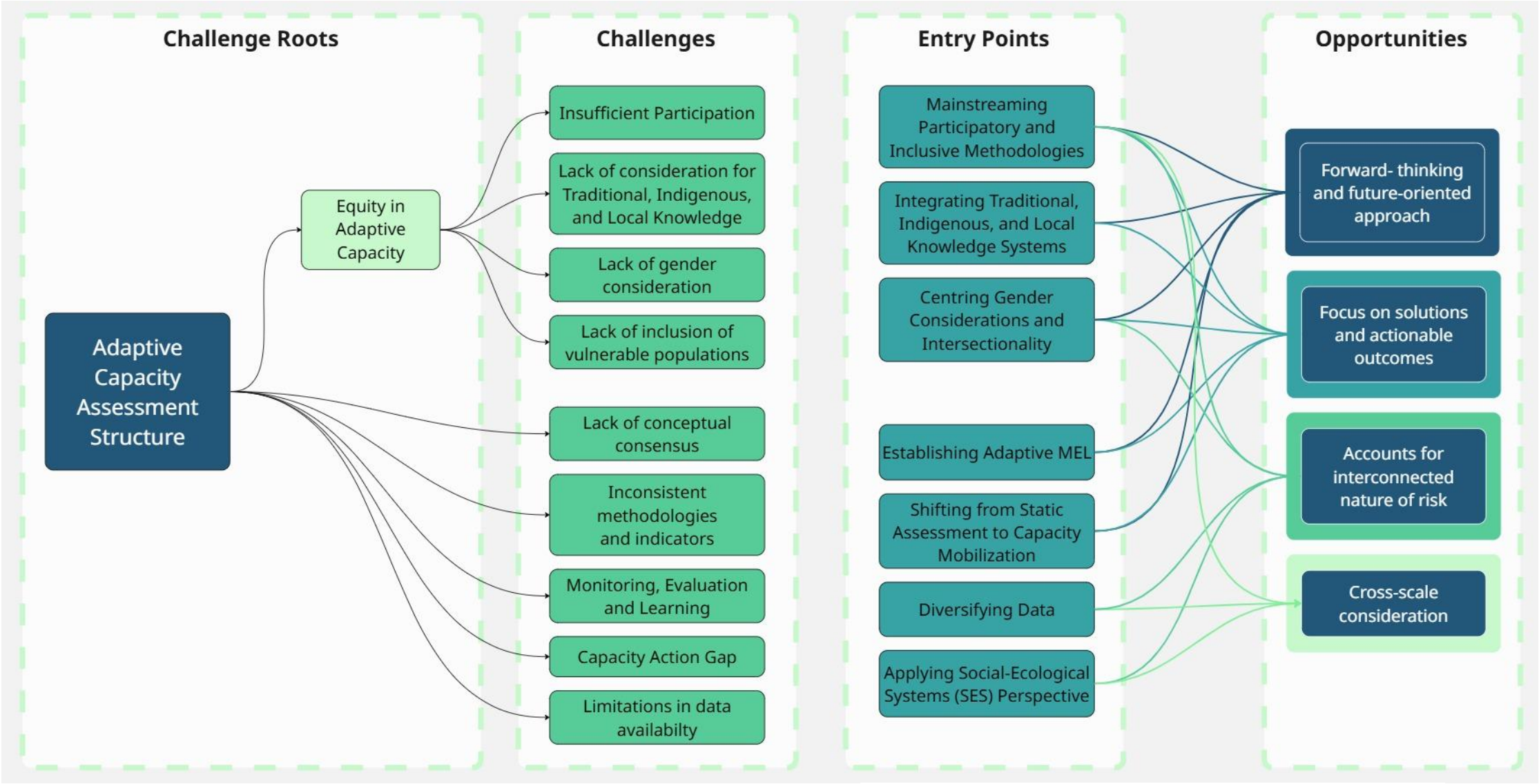


Figure 5 Challenges and Opportunities in ACA (Original Graphic)

adaptation approach to a proactive one, which encourages the creation of flexible future plans for action (Whitney et al., 2017). Engagement with different future scenarios and anticipating changing conditions can reveal possible future vulnerabilities to be addressed through current action.

Generally, the focus of Adaptive Capacity Assessments, if conducted appropriately, is on future action – on how to increase adaptive capacity or how to e it into adaptation action and can therefore help in creating long lasting resilience to climate change impacts (Mortreux & Barnett, 2017).

Focus on Solutions and Actionable Outcomes

A core opportunity presented by conducting Adaptive Capacity Assessments is an emphasis on solutions. Identifying specific areas for intervention and guiding policy development leads towards tangible improvements (Siders, 2019). This is complementary to the forward-thinking nature of the approach. It is not enough to be informed about a current state of Adaptation and capacity for action. Adaptive Capacity Assessments have to be used as a tool to find barriers to adaptation action and develop actions to break those barriers down, such as allocation of resources or policy interventions (Siders, 2019). The ation of capacity into concrete adaptation action is of fundamental importance for sustainable development in the face of climate change (Whitney et al., 2017).

Working together with stakeholders to find practical solutions to adaptation pressures ensures the development of concrete pathways for strengthening adaption responses. Participation in Adaptive Capacity Assessments is a vital method for uncovering and tapping into the underlying mobilising factors that drive effective adaptation (LEG, 2012). By engaging communities, stakeholders, and especially vulnerable groups in the assessment and planning process, their motivations, priorities, and benefits of adapting become clearer (NAP Global Network & UNFCCC, 2019).

With a renewed focus on actionable outcomes, Adaptive Capacity Assessments can be a tool to bridge the Capacity-Action Gap observed.

Addressing Interconnected Nature of Risk

As anthropogenic climate change progresses, the interconnected nature of risk is becoming clearer, leading to the IPCC putting a focus on Interconnected Risk research. Adaptive Capacity Assessments can be a valuable instrument to apply in this research context because it shows how climate risks are linked to socio-economic and biophysical contexts (Whitney et al., 2017).

Adaptive Capacity is a holistic approach that centres the affected system or society instead of a having single-hazard focus (e.g. Choden et al., 2020). This allows for recognition of different manifestations of climate risks across sectors, ecosystems, and social groups. This systemic understanding can account for the complexity of multiple interconnected and cascading hazards and impacts.

Thus, by revealing how capacities, vulnerabilities, and adaptation needs intersect across scales and sectors, Adaptive Capacity Assessments can significantly enhance our ability to map, analyse, and ultimately manage interconnected climate risks.

Cross-Scale and Multi-Level Coordination

Adaptive Capacity varies greatly across different regions and therefore also across spatial scales. While adaptation measures are often enacted at local or household level, adaptation policies are mostly created at national level. Viewing Adaptive Capacity at national or local scales in isolation omits the reality of interactions of scale. Embracing these differences and using complimentary assessment methods can lead to a more holistic understanding of how to mobilise adaptation action (Mortreux & Barnett, 2017). An example for this is the “whole-of-country” approach in the NAP of Kiribati (Infobox 5).

Tailoring assessments to the intended scale by using scale appropriate methodologies and indicators allows for conclusion about the functionality of the overall system (national scale) and its comprising parts (local and

regional scale) in terms of adaptation. Bridging scales and governance levels presents the opportunity to inspire local leadership and coordination of stakeholders, which can result in more effective adaptation action (Vallury et al., 2022; Whitney et al., 2017).

Infobox 5. Kiribati National Adaptation Plan provides the base for implementing ACA and realizing opportunities of the Adaptive Capacity concept

Kiribati's comprehensive approach to climate change adaptation and disaster risk management, as outlined in its National Adaptation Plan (Kiribati Joint Implementation Plan 2019-2028 – KJIP), provides a compelling example of a country well-positioned to leverage the opportunities presented by ACAs.

Forward-Looking and Strategic	➢ KJIP, 2019–2028 takes a long-term, future-oriented approach ➢ Incorporates observed climate trends and future projections, recognizing that adaptation is a continuous process ➢ Plan includes strategies for ongoing monitoring and a follow-up plan post-2028
Action-Focused Planning	➢ Identification of 12 key strategies with detailed actions, outcomes, and indicators ➢ Prioritizes 104 climate adaptation and disaster risk reduction actions and emphasizes mobilizing resources and engaging stakeholders to deliver practical results
Integrated, Multi-Level Coordination	➢ Applies a "whole-of-country" approach in the KJIP ➢ Strengthening connections between national, sectoral, and island-level plans ➢ Decentralizing adaptation planning to support island councils, and builds community-level capacity through partnerships, local committees, and inclusive engagement

The KJIP reflects a comprehensive and actionable framework for adaptation. Its integrated, future-focused, and participatory approaches positions it as a country with the potential of realising the opportunities of adaptive capacity to reduce vulnerabilities and strengthen resilience. Adaptive Capacity Assessments could work complementary with the NAP.

4.4. Entry Points for Adaptive Capacity Assessments

Supported by the Literature Analysis, **seven entry points** have been formulated to address the challenges outlined in chapter 4.3 and to establish pathways to realise the full potential of ACAs and the opportunities the concept holds. These entry points have been formulated with special consideration of the cross-cutting considerations highlighted in the UAE framework (UNFCCC, 2024).

Mainstreaming Participatory and Inclusive Methodologies

Making participatory methods a common practice in ACAs serves as a crucial entry point, as they offer a multifaceted understanding of a system's ability to adjust to change. Moving beyond traditional top-down, indicator-based methods to directly engage diverse stakeholders enhances the relevance, effectiveness, and sustainability of following adaptation, especially at the local or household level, where most adaptation action occurs (Vallury et al., 2022; Yaro et al., 2016).

A key strength of participatory approaches is their ability to capture diverse perspectives, crucial given the variability of adaptive capacity across contexts and identities (Whitney et al., 2017). Assessments must move beyond only considering high-level stakeholders to including marginalized groups, considering gender, age, ability, hierarchy, and wealth. Qualitative and mixed-method approaches—such as ethnographic studies, community-based vulnerability assessments (e.g., CBVA, LAC), social network analysis, stakeholder workshops, thematic analysis (e.g., RCCR), and participatory planning – prioritize local knowledge, governance dynamics, and social interactions (Warrick et al., 2017). These approaches reflect the growing recognition that no universal approach fits all; instead, ACAs must be context-specific, reflecting the complex and dynamic nature of adaptation processes (Whitney et al., 2017).

Inclusive processes enhance community ownership of adaptation plans, aligning actions with local needs and priorities, and fostering trust and long-term engagement (Griffith University, 2020). These steps are vital to closing the capacity–action gap (Schubert et al., 2025). Participatory methods go beyond asset-based models by focusing on how people organize, make decisions, and respond to change. This perspective brings to light dynamic elements of adaptive capacity, such as social networks, governance structures, and institutional flexibility, which are often overlooked in traditional asset-based assessments (Vallury et al., 2022). Actively involving local stakeholders throughout assessment, planning, and implementation builds partnerships and shifts the focus from extracting knowledge to co-producing it (NAP Taskforce, 2024).

The analysis of the academic literature shows that participatory approaches most effectively representing communities are those that integrate local and traditional knowledge and centre gender considerations, this is examined in more detail below.

Integrating Traditional, Indigenous and Local Knowledge

The introduction of diverse knowledge systems into the assessment process enriches adaptation understanding by providing context-specific insights and fosters trust within the communities being assessed. Therefore, methodologies can be shaped in ways that resonate with local values, while also inspiring sustainable adaptation strategies. Local knowledge often complements scientific data, filling crucial gaps where empirical information may be lacking or too generalized (NAP Taskforce, 2024; Yaro et al., 2016).

Embracing and integrating diverse knowledge systems that differ from mainstream climate science not only strengthens the relevance and robustness of assessments but also empowers Indigenous and local peoples, recognizing their agency and expertise (Parsons et al., 2018; Warrick et al., 2017; Yaro et al., 2016). This empowerment is fundamental for building long-term resilience, as it grounds adaptation efforts in local realities and nurtures enduring partnerships (NAP Taskforce, 2024).

Centring Gender Considerations and Intersectionality

Recognizing gender dynamics throughout the ACA process is critical for comprehensive assessments and equitable and effective adaptation. Gender, intersecting with factors like age, ethnicity, and ability, profoundly shapes individuals' vulnerability and exposure to climate risks, their adaptive capacities, and their specific needs (NAP Global Network & UNFCCC, 2019).

To ensure inclusive strategies, it is vital to analyse how climate impacts affect different groups, ensure equitable gender representation in participatory processes and disaggregated indicator led assessments (Yaro et al., 2016). It is also necessary to ensure equitable benefits from adaptation action such as investments. Equitable access to resources, services, and technologies—guided by gender analysis—helps prevent adaptation efforts from reinforcing existing inequalities (NAP Global Network & UNFCCC, 2019).

Valuing gender perspectives provides critical insights for adaptation. Women and marginalized groups possess undervalued knowledge and experiences vital for adaptation efforts, in areas like food security, water, and land use. Recognizing women as agents of change, and promoting their leadership in adaptation planning and governance, strengthens both climate resilience and social equity (NAP Global Network & UNFCCC, 2019).

Shifting from Static Assessment to Capacity Mobilisation

Mobilising adaptive capacity into adaptation action is vital to close the capacity-action gap. Strictly asset and capital focused assessments, have proven to be ineffective in inspiring actionable outcomes and concrete action (Elrick-Barr et al., 2023; Mortreux & Barnett, 2017). Possessing resources or capacity does not automatically translate into adaptation action (Schubert et al., 2025). The efficiency of adaptation measures is closely linked to individual motivation, which influenced by community structure and values (Mortreux & Barnett, 2017).

Motivation can be assessed through psycho-social factors such as risk attitudes, personal experience, trust in authorities, place attachment, competing concerns, and household composition and dynamics (Mortreux & Barnett, 2017). A dynamic and nuanced understanding of how capacities are activated or constrained, leads to more accurate and policy-relevant assessments. Promoting self-efficacy in adaptation was found to be the most relevant entry point to strengthen adaptation action by Schubert et al. (2025) and van Valkengoed & Steg (2019).

Ultimately, placing communities and individuals at the centre – as agents of change – and focusing on how to translate capacity into action must be the core aim of Adaptive Capacity Assessments. This ensures they do not merely catalogue existing conditions but actively support the development of pathways toward tangible, locally driven adaptation. Choden et al. (2020) demonstrate this by engaging with communities and providing actionable recommendations to directly enhance the adaptive capacity of marginalized households (Infobox 6).

Diversifying Data

Diversifying data enables a more nuanced and actionable understanding of adaptation dynamics, which is needed to fully access the previously discussed entry points. Current ACAs mainly use asset approaches or aggregated household data, which omits a lot of the complexity of Adaptive Capacity (Whitney et al., 2017). Disaggregating data – by gender, age, income, ethnicity, disability, or location – reveals how climate impacts differ across social groups and within communities (Adaptation Committee, 2020). It highlights that adaptive capacity varies significantly within communities, this is currently widely discussed in the field of adaptation research and was demanded by several organizations and experts during the SBs (Info box 1).

Using cross-scale indicators, such as coordination of state- and community-level evacuation plans and integration of locally organized groups into regional- and national-level agencies) as suggested by Vallury et al. (2022) offer a pathway beyond household-level aggregation. Understanding these multilevel interactions helps explain how capacity is enabled or constrained and links local needs with broader governance and resources.

Improved coordination among stakeholders is vital for inclusive data-sharing and the development of accessible platforms. Open resources like the State of Adaptation Action (SOA) Platform (Info box 4), the Adaptation Knowledge Portal (UNFCCC) and DesInventar (UNDRR) support more informed and equitable decision-making.

Applying a Social-Ecological Systems (SES) Perspective

Accounting for SES within the assessment process underscores the deep interdependence between human and ecological systems. Recognizing this interconnectedness is essential in identifying climate drivers and feedbacks more comprehensively. The holistic nature of the Adaptive Capacity concept provides a valuable entry point to revisit and strengthen the consideration of ecosystems in adaptation within a broader, interconnected climate risk framework (Whitney et al., 2017).

Reinvigorating the emphasis on ecological systems also creates opportunities to integrate Ecosystem-based Adaptation (EbA) measures. These approaches not only offer sustainability advantages but can match or exceed the effectiveness of conventional adaptation measures, all while delivering additional co-benefits for both communities and ecosystems (Renaud et al., 2013).

Establishing Adaptive Monitoring, Evaluation, and Learning (MEL)

MEL is a crucial, though often overlooked, step in Adaptive Capacity Assessments that moves beyond static assessment to capacity mobilisation (Adaptation Committee, 2023). Continuous assessment, adaptation, and adjustment of approaches allow for accountability and transparency of the methods and ensures the long-term sustainability of ACA projects (Griffith University, 2020). This facilitates iterative learning and provides feedback on what truly mobilises adaptive capacity (Whitney et al., 2017).

Infobox 6. An approach for assessing adaptive capacity to climate change in resource dependent communities in the Nikachu watershed, Bhutan

Choden, K., Keenan, R. J., & Nitschke, C. R., 2020

This case study assesses adaptive capacity to climate change in resource-dependent communities within the Nikachu watershed in central Bhutan. The assessment utilized a **mixed-method approach**, integrating econometric data, social survey information, and landscape ecology measures to derive new indicators for adaptive capacity at both household and village levels. Crucially, **participatory methodologies**, including household questionnaire surveys, focus group discussions, and participant observations, were employed to gather socio-economic data and inform spatial analyses, thereby providing insights into local-level adaptive capacity.

Integrated Methodology	➢ Combines econometric data, social surveys, and landscape ecology indicators ➢ Incorporates **participatory methods** such as household surveys, focus group discussions, and participant observation
Context-Specificity	➢ Conducted at both household and village levels in the Nikachu watershed, Bhutan ➢ Highlights local variations in vulnerability and adaptive capacity within an agro-ecological system
Generation of Actionable Insights	➢ Identifies factors enhancing adaptive capacity (e.g., access to community forests, income diversification) ➢ Offers clear recommendations, including vocational training and support for off-farm income opportunities

4.5. Recommendations for Adaptive Capacity Assessment Research

Two central ways of action have emerged during the creation of this report to further the research on ACAs:

Expert Workshops

While the Literature Review conducted for this report has revealed many challenges and opportunities within ACAs, many practical reasons for current assessment structures are likely not disclosed in the literature. Supplementing this literature review by conducting Expert Workshops allow for exchange between researchers, practitioners, and policymakers. Through this exchange, the entry points can be further refined and supplemented with concrete assessment design propositions. This can open new pathways for research to refine ACAs and more fully harnessing the conceptual strengths of adaptive capacity.

Creation of an ACA Toolkit

Adaptive Capacity is a holistic concept that can be applied to many different settings, sectors, spatial scales, and governance levels. Applications range from assessing the general Adaptive Capacity on an international level towards assessing the Adaptive Capacity of the agriculture sector on a community scale level. The wide range of applications and the mostly local scale of adaptation action makes it unrealistic and undesirable to develop a universal assessment which could not represent the nuances that come with each application and omit the scale dependency of adaptive capacity.

As per decision 11/CMA.1, para. 15, the AC's mandate is the creation of methodologies for assessing adaptation needs. Instead of the development of a universal ACA, we recommend that the AC create a toolkit, compromised of different ACA approaches.

This toolkit's aim would be to recommend methods with appropriate indicators and data types to practitioners, based the specific context and scale of the research. This simplifies the ACA process, allows consideration of the locality of adaptation and simplifies the mobilisation of Adaptive Capacity.

Whitney et al. (2017) have created an overview of different ACA approaches in academic literature, sorted by assessment type. Creating a toolkit, that is instead sorted by geographical scale or governance level, divided into different thematic sectors could be a valuable resource for researchers and practitioners. The divide of most appropriate methods into scale/ level will enable identification of the most effective mix of methods for specific research contexts. Testing and adapting this toolkit over time with practitioners and stakeholders can foster iterative learning in ACA research.

After the creation of the toolkit, we recommend the facilitation of ACA trainings, taking the form of webinars or open-source online courses, to increase the accessibility to the assessment. These trainings will be complimentary to the toolkit and explain its correct use, aiding in the selection of appropriate methodology. Making these workshops freely available on the Adaptation Knowledge Portal, or online learning websites such as UN CC:e-Learn, UNITAR or Coursera also opens up opportunities for community stakeholders to conduct adaptive capacity assessments and facilitates local adaptation activity.

5. Conclusion

This report offers recommendations to strengthen Impact, Vulnerability, and Risk Assessments (IVRA) and Adaptive Capacity Assessments (ACA) by examining gaps and needs in IVRA and challenges and opportunities in ACA through a semi-systematic literature review of academic and grey literature. The analysis highlights that while both assessment types are critical for supporting climate resilience and risk-informed decision-making, they each face persistent conceptual, methodological, and operational shortcomings that undermine their effectiveness.

As part of this work, the IVRA analysis focused on identifying and analysing the most pressing gaps and needs in current impact, vulnerability, and risk assessment practices. Through the analysis of academic and grey literature, data, conceptual, institutional, and inclusivity-related shortcomings were identified that affect the assessment processes altogether. The findings displayed recurring gaps, especially regarding data quality and resolution, inconsistencies in conceptual definitions, and limited integration of local knowledge and participatory approaches. These insights were translated into a set of targeted recommendations aimed at improving assessment design, stakeholder alignment, and policy relevance. Combined, these efforts contribute to a deeper understanding of how IVRA assessments can be strengthened in their planning and implementation processes, particularly when designed for replication across multiple scales.

For ACA, the analysis revealed structural challenges – including lack of conceptual consensus, methodological fragmentation, and a pronounced capacity-action gap – as well as equity-related gaps, such as insufficient integration of participatory approaches, traditional, Indigenous and local knowledge, gender considerations, and the needs of vulnerable groups. At the same time, ACA offers substantial opportunities: fostering forward-looking, solution-oriented assessments, addressing the interconnected nature of risks, and promoting cross-scale and multi-level coordination. Entry points for enhancing ACA include mainstreaming participatory and inclusive methodologies, integrating diverse knowledge systems, centring gender and intersectional considerations, diversifying data, applying social-ecological systems perspectives, and establishing adaptive Monitoring, Evaluation, and Learning (MEL) systems. Concrete next steps for ACA research identified involve the facilitation of expert workshops and the creation of an ACA toolkit to support more systematic and context-sensitive applications.

A tabular overview of the literature analysis, entry points and recommendations for both IVRA and ACA can be found in Appendix C.

Ultimately, addressing the identified gaps and capitalizing on opportunities will require coordinated efforts across research, practice, and policy domains. The mapping of IVRA and ACA methodologies created for this report (Appendix D) supports this coordination and gives a brief overview of the current research field. By advancing methodological coherence, promoting inclusivity, and aligning more closely with real-world decision-making processes, both IVRA and ACA can better inform adaptation strategies - and, in doing so, contribute to the development of more resilient, equitable, and adaptive systems in the face of current and future climate risks.

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Appendix

Appendix A: Glossary

Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Adaptive Capacity	The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences
Impacts	The consequences of realized risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather/climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial.

Loss and Damage and losses and damages	Research has taken Loss and Damage (capitalised letters) to refer to political debate under the United Nations Framework Convention on Climate Change (UNFCCC) following the establishment of the Warsaw International Mechanism for Loss and Damage in 2013, which is to 'address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.' Lowercase letters (losses and damages) havebeen taken to refer broadly to harm from (observed) impacts and (projected) risks and can be economic or non-economic.
Resilience	The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation .
Risk	The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and well-being, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species. In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence, and each may change over time and space due to socio-economic changes and human decision-making.

	In the context of climate change responses, risks result from the potential for such responses not achieving the intended objective(s), or from potential trade-offs with, or negative side-effects on, other societal objectives, such as the Sustainable Development Goals (SDGs). Risks can arise, for example, from uncertainty in implementation, effectiveness or outcomes of climate policy, climate-related investments, technology development or adoption, and system transitions.
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm.

Appendix B: Coding Framework

IVRA Code	ACA Code
Title	Title
DOI	Author(s) / Institution / Organization
Author(s) / Institution / Organization	Year of Publication
Year of Publication	Type of document
Type of document	Intended Audience
Journal Regional focus	Regional focus/ Scale
Hazard	Sectoral focus (UAE Framework)
Sectoral focus (UAE Framework)	Thematic focus (UAE Framework Iterative Cycle)
Conceptual gaps	Adaptive Capacity Understanding
Methodological gaps	Assessment type
Data gaps	Indicators used
Institutional/operational gaps	Participatory / community-based approach
Policy integration gaps	Traditional, Indigenous, and Local Knowledge
Inclusivity gaps	Gender Considerations
Gaps in guidance/training	Vulnerable Groups (Youths/ Children, Disabled People)
Interconnected Risk	Interconnected Risk
Digital/Tool Access Barrier	Mobilisation of Adaptive Capacity/ Actionable Outcome
Recommendations/Needs	Policy integration
	Socio-ecological systems
	Gaps

Appendix C: Overview of the Literature Analysis Findings

Impact, Vulnerability, and Risk Assessment (IVRA)	
Gaps pertaining to	Data Availability
	Concepts
	Institutional/Operational and Policy Integration
	Inclusivity
Needs	Comprehensive data and monitoring
	Advancing Conceptual Clarity and Risk-Sensitive Approaches
	Methodological Improvements and Advanced Modelling Approaches
	Policy and Decision-Making Support
	Local Participation and Knowledge Integration
Entry Points pertaining to	Strengthening Data and Monitoring Frameworks
	Enhancing Conceptual and Methodological Coherence
	Prioritizing Local Participation and Knowledge Integration
	Alignment with Policy and Decision-Making Cycles
Recommendations	Development of regional training modules and technical guidance
	Establish stakeholder-informed normative thresholds

Adaptive Capacity Assessments		
Challenges	General Challenges	Conceptual consensus
		Variation in methodology and assessment types
		Fragmentation of indicators
		Capacity-action gap
		Lack of MEL mechanisms
	Inequity	Lack of Integration of Participatory Approaches
		Lack of Consideration of TILK
		Lack of Gender Considerations
		Lack of consideration of vulnerable groups
Opportunities		Forward-thinking and future-oriented assessments
		Focus on solutions and actionable outcomes
		Addressing interconnected nature of risk
		Cross-scale and multi-level organization
Entry points pertaining to		Inclusive methodologies
		Traditional, indigenous and local knowledge
		Gender
		Diversifying data
		SES
		MEL
		Capacity Mobilization
Recommendations		Focus Group Workshops
		Creation of an ACA Toolkit

Appendix D:
Mapping of Existing Technical Guidance Materials and Assessments

The Technical Guidance Materials and Assessments reviewed through the Literature Analysis are mapped in a Google Sheets file, with one sheet mapping the IVRA and ACA methodologies respectively.

The Google Sheet can be found here:
https://docs.google.com/spreadsheets/d/1l17wPAnTS91yuJw4DvUnlHzYdjo_wigO4HjcEJyXZGc/edit?usp=sharing