



Post-Paris agreement global adaptation assessment framework: towards the global stockage

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**POST-PARIS AGREEMENT GLOBAL ADAPTATION ASSESSMENT FRAMEWORK:
TOWARDS THE GLOBAL STOCKTAKE**

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LIST OF ABBREVIATIONS

PA	Paris Agreement
CBDR-RC	Common But Differentiated Responsibilities and Respective Capabilities
UNEP	United Nations Environment Programme
IPCC	Intergovernmental Panel on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change
MRE	Monitoring, Reporting & Evaluation
TAMD	Tracking adaptation and measuring development
CCA	Climate change adaption
GST	Global stocktake

GLOSSARY

Evaluation	Systematic and objective assessment of an ongoing or completed project or policy
Indicators	Quantitative or Qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor
Metrics	Is a system of measurement that includes the item being measured, the unit of measurement, and the value of the unit
Monitoring	Is an activity that uses systematic collection of data on specified indicators with the aim of tracking change
Baseline	State against which change is measured. It might be a current baseline, in which case it represents observable, present-day conditions. It might also be a ‘future baseline’, which is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines
Adaptive capacity	Combination of strengths, attributes, and resources available to an individual or community that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities
Vulnerability	Here understood as the propensity or predisposition to be adversely affected by climate impacts.

ABSTRACT

The focus of this research is in assessing adaptation to climate change in a post-Paris Agreement scenario. Such a study is important to allow a progress assessment to be made through the Global Stocktake and this will galvanise further momentum to allow continued pursuit of the PA and its long-term goals. The research approach adopted in this proposal includes extensive literature review of existing adaptation efforts, the assessment frameworks available and identifying the potential applicability to the Global Stocktake to be undertaken. The findings from this research indicate that the conceptual framework proposed by Berrang-Ford et al (2019) meets most of the criteria discussed in literature which enable a GST to take place. Further research needs to be carried out to operationalize this conceptual framework.

Keywords: Adaptation assessment, Adaptation efforts, Frameworks, Global Stocktake, Paris Agreement

CHAPTER 1: INTRODUCTION

1.1 Background information highlighting the value of research

Climate change is real. Climate Change is a fact. Working Group I (WGI) of the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report confirms with high confidence that human influence has warmed the atmosphere, ocean, land and that widespread, rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred (Masson-Delmotte et al. 2021). We cannot be any more certain than this, humans are indisputably warming the planet. Report says with 99 to 100% confidence that hot extremes (including heatwaves) have become more frequent and more intense across most land regions since the 1950s and global surface temperature will continue to increase until at least the mid-century under all emissions scenarios considered (Masson-Delmotte et al. 2021). This can be attributed to the thermal inertia of oceans and the long atmospheric lifetime of carbon dioxide and other greenhouse gases (Matthews and Caldeira (2008) as cited in (Eriksen et al. 2011)). These reports further strengthen the case for undertaking climate adaptation initiatives as we are already locked into a certain degree of warming till mid-century.

Even though the risk of climate change is uniform, the impacts faced is highly variable in different parts of the world. Natural drivers and internal variability will modulate human-caused changes, especially at regional scales and in the near term of within the year 2040 (Masson-Delmotte et al. 2021). These modulations need to be considered and acted upon by the respective governments of the world in a manner which protects their populations from facing the worst brunt of the unavoidable consequences of this human-induced warming. As a consequence, adaptation to climate change is considered a necessary measure by many governments across the world (Runhaar et al. 2018). In this context, the salience of the Paris Agreement in playing a facilitating role towards this global goal is recognised. The Paris

Agreement (PA) highlighted the importance of taking climate change adaptation into account in reaching sustainable development as carbon emission reduction alone is not sufficient.

The PA is the latest and legally binding International Climate Agreement. Once required number of countries ratified by providing their written consent, it entered into force in November 2016 and was officially adopted as the Global Climate Action agenda. It is often hailed as an innovation as it deviates from the usual internationally agreed and legally binding obligations and instead, simply requires Parties to make regular, voluntary promises of action replacing punitive action with peer pressure (Milkoreit and Haapala 2019). To this date, 189 countries have formally endorsed the PA. The overarching long-term goal of the PA is to hold the increase in global average temperature increase to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C (Olhoff et al. 2017b) which can be categorised under Mitigation action (Article 2 of the PA). In addition, the PA sets out two other objectives which mandate global action on adaptation efforts (Article 7 of the PA) and financial flows (Article 9 of the PA) to enable the achievement of the long-term goal. According to Article 7 of the PA, which is a legally binding document, the global goal on adaptation is ‘enhancing adaptive capacity, strengthening resilience and reducing vulnerability’ (“Adoption of the Paris Agreement” 2015).

The achievement of the above-mentioned objectives will be facilitated by some key aspects embedded within the PA which include clauses on increased Transparency (Article 13) to allow an effective evaluation of the nations’ progress towards the goals, Capacity Building (Article 11) of developing nations to take climate change action and increased emphasis on Technology development and its transfer (Article 10) (“Adoption of the Paris Agreement” 2015). Among these, an article which measures progress and promotes increased level of action that is often lauded as the global governance innovation is the Global Stocktake (GST), mandated in Article 14 of the PA. Although the PA does not include any

punitive measures for non-action, it intends to achieve its objectives through the five-yearly, consistent review mechanism conducted by the GST.

GST is a stocktaking exercise that occurs every five years, the first GST is scheduled for 2023, and is meant to assess the collective progress of the world towards the collectively agreed objectives of the PA. GST is a hybrid review mechanism for effectiveness and ambition ratcheting instrument (Milkoreit and Haapala 2019). It is an iterative process which is expected to close the gap between short-term climate action and its long-term targets by enabling the nations to re-affirm their commitments through increasingly more ambitious actions. There remains the normative assumption that the nations are willing and able to ratchet up their ambitions regularly and be able to achieve them. Moreover, GST is meant to deliver four adaptation-related objectives. They are: (1) recognition of adaptation efforts of developing country parties, (2) review of the adequacy (2.1), effectiveness (2.2) and support (2.3) provided for adaptation action, (3) enhancing the implementation of adaptation action, and (4) review overall progress towards the global goal on adaptation (“Adoption of the Paris Agreement” 2015).

Despite the importance given to the GST, the corresponding academic literature is rather limited (Hermwille et al. 2019). Although more academic literature is being undertaken by the research community on GST, those which are specifically focused on assessment method of adaptation efforts is still a largely ongoing process. In addition, articles which focus on specific elements which will enable a GST process to be undertaken is limited.

It is generally accepted that the global goal on adaptation is broad and multi-faceted which reflects the inherently varied nature of climate change adaptation efforts across the world (Olhoff et al. 2017b). The immense differences are also a function of the national circumstances, preferences, and capabilities to which the PA pays attention to. Considering the given constraints, UN Adaptation Report 2017 (Olhoff et al. 2017a) notes the following

about adaptation assessment method:

‘No technical work has been mandated to be undertaken by any subsidiary and constituted body in support of reviewing the overall progress made in achieving the global goal on adaptation. Therefore, the details of the global goal on adaptation and how to measure progress against it remain an open question.’

Hence, the development of a global assessment framework that can allow aggregated comparison across time and countries is an urgent requirement to conduct an effective GST and fulfil the PA’s goals is nothing short of an ambitious undertaking.

This research intends to contribute to this ongoing, ambitious task. Although the research does not intend to present a global assessment framework, it aims to isolate elements which can enable the GST process and compare any available frameworks against it for a quick check on its ability to contend against predicted pitfalls of global assessment. It will be of interest to the global community involved in the Global Stocktake, national leaders involved in adaptation planning and assessment, and academics involved in the independent GST. They can utilise the recommendations to facilitate a better assessment of adaptation efforts. This is an important step towards realising the goals set out in the PA.

In the first decade of the 21st century, extreme climatic events, and their impact on nations, including developed nations, has catapulted the concept of adaptation to climate change onto a new level of public awareness and consciousness. The scientific enquiry which followed examined the developed nations’ adaptive capacity, and the persistent ‘adaptation deficit’ in developing nations has led to focused research on barriers and limits to adaptation (Moser and Ekstrom 2010).

Such enquiry and research is critical as emerging literature on adaptation suggests that approaches that have been applied ‘traditionally’ thus far are not necessarily salient to today’s adaptation challenges (Hinkel and Bisaro 2021). If institutional barriers prevent adaptation action rather than lack of knowledge on future climate impacts, then why undertake impact

assessment? (Hinkel and Bisaro 2021). Hence, this research recognises the importance of focusing on salient issues such as barriers to implementation of adaptation actions.

Despite the much-needed focus on such salient issues with respect to adaptation, this research continues to argue for the need to focus on elements facilitating a GST. Given the global nature of the problem, continued efforts and greater financial support are required to tackle this multi-faceted issue. To gain this, the issue needs to be at the forefront of public discourse in a sustained manner. Given this context, a global stock-taking mechanism which occurs every five years in a high-level political fashion, with data from all around the world being reviewed by subject experts and presented in an easy to digest manner to the public is highly invaluable and arguably beneficial to facilitate the entire process to ultimately, achieve the global goal on adaptation. Moreover, this consistent review of the progress will allow nations to set more ambitious targets at the outset of each review to enable the world to reach this global goal in a timely fashion.

1.2 Aim and Objectives

The overall aim is to isolate elements which can enable the GST process and compare any available frameworks against it for a quick check on its ability to contend against predicted or well-established pitfalls of global assessment. The specific objectives are as follows:

- 1) Outline a definition of Adaptation
- 2) Assessing adaptation and the challenges involved
- 3) Outline elements enabling a GST to take place
- 4) Analyse assessment frameworks against elements isolated in (3)

1.3 Research methodology

The research methodology of this study includes literature review combined with a qualitative analysis of the findings. The in-depth literature review will be based on several sources from academic journals, reports from developmental support agencies (IPCC, Global Commission on Adaptation and the NAP Global Network) and grey literature (Berrang-Ford et al. 2019), (Kato and Ellis 2016)). The extended literature review is necessary to clarify some conceptual ambiguity which plagues the topic of adaptation efforts worldwide and to identify if there are any available adaptation assessment frameworks at national and regional scales which could be useful to inform the GST.

The extended literature review must also assess the potential sources of information to gauge how these frameworks could be informed and operationalised. With respect to the GST, nationally determined contributions, national adaptation plans, adaptation communications, and national communications serve as key sources of information. In addition, information from other sources such as those provided by nations for the Sustainable Development Goals and Sendai Framework for Disaster Risk Reduction could be used as well (Huang 2018). Hence, a deeper study of the potential sources is necessary.

Moreover, this literature review allows for the isolation of elements which enables a GST to take place. Other diagnostic frameworks (such as those developed by World Bank) may also be included to help isolate factors which can be used to gauge its applicability to the GST while avoiding some pitfalls associated with effectiveness assessment.

The limitations of the research method are related to the inherent limitations of the sole use of literature review as research method. However, given the governance innovation and the distinctive characteristics of the Global Stocktake and the highly technical nature of this research, literature review is chosen as the most appropriate research method.

The ongoing pandemic made scheduling of interviews with experts highly challenging and hence the research method could not be diversified feasibly. In addition, the firm in which the internship was carried was undergoing some transformational changes during the time of my appointment there. The firm was operating at a reduced capacity and hence dedicated time could not be allocated for my thesis interviews. Therefore, a more diversified research method with multiple layers of analysis and sources of information could not be delivered. However, due to the chosen framework for evaluation, this method is deemed as the appropriate one to answer the research aims and objectives.

A key strength of this research methodology is that all the sources referred to in this research are all either peer-reviewed articles published in reputable academic journals or grey literature which are published on the websites of scientific organisations or news agencies which have their own system of fact-checking prior to publications. Hence, the statements made in this research are evidently based on research that is peer-reviewed or fact checked. Therefore, the reliability and credibility of the statements made, and conclusions reached can be considered as relatively high. Moreover, the articles utilised are mostly from the past 5 years and hence the data is latest available in the adaptation field, which as a field, has gained more attention in the past two decades. Hence, the use of latest available arguments is yet another strength of this research work.

Moreover, this research dedicates much of the thesis to discuss the complex concepts that are involved in this topic of adaptation to climate change. The conceptual ambiguity surrounding this concept and other related concepts are a huge barrier to having a better understanding and hence the ability to make more holistic decisions, especially with respect to assessing the effectiveness of the adaptation efforts. Hence, this exercise of trying to establish a more nuanced understanding of the concepts is valuable to the reader in gaining a good foundation to be able to appreciate the later parts of the thesis. Therefore, this thesis is also a

reader friendly document for those new to the topic.

In conclusion, the methodology used, the structuring of the different sections and dedicated space given to better conceptual clarity and the largely peer-reviewed and fact-checked sources used are key strengths of this thesis.

1.4 Plan of the thesis

Given that the chosen research method is literature review, the entire thesis is very simply organized into three main chapters. Chapter 1 will introduce the topic at hand and provide justifications to highlight the value of the research topic and the need for this research. Moreover, section 1.2 will detail the main aim and specific objectives of this research while 1.3 details the methodology of the research and lastly, section 1.4 details the plan of the thesis.

Chapter 2 will detail the main analysis and findings of the research organized categorically into different sections. Section 2.1 outlines the definition of adaptation which explores the biggest conceptual ambiguity of the thesis. Section 2.2 will go deeper into the assessment of adaptation and the challenges involved in this process.

Section 2.3 will outline the elements which enables a GST to take place and will also explore the various approaches available for adaptation assessment at a supra-national level thus far. And lastly section 2.4 details the assessment framework while comparing it against the elements isolated in section 2.3 to gain some insights on how GST can be enabled through this identified framework. This check allows this research to add value and contribute to the process of the Global stocktake.

Chapter 3 is the conclusion for this thesis and summarise how the research findings contribute towards meeting the aims and objectives of the thesis in a meaningful manner

CHAPTER 2: FINDINGS AND ANALYSIS

2.1 Outline a definition of Adaptation

As we discuss adaptation to climate change in this chapter, it is good to revisit what we mean by it. While weather is what conditions of the atmosphere are over a short period of time, climate is the description of the long-term pattern of atmosphere (NASA, 2016). Thus, climate is the average pattern of weather for a particular region that includes averages of precipitation, temperature, humidity, sunshine, wind velocity, fog and so on. Climate has some inherent variability and extremes of climatic conditions. Climate change is state of the climate that can be identified by changes in the mean or variability of its properties that persists for an extended period (NASA, 2014). Hence, climate change can be caused by inherent climate variability or human activity.

Smit and Pilifosova (2003) claim that adaptation to climate change encompasses not only changes of averages but also climate variability and extremes of climatic conditions. This is important because the systems are adapted to the variability and climate extremes and it is within a system's coping range to adapt to the long-term climate pattern (Smit and Pilifosova 2003). However, the situation only turns problematic when the extreme events change their long-term frequency of occurrence. In these cases, extreme events are out of the established range of the system, which makes the system more vulnerable and the need to adapt to events becomes key to survival in the context of climate change (Smit and Pilifosova 2003).

The ability to adapt to inherent climate variability or yearly climatic conditions is referred as coping range. In Figure 1, the coping range is shaded, and it is visible that there are fluctuations. The fluctuations show the adaptations of the system to cope with the variability. This graph is used to illustrate that the coping ranges are 'flexible and respond to changes in economic, social, political and institutional conditions over time (Smit and Pilifosova 2003).

This coping range expressed in figure below can be referred to as the adaptive capacity of the system to respond to the changes. In this context, we can infer that the system has a built-in capacity to deal with variability which is within its coping range. When the change is beyond the coping range, that is when systems require additional support to deal with the changes. From this point forward and for the purpose of this thesis, adaptation to climate change will refer to any change which system experiences beyond its coping range.

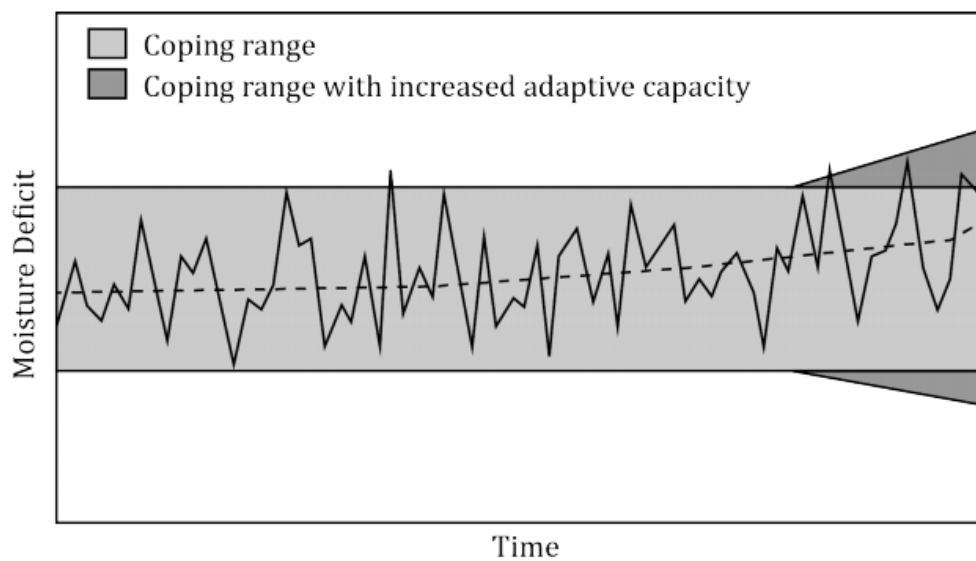


Figure 1: Coping range and extreme events, Source: (Smit and Pilifosova 2003)

As the IPCC has the capability to inform and influence climate action of nations worldwide, its definition is taken up as the starting point of the discussion on definitions. One of the earliest definitions of adaptation (to climate change) is from the IPCC's 2001 report (Ahmad et al. 2001) which defined it as 'adjustment to anticipated changes in future climate conditions'. Preston and colleagues argue that this definition placed undue emphasis on developing more certain insights regarding future climatic situation which have led to a detour from the conceptual understanding of the term itself (Preston, Mustelin, and Maloney 2015) by directing focus towards developing technology to achieve greater certainty. (Nalau

et al. 2021) supported this argument by stating the importance of pursuing adaptation actions despite irreducible uncertainty as the forecasting data gets less granular and less certain to read over longer-term timelines. Many support this argument by asserting that resolving the resolution of climate models to gain more certain insights is particularly not helpful for adaptation research (which subsequently informs practitioners' decisions) (Hinkel and Bisaro 2021).

Another definition offers a more precise take on the concept of adaptation to climate change. It is defined as 'adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts' and adjustment 'refers to changes in processes, practices, or structures' which will neutralise or take advantage of expected impacts of climate change (Smit and Pilifosova 2003). A key clarification offered by this definition is that adaptation refers 'both to the *process* of adapting and to the *condition* of being adapted' and in both statuses, adaptation is a relative term whereby a system adjusts in response to climate related changes. Hence, description of an adaptation requires a specification of who or what adapts, the stimulus for which the adaptation is undertaken, and the process and form it takes and these specifications are illustrated in the Figure 2.2. These can be considered the characteristics of adaptation. Based on their timing, adaptations can be reactive or proactive, and depending on their degree of spontaneity they can be autonomous or planned (Smit and Wandel 2006).

Following that, to describe how adaptation occurs, this research delves into the types of adaptation, processes, and outcomes. Core assumptions that guide adaptation may be encapsulated within the terminology used. Each scientific field develops a set of standardised facts over time that is used to explain core characteristics which loses its nuance as it is disseminated into the public sphere (Ravetz, 1972 as cited in (Preston, Mustelin, and Maloney 2015).

While this process is necessary, it can be pernicious if some ingrained assumptions function as potential constraints instead of serving as effective guiding principles. Therefore, it is important to gain a robust understanding of this term ‘adaptation’ by taking a deep dive into its nuances through an investigation of the heuristics. (Tompkins et al. 2018) clarify further that the conceptual challenges to understanding adaptation is further exacerbated by unstated normative assumptions.

In this context, (Preston, Mustelin, and Maloney 2015) highlighted the distinction made between reactive adaptation and planned adaptation which frames reactive adaptation as being less efficient and more costly compared to planned adaptation. This perspective reflects an underlying assumption of the existence of an optimal condition which is the least costly adaptation pathway. This, in turn, yet again, places much emphasis on the need to isolate the optimal pathway which in turn requires sufficient data points in the climate models to provide clear reflections. Hence, this desire for planned adaptation again raised questions regarding the uncertainties involved in gaining clear insights on future climate conditions with available data before planning can begin, having similar effect as highlighted previously in the IPCC definition.

Moreover, other normative assumptions include ‘adaptation should generate positive benefits’, ‘adaptation is different to coping’ create confusion over the interpretation of the term and hence remain restrictive to the research and practice of adaptation (Preston, Mustelin, and Maloney 2015). Moreover, undefined relationships between concepts such as development, coping, and maladaptation add further add to the confusions (Preston, Mustelin, and Maloney 2015).

(Nalau et al. 2021) emphasised that adaptation practitioners supported this view that reactive adaptation is the least preferred option even if some practitioners argued that reactive adaptation is easier to implement. In the context of uncertainty, Nalau et al (2021) suggested

that adaptation is dynamic which means that any adaptation measure should allow a margin for changes to be made with time, social norms and moral contexts which may shift over time. This is a pragmatic approach that can be taken with respect to adaptation.

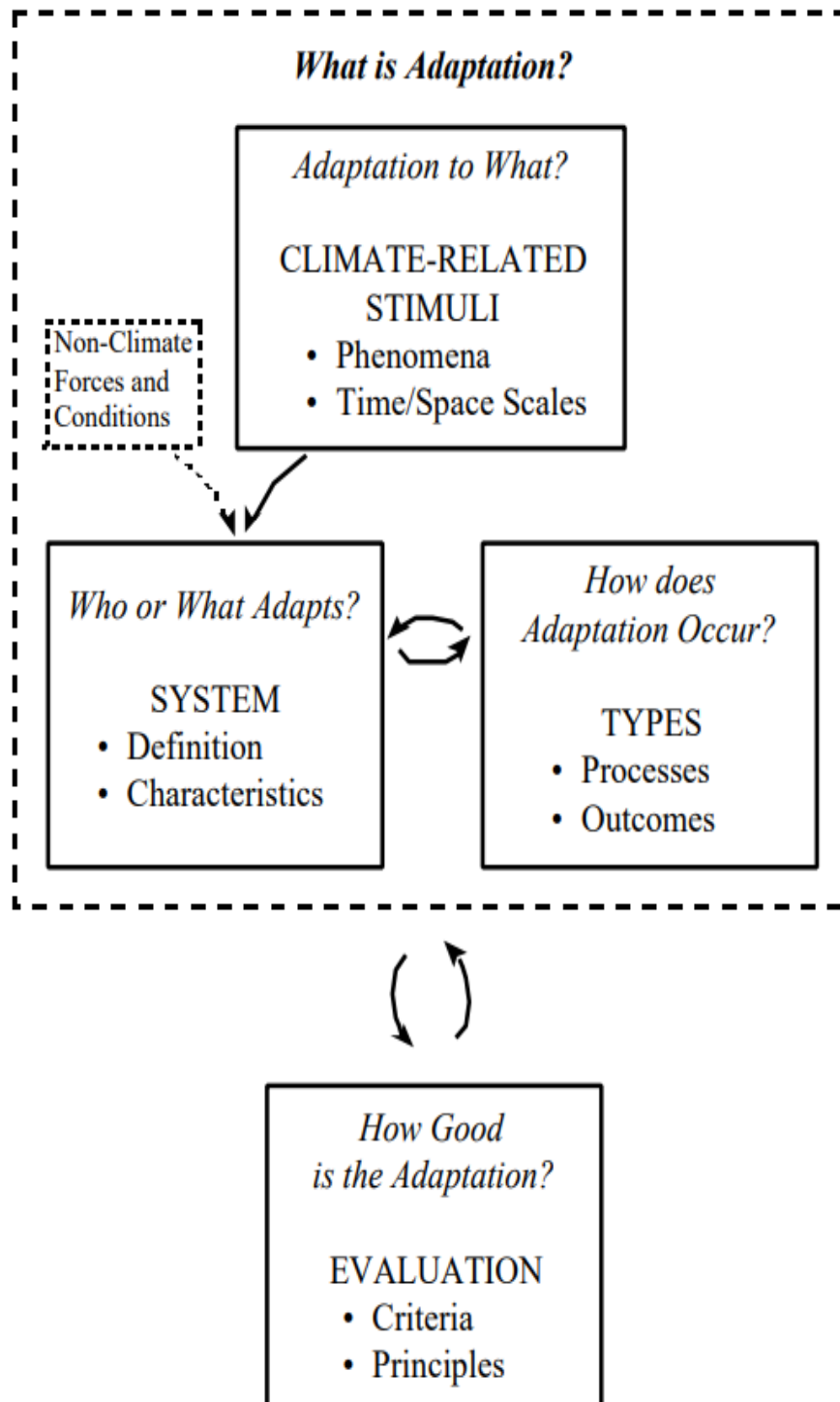


Figure 2: What is Adaptation? Source: (Smit and Pilifosova 2003)

This approach provides room for manoeuvre and directs focus towards building solutions that are tolerant towards the uncertainty faced in future climate predictions that are calculated based on latest available data now. Hence, the result is an adaptation measure which can be modified if needed in the future that is neither planned (as in built with certainty on decision) nor reactive.

A critical point to highlight at this juncture is that these arguments about reactive adaptation were happening well into 2020s which is many years after the release of the Hyogo Framework (2005) that urged nations to make disaster risk reduction a priority and reduce underlying risk factors which draws attention away from the planning stage (or in other words, the timing of the adaptation action implementation) of adaptation and towards the root cause of the problem which necessitates the adaptation in the first place. Some authors argue that this direction of thinking is more focused on the adaptation technique and hence more beneficial to the entire process. An important lesson to be learnt here is that a clearer understanding of the term on a global scale may have led us to this point at a faster pace. We can note with a relief that the PA cites references to the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction, and the UNEP Adaptation Gap Report 2017 urges the world to use these previous frameworks as a base for the upcoming adaptation GST.

A strong emphasis on the context-specificity of adaptation has engrained the perception that adaptation is a local process ((Preston, Mustelin, and Maloney 2015), (Ford and Berrang-Ford 2016)). This perception contributed to an increasing burden of climate adaptation planning, policy development and implementation on local governments which often lack capacity to take action and this has been observed in urban climate adaptation planning globally (Nalau et al. 2021). Although it must be recognised that this also resulted in creation of coalition between local governments which ended up being fruitful endeavours too.

Furthermore, the authors cite Lemos and Tompkins (2008) ‘while all adaptation is local, adaptive capacity is not’. Although there is higher recognition of the more robust, multi-level adaptation, it is yet to be operationalised (Milkoreit and Haapala 2019). Nalau et al (2021) further nuance this argument by asserting that instead of defining adaptation at one singular scale (local vs others), it should be seen as a guide and applied in specific contexts as needed. For example, literature on multi-level governance and mainstreaming increasingly points out the need to use multiple scales in adaptation action (Pelling and Garschagen 2019).

Other nuances to the concept of adaptation were identified in many studies. For example, Nalau et al (2021) highlighted three of such emerging nuances: Flexibility, Risk-based adaptation, and values-based adaptation. Flexibility is featured in many of the above-mentioned approaches to adaptation. Reactive adaptation maintains system flexibility, avoid lock-in and maladaptation by too early decisions while ‘adjustments to future climate conditions’ increases flexibility by waiting for more certain information. The other two approaches have a long history in adaptation literature but brings a sharper focus on more implicit issues such as equity and justice (Pelling and Garschagen 2019; Nalau et al. 2021). These authors highlighted the very practical difficulty in accommodating current priorities and future potential changes in values and further coordinate adaptation across multiple sectors and stakeholder groups over the long term.

Last but not the least, Nalau et al (2021) warn of the use of ‘no-regrets’ in adaptation as it is unclear what this means exactly. The authors assert that it is very difficult to justify how such actions enable more robust decisions and finding a balance between what is a regret now and what regret looks like in the future is a key question in how this can be made applicable. Moreover, this ‘no-regret’ adaptation has closer proximity towards ‘win-win’ that is touted as a position whereby everyone benefits.

However, Nalau et al (2021) poignantly highlight that practitioner truly understand that

ultimately adaptation is about trade-offs where hard decisions must be made and there is some calculated loss to be accepted. This is a very important recognition to be given to this process of adaptation which has a ton of uncertainty to be considered and hence the margin for error or trade-offs is very high and likely too.

In conclusion, we can largely accept that there is no universally accepted definition of adaptation ((Olhoff et al. 2017b), (Dupuis et al. 2013), (Tompkins et al. 2018), (Milkoreit and Haapala 2017)). However, we are unable to start the research with an open to question core concept. Hence, this research will subscribe to the definition given in the UNEP Adaptation report's Glossary which is very close to the definition provided by Smit and Pilifosova (2003).

Adaptation can be defined with respect to the human and natural systems separately. In human systems, the process of adjustment to actual or expected climate and its effects 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 (Olhoff et al. 2017b). Focus must be given to some terms to better understand the concept. For example, one is 'moderate harm' which indicates that the effects of climate change are already felt, and that any adaption measure is only an alleviation attempt to mitigate the worst of the consequences and society must be prepared to face some.

Firstly, the reason for highlighting the various arguments and nuances with respect to this concept is to convey the complexity involved. Moreover, once a particular understanding of adaptation is developed and accepted, it tends to steer and inform research priorities, policy debates, and funding agency guidelines (Nalau et al. 2021). Hence, it is vital to have a nuanced understanding of this complex term and be intentional about its usage to maximise the effectiveness of adaptation actions and minimise unintended consequences as much as possible. Furthermore, with respect to the assessment framework which will be discussed later

in the text, the definition must be read in conjunction with its purpose or intended objective to arrive at a meaningful understanding of the proposed or undertaken adaptation efforts.

Moreover, the complexity can be further clarified through clear elaboration of the context in which the adaptation term is used and understood.

Secondly, despite a growth in adaptation research and better understanding of the pitfalls involved, many scientists argue that an ‘adaptation deficit’ exists in both developing and developed nations as the improved research results has not translated into the implementation of adaptation policies (Repetta 2008, as cited in (Preston, Mustelin, and Maloney 2015)). In this context, perhaps, an effective stocktaking mechanism which can convey this deficit in a clear manner might serve to boost attention to this issue and increase momentum towards a solution.

In conclusion, despite the absence of a universally accepted definition of adaptation to guide the global efforts on adaptation, this section has provided a look into the various nuances of the concept. The various arguments which aim to highlight the various differentiated uses for this complex and abstract term has been showcased and analysed for its applicability.

The key message to be conveyed through this section is the fact that the absence of a universally accepted definition is a surmountable challenge if the individual projects / nations define how they utilise this complex term and be deliberate about the terminology they select to represent their initiatives while keeping the heuristic pitfalls highlighted here in mind as they do so. This will allow more clarity to be achieved and easier communication of the results of the undertaken adaptation initiatives.

2.2 Assessing adaptation and the challenges involved

Breaking down Adaptation into its components

Adaptation, whether analysed for the assessment purpose or practice, is intimately associated with the concepts of vulnerability and adaptive capacity (Smit and Wandel 2006). These are also the goals of the GST. The global goal on adaptation is ‘enhancing adaptive capacity, strengthening resilience and reducing vulnerability’.

In addition, the GST is expected to deliver four functions for adaptation as well as it plays its intended role in the Paris Agreement. The four functions are: (1) recognition of the national adaptation efforts, (2) enhancement of adaptation implementation, (3) adequacy and effectiveness of adaptation and support and (4) review of progress on the global goal of adaptation as agreed.

As the terms utilised to define the global goal on adaptation contains terms which are quite demanding and abstract on their own (adaptive capacity, resilience, and vulnerability), this section will dedicate some time to bring a certain degree of clarity to the conceptual understanding of these terms as a first step.

Adaptations are manifestations of adaptive capacity, and they represent ways of reducing vulnerability also while vulnerability of any system is reflective of the exposure and sensitivity of that system to hazardous conditions and the ability to cope or resilience of the system to adapt or recover from these effects of the conditions (Smit and Wandel 2006).

Resilience is defined as the ability of a social or ecological system to continue functioning when confronted with shock and stress (Nelson et al., 2010 as cited in (Owen 2020)). Adaptations may not be effectively reducing vulnerability if they solely focus on exposure and do not address the underlying systemic issues which is the root cause of the vulnerability (Owen 2020).

The vulnerability relationships are as shown above in Figure 2.3. As the larger sets represent the broader stresses which determine exposure and sensitivity and influence adaptive capacity at the local level denoted by smaller embedded sets, the interaction of environmental and social forces determines exposures and sensitivities, and various social, cultural, political and economic forces shape adaptive capacity (Smit and Wandel 2006). The overlap is a key element which reflects that the processes driving exposure, sensitivity and adaptive capacity are frequently interdependent and the finer scale interaction of these elements represents local vulnerability.

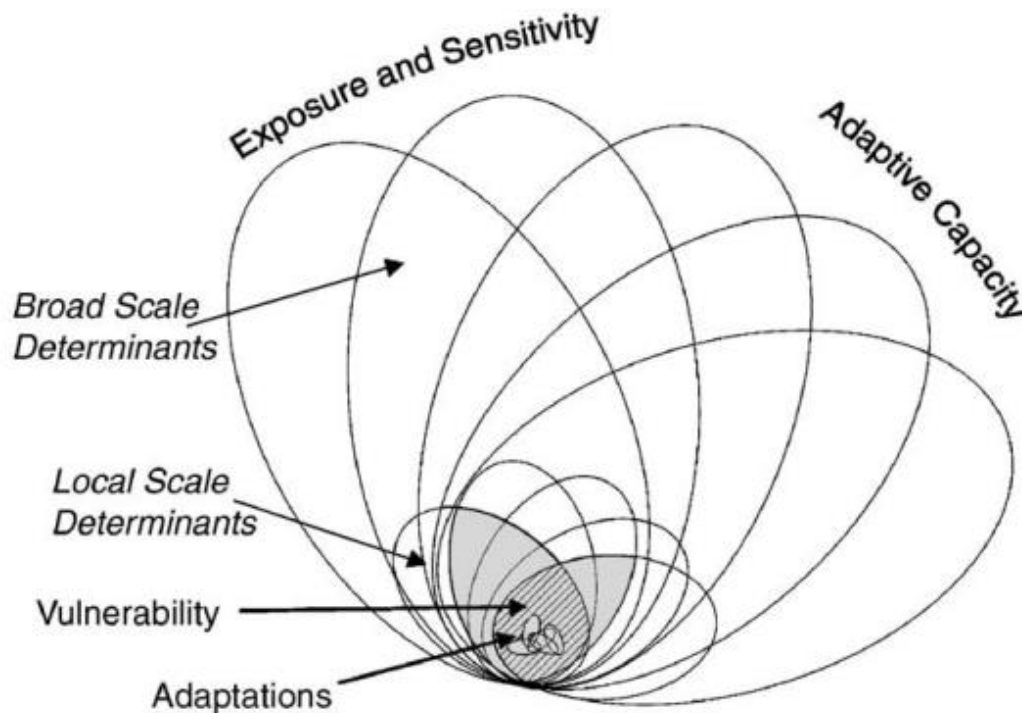


Figure 3: Nested hierarchy model of vulnerability, Source: (Smit and Wandel 2006)

From the descriptions above, it does not imply that the relative vulnerability can be numerically calculated as the sum of individual elements and their determinants are dynamic (they vary over time), they vary by type, they vary from stimulus to stimulus and they are place- and system-specific (Smit and Wandel 2006).

Based on extensive literature, authors find that: (1) adaptive capacity is a similar concept to ‘adaptability, coping ability, management capacity, stability, robustness, and resilience; (2) the forces that influence the ability of the system to adapt are the drivers or determinants of adaptive capacity; (3) local adaptive capacity is reflective of broader conditions (Smit and Wandel 2006).

This conceptualisation of two broad contributing elements of vulnerability (exposure and sensitivity plus adaptive capacity) are consistent with literature and supported by other sources. For example, European Capacity Building Initiative’s pocket guidebook to adaptation conceptualises that for effective adaptation to take place, understanding causes of vulnerability to climate change and assessing adaptive capacity are crucial (Sharma and Venturini 2019).

Owen (2020) argues that definitions and objectives of adaptation and other terms are not necessary for adaptation initiatives to be effective. However, operational difficulties encountered on the ground dispute this claim. For example, Farand (2021) writes that during the online board meeting of the Green Climate Fund, two out of three adaptation projects presented to the technical advisory panel for funding by LDC were not approved. The independent body cited that the lack of clarity as to whether the projects were aimed at climate adaptation and lack of historical data to support this measure were the reasons for the rejection. Conceptual ambiguity is having a real impact on the practitioners of adaptation by prohibiting access to funding for the world’s most vulnerable population. Hence, this offers further proof and motivation to gain a clearer understanding of the key concepts or by the least, ensure that the projects have clear objectives and some data to add justifications to their fund proposals for adaptation projects.

In case of LDCs, perhaps, they need support to craft project proposals which are adhering to the requirements and especially are supported with required data points. In case of

lack of data, other outcome or impact indicators needed to be agreed upon and the technical panels of such organisations have to offer flexibility in these cases.

Even with the above mentioned attempts at further clarification of these key concepts, it must be noted that there is currently no universally agreed understanding or guidance on how to define and assess adaptive capacity, resilience and vulnerability as per the PA's global goal on adaptation nor on how to define, assess adequacy and effectiveness under the four adaptation functions of the GST (Christiansen, Olhoff, and Dale 2020). Therefore, this section has contributed to a deeper understanding of the existing concepts only.

Challenges in assessing adaptation efforts

With these conceptual clarity in mind, we can now go into the assessment part of the Global stocktake. Evidence indicates that adaptation activities do not always work as intended and there is even less insight into what counts as effective adaptation in practice (Owen 2020).

Three main factors which challenge the implementation of frameworks that guide evaluation design for adaptation efforts are: uncertainty in actions and objectives on what constitutes adaptation (this topic is discussed in previous section and consistently throughout the thesis), lack of agreement about methods for data collection, and attribution of effective outcomes to specific adaptation activities (de Coninck et al. 2018). Evaluation usually demonstrates linear connectivity between activities and outcomes; however, adaptation is highly cyclical, with no unique, characteristic end point and hence it is highly unlikely that the society will become fully adapted (Smit and Pilifosova, 2001 as cited in (Owen 2020)). Therefore, any attempts to evaluate must incorporate the adaptation status as a continuous and circular process with no distinct end point.

(Field et al. 2014) note that determining the right metrics and indicators to monitor

progress is not straightforward, in part because different people and organisations have starkly different uses for evaluation of adaptation outcomes. Economic motivations prompted the initial evaluation as funding agencies wanted standard indicators to compare outcomes across programmes all over the world to decide which to provide funding for (Ford et al., 2013 as cited in (Owen 2020)). Moreover, the complexity of adaptation presents a major hurdle for a comprehensive, global assessment of progress as it requires use of metrics that covers the wide ranging diversity of efforts and can also be aggregated (those which can be aggregated do not allow for context specificity) (Olhoff et al. 2017a).

Although the economic motivation is still the driving factor, evaluation assesses more than economic efficiency; it also allows stakeholders to understand if they are adapting well and define the beneficiaries of this initiative (Owen, 2020). Meaningful indicators and metrics will vary based on different values and goals as community members' goals may not match those of funding organisations. Hence, evaluation frameworks must acknowledge, if not balance, these competing needs for information (Owen, 2020).

Another difficulty for evaluation research is the attribution of causality between actions and outcomes. Impacts can be simultaneously underlying and acute, direct, and indirect, and cumulative, synergistic, and distributional (Moser and Boykoff, 2013 as cited in (Owen 2020)). Contextual factors make it even more challenging to attribute improved conditions directly to adaptation activities.

Yet another difficulty for evaluating adaptation is that climate change operates on longer timescales than most projects and outcomes may not be perceivable for decades or even longer time scale (Owen 2020). (Olhoff et al. 2017a) also support this view and state that long time horizons mean that the impact of the proposed adaptation measure of policy may be not explicitly visible for some time and there is considerable uncertainty in future due to the complex inter-connectivity between systems.

Another challenge in this process is the lack of agreement on data collection or its availability (de Coninck et al. 2018; Owen 2020; Olhoff, Väänänen, and Dickson 2018). This challenge is critical as it directly impacts the process of evaluation. Without the required data, any evaluation based off of it would be partial and incomplete. The challenge is resolving data and information challenges for measuring adaptation. Existing data are limited, too broad and insufficiently catered to the unique requirements of adaptation and there is a need for standardised guidelines and approaches on how data can be collected, need for data sets which are sufficiently granular and updated regularly (Olhoff, Väänänen, and Dickson 2018).

Although GST is likely to build on top and based off of the national reporting data from countries worldwide, not all data for measuring progress of adaptation needs to come from countries themselves (Olhoff, Väänänen, and Dickson 2018). Moreover, the flexibility allowed for in the adaptation reporting will likely lead to differences in content and timing of reporting which could hamper the use of these data to measure progress against enhancing adaptive capacity, strengthening resilience, and reducing vulnerability which are the three components of the global adaptation goal (Kato and Ellis, 2016 as cited in Olhoff, Väänänen and Dickson, 2018).

In fact, national reporting can be complemented by science-based data from other sources as well and such third party sources are specifically mentioned in the PA. This is where IPCC can play a role by getting UN organisations to gather required data and request for additional data as well and combining them with modification to allow for synergies between data already collected under the SDG and Sendai framework; this would be both cost-effective and less burdensome (Olhoff, Väänänen, and Dickson 2018)

Another critical issue is the identification of adaptation-relevant activities that are mainstreamed into existing policies and are not labelled explicitly as climate change

adaptation and also, may not directly lead to or result in enhanced adaptive capacity, reduction of vulnerability or strengthened resilience (Olhoff et al. 2017a). This could be resolved by considering whether climate impacts are addressed in the design of policy interventions (Dupuis and Biesbroek, 2013 as cited in (Olhoff et al. 2017a).

These above-mentioned challenges are not unsolvable. The scholars who analysed the adaptation initiatives have established several components for good adaptation practices such as strengthening institutional partnerships and engaging local individuals. Critical assessments are necessary to examine how success is defined - for whom and by whom (Owen 2020).

2.3 Outline elements enabling a GST to take place

Approaches to assessing adaptation – arguments for and against

Components-based approach

This section elaborates one way the assessment of adaptation activities could take place. By doing a wide search on journal databases to identify adaptation publications, the author reviewed articles in Web of Knowledge using a three-part criteria: (1) adaptation activity was implemented beyond planning, gathering information and raising awareness stages, (2) responded to a combination of social, environmental, climatic changes, and (3) was at least partially effective (activity is considered effective if it achieves one or more expressed goals or outcomes (Adger et al, 2015 as cited in (Owen 2020))).

(Owen 2020) extracted 110 case studies from the final set of reviewed articles and placed them in three main divisions of adaptation activities which were social (sub-divisions of educational, informational, and behavioural), institutional (sub-divisions of economic options, laws and regulations, and policies and programs), and physical (sub-divisions of

engineered and built environments, technological innovations, ecosystem-based adaptations, and services). It must be noted that the case studies were wide ranging in terms of approach, objective, and content.

The effectiveness of these adaptation activities, on the other hand, were coded using five broad categories: reducing risk and vulnerability to climate change impacts, improving ecosystems or natural resources, enhancing social well-being for individuals or communities, increasing access to economic resources and strengthening institutions, policies or governance structures (Brooks et al., 2011, Adger et al, 2005 and IPCC's Summary for Policymakers as cited in (Owen 2020)). In addition, author highlights that justice and equity are considered key components of effectiveness as well (Adger et al, 2005 as cited in (Owen 2020)).

The insights gained from the study are that adaptation activities in the social division were reported most often, and for division of adaptation activities of institutional actions, the results were most often connected to policies and programs (sub-division) that represent overarching approaches to adaptation such as ecosystem-based adaptation and adaptive management (Owen 2020). These management approaches offered foundational support for other tangible adaptation activities to be undertaken. In the physical division of adaptation activities, a diverse range of sub-divisions existed, and ecosystem-based services were most frequent. Most case studies of the chosen 110 for evaluation combined activities across all three divisions (Owen 2020).

With respect to effectiveness, more than three-quarters of cases revealed effectiveness across multiple categories (amongst the five broad categories used as effectiveness metrics) which used quantitative or qualitative descriptions and most cases demonstrated effectiveness by reducing risk to climate change impacts (largely dealt with availability of water resources or investing in information and communication technologies such as knowledge sharing or early warning systems) (Owen 2020). The second most reported effectiveness category is

enhancements in social relationships and community well-being, followed by improving ecosystem health, environmental quality, and natural resources as third most, following that the category of increasing people's income and access to economic resources and lastly, strengthening of institutional connections, influencing policies and improving governance practices were reported less often (Owen 2020).

In addition to the effectiveness criteria, only one-third of the authors noted fairness in outcome distribution or in representation and called for diversification of representation in decision-making and less than 15% of cases provided qualitative or quantitative evidence of justice or equity (Owen 2020). Of those reported, majority were community-based efforts or knowledge sharing or information networks. Developing cooperative organisations and implementing agroecology or agroforestry practices were two activities which showed effectiveness across four indicators more than 60% of time.

Given the great variety of what adaptation involves, the act of categorizing effective examples in practice is clarifying (Owen 2020). Owen (2020) highlights the need to evaluate root causes of the biophysical risks, vulnerability and exposure and not pursue mitigating the symptoms only, this allows effectiveness to be measured in multiple ways. Hence, reporting effectiveness should be an inherent part of the adaptation process but caution must be taken in how it is defined, monitored, and documented (Owen 2020).

Moreover, the definition in each context must include effectiveness for whom and effectiveness of what. Most importantly, given the multiplicity of definitions, objectives, approaches, ontologies, and epistemologies inherent within adaptation, there is currently little evidence to support the practicality, usefulness, or need for standardised practices (Owen 2020). Instead, indicators, and frameworks should be flexible enough to fit various social, environmental, and political contexts (Owen 2020; Dilling et al. 2019).

The above mentioned approach is critiqued in many studies. On a similar tangent, collective progress on adaptation could be tracked in another manner using the three components given in the Article 7 of PA: adaptive capacity, resilience, and vulnerability and one example of such an indice is the University of Notre Dame Global Adaptation Initiative (ND-GAIN) country index (Olhoff, Väänänen, and Dickson 2018). Other examples of such vulnerability indices include The Climate change Vulnerability Index (CCVI), The Global Climate Risk Index and The DARA Climate Vulnerability Monitor but unfortunately, there is low support and consensus for utilising this ranking system as indicated in studies and hence it will be challenging to utilise this for global tracking purposes (Olhoff et al. 2017b). Moreover, these indices face methodological challenges to distinguish the three components of adaptation from each other in the causal manner and it would be challenging to distinguish effects of other policies which may have supported too.

Sub-divisions of components-based approach – Assessing adaptation activities

Even though Monitoring and Evaluation efforts in countries have led to enhanced understanding of how adaptation takes place and the reasons affecting the effectiveness of programmes, this has limited perspective for answering broader questions about how adaptation takes place across nations and assess progress over time (Olhoff et al. 2017a). These global assessment efforts have two approaches which are assessing adaptation activities and another on assessing adaptation results. Table 1 below shows the descriptive, evaluative questions that can be asked to assess activities and results.

	ADAPTATION ACTIVITIES	Indicator Examples	ADAPTATION RESULTS	Indicator Examples
Descriptive Questions	What is/are a country's key areas of adaptive capacity, resilience, and vulnerability?	Impact and vulnerability assessments, global risk maps	What has resulted from these activities?	Farmers use more efficient irrigation technologies to cope with water shortages
	What are a country's national adaptation goals and targets?	Visions, goals, targets set out in adaptation planning documents	How has adaptive capacity, resilience, and vulnerability changed?	Change in number of people living in flood plains, change in extreme heat mortality
	How are countries making decisions on adaptation?	National or subnational working groups, ministerial/departmental leadership, integration of equity and justice considerations into decision-making processes		
	What are countries doing to increase adaptive capacity and resilience, and decrease vulnerability?	Creation of national adaptation plans, public awareness-raising, reforms to standard operating procedures, legislative reforms		
	ADAPTATION ACTIVITIES	Judgements	ADAPTATION RESULTS	Judgements
Evaluative Questions	Are countries responding to the right risks, and in ways that do not create long-term maladaptation?	Do national impact and vulnerability assessments reflect scientific consensus?	Do outcomes meet goals and targets?	Are countries' adaptation efforts leading to the intended objectives?
	Do goals and targets reflect key areas of adaptive capacity, resilience, and vulnerability?	Are goals and targets sufficiently ambitious to address key risks?	Have changes in adaptive capacity, resilience, and vulnerability addressed a country's risk profile?	Are countries making sufficient progress fast enough?
	Do countries have robust decision-making processes?	Do governments demonstrate decision-making processes that represent the spirit of the Paris Agreement (e.g. gender-responsive, participatory, transparent)?		
	Are countries making sufficient effort to meet goals and targets?	Are countries doing enough to adapt to current and future risk?		

Table 1: Assessing adaptation activities and results, Source: (Olhoff et al. 2017a)

Assessing adaptation activities looks at what nations are doing to increase adaptive capacity and resilience and decrease vulnerability, and these can be descriptive or evaluative in nature, as per the table shown above. The descriptive assessment questions such as: what are a country's major vulnerabilities? How are decisions shaped and influenced? What efforts are countries taking to address climate risks? The global assessment framework needs to identify a comprehensive list of metrics which can be aggregated across nations and over time (Olhoff et al. 2017a).

Different metrics answer different questions and common metrics include the scope of targets in strategic national documents, the nature of decision-making coordination across

departments, types of activities carried out within the adaptation field and as these metrics are currently being used by nations, the potential for aggregable data at global level is high (Olhoff et al. 2017b). Metrics which indicate the organisational and administrative aspects, presence of governance structures to support adaptation, if equity and participatory considerations are being taken during the planning processes are vital too (Olhoff et al. 2017a). Policy focused descriptive questions look at what governments are implementing to respond to current or future impacts and address vulnerabilities and risks.

Evaluative questions examine whether the policies identified through descriptive questions are adequate to achieve the progress towards adaptation and the questions are: are countries responding to the ‘right’ climate risks? Are goals reflective of the most vulnerable aspect of the risk or population? Evaluate if decision-making is carried out in an appropriate and inclusive manner? These evaluations cannot directly be answered through data collection as these are influenced by the values and collective perceptions regarding what it means to adapt to climate change and hence it is important to state the principles which influence the analysis and providing space for multiple concerns to be voiced (Olhoff et al. 2017a).

Sub-divisions of components-based approach – Assessing adaptation results

This approach measures the outcomes and impacts of adaptation results. The descriptive assessment inquires the effect of the various activities against the goals and targets set in policies (a look at the outcomes of the adaptation) and looks at broad changes in the components of adaptation: vulnerability status, adaptive capacity, and resilience (a look at the impact of the adaptation on a longer term) (Olhoff et al. 2017a). The inherent question at hand is whether the issue is worsening or becoming better over time and the issue being the adaptation. This means to measure the changes in key vulnerability areas such as food

security and the aspects of political, economic, social, and environmental contexts also as these have an impact on a nation's adaptive capacity and understanding of these dynamics is critical to assessing whether adaptation efforts are making a positive contribution (Olhoff et al. 2017a).

The major challenge in these results-based assessment is the need to find ways to measure the contribution of adaptation activities to changes in adaptive capacity and other components. These changes are influenced by a very complex web of factors including the general levels of development and unintended consequences of other government initiatives and therefore, isolating the incremental contribution of the adaptation activity in question will be a major hurdle for adaptation assessment (Olhoff et al. 2017b).

In conclusion, the main insights drawn from these studies which enable evaluation of the GST are inclusion of some elements into any adaptation efforts which can be utilised under the approach elaborated thus far. These are (1) evaluate if the adaptation action addresses root causes of the risk, vulnerability, or exposure, (2) include evaluation of the effectiveness (for whom and of what) with objectives and criteria co-decided by key stakeholders jointly, (3) make explicit the assumptions, and notions of progress, or rather the theory of change proposed for the activity (4) be flexible enough to fit various social, environmental, and political contexts, (5) show understanding of the underlying power dynamics, sensitivity to arguments on justice and equity, and (6) able to justify causal relationships between adaptation effort and adaptation result / outcome.

Sectoral approach

Contrary to Owen (2020)'s claims that there is little evidence to support usefulness or need for standardized practices, (Olhoff, Väänänen, and Dickson 2018) assert that there are

key reasons for supporting a global review on adaptation efforts by sectoral approach. Firstly, global perspective on adaptation allows a snapshot of the current state of adaptation worldwide, provides a foundation to evaluate adaptations taking place at different settings and is key to monitoring the evolution of adaptation over time (Ford and Berrang-Ford 2016).

Next, there is conscious understanding that adaptation action and inaction can have implications that transcend national contexts. For example, national adaptation initiatives may not be aware of potential transboundary benefits of domestic adaptation and the transboundary risks of inadequate or maladaptive adaptation responses (Field et al. 2014).

Such recognition indicate that global action and coordination of adaptation is required and a global framework for adaptation can enable the focus on such impacts, their interlinkages with sustainable development and potential political barriers (Olhoff, Väänänen, and Dickson 2018). Therefore, many argue that global framework for adaptation can enable an increased recognition of the status of adaptation, is a requirement for tracking adaptation progress and outcomes across countries and over time (Olhoff, Väänänen, and Dickson 2018; Ford and Berrang-Ford 2016).

Olhoff, Väänänen and Dickson (2018) sharply highlight that the greater the clarity, consistency and comparability there is in the reporting, the greater the usefulness of the GST for global adaptation tracking purposes and outline 3 priorities for action areas. The three are: (1) agreeing on what to track by establishing a conceptual clarity on the global goal on adaptation, (2) agreeing on how to track it using methodologies, metrics, indicators and (3) addressing information and data challenges (this point is already discussed in the previous section).

The existing situation stands that most assessments of adaptation have covered mainly impacts, vulnerability, and adaptation planning and very few have assessed the processes of

implementation and evaluating them (Nobel et al., 2014 as cited in (Olhoff, Väänänen, and Dickson 2018)) and furthermore, even fewer studies have attempted to make a comparison between countries (Ford and Berrang-Ford 2016). As a result, our understanding of global adaptation status is quite partial and disunited and furthermore there is a lack of a clear goal, a baseline, a standard measurement unit, well-established methodologies and data sources are lacking (Olhoff, Väänänen, and Dickson 2018).

Agreeing on what to track

Alternative to the approach discussed thus far in this document, the global goal could be tracked using key sectoral and cross-cutting priorities for increased adaptive capacity, resilience and reduced vulnerability and this is in closer alignment to the approaches adopted by many nations in their Nationally Determined Contributions (key adaptation sectors prioritised in NDCs are: Agriculture, Water, Health, Coastal, Forestry, Ecosystems and Biodiversity, Infrastructure and Tourism), National Adaptation Plans, national monitoring, reporting, and evaluation frameworks, and development plans, and green growth strategies (Olhoff, Väänänen, and Dickson 2018).

There are going to be many differences in countries if a sectoral approach is taken as the tracking tool. However, there are some considerable convergence of countries in terms of climate risks and adaptation priority sectors and in this case, for each of the priority sector, United Nations Framework Convention on Climate Change (UNFCCC) process could identify and agree on key aspects to be tracked globally while allowing flexibility to the nations to include additional nationally specific aspects if required (Olhoff, Väänänen, and Dickson 2018).

This approach can facilitate linking assessment of collective goal on adaptation

combined with reporting on adequacy and effectiveness of adaptation action, financial support received and this approach is conceptually simpler as it prevents dealing with aggregation. Moreover, defining and tracking progress on a limited number of key sectoral and cross cutting adaptation dimensions globally could be combined with more specific adaptation targets nationally which offers flexibility and could potentially simplify political negotiations (Olhoff, Väänänen, and Dickson 2018).

This sectoral approach is also very similar to that adopted by the Sendai Framework for Disaster Risk Reduction (Sendai Framework) and the Sustainable Development Goals (SDG). Yet another advantage in this approach is that this can avoid undue burden on developing countries in terms of reporting and that differences between countries in adaptation priorities, current and future vulnerabilities, and institutional characteristics and capacity can also be acknowledged (Olhoff, Väänänen, and Dickson 2018). Table 2 shown below shows a comparison of PA with Sendai Framework and SDGs and makes a compelling case for a sectoral approach in its ease of use (Olhoff, Väänänen, and Dickson 2018).

	Sustainable Development Goals	Sendai Framework	Paris Agreement
Objective of the agreement	Contributing to the achievement of sustainable development and serving as a driver for implementation and mainstreaming	A substantial reduction of disaster risk and losses in lives, livelihoods and health and in economic, physical, social, cultural, and environmental assets	Holding the increase in the global average temperature to well below 2°C and pursuing efforts to limit it to 1.5°C (mitigation); increasing the ability to adapt to the adverse impacts of climate change (adaptation); making finance flows consistent with a pathway toward low GHG emissions and climate-resilient development (Art. 2)
Quantitative goals or targets at global level	Yes, 17 global goals with several targets each Countries may define additional national targets	Yes, seven global targets. Countries may define additional national targets	Yes, for mitigation. The global goal on adaptation is qualitative. Countries define their own targets and so far no global targets have been agreed
Purpose of tracking progress	Measure global progress toward achievement of the SDG goals and targets	Measure global progress in implementation of the seven Sendai targets	Global Stocktake: “assess the collective progress towards achieving the purpose of this Agreement” (Art. 14). Transparency framework: “Clarity and tracking of progress towards achieving Parties’ individual NDCs and Parties’ adaptation actions” (Art. 13)
Development process	By an “Inter-Agency and Expert Group on Sustainable Development Goal Indicators,” adopted by UN General Assembly	By an “open-ended intergovernmental expert working group” comprising experts nominated by States and supported by the UNISDR; adopted by UN General Assembly	Details of the Global Stocktake are still being negotiated (Art. 14). “Modalities, procedures and guidelines” for national reporting under the transparency framework (Art. 13), and details of the Adaptation Communications (Art. 7) are still to be agreed upon by the COP; Parties may develop country-specific adaptation M&E systems (Art. 7). ^{vii}

Table 2: Comparison of Key Aspects of the Sustainable Development Goals, the Sendai Framework and the Paris Agreement, Source: (Based on Leiter and Olivier (2017) as cited in (Olhoff, Väänänen, and Dickson 2018).

Agreeing on how to track

This involves identifying or developing appropriate methodologies, metrics, and indicators for tracking adaption and the suitability of metrics depends on what one wants to track, the scale involved and more specifically, consistency and comparability of what is being measured, how it is measured to allow for comparison and aggregation across scales and over time (Olhoff, Väänänen, and Dickson 2018).

The methodological issues related to the measurement, aggregation and comparison of adaptation results remain unresolved (Christiansen, Olhoff, and Dale 2020). In fact, a range of metrics and indicators and methodologies for tracking adaptation and its outcomes already exist and there is a large literature available as well but much is developed to evaluate adaptation at national level which includes challenges such as baselines, attribution, timelines and lack of standardisation (Christiansen, Olhoff, and Dale 2020).

Although various compilations of quantitative, qualitative metrics and standards and methodologies exist and provide useful beginning point for sectoral and global tracking efforts (For example, World Health Organisation's Global Overview (World Health Organization 2015)), several countries have provided such inputs in the adaptation section of their NDCs as well but these are far from comprehensive and comparable (Olhoff, Väänänen, and Dickson 2018).

It is important to note that many of the indicators created for SDG and Sendai framework are directly relevant for adaptation and could be used to track progress globally and adaptation indicators are classified as outcome, input, process, and impact (Olhoff, Väänänen, and Dickson 2018). Table 3 provides examples of such indicators which are divided according to their presence in Sendai Framework or SD Goals.

Outcome indicators demonstrate that an adaptation objective has been achieved but

since ‘adaptation’ is not an outcome in its own right, proxies for measuring ‘reduced vulnerability’ or ‘increased resilience’ are required (Bours, McGinn, and Pringle 2014).

Process and input indicators such as financial resources provided to adaptation and existence of legal frameworks are used as proxies for progression towards meeting the outcome and can be very useful for tracking complex endeavors that adaptation involves (Bours, McGinn, and Pringle 2014).

Impact indicators measure long-term effects of outcomes of adaptation interventions and aim to capture change in adaptive capacity and resilience to climate shocks in natural and human systems. Most existing efforts focused on measuring inputs and processes and there is a gap in terms of adaptation outcomes and adaptation impacts (Olhoff et al. 2017b).

The insights gained from this approach which can be taken to the context of enabling an effective GST are: (1) The need to combine indicators with those already presented in SDG and Sendai Framework, (2) Inclusion of a range of indicators: Outcome, Process, Input, and Impact indicators and (3) agreeing on the key sectors to be taken in and encompassed into the assessment framework.

In conclusion, this section discusses two broad approaches which can be taken to inform the structure of the Global Stocktake assessment exercise in 2023. The two are sectoral approach which are closely related to the way Sendai Framework assessment works and the adaptation components approach which assesses the vulnerability, adaptive capacity, and resilience of a system. The section also delved into the various criticism of the two approaches and extracted recommendations from them. These recommendations are condensed into a list as shown in Table 4.

Table 4 in the following page can be used to qualitatively check against any assessment framework in its ability to contribute to the GST take in a meaningful manner.

Sustainable Development Goal Indicators Relevant to Climate Change Adaptation		
Goal		Indicators
Climate action	13.2.1	Number of countries that have formally communicated the establishment of integrated low-carbon, climate-resilient, disaster-risk reduction development strategies (e.g., a national adaptation plan process, national policies and measures to promote transition to environmentally-friendly substances and technologies)
	13.1.1	Number of deaths, missing people, injured, relocated, or evacuated due to disasters per 100,000 people
	13.3.1	Number of countries that have integrated mitigation, adaptation, impact reduction, and early warning into primary, secondary, and tertiary curricula
Zero hunger	2.4.1	Percentage of agricultural area under sustainable agricultural practices
	2.4.2	Percentage of agricultural households using irrigation systems compared to all agricultural households
Clean water and sanitation	6.4.1	Percentage change in water use efficiency over time
	6.5.1	Degree of integrated water resources management implementation (0–100)
Sustainable cities and communities	11.b.1	Percentage of cities implementing risk reduction and resilience strategies aligned with accepted international frameworks (such as the Sendai Framework)
Life on land	15.2.1	Forest cover under sustainable forest management
Sendai Framework Compound Indicators That Could Relate to Climate Change Adaptation (Outcomes and Enabling Environments)		
Global Target		Indicators
Disaster mortality	A-1	Number of deaths and missing persons attributed to disasters, per 100,000 population
Affected people	B-1	Number of directly affected people attributed to disasters, per 100,000 population (including population injured or ill, whose dwelling is damaged or destroyed, and whose livelihood is disrupted or destroyed)
Economic loss	C-1	Direct economic loss attributed to disasters in relation to global gross domestic product (including losses from agriculture, housing sector, productive assets, critical infrastructure and cultural heritage damaged or destroyed)
Critical infrastructure and basic services	D-1	Damage to critical infrastructure attributed to disasters (including health and educational facilities damaged or destroyed and critical infrastructure units and facilities)
	D-5	Number of disruptions to basic services attributed to disasters (including educational, health, and other basic services)
Developing countries' support	F-1	Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–30
Early warning systems	G-1	Number of countries that have multihazard early warning systems

Table 3: Examples of Sustainable Development Goals and Sendai Framework indicators of relevance to climate change adaptation, Source: (Olhoff, Väänänen, and Dickson 2018)

S/N	Type of assessment	Elements in assessment frameworks enabling GST
1	Sectoral approach	Synergies with indicators from Sendai Framework & SDG
2		Inclusion of a range of indicators: outcome, process, input, impact
3		Collectively agreed priority sectors for indicator development under the UNFCCC process
4	Non-sectoral, adaptation components based approach	Adaptation addresses root cause of risk, vulnerability or exposure
5		Indicators for effectiveness to be specific (i.e., effective for whom & what) decided by key stakeholders
6		Make explicit the assumptions and notions of progress
7		Flexible enough to fit various social, environmental, political contexts
8		Sensitive to underlying power dynamics, justice & equity
9		Able to justify causality between adaptation effort and outcome, to an extent

Table 4: Elements in assessment framework enabling GST, Source: (Author 2021)

Proposed criteria for GST

Criteria	Description	Associated articles in the Paris Agreement
1. Aggregable	Does the measure reflect a consistent definition of adaptation that is comparable at the national level, and is available for a comprehensive number of countries globally such that data could be systematically aggregated (qualitatively or quantitatively)?	Article 14 focus on collective progress and Article 7 inclusion of overall progress To some extent Article 7's consideration of adaptation recognition
2. Transparent	Are definitions, assumptions, and methods transparent and consistent between countries?	Article 13 requirement for a transparency framework to inform the global stocktake
3. Longitudinal	Can the measure be tracked over time to monitor and evaluate progress?	Article 7 and 14's focus on progress implies tracking over time
4. Feasible	For global synthesis/aggregation of national assessments submitted to UNFCCC: Does the measure avoid placing undue additional reporting burden on countries? For global tracking of adaptation using publically available data: Is the measure reasonably available or can it be collected for all countries?	Implicit
5. Coherent	Does the measure reflect a concept or construct that is coherent with a general understanding of what constitutes meaningful adaptation? Are assumptions underpinning the use of proxies empirically validated or theoretically sound?	Implicit in the Paris Agreement, particularly Articles 7, 13, and 14
6. Sensitive to national context	Is the measure sensitive to diverse national contexts (for example, different political, economic, and socio-cultural priorities and resources)? Does the measure avoid unjustified, poorly evidenced, or generalized assumptions — implicit or explicit — regarding what is 'good', 'appropriate', or 'sufficient' adaptation?	Implicit but unspecified; degree of desired normativity unresolved

Table 5: Criteria for the global assessment of adaptation, Source: (Olhoff et al. 2017b)

Table 5 shown above indicates a list of criteria to be fulfilled by the GST as per the articles and mandates indicated in the Paris Agreement. These criteria are: (1) **aggregable** which is the extent to which frameworks use metrics that are comparable, consistent, comprehensive, coherent and can be measured qualitatively and quantitatively (Ford and Berrang-Ford 2016), (2) **transparent** in the methods used, inherent assumptions, guiding principles and choice of indicators used, (3) **longitudinal** which allows for tracking changes over time or from a baseline, (4) **feasibility**, if the national reporting data is utilised then it must keep reporting burden on nations to minimum and if publicly available data is utilised, then indicators must be available or it can be reasonably collected for majority of nations, (5) **coherent** is vital, since no conceptual manner to measure adaptation directly, the proxy indicators used has to be in line what we understand as adaptation, and (6) **sensitive to national contexts**, as it needs to be reflective of the wide range of vulnerability profiles, economic, social and cultural contexts as well (Olhoff et al. 2017a). These are mainly to assess the progress towards the overall goal set in the PA which is one of the four functions of the GST.

However, other functions of the GST include assessing the effectiveness. Dupuis and Biesbroek (2013) as cited in (Olhoff et al. 2017a) propose a proximity-to-target approach which focus on if the government is achieving their pre-identified goals, it can be checked for adequacy to sufficiently reduce the existing vulnerabilities and risks faced by the nations. Hence, GST should allow for both the checking of the progress of what governments are doing and if they doing enough to address the risks.

Moreover, uncertainties in climate impacts and adaptation outcomes as well as changing risks are constraints which will affect the results of the assessment (Olhoff et al. 2017b).

Sources of information available for the GST

The GST is a monumental initiative tasked with tracking the progress on the global goal on adaptation and hence it requires data from a multitude of sources. The following sources are as indicated in studies.

Firstly, the UNFCCC prepared synthesis report on the state of adaptation efforts, experience and priorities which will build on the information included in the national submissions from countries such as the Adaptation Communications (AC), National Adaptation Plan (NAP), a nationally determined contribution (NDC), a national communications (NC) and biennial transparency reports (BTR) for adaptation (Christiansen, Olhoff, and Dale 2020).

Secondly, the latest IPCC reports and this includes the Sixth Assessment Report by Working Group II of the IPCC which was published in early August 2021 and the special reports published under the sixth assessment cycle of the IPCC. These reports are particularly helpful for the global stock taking exercise as they are distinctively placed at the critical nexus between policy and science with a formal mandate from UNFCCC to provide autonomous scientific evaluations (Christiansen, Olhoff, and Dale 2020).

Thirdly, other reports and information which include those from subsidiary bodies (Subsidiary Body for Implementation, SBI and Subsidiary Body for Scientific and Technological Advise, SBSTA), reports from other formal bodies (the Adaptation Committee, the Technology Executive Committee, etc), relevant reports from UN agencies and other international organisations (SDG report, Sendai Framework Progress Report, Global Commission on Adaptation, Global Centre on Adaptation report, UNEP Gap Report, etc), submissions from non-party stakeholders (reports from NGOs or other organisations working on the ground, etc), UNFCCC observer organisations and regional institutions and voluntary

submissions from parties or regional negotiation groups (Christiansen, Olhoff, and Dale 2020). Although the varied sources ensure that no relevant information for the GST is excluded, it is challenging to imagine that this amount of data can be meaningfully managed and insight extracted by the GST process.

Types of information available for the GST from the various sources

The UNFCCC has created instruments for national communication and reporting on adaptation which has resulted in a wide array of instruments that seem closely related and even intersecting at times due to the degree of flexibility offered on what information can be included in those instruments (Christiansen, Olhoff, and Dale 2020). This is an indication that the instruments have developed over time to fulfill multiple functions, to appease the countries' request to avoid overly strict reporting requirements and the need to get around placing excessive pressure on developing nations, in terms of reporting.

Generally, these instruments can be categorised as ex-ante or ex-post. Ex-ante (NDC, NAP, AC, etc) instruments provide forward-looking information on what a country intends to do or is planning to do in the future while ex-post (BTR and NC) instruments provide backward-looking information on what the country has already done in terms of adaptation (Christiansen, Olhoff, and Dale 2020). In reality, it should be noted that most instruments under UNFCCC related to adaptation have some provisions for providing both ex-ante and ex-post information even if this information is not key to the central ambition of the instrument (Christiansen, Olhoff, and Dale 2020).

NDCs are an instrument primarily designed to convey mitigation ambitions (legally obligatory) but following the Lima Call for Climate Action, countries also include an adaptation component (voluntary basis, not obligatory), especially the developing countries

who also articulate the support they need to achieve this (Christiansen, Olhoff, and Dale 2020) and are submitted every 5 years.

The typical components of the adaptation component of the NDCs are: (1) national circumstances (geography, political and economic context), (2) description of one or more long-term goals or vision for national adaptation and development, (3) impact and vulnerability assessment (analysis based on downscaled climate scenarios and associated national impacts on key vulnerable development sectors and regions), (4) legal and regulatory frameworks that provide basis for adaptation actions, (5) adaptation measures planned or under implementation (limited detail on exact activities with aggregate quantitative targets and goals in some cases only), (6) costs, losses and damage due to climate impacts (including cost analysis), (7) means of implementation (with type of support needed in terms of capacity building or technology or finance), (8) M&E of adaptation and (9) synergies between mitigation and adaptation (Christiansen, Olhoff, and Dale 2020).

As NDC is primarily an ex-ante document probably has limited information to guide the stocktaking process of the GST. Moreover, (Christiansen, Olhoff, and Dale 2020) state that the existing NDCs were prepared without formal guidance and hence the adaptation components are not consistent, comparable and aggregate across countries. This further necessitates the importance of more guidance for the reporting on adaptation components to enable an effective GST to take place.

NAP is a forward-looking planning document which aspires to support Least Developed Countries (LDC) and developing nations to create and put into action plans for their medium to long-term adaptation needs (also attract donor support for their initiatives) at a national level in a deliberate manner (Christiansen, Olhoff, and Dale 2020). It includes mainstreaming adaptation into national planning, increasing capacity for taking actions and

improve coordination between stakeholders involved; it was agreed that this process is a continuous, progressive and iterative process that is updated regularly (Christiansen, Olhoff, and Dale 2020).

The typical contents of a NAP are as follows: (1) national vulnerability assessment identifying broad impacts of climate change in different sectors and potential adaptation options, (2) review and appraisal of broad adaptation options and prioritisation amongst them, (3) synthesis of above into a range of higher-level national strategic priorities for adaptation, (4) stakeholder mapping and (5) M&E system for the NAP process with regular schedule for updating the NAP. NAP will provide information which meets some objectives of the GST.

However, since NAP is an ex-ante document, it may not provide information for objective 1 which is the look into what adaptation activities were implemented. However, for the other 3 objectives, this document probably has information which is valuable. For example, as this document intends to attract donors, the information on support required and given thus far and also the effectiveness is most likely included as evidence to convince the donors to provide additional support, if required.

AC is newly established under the article 7 of the PA in 2015 and is slated to be submitted separately, regularly and periodically and perhaps simultaneously with other UNFCCC instruments such as the NDCs and contain information as individual nations deem fit in time for the GST (Christiansen, Olhoff, and Dale 2020). AC is a legally obligatory submission, however the exact content is flexible/voluntary (“Adoption of the Paris Agreement” 2015). Its key objectives are to increase the visibility of adaptation and its counterbalance with mitigation, increase adaptation action and assist developing countries, provide input to the GST and enhance learning and understanding of adaptation needs and actions (“Adoption of the Paris Agreement” 2015).

BTR is the main reporting instrument under the Enhanced Transparency Framework of the Paris Agreement, is used to report on mitigation, adaptation and an array of other activities as well and has more explicit provisions for reporting adaptation such as inclusion of the Monitoring and Evaluation (M&E) (Christiansen, Olhoff, and Dale 2020). It is scheduled for first submission in 2024 and updated every two years and hence the first BTR will not be in time and hence cannot be included in the first GST taking place in 2023 (Christiansen, Olhoff, and Dale 2020).

It must be noted that the type of information required in the AC and BTR according to guidelines are similar (further guidance for AC is in progress and will be published in 2022) and are as follows: (1) national circumstances, institutional arrangements and legal frameworks, (2) summary of climate change impacts (current and future), (3) summary of the highest and most urgent climate impacts to be addressed through adaptation and barriers preventing them from being implemented, (4) description of adaptation plans, goals, policies implemented / to be implemented to address barriers in (3), (5) description of adaptation actions and activities that have been planned and implemented based on the plans, goals and policies, (6) description of specific results and impacts achieved through those adaptation actions, and (7) lessons learned (Christiansen, Olhoff, and Dale 2020).

Based on the above, the information provided in AC and BTR can cover objective 1 of the 4 objectives of the GST which is enable recognition of the adaptation efforts of all parties, including developing countries although the term ‘recognition’ is not clearly defined. Moreover, the lessons learned section can potentially contribute to enhancing the implementation of adaptation actions (objective 3) and give an idea of the adequacy (objective 2.1) of the adaptation activities.

For example, particular sections of AC and BTR from nations can provide information

on adaptation activities which can be undertaken in the context of their social, economic and environmental constraints which can potentially be replicated in similar contexts. However, based on the above readings, although there is some good potential to gain insights regarding the effectiveness (objective 2.2) as well as overall progress of adaptation on global goal (objective 4) from lessons learnt and description of impacts of achieved, there is no provision for information which highlights the support (objective 2.3) received for adaptation activities. Hence, AC and BTR probably cannot be utilised to verify the all 3 parts of the 2nd objective of GST in a comprehensive manner. It is likely that this gap in information needs to be fulfilled by other sources, perhaps the information from international funding organisations or development agencies which support adaptation efforts.

Moreover, the potential of this information to fulfill objective 4 needs to be considered carefully based on the information sources and we can infer that the quality of the review of the overall progress will be largely dependent on the granularity of the quantitative and qualitative data provided in AC and BTR and other instruments. By granularity, I mean the consistency, coherence, comparability (Ford and Berrang-Ford 2016; Christiansen, Olhoff, and Dale 2020) of the data provided on the adaptation activities that enable aggregation from national to collective level. Many authors argue that

National communications (NC) is probably a useful source of information given that it is an ex-post instrument and given that this document has guidance for inclusion of information on adaptation, it is a potentially good source of information but it's overlap with AC and BTR in terms of content is likely expected (Christiansen, Olhoff, and Dale 2020).

The following table 3 below summarises the information provided on the types of information which are provided in each instrument, the submission times and the manner in which these information help to fulfill the objectives of the GST.

From the analysis and the tabulation thus far, we can conclude that there are still unresolved methodological issues when it comes to aggregating the data for global analysis in the GST progress monitoring objective. Furthermore, the lack of agreement on the metrics to be used remains a consistent challenge to this process as M&E systems need to provide possibly opposing aims of providing useful operational data on how programs achieved specific goals while providing data that can be aggregated across diverse sectors (Christiansen, Olhoff, and Dale 2020). Following that, the inherent flexibility offered in guidelines will worsen the challenge of aggregation and also, there is currently no plans to do a technical review of the AC and reporting formats and hence potential biases may go unnoticed and limit scope of assessment of GST (Christiansen, Olhoff, and Dale 2020).

The IPCC report offers some insights on enhancements of adaptation and effectiveness of different adaptation options could feed into the GST but structure needs to be amended.

In conclusion, the findings so far indicate the need for better guidance on the reporting to ensure that the data provided by the parties are comparable to allow for aggregation at the global level and fulfill the objective 4 on adaptation. Moreover, we find that there are limited sources of data for the analysis of support provided for the adaptation initiatives and hence this can be included in the guidance for parties to enable collection of more data or ensure such dataset is gathered from 'other sources' such as international, regional funding organisations.

	AC	BTR	NAP	NDC	NC
Category of information	Forward-looking	Backward-looking	Forward-looking	Forward-looking	Backward-looking
Adaptation is mandatory?	'Shall' be submitted	'Should' be submitted, not mandatory	Voluntary	'Invites' (Lima Call for Action) but no guidelines	Yes, with guidelines
Timing of submission	In time for stocktake,	Before 2024, every 2 years after that	Assessed regularly as decided by countries	Every 5 years	Every 4 years
Information provided	<ul style="list-style-type: none">National circumstances, legal frameworksSummary of climate change impacts (current and future)Summary of highest, most urgent climate impacts + barriersAdaptation plans, goals to address barriersAdaptation activities implemented or plannedSpecific results and impacts of adaptation actionsLessons learned	<ul style="list-style-type: none">National vulnerability assessmentAppraise broad adaptation options with prioritisationSynthesis into national strategic prioritiesStakeholder mappingM&E system for NAP process	<ul style="list-style-type: none">National circumstancesLong-term goals for national adaptation & developmentImpact and vulnerability assessment with downscaled climate scenarioLegal and regulatory frameworksAdaptation measures planned or on-goingCosts, losses due to climate impactsMeans of implementation	<ul style="list-style-type: none">National vulnerability and adaptation assessmentIdentify most vulnerable areasAdaptation strategiesEvaluation of adaptation strategies and measures and the methodologies to be 'consistent, transparent and well document'	
GST Objective 1 (Recognition of Adaptation efforts)	Yes		No	Yes	Yes
GST Objective 2.1 (Review adequacy of adaptation)	Yes, to a certain extent		Yes	Yes, to a certain extent	Yes
GST Objective 2.2 (Review effectiveness of adaptation)	Yes, to a certain extent		Yes, to a certain extent	No	Yes
GST Objective 2.3 (Review support provided)	No		Yes, to a certain extent	No	No
GST Objective 3 (Enhance implementation of adaptation efforts)	Yes, to a certain extent		Yes	No	Yes
GST Objective 4 (Review of overall progress towards global goal)	Yes, the guidelines to be improved to offer consistency, comparability and coherence for aggregation at global level		Yes, to a certain extent	Yes, to a certain extent	Yes, guidelines to be improved

Table 6: Information instruments to inform GST, Source: (Author, 2021), devised with data from (Christiansen, Olhoff, and Dale 2020) and (Olhoff, Väänänen, and Dickson 2018)

2.4 Analyse assessment framework against elements isolated in 2.3

The chosen assessment framework for analysis is the one proposed by (Berrang-Ford et al. 2019). The reasons for choosing this framework for analysis are that (1) it claims applicability to GST and scalability to global scale, (2) published in 2019 which is 2 years after the publishing of the UNEP's Adaptation Gap Report 2017 offering a comprehensive guide for establishing a global assessment framework for adaptation (implicit assumption that the framework kept in consideration the concerns raised in the Gap Report), and (3) conceptual framework which situates multiple, relevant concepts within the same framework.

Available Conceptual Framework for global adaptation assessment (Berrang-Ford et al. 2019)

Berrang-Ford et al (2019) propose a conceptual framework for adaptation tracking and its assessment which they claim can be applied systematically and consistently across all possible levels of governments (vertically) or sectors (horizontally), and over time. This reflects its applicability to the PA's GST for tracking progress towards the global adaptation goal. Moreover, the authors reinforce their framework by claiming that such tracking allows propagation of adaptation, sharing of good practices, and encourages creative competition. Instead of focusing on specific indicators or metrics, this conceptual framework outlines key concepts, elements, and questions to be used to systematically assess adaptation over time and across governments (Berrang-Ford et al. 2019).

The framework presented aims to integrate both the contexts within which adaptation is created by governments and the concrete action that showcases what the government is doing (adaptation efforts), combined with changes in climate vulnerability (adaptation results). Figure 4 shown below represents this graphically. (Berrang-Ford et al. 2019) details that aligning position across the four components – vulnerability profile and context, adaptation

goals and targets, adaptation efforts, and adaptation results – is the key which enables the framework’s approach to adaptation assessment by tracking whether vulnerability is changing and what works in given context. This framework does not propose new tools for assessing but bring the existing components into a single framework (Berrang-Ford et al. 2019).

Berrang-Ford et al (2019) state that descriptive assessment considers the four components mentioned above, uses the vulnerability profile that the government is responsible for addressing as motivation for adaptation efforts and the baseline with which targets can be developed. The government’s national contexts such as capacity are considered crucial underpinning the adaptation goal and moreover, longitudinal assessment is important to observe not only the changes in vulnerability but also the climate risks (Berrang-Ford et al. 2019).

The goals and targets are separate from adaptation efforts as governments rank the vulnerability scenarios in order of importance and derive the adaptation efforts from there without a direct translation of vulnerability assessments into efforts. Adaptation efforts indicate what a government is doing, and the goals are ways in which governments prepare for adaptation and hence the adaptation efforts include both process and outcome-based concepts (Berrang-Ford et al. 2019).

Adaptation results consider the changes in vulnerability that arise in response to government’s effort and assessed through similar indicators for vulnerability assessment and can be complemented by quantitative and qualitative evidence to link the changes to the adaptation efforts (Berrang-Ford et al. 2019). The adaptation gap report (2017) supports this argument by highlighting that contribution of efforts to certain outcomes and impacts appears to be more useful than attribution which is challenging to connect and very unlikely to be reliable across different nations (Olhoff et al. 2017b).

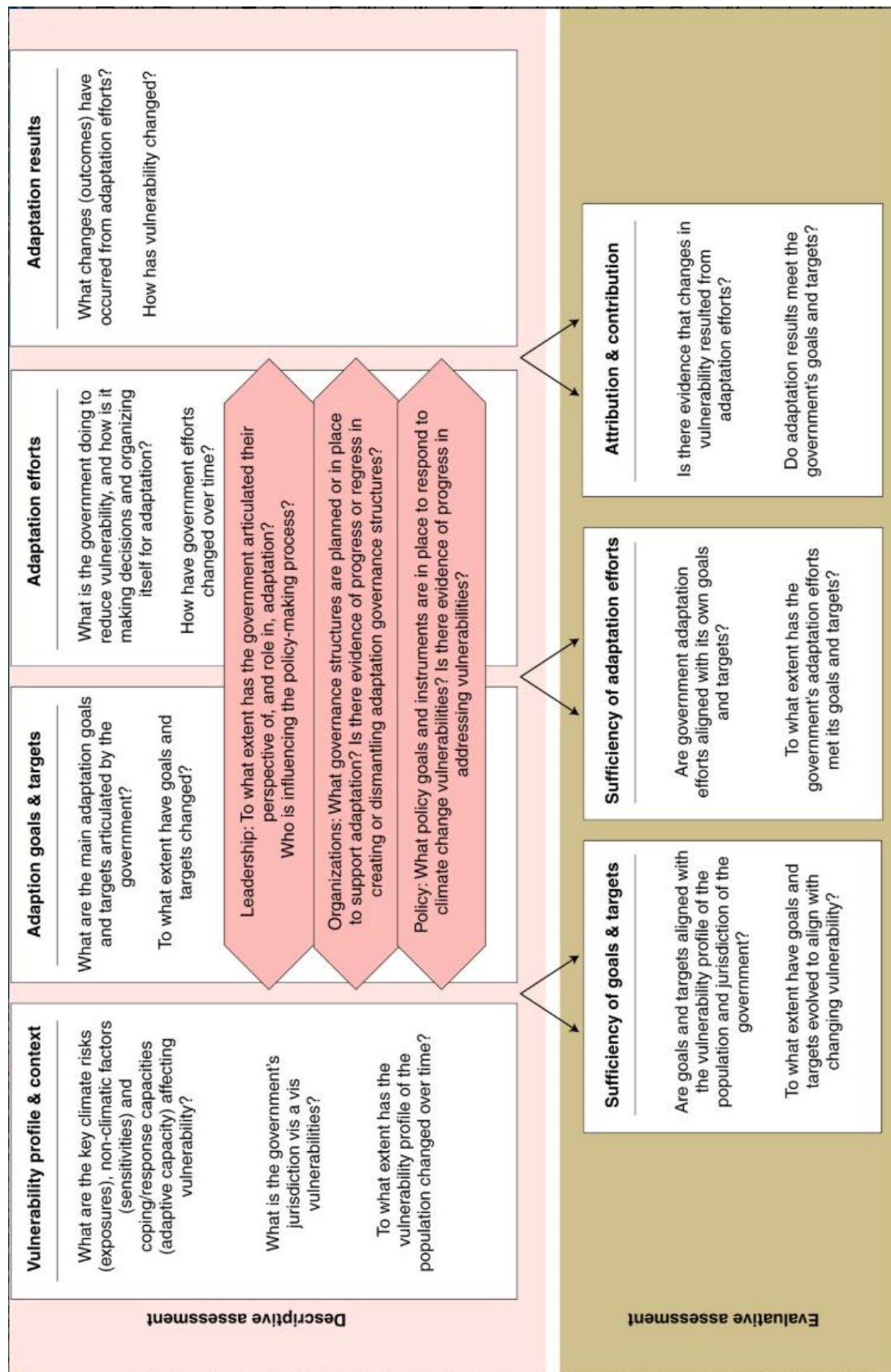


Figure 4: Conceptual framework proposed, Source: (Berrang-Ford et al. 2019)

Berrang-Ford et al (2019) also allows us to assess progress on adaptation by evaluating alignment across the four components and for instance, evaluation of adaptation goals is based on the extent to which they are in line with major population vulnerabilities and contexts. This can include a variety of measures such as questioning if the right vulnerabilities were prioritised and address within goals and are goals sufficiently ambitious given the vulnerabilities (Berrang-Ford et al. 2019). Evaluation of adaptation efforts, on the other hand is based on alignment of government actions with their own vulnerability assessment and goals.

Three inter-linked sub-components enables adaptation efforts and their goals to be analysed and they are: leadership (identify sources of leadership), organisation (how adaptation is institutionalised in governments) and policy (catalogues the array of tools that governments are adopting to respond to climate-related risk) and they should be assessed together due to their hyper connectivity (Berrang-Ford et al. 2019).

Firstly, leadership tries to identify who is responsible for and initiating the policy changes which can be a combination of state and non-state actors (their involvement is a distinctive characteristic of this process) including their relationship which could give clues on how the vested interests of each stakeholder shapes and contributes to how adaptation is defined (Berrang-Ford et al. 2019).

One methodological tool which can be used to explicate these variables include a discourse analysis of target setting and policy making which can help to gain an idea of the extent to which adaptation is pushed to the foreground and the way it is packaged and presented by governments (Berrang-Ford et al. 2019). As for identifying the underlying relationships between the various actors, private-sector investments in adaptation-related projects and partnership building with non-state actors can be use as proxies (Berrang-Ford et al. 2019).

Secondly, organisations making policy affect what actions are deemed appropriate and worthy of response with respect to climate impacts and how generally limited resources of government are allocated (Berrang-Ford et al. 2019). For instance, it includes the array of manners in which governments and other organisations have established their knowledge creation on adaptation (through in-house expertise or private sector consultants, etc) and how adaptation is organised (through mainstreaming into existing policies or establishing a new field to enable action) are important considerations (Berrang-Ford et al. 2019). This is a key criterion as organisations can serve as enablers and inhibitors of climate change governance.

The indicators which can be used for this purposes are well-established and are vertical or horizontal coordinative mechanisms, mainstreaming, spread of responsibilities on climate change and how adaptation knowledge is organised and the methodological tools which can be used are structured surveys and self-assessments (Berrang-Ford et al. 2019).

Thirdly, deconstructing adaptation policies which are considered as the adaptation goals that governments adopt and the means by which they seek to fulfil those goals (Berrang-Ford et al. 2019). The longitudinal analysis of policy will be undertaken through periodic collection of policy data in an iterative process designed to reveal the waxing and waning of adaptation policies over time.

The figure 5 below illustrates how policy change can be observed through shifts in different elements of a policy and provides a complex picture of policy progress over time. It identifies six components of policies that capture goals and means of implementation and are organised based on three levels of abstraction in increasing detail (Berrang-Ford et al. 2019).

With this thorough understanding of the framework, we can now begin to analyse it against the elements isolated in section 2.3. Refer to the table 7 for a summary of the findings.

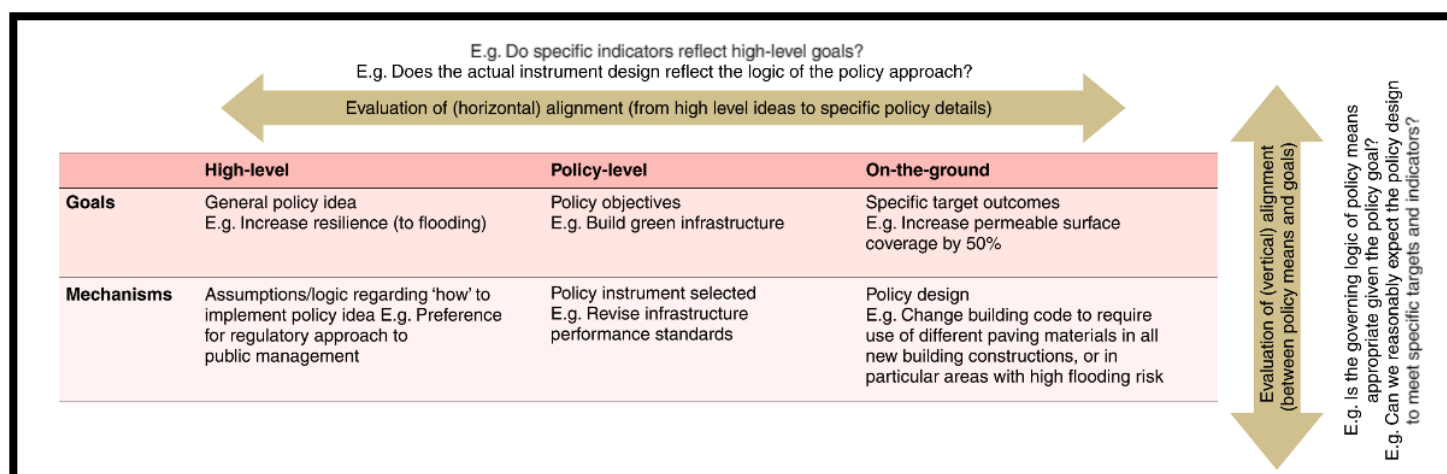


Figure 5: Key components of policies, Source: (Berrang-Ford et al. 2019)

Analysis of framework against elements isolated in section 2.3

The framework proposed by Berrang-Ford et al (2019) is an approach that is suitable for a sectoral analysis and component-based analysis. From the above description of the assessment framework, it can be extracted that the framework does not explicitly indicate any synergies with other frameworks such as Sendai Framework or SDGs (element 1 isolated in section 2.3, refer to table 7 on page 56). However, as this framework is conceptual one and due to that, the authors do not get into the level of a details that entails provision of specific indicators. Hence, there are potential synergies that can be optimised at a later stage when the framework gets into that detailed stage with indicator development. Especially in the vulnerability reduction indicators, which are potentially quite like SDGs and Sendai Framework indicators as detailed in earlier sections. Refer to table 7 on page 56 for a tabular compilation of the assessment of the framework against the elements isolated in section 2.3.

The framework also includes and suggests provisions for use of all range of indicators (element 2 isolated in section 2.3, refer to table 7 on page 56) from outcome to impact during the various stages in the descriptive and evaluative assessments and there is mentioning of the need to include them in the indicator selection as observed during the description of the

indicators.

As for the 3rd criteria on collectively agreed priority sectors, the framework has specified that it can be applied nationally or globally and hence due to the conceptual level at which the granularity of framework is limited, it is not possible to explicitly decide on this criterion. However, given that the framework can be scaled, the priority sectors will probably be negotiated by nations at a collective level if this framework is chosen for the GST.

As for the non-sectoral approach criteria, the framework meets all the indicated criteria by explicitly indicating provisions for them. By differentiating the vulnerability profile from the adaptation goals, the framework assesses the nation's prioritisation of the goals to address the key causes of risk and vulnerability. Moreover, the evaluative assessment pits the goals and targets against the vulnerability profile of the population and thereby creates space for indicators which define the effectiveness in terms of, for what.

With respect to the question of effectiveness for whom, the leadership sub-component which uses the methodological tool of discourse analysis will bring out these nuances and the framework is also well-catered for that. Furthermore, such analysis will also elucidate the assumptions and notions as viewed from multiple stakeholders' perspectives and fulfils that criterion too. In addition, this approach possibly also indicates the underlying power dynamics between the state and non-state actors that can enlighten the questions on power dynamics, justice, and equity (refer to table 7 page 56), provided the discourse analysis is done in an objective manner.

Lastly, the framework can accommodate to fit various social, environmental, political, and economic contexts as the nations have the flexibility to chart their own indicators, although some negotiations is probably required to align the indicators. The framework does press for evidence that changes in vulnerability results from adaptation efforts but suggests a contribution of the adaptation efforts towards vulnerability changes rather than attribution and

supported by other sources (Olhoff et al. 2017b).

S/ N	Type of assessment	Elements in assessment frameworks enabling GST	Framework by Berrang-Ford et al (2019)
1	Sectoral approach	Synergies with indicators from Sendai Framework & SDG	No indications
2		Inclusion of a range of indicators: outcome, process, input, impact	Yes, all range of indicators included
3		Collectively agreed priority sectors for indicator development under the UNFCCC process	Decided by the individual nations, potentially negotiated
4	Non-sectoral, adaptation components based approach	Adaptation addresses root cause of risk, vulnerability or exposure	Yes
5		Indicators for effectiveness to be specific (i.e., effective for whom & what) decided by key stakeholders	Yes
6		Make explicit the assumptions and notions of progress	Yes
7		Flexible enough to fit various social, environmental, political contexts	Yes
8		Sensitive to underlying power dynamics, justice & equity	Yes, through further methodological tools which complement the framework
9		Able to justify causality between adaptation effort and outcome, to an extent	Yes, attempts to provide contribution rather than attribution

Table 7: Comparing Berrang-Ford et al (2019) framework against isolated elements,

Source: (Author, 2021)

On top of the above assessment based on the criteria isolated from literature review, another assessment can be done against the framework using the criteria for a global assessment of adaptation which can be found on page 39 of the thesis.

Even when compared against those criteria, the Berrang-Ford et al (2019) framework can meet 5 out of 6 criteria (aggregable, transparent, longitudinal, feasible, coherence and sensitive to national contexts). Firstly, the framework offers a consistent definition of adaptation through the synthesis of vulnerability, adaptation goals, efforts, and results into a single framework. Secondly, the framework makes provisions for assumptions to be elucidated in the evaluative and descriptive assessment built into it. Next, the analysis can be performed in a longitudinal manner over time, and this is one of the major selling points described by the authors as they introduce the framework.

Following that, as for the feasibility, given that the framework is only conceptual and does not go into the details of the indicators used, the information currently available cannot be utilised to gauge the feasibility of the framework. Next, for the coherence, the interlinkages between the four components of the framework combined with the descriptive and evaluative assessments built into the system can satisfy this criterion. And lastly, given the nature of this conceptual framework, it lends itself to be utilised in all diverse national contexts which is another one of the key strengths and selling points mentioned by the authors.

Furthermore, the framework urges to consider the leadership involved in the adaptation planning, organisations which are responsible for implementation of the planning and their tracking progress tracking mechanisms and finally policies which are put in place to reify these goals. The effectiveness of these measures can be measured through the evaluative assessment.

In yet another form of testing of this framework, it can be compared against the four functions of the GST with respect to the global goal on adaptation: (1) recognition of

adaptation efforts of developing country parties, (2) review of the adequacy (2.1), effectiveness (2.2) and support (2.3) provided for adaptation action, (3) enhancing the implementation of adaptation action, and (4) review overall progress towards the global goal on adaptation. Given the understanding of the framework established thus far, it can meet the function 1 (via the adaptation efforts section), 2.1 (via the evaluative assessment of adaptation efforts, goals, and results), 2.2 (via changes in vulnerability), 3 (through longitudinal analysis of the framework) and 4 (through the entire framework to assess global progress once the indicators are created and agreed upon). However, this framework may not be able to support function 2.3 to review the adequacy of support received. This needs to be addressed in other ways to ensure the framework can fully contribute to meeting all the functions of the Global stocktake.

One key challenge of this framework is establishing a causal link / contribution of the adaptation efforts to the adaptation results which may be reflected in changes in vulnerability.

Another key barrier to this framework being chosen to be utilised for the GST is: Bridging the gap between conceptual frameworks and their operational implementation in the field. Hence, the true robustness of the framework can be determined when it is collectively agreed upon by the governments to be adopted for use at the GST. Despite the operational challenges, this framework remains as one meaningful contender for the global assessment framework.

In conclusion, the conceptual framework by (Berrang-Ford et al. 2019) is one that can enable a GST to take place in a manner which avoids the pitfalls of the predicted pitfalls of global assessment as it meets most of the criteria isolated in section 2.3 on enablers of a GST. Moreover, given the fact that this proposal was elucidated after the publication of the UN Adaptation Gap Report of 2017 offers more possibility for this framework to be adopted. UN Adaptation Gap Report offers quite a comprehensive summary of the wide-ranging challenges

of global assessment with predicted pitfalls and potential available frameworks for the assessment.

This concludes the section on analysis and findings. The section has managed to outline a definition of concept of adaptation in section 2.1, introduced the assessment of adaptation and the challenges involved in this process in section 2.2 and dealt with outlining elements enabling a GST to take place in section 2.3. Sections 2.1 and 2.2 are foundational sections that create an understanding of the context of adaptation and assessment in general. Section 2.3 then goes into the details of isolating elements which enable a GST to take place from the literature reviewed. In last section of 2.4, the isolated elements are then compared against a chosen conceptual framework to test the robustness of the framework to fulfil the needs of the GST.

CHAPTER 3: CONCLUSION

Drawing references from the research objectives, this section will summarise the conclusions reached. Moreover, it will also highlight the potential gap for future research to be undertaken.

With respect to objective 1 on outlining a definition of adaptation, the research explored the various definitions and delved deep into the multi-fold nuances of the concept, highlighted the importance of utilising the appropriate heuristics or term intentionally as this is key to handling this complex term in a meaningful manner. In conclusion, there is no universally accepted definition of adaptation (Olhoff et al. 2017b; Tompkins et al. 2018; Milkoreit and Haapala 2017). However, for the purpose of this research, the definition is taken from the UNEP Adaptation Gap Report.

As per the UNEP, adaptation can be defined with respect to the human and natural systems separately. In human systems, the process of adjustment to actual or expected climate and its effects 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 (Olhoff et al. 2017b). Focus must be given to some terms to better understand the concept. For example, one is ‘moderate harm’ which indicates that the effects of climate change are already felt, and that any adaption measure is only an alleviation attempt to mitigate the worst of the consequences and society must be prepared to face some.

With respect to objective 2 on assessing adaptation and the challenges involved, the section highlighted a multitude of factors. From exploring the individual adaptation components that can be studied to create a more holistic method of assessment of the adaptation efforts to the numerous challenges present in assessing the efforts.

The challenges are numerous from conceptual ambiguity to indicator choices. Some of

the challenges are lack of agreement on data collection methods, attribution of effective outcomes to adaptation efforts, recognition of adaptation as a linear process in frameworks (adaptation is actually a non-linear process and is cyclical as well), longer timelines for adaptation outcomes to be known, flexibility about reporting timing and content in national communication reports and of course, accounting for mainstreaming of adaptation activities which may not be explicitly labelled as such. However, these challenges can be managed through a sensitive framework that is uniquely catered to the adaptation concept.

As for objective 3 on outlining elements enabling a GST to take place, the research analysed the various approaches available for assessing adaptation, the advantages, and disadvantages of each approach in depth, explored the methodology of implementing the approaches, looking at the sources of data available and of course, the guidance for metrics and assessment indicators. From this extensive literature review, the research isolated a list of elements which enable a GST to take place that can be used to appraise any adaptation assessment frameworks proposed for the GST.

With respect to the last objective on exploring assessment frameworks, the research narrowed down on the assessment framework proposed by (Berrang-Ford et al. 2019). This section compared this framework against the elements isolated in previous section and various other criteria and found the framework to be quite robust in fulfilling most of the criteria set. This is evidence-based support for this framework to be utilised in GST.

Some research gaps were identified and could not be addressed due to the scope of this research and time constraints. Firstly, one of the functions of the GST is to review the support provided for adaptation activities to developing nations. This function could not be addressed by the chosen assessment framework and the analysis of the sources of data for GST also did not present many options to fulfil this function. This could be addressed in further research projects.

Next, the framework chosen for analysis is a conceptual one and hence to operationalise it, further research needs to be done potential indicator and this process could benefit from the synergies present with the Sendai Framework and SDGs.

In conclusion, this research has managed to meet the overall aim by isolating elements which can enable the GST process and compare available framework against it for a quick check on its ability to contend against predicted or well-established pitfalls of global assessment.

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