Food and Agriculture Organization of the United Nations

Integrating agriculture in National Adaptation Plans (NAP-Ag) Programme

Toolkit for value chain analysis and market development integrating climate resilience and gender responsiveness

September 2020

Toolkit for value chain analysis and market development integrating climate resilience and gender responsiveness

Integrating agriculture in National Adaptation Plans (NAP-Ag) Programme

Published by
the Food and Agriculture Organization of the United Nations
and
United Nations Development Programme

Required citation:
FAO and UNDP. 2020. *Toolkit for value chain analysis and market development integrating climate resilience and gender responsiveness - Integrating agriculture in National Adaptation Plans (NAP-Ag) Programme*. Bangkok. https://doi.org/10.4060/cb0699en

ISBN 978-92-5-133192-7 [FAO]

Contents

ANNEXES

TABLES

FIGURES

Preface

This *Toolkit for Value Chain Analysis and Market Development Integrating Climate Resilience and Gender Responsiveness* aims to help countries in selecting and analysing value chains for opportunities to improve climate change resilience and reduce gender inequalities. It is published in accordance with the 2018 Intergovernmental Panel on Climate Change's (IPCC's) Special Report on Climate Change and Land which reported on the impact of global warming of 1.5 °C (IPCC, 2018) above pre-industrial levels. It emphasizes that containing global warming within a 1.5 °C margin is not possible without the substantial contribution of the agriculture sectors. Furthermore, the IPCC Special Report provides countries with clear guidance on how science, technology and innovative approaches should be pursued to address climate change for the land-use sector. Subsequently, this toolkit helps countries in identifying and prioritizing investments to promote market development in line with these opportunities.

At the same time, there is a need for accelerated implementation for achieving the nationally determined contributions (NDCs) under the Paris Agreement, as well as a greater push for government-led ambition to do so. With 89 percent of countries identifying agriculture as a major priority sector in their NDCs, investing in adaptation of agriculture sectors is required. The NDC Global Outlook Report 2019 observes that agriculture is one of the greatest concerns in terms of vulnerability in the NDC sector. Agriculture plays a relevant role in mainstreaming the NDC process. However, progress in translating these efforts into budgets is still lacking (UNDP and UNFCCC, 2019). Key strengths of the value chain approach include assisting in adaptation planning, analysis of vulnerabilities and hotspots across a value chain, assessing risks at each node, identifying new market opportunities to help communities adapt, and suggesting partnerships in which there is mutual benefit from the implementation of the strategies.

This toolkit intends to provide policy makers, planners, project developers, technical advisors and implementers at local, regional or national level, with good practices of climate-resilient and gender-responsive value chain development.[1] It aims to act as a repository of relevant tools and methodologies for identifying relevant stakeholders and engaging with them to collect data and analyse it to design interventions. Climate change threatens agricultural value chains and having a gender-responsive value chain approach is useful in analysing the climate risks, as it looks at stages during and beyond production, while using a more systemic approach to risk management.

1. FAO also developped a specific tool for Value Chain Analyis to support decision making, that includes cost-benefit and value-added analyses. Please refer to FAO, 2013.

Acknowledgements

The *Toolkit for value chain analysis and market development integrating climate resilience and gender responsiveness* was drafted by Himanshu Dhingra (Ernst and Young), Vipul Nanda (Ernst and Young), Amit Bajaj (Ernst and Young), under the supervision of Amit Vatsyayan (Ernst and Young) and in substantive collaboration and iteration with UNDP and FAO teams. This publication was developed under the supervision of Rohini Kohli (UNDP) and Julia Wolf (FAO), with technical guidance from Shovon Kibria (UNDP).

Review and suggestions were provided by: Catherine Hill (UNDP), Srilata Kammila (UNDP), Sibyl Nelson (FAO), Nat Pinnoi (UNDP), Alejandra Safa (FAO) and Julie Teng (UNDP).

The toolkit benefited from a technical workshop held in Bangkok with the Ernst and Young team and the following team members: Bettina Gatt (FAO), Catherine Hill (UNDP), Srilata Kammila (UNDP), Shovon Kibria (UNDP), Rohini Kohli (UNDP), Pradeep Kurukulasuriya (UNDP), Umberto Labate (UNDP), Benjamin Larroquette (UNDP), Reis Lopez Rello (UNDP), Mariana Simoes (UNDP), Yusuke Taishi (UNDP) and Julie Teng (UNDP).

The final draft of the toolkit was reviewed by Daniele Gelz (Manager, Aid for Trade Program, UNDP), Shovon Kibria (UNDP), and Benjamin Larroquette (UNDP).

Thanks are owed to Melanie Pisano (UNDP), Rebecka Ramstedt (FAO) and Subhi Shama (UNDP) who coordinated the publication and dissemination of the Toolkit. The authors are grateful to Tiffany Noeske for editing the toolkit and to Laframboise Design for the layout.

Any omissions of contributors to this guide are unintentional.

If you seek more information or would like to provide feedback, please contact: FAO-NAPs@fao.org or rohini.kohli@undp.org.

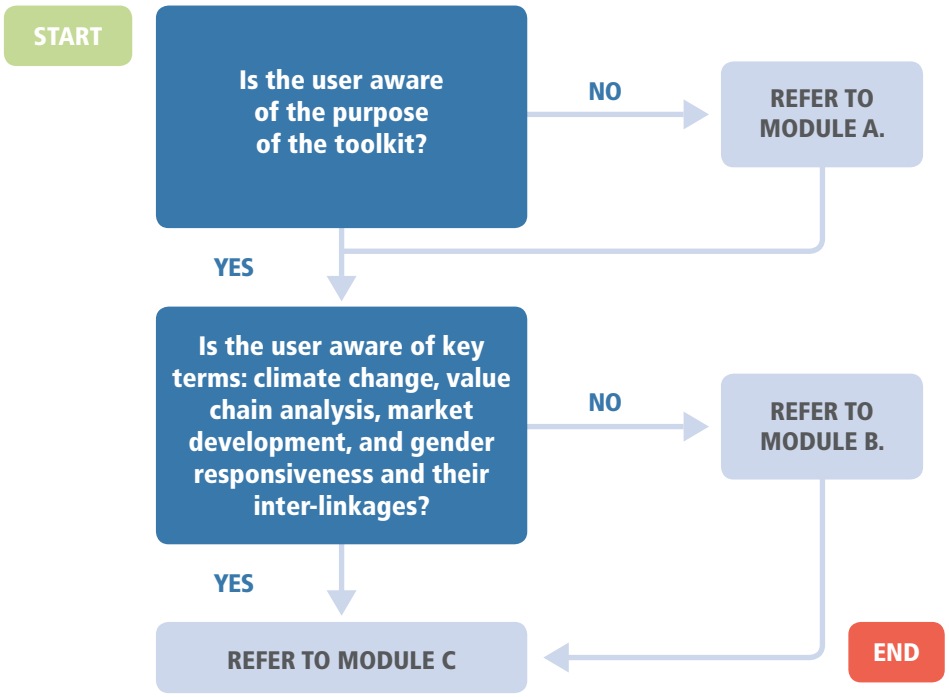
This work has been made possible thanks to the financial contribution of the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU) through its International Climate Initiative (IKI).

Abbreviations

ASEAN	Association of Southeast Asian Nations
AEZ	Agro-ecological zones
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany)
COP	Conference of the Parties
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussion
FI	Financial institutions
GAEZ	Global agro-ecological zone
GDP	Gross domestic product
GREAT	Gender Responsive Economic Actions for the Transformation of Women
ICT	Information and communications technology
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
IIASA	International Institute for Applied Systems Analysis
LDC	Least developed countries
MoAL	Ministry of Agriculture and Livestock (Zambia)
M&E	Monitoring and evaluation
NAPA	National Adaptation Programme of Action
NAP-Ag	Integrating Agriculture into National Adaptation Plans
NAP	National Adaptation Plan
OTC	Over-the-counter
PPP	Public-private partnership
PPS	Proportional to size
RBM	Results-based management
RCPs	Representative Concentration Pathways
SHGs	Self-help groups
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	The United States of America
USD	United States Dollar
VC	Value chain
VCA	Value chain analysis
VCF	Value chain finance
WHO	World Health Organization
ZARI	Zambia Agriculture Research Institute

Figure 1

Overall schematic for using the toolkit



MODULE A. About this document

1. Objective

The objective of the toolkit is to help countries in selecting and analysing value chains for opportunities to improve climate change resilience and reduce gender inequalities; and subsequently help in identifying and prioritizing investments to promote market development in line with these opportunities.

2. Intended users

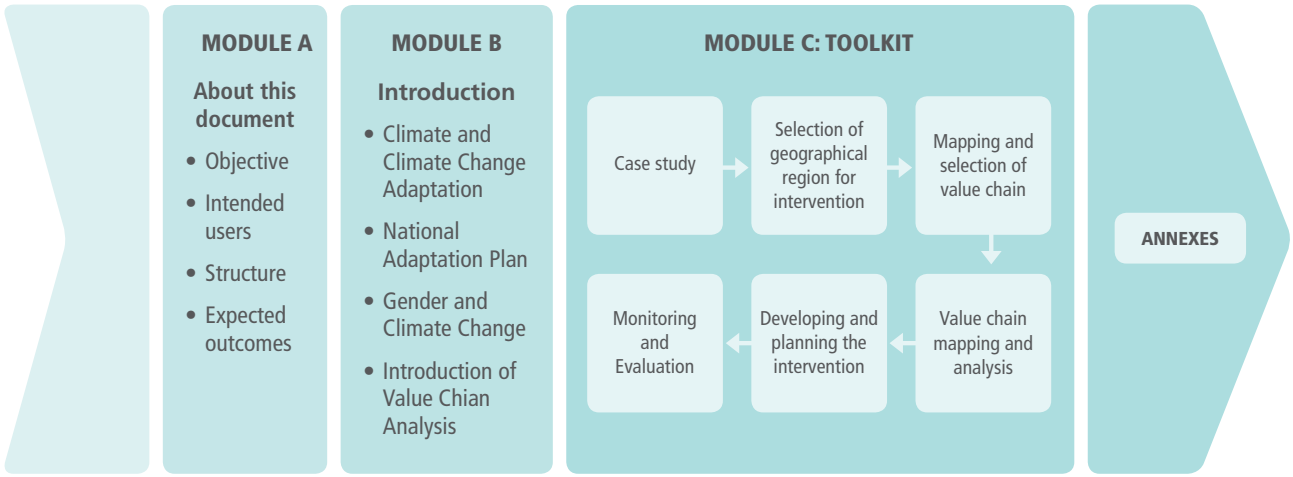
- The toolkit is targeted at policy makers, planners, project developers, technical advisors and implementers at local, regional or national level, to assist them in integrating climate change resilience and gender responsiveness into market development strategies for agriculture commodities.
- The toolkit may also be used by market research firms, strategy consulting organizations, independent consultants or any other organization working on market development of select value chains.

3. Structure

The document is divided into three modules (A to C) which have been further divided into subsections. The schematic below shows the structure of the document:

Figure 2

Structure of the document



Below is a brief description of the content covered in each of the modules:

Table 1

Description of the modules

Module	Topic	Description
A	About this document	This section covers the details about the document in terms of its objective, intended users, structure, and expected outcomes.
B	Introduction	This section gives a brief overview of climate change and climate change adaptation and of gender and its linkages with climate change. It provides an introduction to NAPs in the context of adaptation planning and, subsequently, presents the concept of value chain analysis. It also underlines the need to integrate climate change resilience and gender responsiveness with the value chain approach.
C	Toolkit	This section gives step-by-step guidance on conducting a value chain analysis that integrates climate change resilience and gender responsiveness into value chain development strategies. It demonstrates the same using a case study. The toolkit also provides guidance on undertaking M&E.

4. Expected outcomes of this toolkit

The toolkit intends to achieve the following outcomes:

- Climate-resilient and gender-responsive value-chain development;
- Act as a repository of tools and methodologies for identifying relevant stakeholders, engaging with them to collect data and analysing it to design interventions;
- Enable practitioners to draw relevant lessons from good practices shared throughout the toolkit; and
- Be a repository of relevant resources on gender-responsive and climate-change resilient value chain analysis and value chain development.

MODULE B. Introduction

1. Climate Change and Climate Change Adaptation

1.1 WHAT IS CLIMATE CHANGE AND CLIMATE CHANGE ADAPTATION?

"Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." (UN, 1992).

In addition to amplifying existing risks, climate change will lead to the creation of new risks for the entire eco-system. It is projected that in urban areas, the risk would increase for people, assets, economies and ecosystems. This would be amplified in cases of lack of essential infrastructure or services, or living in exposed areas (Pachauri and Meyer, 2014). Moreover, it is projected that in rural areas, the risks would involve significant impact on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops. Limiting the rate and magnitude of climate change can lead to the reduction of these risks (Pachauri and Meyer, 2014).

Reducing and managing the risks of climate change requires using mitigation and adaptation strategies. While the former focuses on reducing the emission of greenhouse gases, the latter places emphasis on increasing the adaptive capacity of socio-economic systems to minimize the adverse impact of climate change and capture opportunities (Pachuari and Meyer, 2014).

As the United Nations Development Programme (UNDP) Strategic Plan (2018–2021) lays out a commitment to strengthening sustainable development pathways and building resilience in developing countries, the UNDP is currently supporting a number of countries to implement a large portfolio of climate change adaptation (and mitigation) projects. This toolkit focuses on climate change adaptation as it is developed under the NAP-Ag programme, which is an adaptation planning project. Adaptation is a key pillar in response to climate change as it is necessary to address the various impacts of climate change that are already unavoidable due to past emissions (Mimura *et al.*, 2014). More so, adaptation is the main priority for many developing countries because of the expected adverse impact of climate change on national development, sustainability and security (FAO, 2017b).

As adaptation options exist in all sectors, but with different sectors and regions having differing contexts for implementation and potential to reduce climate-related risks (Pachauri and Meyer, 2014), the subsequent section deals with the focus sector of this toolkit – agriculture.

1.2 CLIMATE CHANGE ADAPTATION IN THE AGRICULTURE SECTOR

The three key reasons for addressing agriculture in climate change adaptation are:

- **The agriculture sectors (crops, forestry and fisheries and aquaculture) are one of the most sensitive and highly exposed sectors to the impact of climate change** – Varying by region, climate change impacts all agriculture sectors[1] in several ways. An analysis of post-disaster needs-assessments of the period 2003–2013 revealed that the agriculture sectors in developing countries absorbed one–quarter of the total impact of climate-related disasters (FAO and UNDP, 2017). On the other hand, climate change could also have some advantages. For instance, farmers in higher latitudes may temporarily reap benefits from the effects of carbon dioxide fertilization, longer growing seasons and higher yields. An example is the potential increase of 34 – 54 percent in yield of wheat, maize and soybeans in Boreal Europe by 2080 (Porter *et al.*, 2014).
- **Agriculture and allied activities are not only important to the food security of a country, they also have a key economic role in many developing countries, being a source of livelihood and income for the most vulnerable populations.** Per the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), 50 percent of the key climate change risks identified are linked to food security (FAO, 2016b); with climate change affecting all four pillars of food security, i.e. food availability, access to food, utilization and stability (FAO and UNDP, 2017). With a growing global population, this challenge gains additional significance as the agriculture sectors need to meet the increased food demands. More so, the agriculture sectors are also the primary source of livelihood in most developing countries, with 40 percent of the world's economically active population (about 1.3 billion people), in 2010, being directly engaged in crop and livestock production. This figure is much higher in many developing countries.
- **Agricultural production involves the management of many natural resources.** The agriculture sectors are one of the primary users of scarce natural resources, such as land and water, and compete with other economic sectors that also require these resources (FAO and UNDP, 2017). Hence, adaptation measures can play a key role in the adaptation of ecosystems to climate change (FAO and UNDP, 2017).

1. This refers to agriculture & allied sectors including agriculture, forestry and fisheries.

1.3 CLIMATE CHANGE ADAPTATION PLANNING IN LIGHT OF NATIONAL ADAPTATION PLAN

As adaptation takes place in response to multiple stresses, it highlights the need to connect adaptation with development strategies and plans, and disaster risk management (Pachauri and Meyer, 2014). More so, adaptation may also have greater resonance with governments when it is viewed as a development issue (Mimura *et al.*, 2014).

Planning is central in connecting adaptation to development needs and challenges; integrating adaptation into planning and decision making can promote synergies with development and disaster risk management (Mimura *et al.*, 2014; Pachauri and Meyer 2014). Flexible and adaptive planning is one of the key pillars of adaptation plans due to decision making being done amid uncertainties about future climate change and its various impacts (Mimura *et al.*, 2014).

When the effectiveness of adaptation measures reach their limit with greater magnitudes and rates of climate change, a long-term planning perspective would increase the likelihood of even immediate adaptation measures enhancing future options and preparedness. Due to the complexities of climate change, all levels of government need to work closely together in addressing it; therefore actions to address climate change need to be planned and integrated at multiple levels.

Established in 2001, the National Adaptation Programmes of Action (NAPAs) were developed to address the challenges and various impacts that climate change posed to development. Focussing on the immediate term, they established urgent and immediate priority needs for adaptation in LDCs. An analysis of preparation and implementation of NAPAs showed that they were a good starting point for adaptation planning. However, climate change planning had yet to systematically address longer-term adaptation needs, and also consider the integrated sectoral impacts of climate change and adaptation. It was in this context that the National Adaptation Plans (NAPs) were formed to provide additional support to LDCs. The NAPs specifically bolster the LDCs medium- to long-term adaptation planning capacities within the existing planning process across multiple government levels and sectors. (Kohli and Teng, 2018).

National Adaptation Plans (NAPs)

At its seventeenth session, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) established the National Adaptation Plan (NAP) process to address effective climate change adaptation in least developed countries (LDCs) and other developing countries. The objectives of the NAP process are:

- To build adaptive capacity and resilience in order to reduce vulnerability to the impacts of climate change; and
- To facilitate a multi-sectoral and multi-level integration of climate change adaptation into relevant new and existing policies, programmes and activities, particularly those related to development planning, processes and strategies.

The initial guidelines in the annexure to decision 5/CP.17 (i.e. the fifth decision adopted by the COP in its seventeenth session) proposed four elements as the building blocks of the NAP process:

- lay the groundwork and address gaps;
- preparatory element;
- implementation strategies; and
- reporting, monitoring and reviewing.

Please refer to Annex 02 for the decision 5/CP.17 and its annexure.

National Adaptation Plans (NAPs)

Subsequently, the UNFCCC Least Developed Countries Expert Group's technical guidelines built on these elements by proposing 17 detailed steps across all the elements. The technical guidelines also provide key guiding questions to facilitate implementation of the steps along with indicative activities or tasks under each of the steps. As the NAP process is designed to be flexible and non-prescriptive, accordingly, the countries are not obligated to apply all the steps and can select and sequence the steps as applicable to them.

As a supplementary document to the technical guidelines, the Food and Agriculture Organization of the United Nations (FAO) published a sectoral document, *Addressing Agriculture, Forestry and Fisheries in National Adaptation Plan: Supplementary guidelines*; with the guidelines also being referred to as the NAP-Ag guidelines. To facilitate integration with adaptation planning across different economic sectors, the NAP–Ag guidelines follow the same four elements as that of the UNFCCC NAP technical guidelines, with the elements and steps in NAP-Ag guidelines being relevant to agriculture. Please refer to Annex 3 for NAP-Ag guidelines (elements and steps).

These guidelines were developed under the "Integrating Agriculture into National Adaptation Plans" (NAP-Ag) programme, with funding from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the United Nations Development Programme (UNDP) and FAO. It supports the integration of climate change adaptation concerns related to agriculture-based livelihoods with the existing national planning and budgeting processes of eleven developing countries, including four LDCs.

The programme's stated objectives are:

- strengthen the technical capacities of relevant ministries and institutions;
- develop integrated roadmaps for NAPs;
- improve evidence-based results for NAPs through an impact assessment framework; and
- promote agricultural NAPs through advocacy and knowledge-sharing.

Please refer to Annex 4 for a sample NAP.

1.4 WHY A VALUE CHAIN APPROACH TO CLIMATE CHANGE ADAPTATION?

With climate change threatening agricultural value chains at all stages of production, including linking commodity producers to processors and markets, understanding associated climate risks and having a value chain approach is useful in analysing the climate risks at stages that go beyond production, while using a more systemic approach to risk management (Daze and Deckens, 2016; Vermeulen, 2015; Bagamba and Deckens, 2014).

The key strengths of the value chain approach can assist in adaptation planning, through analysing vulnerabilities and hotspots across a value chain. Other strong factors require assessing risks at each node and identifying new market opportunities to help communities adapt. This can be achieved through suggested partnerships in which there is mutual benefit from the implementation of the strategy (Amado and Adams, 2014).

VCs, as engines of growth, create added value that has five components:

1] salaries for workers;

2] a return on assets (profits) to entrepreneurs and asset owners;

3] tax revenues to the government;

4] a better food supply to consumers; and

5] a net impact on the environment, positive or negative.

This value added sets in motion three growth loops that relate to economic, social and environmental sustainability, and directly impacts poverty and hunger. The three growth loops are: (1) an investment loop, driven by reinvested profits and savings; (2) a multiplier loop, driven by the spending of increased worker income; and (3) a progress loop, driven by public expenditure on the societal and natural environments. (FAO, 2014a)

For details on value chain, value chain analysis and the value chain approach please refer to Section 3 in module B.

2. Gender and climate change

2.1 WHAT IS GENDER[2]

"Gender refers to the social attributes and opportunities associated with being male and female and the relationships between women and men and girls and boys, as well as the relations between women and those between men. These attributes, opportunities and relationships are socially constructed and are learned through socialization processes. They are context / time-specific and changeable. Gender determines what is expected, allowed and valued in a women or a man in a given context. In most societies there are differences and inequalities between women and men in responsibilities assigned, activities undertaken, access to and control over resources, as well as decision-making opportunities. Gender is part of the broader socio-cultural context. Other important criteria for socio-cultural analysis includes class, race, poverty level, ethnic group and age." (UN, 2018).

In regards to climate change adaptation, gender refers to:

- the impact socio-political relations between men and women have on the planning and implementation of adaptation actions;
- access to and control over resources;
- differing impact climate change and adaptation measures have on men and women; and
- the differing contributions of men and women to adaptation actions (Least Developed Countries Expert Group, 2015a).

2. While developing the toolkit, it was recognized that apart from men and women, the term 'gender' includes the third gender. However, as literature and data mainly refer to men and women, the toolkit was developed accordingly. Should the user wants to include the third gender for the analysis, they may do so.

Lack of gender equality can lead to differentiated vulnerabilities, as gender dynamics in societies contribute to the shaping of men and women's respective power, roles and resources (Least Developed Countries Expert Group, 2015b). Significant gender-based differences exist in relation to the access of and control over resources, work opportunities and wages, time spent in productive and household roles, and leadership and participation in decision-making processes Least Developed Countries Expert Group, 2015a).

2.2 WHAT IS GENDER RESPONSIVENESS?

Gender responsiveness contributes to gender equality as it involves identifying, reflecting on and implementing interventions that are required to address existing gender gaps and overcome historical gender biases in policies and interventions (Least Developed Countries Expert Group, 2015a).

Table 2

Gender responsiveness scale

Gender-neutral	Gender-sensitive	Gender-responsive	Gender-transformative
• These policies and programmes are assumed to affect both sexes equally, but are often gender-blind; and • ignore the different roles, responsibilities and capabilities of the sexes, and the social processes that determine these.	• These policies and programmes consider gender norms, roles and relations; • not necessary that they would address the inequality generated by unequal norms, roles or relations.	• These policies and programmes consider the different socially-determined roles, responsibilities and capabilities of men and women; • consider cultural settings and power relations based on information derived from both men's and women's activities; and • respond to the different needs and interests of men and women.	• These policies and programmes consider gender norms, roles and relations for women and men and analyse how they affect access to, and control over, resources; • consider women's and men's specific needs and address the causes of gender based inequities; and • include ways to transform harmful gender norms, roles and relations, to foster progressive changes in power relationships between women and men.

Source: Garder Kabeer, N. 2003.

2.3 GENDER RESPONSIVENESS IN THE CONTEXT OF AGRICULTURE SECTORS AND CLIMATE CHANGE

- The need for gender responsiveness in the agriculture sector can be assessed by the fact that on average, women make up 43 percent of the agricultural labour force in developing countries, with the composition ranging from 20 percent or less in Latin America to 50 percent or more in some countries in Asia and Africa (FAO, 2014b). However, most female farmers are smallholders and engage in subsistence farming (UNDP *et al.*, 2015). They control less land than men and have comparatively limited access to inputs, seeds, credits, and extension services. In comparison to men, women farmers are routinely paid less for their labour, tend to be excluded from agricultural decision-making and are under-represented in agricultural organizations. Women also carry a disproportionate share of household workload (CARE, 2017). At the same time, it is pertinent to note that though women tend to be more vulnerable than men, it is not because of their sex, but rather is a result of their marginalization. Therefore, depending on the level of marginalization, there might be context-specific situations where men may be more vulnerable (Least Developed Countries Expert Group, 2015a).
- Not analysing the agriculture sectors through a gender lens leads to failures in addressing gender inequalities and results in ill-informed projects and programmes, loss in agricultural output and income, food and nutrition insecurity, i.e. overall social costs (The World Bank, 2009).
- On the other hand, gender responsive agricultural policies and practices could have benefits both for the economy, as well as for men and women. Closing the gender gap in access to land and seeds, fertilizers, credit, extension advice and markets, could increase agricultural output in developing countries.
- Climate change affects genders differently, and therefore leads to the magnification of existing gender inequalities (Least Developed Countries Expert Group, 2015a). A gender-responsive approach to climate change would strengthen resilience as it would lead to the inclusion of the different capacities, experiences, expertise and perspectives possessed by men and women in the adaptation initiatives (UNDP *et al.,* 2015). A gender-responsive adaptation plan follows these three criteria:
  - recognizes gender differences in adaptation needs, opportunities and capacities;
  - ensures equitable participation and influence of women and men in the adaptation decision-making process; and
  - ensures gender equitable access to, and control over, financial resources and other benefits resulting from adaptation investment (FAO and UNDP, 2018).

Case study I: Climate action – women hold the key

Among the 11 countries that are part of the NAP-Ag programme, Viet Nam is one of the most vulnerable to the impacts of climate change and natural disasters. With a majority of the population living in low-lying river basins and coastal areas, it is estimated that more than 70 percent of the population is at risk of multiple hazards. Though disasters would cause both men and women to lose jobs in the country, women's conditions are at a higher risk of deterioration compared to men, as many poor women work in the informal sector in worse working conditions and on lower wages than men. Moreover, women are also the first ones to take care of family members when disasters strike, therefore any disaster risk-reduction planning and adaptation to climate change is incomplete without the inclusion of women.

Even though over the years, women have built capacities, talents, skills and knowledge towards risk management, there is a lack of recognition of their role and contribution, as evidenced by their limited decision-making roles in local, formal, political and management structures; and their restricted involvement in flood and storm control to childcare and food distribution. In order to address such institutional concerns in Viet Nam, in 2016, the UN Women organized a roundtable in Hanoi with the theme of 'Climate Action: women hold the key' which focused on solutions to increase women's participation in design and implementation of gender-responsive climate policies.

Source: UN, 2018.

- Literature on vulnerability and climate change adaptation in the agriculture sector has identified gender as one of the primary factors that can impact an individual's vulnerability and ability to adapt (Carr and Thompson, 2014). Applying intersectional approaches (encompassing gender) within the agriculture sector can provide pathways to understand the linkages between social dimensions of identity (encompassing gender) and social institutions (formal and informal), which shape interactions between value chain actors, households, and agro-ecosystems. This would provide in-depth understandings of adaptive capacities (Thompson-Hall, Carr and Pascual, 2016). Therefore, when a gender-responsive approach to the agriculture sector in the context of climate change adaptation is applied during the planning and implementation phase, it would avoid reinforcing existing gender inequalities and lead to identification of relevant adaptation options (FAO and UNDP, 2018). The approach is also essential in ensuring that adaptation plans are effective and sustainable, while also decreasing the risk of maladaptation, as gender-specific socio-cultural legal challenges make it difficult to either take advantage of opportunities or to adapt to change (Habtezion, 2012; FAO, 2016b; Least Developed Countries Expert Group, 2015a).

2.4 WHY A VALUE CHAIN APPROACH TO GENDER RESPONSIVENESS?

A value chain approach would enhance gender equality as it entails understanding issues and constraints that lead to exclusion and marginalization of stakeholders across all levels of the value chain (Camagni and Kherallah, 2014). Consequently, a value chain development strategy would focus on designing interventions to address the various interlinked root causes of its underperformance including gender inequalities (FAO, 2016b).

For details on value chains, value chain analysis and the value chain approach, please refer to Section 3 in module B.

3. Introduction of value chain analysis

3.1 WHAT IS A VALUE CHAIN?

A value chain consists of a range of activities required to bring a product from its inception to its end consumer, through a series of steps involving physical transformation and input of various producer services, and disposal after use (Kaplinsky and Morris, 2000). In the context of agriculture, a value chain would be a set of actors and activities that are involved in bringing an agricultural product from production to final consumption, with value addition at each stage (FAO, 2018c).

By considering value addition at every level, a value chain approach treats production as one of the components, and hence differs from the traditionally exclusive focus on production (UNIDO, 2009, 2009). An extended value chain includes value chain actors and other interlinked components as detailed below (Kaplinsky and Morris, 2000). Refer to Figure 3 for an illustrative extended value chain.

- **Rules, standards and norms –** includes the enabling environment, i.e. macroeconomic factors consisting of policies and regulations (such as land and property rights, and/or taxes and tariffs); facilitating institutions (such as infrastructure, and governance); and social norms (such as gender), which can shape the market environment; and
- **Supporting functions / facilitating services –** functions and services that support value chain operations through financial, business or extension services (Camagni and Kherallah, 2014; UN Industrial Development Organization, 2009), such as as input providers, market intelligence and quality management systems).

3.2 WHAT IS VALUE CHAIN ANALYSIS?

A value chain analysis is the process of compartmentalizing the different parts of the chain to better understand its structure and specific functions. Amongst others, this involves:

- identifying actors at each stage of the chain and detailing their functions and relationships;
- determining the chain governance/leadership;
- identifying activities with added value; and
- flow of goods, information and finance throughout the chain (UNIDO, 2009, 2009).

3.3 WHY USE THE VALUE CHAIN APPROACH?

To identify climate-smart interventions, it is important to take a holistic view of the entire food system and consider how it will be affected by climate change and where it is most vulnerable. Since food systems are extremely complex, analysis must take place at a workable scale. Such an analysis can be realized by adopting a value chain approach. (FAO, 2017a).

Using a value chain approach and undertaking the ensuing analysis would enable the user to understand the evolving industry dynamics and identify change agents and leverage points for interventions (UNIDO, 2009, 2009). In the development sector, the value chain approach is used by donors and development assistance agencies to better target their support and investments in various areas, such

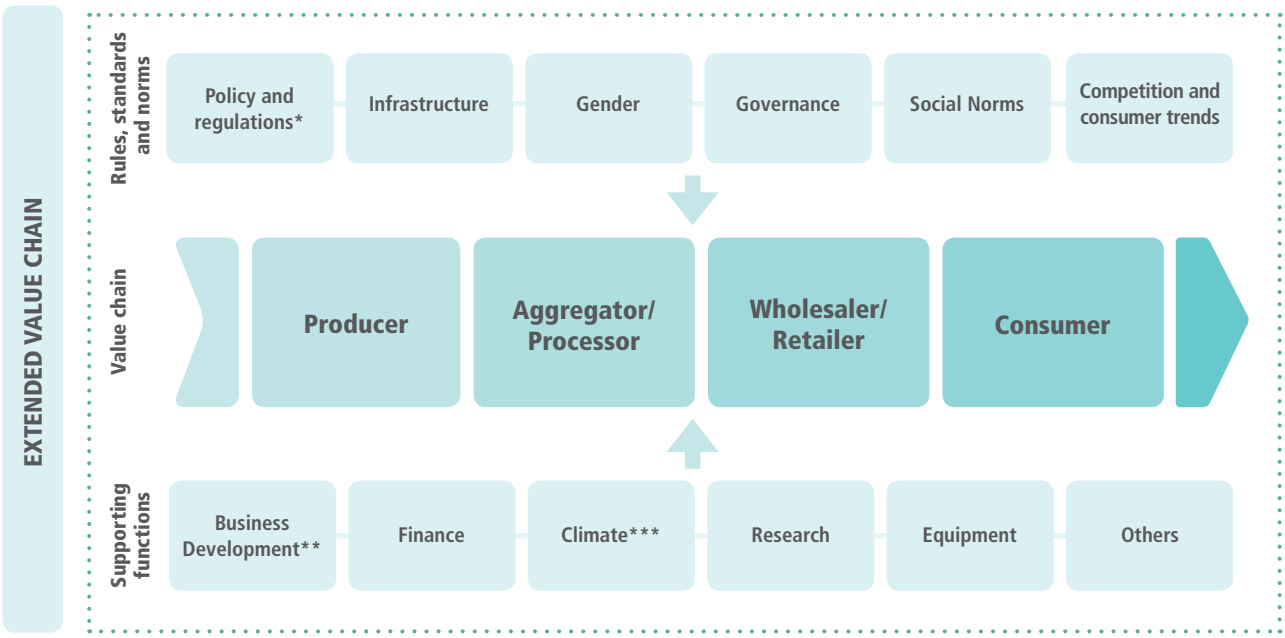
as income distribution and equity among value chain participants. Promoting agriculture value chains can lead to greater socio-economic benefits by way of increased productivity, improved employment opportunities, access to greater markets and higher export levels (UNIDO, 2009).

The value chain approach allows to understand and ameliorate the three phases of the development cycle:

- The first phase, measuring performance, assesses a value chain in terms of the economic, social and environmental outcomes it delivers relative to its potential.
- The second phase, understanding performance, exposes the root causes of underperformance by taking into account how value chain stakeholders and their activities are linked to each other and to their economic, social and natural environment in a system; how these linkages drive the behaviour of individual stakeholders in terms of their commercial behaviour; and how value determination in end markets drives the dynamics of the system.
- The third phase, improving performance, follows a logical sequence of deriving a core value chain development strategy based on the analysis conducted in phase two and the vision stakeholders have agreed on and selecting upgrading activities and multilateral partnerships that can realistically achieve the scale of impact envisioned (FAO, 2014a).

Figure 3

An illustrative extended value chain



** This includes, but not limited to, land & property rights, and taxes & tariffs*

*** This includes, but not limited to, input providers, and market information/trade intelligence*

**** By climate, the toolkit refers to the climatic conditions, including climate change, which might have an impact on the value chain*

Adapted from: Camagni, M., & Kherallah, M. 2014. *How to do Commodity Value Chain development projects.* ROME, International Fund for Agricultural Development (IFAD)

3.4 DIFFERENT APPROACHES TO VALUE CHAIN ANALYSIS

There are three main approaches to undertaking value chain analysis, which can be broadly classified per Table 3 below. It is imperative to note that these approaches are not mutually exclusive but using a combination of the three is usually the best approach (Lusby and Panlibuton, 2007).

Table 3

Approaches to value chain analysis

	Studies	Participatory (workshops, FGDs, etc)	Dive-in (learn as you go)
Methodology	• Classical approach with consultants spending several weeks conducting primary research, reviewing statistics and such others; • Information, such as climate and gender related risks and vulnerabilities gathered from the field, is used to design climate-sensitive and gender-responsive programmes.	• As a streamlined approach, it brings together key value chain representatives for workshops, focus groups, etc.; • The value chain actors provide information, such as climate- and gender-related risks and vulnerabilities, and analyse it, with the support team acting as facilitators; • Information gathered is used to design climate-sensitive and gender-responsive programmes.	• Is premised on the belief that to best analyse the value chain, it is important to have in-depth relationships with the value chain actors and learn from them incrementally; • Consequently, it dives into the value chain based only on an initial facilitation activity; and • Climate sensitive and gender responsive support initiatives begin as soon as the target groups are selected.
Advantages	• Provides deep insights to issues, constraints (such as risks and vulnerabilities), and opportunities in a value chain; • Could help identify the value chain with greatest growth potential; • Institutional affiliation with a potential implementing agency could be helpful in translating analysis into action; • Appropriate for developing new products or markets.	• Provides initial insights to help select appropriate initiatives; • Develops relationships with value chain actors and sponsor organizations; • Reinforces business linkages and partnerships amongst value chain actors; • Solutions to the constraints (such as risks and vulnerabilities) identified would be more appropriate to the local setting; • With stakeholders taking ownership of the value chain development process, they are more likely to remain actively engaged after he intervention ends; • Less expensive than studies.	• Avoids drawn out analysis and is therefore less expensive; • Develops initiatives based on an in-depth understanding of target group's needs and priorities; • Responsive to changing conditions.

	Studies	Participatory (workshops, FGDs, etc)	Dive-in (learn as you go)
Disadvantages	• Time consuming and expensive; • Excessively analytical; • Limited representation of value chain actors in the programme design.	• Analysis could be subjective; • As the information is dependent on a small number of workshop / focus group participants, it requires validation.	• Risk of being involved in a value chain for which there are no promising initiatives.

Lusby and Panlibuton, 2007; Haggblade and Gamser, 1991; Bammann, 2007

3.5. VALUE CHAIN ANALYSIS IN THE CONTEXT OF MARKET DEVELOPMENT

Even though economically vulnerable populations depend on markets for their income and livelihoods, markets oftentimes do not operate in a way that meets their needs. This may be due to markets being inaccessible or the market systems being unable to provide sufficient economic choices and opportunities for these populations (SIDA, 2011). Consequently, market development is understanding and intervening in market systems in a ways that enable them to function more efficiently and sustainably for already vulnerable populations (The Springfield Center, 2015). An effective market development support must be flexible in its response to the underlying causes pertaining to the market's failure to serve poorer populations. This support does not require a large resource transfer, but rather calls for the identification of those problems and interventions which best influence the function of these markets (SIDA, 2011).

The development of functioning market systems with a vibrant private business sector has links to many other development dimensions, including gender equality and sustainable use of natural resources (SIDA, 2011). For example, if market development strategies are developed and implemented using a gender lens, it would involve tackling power relations in households and markets through interventions designed to, amongst others, challenge prevailing norms pertaining to the markets in which women engage / should engage. This would ensure that women gain a fairer share of benefits from the market, and also hold visible strategic and leadership positions in the market (Christian Aid, 2016).

A value chain approach is pro-poor because the value chain analysis focuses on markets and commercial viability, ensuring economic viability and sustainability at its core. Therefore, it is compatible with market development approaches (Coles, Keane and Mitchell, 2009). A value chain is part of a wider market system involving the rules, standards and norms, and supporting functions / facilitating services. Each of these can shape the functioning of the value chain and can be analysed as its own 'interconnected' market system (Nutz and Sievers, 2015). An understanding of the underlying constraints in this 'interconnected' market system can be used to design interventions intended to create scalable and sustainable change in the value chain. The planning and implementation of such interventions is called value chain development (Nutz and Sievers, 2015).

Case Study II: The GREAT Women Project, Philippines

The Gender Responsive Economic Actions for the Transformation of Women Project (GREAT women project) began in 2006 with the support of the Canadian Government, as a governance and capacity development project aimed at promoting a gender responsive environment for women's economic empowerment, with a focus on micro/small/and medium enterprises.

The project delivered on its objectives by educating and capacity development of women through acquiring information about economic rights and opportunities, practical skills, business services, equipment, and credit. It sponsored women to attend trade fairs and exhibitions, and thereby enabled them to promote their products and expand their market. Further, a negotiation skills training was conducted and provided women with knowledge to correctly price their products, which ensured them a fair return. Furthermore, the project also provided specialized training, customized to women entrepreneur's varied localities. For example, in the case of small-scale women entrepreneurs of the bamboo industry, the project assisted in addressing challenges related to lack of capital, poor quality products and lack of product development.

The Philippine Commission on Women was the lead executing agency and partnered with 12 other government agencies, 8 pilot provincial governments and 35 municipal local governments to support the development of the entrepreneurs.

Source: Philippine Commission on Women. 2009.

Traditionally, value chain development has envisaged an upgrading strategy. Upgrading allows the user to understand how the income of the target group can be increased; and refers to the acquisition of technological, institutional and market capabilities that would improve the competitiveness of the target group and enable them to access viable value chains or improve their position in existing chains (Coles, Keane and Mitchell, 2009). More so, as the value chain approach provides a framework for engaging both businesses and target groups, consequently successful value chain development projects aim for win-win outcomes for all actors (Coles, Keane and Mitchell, 2009).

MODULE C. Toolkit

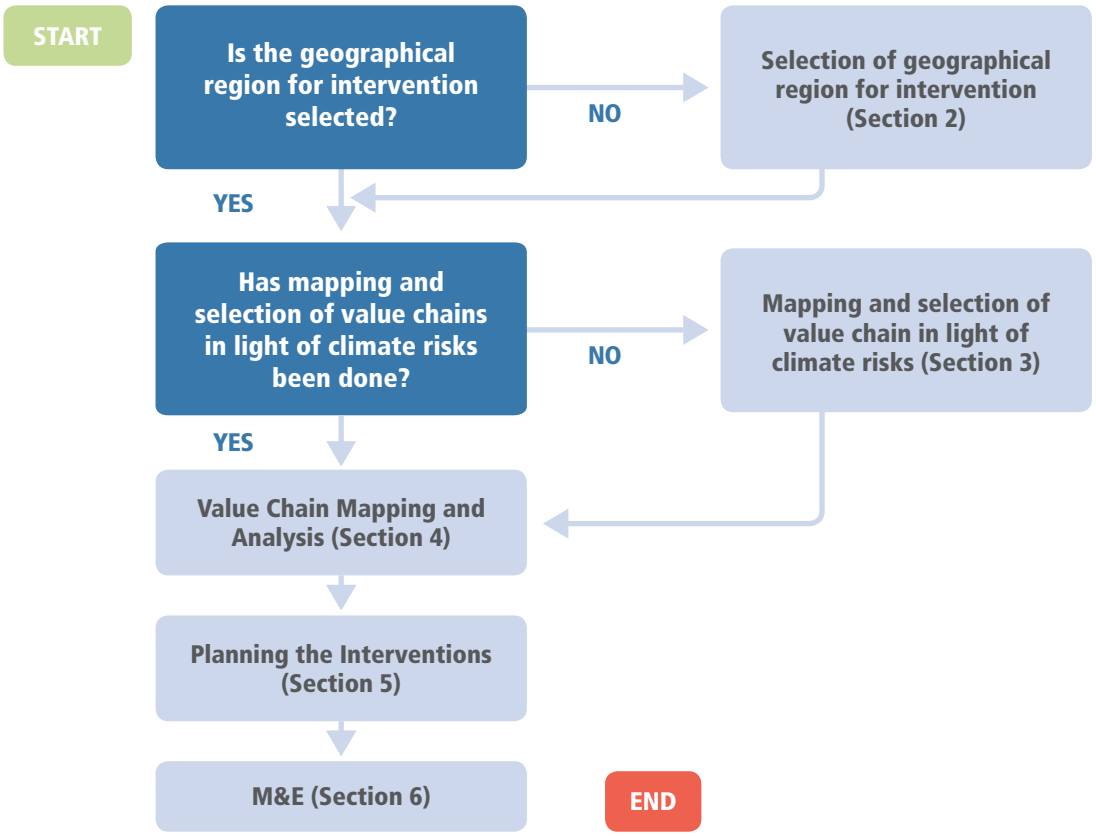
This module presents tools and methodologies for under taking a value chain analysis, which integrates climate change, market development and gender responsiveness.

The toolkit consists of five interlinked sections (2–6), and is designed to provide the user with flexibility depending on which stage of analysis the user is at. To the extent possible, the toolkit is illustrated through an ongoing sample case study of Zambia along with short case studies[3] [4].

Please refer to Figure 4 for a schematic regarding the key steps involved in the toolkit.

Figure 4

Schematic regarding key steps involved in the toolkit



If the toolkit user faces time and resource constraints while undertaking value chain mapping and analysis, the user is encourage to reference Annex 20 for alternative options to pursue.

3. In some cases, the user will note that tables, figures, tools, and questionnaires have been marked as 'illustrative'. Please note that the term 'illustrative' has been used to allow the user to make appropriate country/region specific methodological or detail-based changes.

4. While developing the toolkit, it was acknowledged that there are two primary ways of undertaking a value chain analysis. In the first method, the product is selected first followed by the geographical region / intended impact community. In the second method, the geographical region / intended impact community is selected first, followed by identification of the product. In this toolkit, the latter methodology has been followed in order to appropriately incorporate climate change and gender-responsive considerations.

Country case study: Zambia

Background – Zambia is a landlocked country in south-central Africa with a population of 16.6 million (2016). Agriculture is an important sector for the country, contributing an average of 8.2 percent to the national gross domestic product (GDP) over the period 2011–2015. 72 percent of its people are employed in the agriculture sector, of which almost 65 percent are women. Many of the smallhold farmers are reliant on rain-fed agriculture and unsustainable land use practices, which makes them extremely vulnerable to the effects of climate change and variability.

Zambia spans an area of over 75 million hectares, of which 58 percent (42 million hectares) is classified as having medium to high potential for agriculture production. Presently, around 15 percent of this land is under cultivation. With its mostly tropical climate, Zambia's temperature, rainfall and weather conditions are also favourable for agriculture. While maize is the most cultivated crop in the country, other major produce includes cotton, soybean, coffee, groundnut, wheat, rice and sunflower seeds.

Reason for selection as a case study[1]

Zambia is divided into three agro-ecological zones – I, IIa, IIb, and III. Temperature trends between 1960–2006 indicate that the mean annual temperature has increased by 1.3 °C, which translates into an average rate of 0.3°C per decade. The mean annual temperature is projected to increase by 1.2 to 3.4 °C by the 2060s, and 1.6 to 5.5 °C by the 2090s. This increase is projected to be highest in southern and western regions of Zambia. Since 1960, the mean annual rainfall has decreased by an average rate of 2 mm per month every decade. These changes in temperature and rainfall will affect the length of growing season. The length of the growing period is projected to decrease, particularly in the central and southern regions, by more than 20 percent by the end of the 21st century. Apart from the decrease in the length of growing season, the probability of crop failure is also projected to increase. The combination of these two may have serious implications on farmers' ability to adapt.

With respect to food security, these implications can be further exacerbated when considered along with the fact that maize and cassava provide over 50 percent of the population's intake of energy and proteins and as agriculture in the country is predominantly rainfed, the yields of these crops are directly dependent on the timeliness of the rainy season and stability of temperatures.

Approximately 70 percent of agricultural labour is provided by women. Though most land in Zambia is held under custom, customary tenure systems do not provide women with significant land rights. In cases where they do, the traditional institutions do not implement the rules effectively. Yet Zambia's Land Acts do not apply to customary land.

Finally, the NAP process is anchored in the development of the country's 7th National Development Plan, with Zambia being one of the partner countries in the NAP-Ag programme coordinated by UNDP and FAO.

1. For additional case studies, please aslo refer to FAO and UNDP, 2018 and FAO, 2019g.

Soure: FAO and UNDP, 2018.

Methodology	Overview of Module C: the toolkit
	Selection of geographical regions / areas for intervention (Section 2)
Desk study	• Developing climate change vulnerability mapping for the region • Dividing the region under consideration into agro-ecological zones
Desk study / workshop 1[5]	• Selection of geographical regions for intervention based on agro-ecological zones and climate change vulnerability map
	Mapping and selection of value chains in light of climate risks (Section 3)
Desk study / workshop 2	• Mapping climate change risks and vulnerabilities and market demand of potentially suitable value chains • Developing a short list of promising value chains • Determining the criteria and developing the matrix for value chain selection
Desk study	• Desk study • Selecting the value chain
	Value chain mapping and analysis (Section 4)
Desk study and field visit 1	• Value chain mapping
Desk study	• Value chain analysis
Workshop 3	• Validating constraints and opportunities
	Planning interventions (Section 5)
Desk study	• Developing climate change vulnerability and risk interventions
Field visit 2	• Assessment of potential interventions
Desk study	• Identifying the activities for the selected intervention
Workshop 4	• Validating interventions and activities • Prioritizing interventions and activities • Identifying facilitative agencies for implementation
	Monitoring and evaluation (Section 6)

5. As one of the initial steps in conducting a workshop, it is recommended that the user sensitizes stakeholders with the workshop objective along with the key terms

2. Selection of geographical regions for intervention

People living in different regions have various environmental and socio-economic factors to be considered and may respond differently to climate change (Shukla, Chakraborty and Joshi, 2017).

This section enables the user to select the geographical regions where intervention may be most needed.

Steps for shortlisting of the geographical regions for intervention	
Step 1:	Developing climate change vulnerability mapping for specific regions
Step 2:	Dividing regions under consideration into agro-ecological zones
Step 3:	Selection of geographical regions for intervention based on agro-ecological zones and climate change vulnerability map

2.1 DEVELOPING CLIMATE CHANGE VULNERABILITY MAPPING FOR SPECIFIC REGIONS

Climate change vulnerability is defined as any circumstance that makes a community or system susceptible to the adverse effects of climate change (Oxfam, 2009). It is further influenced by factors such as climate-change related hazards, poverty, unequal access to resources, food security and conflict (UNFCCC, 2011). Climate change hazards affect the lives of economically challenged communities in multidimensional ways. Direct effects include impact on livelihood, crop yields and damage to shelters. Indirect effects include food insecurity and inflation (Pachauri, Meyer, 2014). People who are culturally, socially, politically, economically, institutionally, or otherwise marginalized, are especially more vulnerable to climate change (Pachauri and Meyer, 2014).

In the Third Assessment Report of IPCC, "vulnerability" is defined as *"the function of Exposure, Sensitivity and Adaptive Capacity"* (Kuntiyawichai *et al.*, 2015). To map the climate change vulnerability of the region under consideration, the user needs to recognize and develop an understanding of these three components. The following sections provide details of these components.

2.1.1 Exposure to climate hazards

Exposure is defined as the extent to which a system is subjected to significant variations in the climate, specifically in terms of the degree and duration of these variations (Kuntiyawichai *et al.*, 2015). A climate hazard, in this context, could be a brief extreme-weather event, such as a severe storm, or could be a slow trend, such as rising sea levels. The system that it affects may constitute people, property, assets or ecosystems present in hazard zones that are subject to potential loss (Pachauri and Meyer, 2014; Oxfam, 2009).

Climate change is characterized mainly through the difference in temperature and precipitation from the baseline year (Shukla, Chakraborty and Joshi, 2017). The first step to determine the extent of exposure is to look at the existing and historical climate of the region, while noting the occurrences of extreme weather events, such as droughts, floods and heat waves etc. The data on major climate parameters, such as temperature and rainfall, can be sourced from a metrological agency at national or sub-national level (Vincent, 2010).

Determining the extent of climate change depends on the quantity of emissions of GHGs and their atmospheric interactions, therefore it is necessary to use scenarios that include different future projections of the system in terms of demographic, social, economic, technological and environmental conditions (Vincent, 2010). It is recommended using IPCC's Representative Concentration Pathways (RCPs)[6], namely, RCP 2.6, RCP 4.5, RCP 6.0, and RCP 8.5 (Shukla, Chakraborty and Joshi, 2017). Appropriate climate models may be accessed through IPCC or meteorological office websites to make the predictions corresponding to these RCPs.

2.1.2 Sensitivity

Sensitivity is defined as the degree to which the system (people, property, ecosystem) is affected by climate-related hazards (Kuntiyawichai *et al.*, 2015). Different systems respond in different ways and exhibit different levels of sensitivity when exposed to the same climate hazard. Spatial distribution of the hazard also needs to be considered while assessing the sensitivity, for example, is flooding more likely to occur in certain locations compared to other locations in the region (Kuntiyawichai *et al.*, 2015; Vincent *et al.*, 2010)?

Sensitivity can be captured across two themes: demographic sensitivity and ecological sensitivity (Shukla, Chakraborty and Joshi, 2017; Kuntiyawichai *et al.*, 2015; Malik, Awan and Khan, 2012).

Demographic sensitivity can be captured through indicators, such as:

- population density;
- percentage of agricultural labour; and
- percentage of access to improved water and sanitation facilities (Shukla, Chakraborty and Joshi, 2017).

Ecological sensitivity, on the other hand, can be captured through indicators, such as:

- percentage of net-sown areas;
- percentage of protected areas; and
- percentage drought- or flood-prone areas (Shukla, Chakraborty and Joshi, 2017).

2.1.3 Adaptive capacity

Adaptive capacity is defined in the Fourth Assessment Report by IPCC as "the ability or potential of a system to respond successfully to climate variability and change and include adjustments in both behaviour and in resource and in technologies" (Kuntiyawichai *et al.*, 2015). Adaptive capacity is also influenced by various socio-cultural factors, such as gender, ethnicity, religion, class and age. The differences in these factors lead to the differences in human and financial capital and thus the ability to respond to climate-related hazards (Vincent *et al.*, 2010).

Assessment of adaptive capacity can be done through the use of context-specific indicators (Vincent *et al.*, 2010). These indicators may be classified under two themes: socio-economic indicators and infrastructural indicators (Shukla, Chakraborty and Joshi, 2017; Kuntiyawichai *et al.*, 2015; Malik, Awan and Khan, 2012).

6. Representative Concentration Pathways (RCPs), developed for the IPCC Fifth Assessment Report, follows a parallel approach and provide a comprehensive set of narratives or scenarios based on population, income, energy, aerosol, and emission parameters which feed into global circulation models to predict future climate.

Note for the user: There is no universally accepted list of indicators that characterize either vulnerability or a standardized method of combining them to form a vulnerability index (Hinkel, 2015; Shukla, Chakraborty and Joshi, 2017). Hence, user discretion is required for the following:

- selection of indicators;
- methodology used to calculate the sub-indices of vulnerability;
- methodology used to calculate the vulnerability index; and
- methodology used to identify the most vulnerable regions.

2.1.4 Illustration for identifying a vulnerable region, based on vulnerability index

- To calculate the exposure index, the indicators selected could be the projected change in annual mean temperatures and precipitation (Asian Development Bank, 2009). The following is an illustrative table used to capture the exposure index:

Table 4

Illustrative table to capture the exposure index

District	Current and past data		Future scenario (RCP 2.6)*		Projected change in annual mean temperature		Projected change in annual mean precipitation	Exposure index
	Temperature	Precipitation	Temperature	Precipitation				
	Annual mean	Annual mean	Annual mean	Annual mean				
Dist. 1								
Dist. 2								
…								

*Separate table will be made for each of the RCPs.

- Table 5 depicts the illustrative indicators for calculating sensitivity, as well as the format to capture the sensitivity index:

Table 5

Illustrative table to capture the sensitivity index

District	Demographic sensitivity			Ecological sensitivity			Sensitivity index
	Population density	Percent agricultural labour	Percent access to improved WASH facilities	Percent net sown area	Percent protected area	Percent flood prone area	
Dist. 1							
Dist. 2							
…							

- Table 6 depicts the illustrative indicators for calculating adaptive capacity, as well as the format to capture the adaptive capacity index:

Table 6

Illustrative table to capture the adaptive capacity index

District	Socio-economic			Infrastructural			Adaptive capacity index
	GDP per capita	Literacy rate	Life expectancy	Percent net irrigated area	Percent road density	Percent electricity coverage	
Dist. 1							
Dist. 2							
…							

Illustrative calculation for the exposure/sensitivity/adaptive capacity index
(Shukla, Chakraborty and Joshi, 2017)

- **Step 1:** Populate the matrix based on the selected parameters;
- **Step 2:** Normalize the value of the indicators using linear (min-max) scaling, since each of the indicators have different units. Please refer to Annex 8 for details on normalization;*[7]
- **Step 3:** Calculate the standard deviation of the parameters;

7. *For section 2, the user is suggested not to multiply by 100, so that the index is between 0 – 1 in this section.

- **Step 4:** Calculate the constant K using the formula below; (Iyengar and Sunadarn, 1982)

$$k = \left(\sum_{i=1}^{m} \frac{1}{\text{Standard deviation } (y_i)} \right)^{-1}$$

- **Step 5:** Calculate the weight of each parameter using the below formula;

$$w_i = \frac{k}{\text{Standard deviation } (y_i)}$$

- **Step 6:** Multiply the weight with the normalized value calculated in step 2 to determine the weighted score; and
- **Step 7:** Add the weighted scores of all the indicators to determine the index for that geographical region.

Calculating the vulnerability index

Vulnerability index = 1/3 * [exposure index + sensitivity index + (1 – adaptive capacity index)] (Shukla, Chakraborty and Joshi, 2017; Malik, Awan and Khan, 2012; Heltberg and Osmolovskiy, 2010)

- Using this formula, there would be four vulnerability indices, each pertaining to a climate- change scenario as mentioned in 2.1.1.

Identifying the most vulnerable regions

- Step 1: Divide the values obtained for each scenario into 5 quantiles ranging from 0–0.2, 0.2–0.4, 0.4–0.6, 0.6–0.8, and 0.8–1; and
- Step 2: All districts with a vulnerability index in the highest quantile across four scenarios or maximum scenarios should be selected for the next steps. For example, in the case of Table 7 below, only Dist.1 would be considered for Section 2.2 (Shukla, Chakraborty and Joshi, 2017).

Table 7

Illustrative table for identifying the most vulnerable regions

	Vulnerability index (RCP 2.6)	Vulnerability index (RCP 4.5)	Vulnerability index (RCP 6.0)	Vulnerability index (RCP 8.5)
0.0 - 0.2				
0.2 – 0.4				
0.4 – 0.6				
0.6 – 0.8	Dist. 2	Dist. 2		
0.8 – 1.0	Dist. 1	Dist. 1	Dist. 1, Dist. 2	Dist. 1, Dist. 2

Exercise 1:

Based on the steps to calculate the indices and the table below, please calculate the illustrative adaptive capacity index.

	GDP per capita (in USD)	Percent road density	Adaptive capacity index
Dist. 1	1 200	74	
Dist. 2	1 500	66	
Dist. 3	2 000	72	
Dist. 4	600	70	

Please refer to Annex 19 for the answer.

2.2 DIVIDING THE REGION UNDER CONSIDERATION INTO AGRO-ECOLOGICAL ZONES

Over the past 30 years, FAO and the International Institute for Applied System Analysis (IIASA) have been continuously developing the AEZ methodology. This methodology could help assess the agricultural resources and potential of various regions on factors that include land productivity and rainfed arable land. The objective is to define AEZs, which have similar combinations of climate and soil characteristics, and similar physical potential for agriculture production. The following five thematic areas have been assessed for achieving this:

- **Land and water resources:** includes soil resources, terrain resources, land cover, protected areas and selected socio-economic and demographic data;
- **Agro-climatic resources:** includes multiple climatic indicators, such as annual temperature, annual precipitation, length of growing period, etc.;
- **Suitability and potential yields:** measured for up to 280 crops or land utilization types under alternative input and management levels for historical, current and future climate conditions;
- **Downscaled actual yields and production:** measured for main crop commodities; and
- **Yield and production gaps:** Represented in terms of ratios and differences between actual yield and production and potentials for main crops.

In the first instance, the user will need to locate the AEZ mapping for the region under consideration from appropriate sources, such as GAEZ Data Portal (which provides free access to data and allows for visualization and analysis), the meteorological department of the country, or published national reports on AEZs.

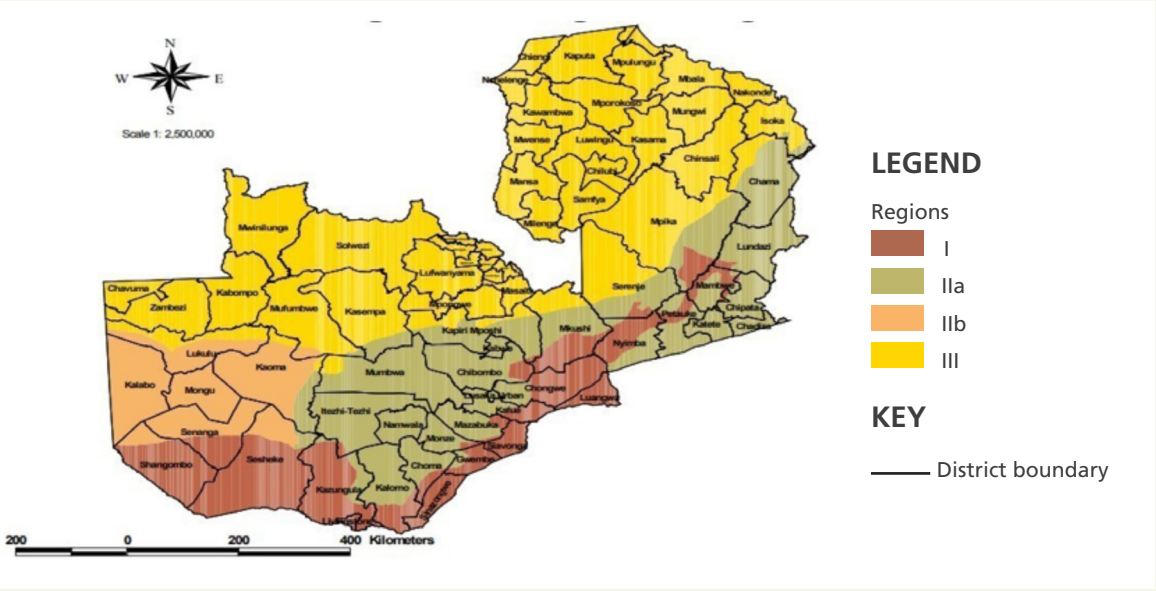
Illustrative Zambia case

Zambia has been divided into ten provinces, namely, Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, North-Western, Southern, and Western. The country has been divided into AEZs – I, II, and III, primarily based on rainfall distribution.

ZONE I: receives less than 800 mm of rainfall annually and constitutes 12 percent of Zambia's total land area;

ZONE II: receives between 800 mm to 1 000 mm of rainfall annually and constitutes 42 percent of the country's land area. This zone has been further divided into IIA and IIB; and

ZONE III: receives between 1 000 mm to 1 500 mm of rainfall annually and constitutes 46 percent of the country's land area.



Sources: Zulu, P. 2018. and Central Statistical Office. 2018.

2.3 SHORTLISTING OF GEOGRAPHICAL REGIONS FOR INTERVENTION BASED ON AEZ AND CLIMATE CHANGE VULNERABILITY MAP

Climate, soil and terrain are important environmental factors that may decide or even limit the productivity of agriculture systems (Shukla, Chakraborty and Joshi, 2017). These dimensions are captured through the agro-ecological zoning of a particular region. Since climatic conditions act as one of the main factors in determining the productivity of these zones, it is imperative to assess the vulnerability of these systems to the impacts of climate change (Shukla, Chakraborty and Joshi, 2017). It is recommended combining both climate change vulnerability (as per section 2.1) and AEZs (as per section 2.2) together to determine the geographical regions for intervention.

Based on the availability of time, resources, the distinction between the various regions and the data collected, one of the following methods may be used to shortlist the geographical regions:

- **Self-assessment:** The user would need to analyse the collected data by themselves to select the geographical region for intervention. This method can be used when enough data is available to present a clear case for which region should be selected.
- **Multi-voting technique** (American Society for Quality, 2018): In this method, the decision is reached through a stakeholder consultation process. The user should convene with climate change and agriculture-allied sector experts and share the collected data with them. Based on data presented and stakeholder expertise, they would then vote for the regions.

Table 8

Illustration of a multi-voting technique

Districts	Round 1 vote	Round 2 vote	Round 3 vote
District 1	4	5	8
District 2	2		
District 3	2		
District 4	5	6	8
District 5	2		
District 6	3	5	4
District 7	3	3	

With this voting technique, at each stage, the district receiving the least number of votes is eliminated. After the first round, districts 2, 3, and 5 have been eliminated, having received the least amount of votes (2). In the next stage, the stakeholders must vote again and select from the remaining provinces. The activity ends with the shortlisting of Districts 1 and 4 having received the maximum number of votes.

3. Mapping and selection of value chains in light of climate risks

When selecting a value chain, it is important to consider both the risks posed by climate change and its impacts. Sustainable food value chains for climate-smart agriculture interventions should be selected on the basis of their vulnerability to climate change; their potential contribution to climate change adaptation and mitigation; and their ability to improve the resilience of producers and other value chain actors (FAO, 2017a).

Selection of value chains is a critical step[8] in programme design and requires strategic thinking about the overall programme objectives and how to maximize their impact (Lusby and Panlibuton, 2007). The subsequent sub-sections cover the steps for mapping and selecting value chains (Schneemann and Vredeveld, 2015).

8. * Steps in this sub-section will need to be replicated across all the geographical regions, shortlisted in the previous step.

3.1 MAPPING CLIMATE CHANGE RISKS AND VULNERABILITIES, AND MARKET DEMAND OF POTENTIALLY SUITABLE VALUE CHAINS

Step 1: Prepare a longlist of value chains

The user should aim to make an exhaustive longlist of value chains. In relation to the region selected in the preceding section, the list should include new and/or lesser known value chains as well as more common value chains (including their existing and potentially new products).

Step 2: Identify and finalize the parameters

In this step, the user selects a few key parameters from the *'climate change'*[9] and *'demand side indicators'* section in Annex 5 and/or other linked parameters. During this process, the user should try to select an equal number of parameters for each criteria. In cases where data is not available for any of the parameters, the user may drop them.

Step 3: Develop a matrix for comparing the longlist of value chains across the parameters

The user should undertake secondary research to collect data pertaining to the parameters finalized in Step 2. Sources of data may include national statistics offices, state statistics offices, government websites (national/state) of respective departments, and existing reports from other organizations (such as research organizations, multi-lateral organizations) etc. Once collected, the data will need to be normalized (please refer to Annex 8 for details on normalization). Upon normalization of the data, the user should populate the matrix with the normalized score (please refer to Table 10 for the illustrative representation of this step).

Please refer to Annex 6 for an illustrative list of climate change risks and opportunities.

Note for sub-sections 3.2 and 3.3

- As multiple value chains have to be considered, stakeholders should include participants from different government departments and industry associations (such as farmer associations, agricultural cooperatives, etc);
- Where possible, due care should be given to ensure that the participants are representative of the socio-economic structure of the selected geographical area; and
- The toolkit is designed in a way that allows users to cover the stakeholder workshops mentioned in these two sub-sections across continuous days.

9. While selecting the parameters and assigning weights to them, the user should note that the matrices are designed to ensure that the value chain (s) with the highest score is shortlisted / selected. Therefore, the relationship of the parameter with the criteria should be kept in mind. For example – when assigning weights for *'impact due to expected change in temperature across different climate change scenarios'* for i) climate change risks and vulnerabilities and ii) resilience – a high score in the former will increase the vulnerability and in the latter it will decrease the resilience of the value chain.

3.2 DEVELOPING A SHORTLIST OF PROMISING VALUE CHAINS

During this step, the longlist of value chains are narrowed down to 3–6 promising value chains through a stakeholder workshop.[10]

The following steps need to be followed for shortlisting:

Step 1: Assigning weights to parameters pertaining to climate change risks and vulnerabilities, and market demand

Each parameter selected in Step 2 of sub-section 3.1 would need to be assigned a weight which is decided with the help of stakeholders. The tool in Annex 7 can be used for capturing stakeholder opinions about the importance of the selected parameter. The stakeholder opinions can then be aggregated to calculate the weight for each parameter.

Illustrative Zambia case

In the case of Zambia, the table below shows an illustrative matrix for assigning sample weights to climate change risks and vulnerabilities, and market demand parameters.

Table 9

Illustrative matrix for assigning sample weights to climate change risks and vulnerabilities, and market demand

No.	Selection criteria / parameters	ST1	ST2	ST3	…	Total	Percentage	Assigned weight
Climate change risks and vulnerabilities								
1.	Changes in weather patterns in the last 5 years	5	4	5	…	58	(58/T*100) =4.2%	4%
2.	Changes in annual yield (producer level)	4	4	5	…	52	4%	4%
3.	Impact due to expected change in temperature across different climate-change scenarios	3	3	2	…	32	2.8%	3%
4.	…	…	…	…	…	…	…	…
Market demand								
1.	Volume and value of (local) market demand in the last 5 years	…	…	…	…	…	…	…
2.	Volume and value of (export) market demand in the last 5 years	…	…	…	…	…	…	…
3.	Percent share of the value chain in GDP	…	…	…	…	…	…	…
Total						**T1**		

10. The user can also utilize the workshop for a quick validation of the indicators selected in Step 2, sub-section 3.1.

Step 2: Shortlisting value chains based on their climate change risks and vulnerabilities, and market demand

After weights have been assigned to each parameter, and data has been collected and normalized, the tool in Annex 8 is used for preparing the matrix. This will provide the user with value chains being ranked based on their climate change risks and vulnerabilities, and market demand. A pre-determined number of value chains may be selected for the subsequent steps. For an illustrative comparison matrix, please refer to Table 10 below.

Illustrative Zambia case

In the case of Zambia, the table below shows an illustrative comparison matrix for the value chains.

Table 10

Illustrative comparative matrix for comparing value chains on climate change risks and vulnerabilities, and market demand

No.	Selection criteria / parameters	Assigned Weight	Cotton		Wheat		Maize	
			Score	Weighted Score	Score	Weighted Score	…	…
Climate change risks and vulnerabilities								
1.	Changes in weather patterns in the last 5 years	4%	88	3.5	78	3.1	…	…
2.	Changes in annual yield (producer level)	4%	85	3.4	80	3.2	…	…
3.	Impact due to expected change in temperature across different climate change scenarios	3%	82	2.5	68	2.0	…	…
4.	…	…	…	…	…	…	…	…
Market demand								
1.	Volume and value of (local) market demand in the last 5 years	…	…	…	…	…	…	…
2.	Volume and value of (export) market demand in the last 5 years	…	…	…	…	…	…	…
3.	Percent share of the value chain in GDP	…	…	…	…	…	…	…
Total		**100%**		**T1**		**T2**		

Step 3: Selecting the most promising value chains for further analysis

To select the most promising value chains, use a comparative matrix to create a list of the total scores for all the value chains, then select the top 3 to 6 value chains. If the intention is to conduct value chain analysis for all the promising value chains, the user can skip the sub-sections (3.3 to 3.5) and move directly to Section 4. Otherwise, the user may proceed through the sub-sections (3.3 to 3.5) to conduct a more comprehensive analysis.

3.3 DETERMINING THE CRITERIA AND DEVELOPING THE MATRIX FOR VALUE CHAIN SELECTION

To meet the objectives of the toolkit, the over-arching criteria for further shortlisting are:

- market development;
- opportunity to promote gender equality;[11]
- climate change risks and vulnerabilities; and
- alignment with government policies.

Determining the criteria and developing the matrix for value chain selection

Step 1:	Finalizing the parameters for comparison of shortlisted value chains
Step 2:	Assigning weights to the parameters
Step 3:	Developing a matrix for comparing the shortlisted value chains across the parameters

Step 1: Finalizing parameters for comparison of shortlisted value chains

During this step the parameters for comparison of the shortlisted value chains will be finalized. Annex 5 provides a comprehensive list of parameters to refer to, and from which relevant parameters may be selected. A brief secondary search or consultation with stakeholders (workshop) might be required at this stage to check the availability of the data corresponding to these parameters. If the data corresponding to any of the parameters is not readily available, that parameter may be dropped.

Step 2: Assigning weights to parameters

Once the parameters have been finalized, a matrix would need to be prepared for comparing the value chains on the selected sub-criterion. Each parameter would need to be assigned a weight which should be decided through a stakeholder consultation. The tool in Annex 7 can be used for capturing stakeholder opinion on the importance of the selected parameters. These opinions can be subsequently aggregated to calculate the weight for each parameter. Please refer to Table 11 below for an illustration.

11. Cognizant of the fact that women (and) men are not a homogenous group, therefore depending on the availability of the data the user can select parameters which have dis-aggregated data based on other socio-economic factors the user may want to consider.

Step 3: Developing a matrix for comparing the shortlisted value chains across the parameters

After the weights have been assigned to each parameter, the tool in Annex 8 could be used for preparing the matrix.

Illustrative Zambia case

Table 11

Illustrative matrix for assigning sample weights to the four criteria

No.	Selection criteria / parameters	ST1	ST2	ST3	…	Total	Percentage	Assigned weight
Market Development								
1.	Share (%) of the value chain in gross domestic product (GDP)	5	4	5	…	58	(58/T*100) =4.2%	4%
2.	Volume of unmet market demand	4	4	5	…	52	4%	4%
3.	Volume and value of (local and export) market demand in the last 5 years	3	3	2	…	32	2.8%	3%
4.	…	…	…	…	…	…	…	…
Climate change risks and vulnerabilities								
1.	Changes in weather patterns in the last 5 years	5	5	5	…			
2.	Changes in annual yield (producer level)	3	3	4	…			
3.	…	…	…	…	…	…	…	…
Opportunity to promote gender equality								
1.	Ratio of female land-holding in the value chain	3	4	4	…			
2.	…	…	…	…	…	…	…	…
Alignment with Government Policies								
1.	Schemes dedicated to the value chain	5	5	4	…			
2.	…	…	…	…	…	…	…	…
Total						**T**		

Exercise 2:

Consider Annex 7, which has the maximum and minimum number (weight) a parameter could receive:

a) What is the lowest number of stakeholders which could have been involved to compute the table below?

b) What is the highest number of stakeholders which could have been involved to compute the table below?

c) Assuming that the number of stakeholders is twenty, please compute the assigned weight for 'Ratio of female land-holding in the value chain'.

Table 12

Illustrative comparative matrix for selection criteria and parameters

No.	Selection criteria / parameters	ST1	ST2	ST3	…	Total	Percentage	Assigned weight
Market development								
1.	Share (%) of the value chain in gross domestic product (GDP)	5	4	5	…	58		
2.	Volume of unmet market demand	4	4	5	…	52		
3.	Volume and value of (local and export) market demand in the last 5 years	3	3	2	…	32		
Climate change risks and vulnerabilities								
1	Changes in weather patterns in the last 5 years	5	2	3	…	35		
2	Changes in annual yield (producer level)	5	5	5	…	50		
Opportunity to promote gender equality								
1	Ratio of female land-holding in the value chain	…	…	…	…			
Total						260		

Please refer to Annex 19 for the answer.

3.4 DESK STUDY

- At this stage, data needs to be collected for all the promising shortlisted value chains across the parameters finalized in sub-section 3.3. The user may collect this data through desk-based secondary research or hire a research-based consulting organization to collect it. Please refer to sub-section 3.1 step 3 for an illustrative list of secondary sources of data.

3.5 SELECTING THE VALUE CHAIN

- Once collected, the data will need to be normalized. Please refer to Annex 8 for details on normalization.
- Upon normalization, the data will need to be entered into the value chain selection matrix. This will provide the user with a value chain ranking. The highest ranked value chain should be selected for the subsequent steps. For an illustrative comparison matrix, please refer to Table 13 below.

Illustrative Zambia case

In the case of Zambia, the figure below shows an illustrative comparison matrix for promising value chains.

Table 13

Illustrative comparative matrix for promising value chains

No.	Selection criteria / parameters	Assigned weight	Cotton		Wheat		Maize	
			Score	Weighted score	Score	Weighted score	…	…
Market Development								
1.	Share (%) of the value chain in gross domestic product (GDP)	4%	88	3.5	78	3.1		
2.	Volume of unmet market demand	4%	85	3.4	80	3.2		
3.	Volume and value of (local and export) market demand in the last 5 years	3%	82	2.5	68	2.0		
4.	Number and size (workers) of SMEs in the value chain, both formal and informal	4%	84	3.4	70	2.8		
5.	Cost of production	…	…	…	…	…		
6.	…	…	…	…	…	…		
Climate change risks and vulnerabilities								
1	Changes in weather patterns in the last 5 years	5%	80		70			
2	Changes in annual yield (producer level)	4%	78		78			
3	Impact due to expected change in temperature across different climate change scenarios	4%	70		70			
4	…	…	…	….	…	….	…	…

No.	Selection criteria / parameters	Assigned weight	Cotton		Wheat		Maize	
			Score	Weighted score	Score	Weighted score	…	…
Opportunity to promote gender equality								
1	Ratio of female land-holding in the value chain	4%	75		70			
2	Ratio of female workers in the value chain	3%	70		65			
3	…	…	…	….	…	…	…	…
Alignment with government policies								
1	Schemes dedicated to the value chain	5%	88		75			
2	PPPs and joint ventures between government and private companies in the value chain	4%	75		70			
3	…	…	…	…	…	…	…	…
Total		**100%**		**75**		**68**		

Exercise 3:

Based on the tables below, please calculate the following:

a) Score of cotton for the parameter – share (percentage) of the value chain in GDP

b) Weighted score of cotton for the parameter – share (percentage) of the value chain in GDP

c) Volume of unmet market demand of wheat (in tonnes)

	Cotton	Wheat	Rice	Maize
Share (%) of the value chain in Gross Domestic Production (GDP)	**2**	**1**	**3**	**0.5**
Volume of unmet market demand (in tonnes)	**200**		**100**	**50**

No.	Selection criteria / parameters	Assigned weight	Cotton		Wheat		Maize	
			Score	Weighted score	Score	Weighted score	…	…
Market development								
1.	Share (%) of the value chain in GDP	4%			20	0.8		
2.	Volume of unmet market demand	4%	100	4.0	66.67	2.66		
Climate change risks and vulnerabilities								
1.	…	…	…	….	…	….	…	…
Opportunity to promote gender equality								
2.	…	…	…	….	…	…	…	…
Alignment with Government Policies								
1.	…	…	…	….	…	…	…	…
Total		**100%**		**75**		**68**		

Please refer to Annex 19 for the answers.

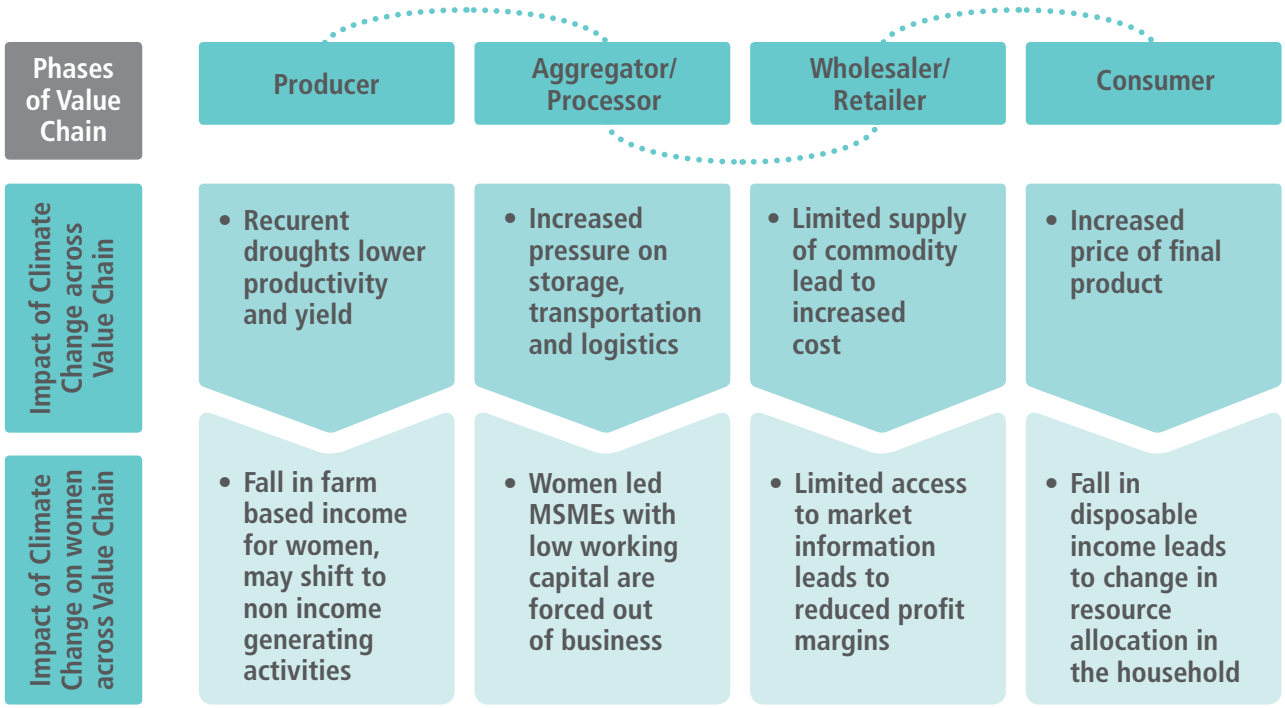
4. Value chain mapping and analysis[12]

The linkage between climate change and gender have been detailed in module 2 of this toolkit. Expert subject matter on agriculture, gender and climate change, along with secondary research, should enable the user to develop an initial understanding of the possible gender-differentiated impact of climate change at each stage of the value chain (refer to Figure 5). This feeds into the development of questionnaires with the results enabling users to understand the interlinkage in much greater detail.

12. The tools have been designed in a way to facilitate the user to collect all the data in a single field visit. However, the number of field visits the user may want to take to collect the data is dependent on them.

Figure 5

Illustrative impact of climate change on women across a value chain



Notes on research and sampling methodology

1. The tools suggested are a mixture of both qualitative and quantitative approaches. Where quantitative tools have been suggested, it is recommended that the user base the sample size on the best practice of 95 percent confidence level with a 5 percent confidence interval.
2. Post determination of the sample size, at producer level, the selection of interview areas (at the lowest administrative level) could be based on the Probability Proportional to Size (PPS) method, with the respondents being selected using a judgement sampling to ensure fair representation of men and women*[13] across different communities, income groups and castes, etc; and
3. For other value chain actors, even where a statistically significant sample size of respondents are recommended, the user could identify the respondents based on a combination of snowball and judgement based sampling; and
4 The sampling strategy design should keep in mind the sub-social groups against which the user wants to analyse the value chain.

13. It is recommended that the user includes a representative sample of young men and women ('youth') so as to ensure that the concerns of the youth pertaining to their involvement in the agriculture sector are recognized and interventions are designed to address them as well.

4.1 VALUE CHAIN MAPPING

A value chain map provides a brief and simple overview of the various channels involved in taking a product from production to the end consumer. The key objectives of a value chain map are to:

- visualise networks for a better understanding of the connections between the actors and processes in a value chain; and
- showcase the interdependency between actors and processes in the value chain (Sanogo, 2010).

Methodology	Steps for developing a value chain map which integrate climate risks, market analysis and gender responsiveness
Desk study	**Step 1:** Mapping the core processes in the value chain
Desk study	**Step 2:** Identifying and mapping the main actors involved in these processes
Field visit	**Step 3:** Mapping climate change risks and vulnerability
Field visit	**Step 4:** Mapping the number of actors and jobs
Field visit	**Step 5:** Financial analysis
Field visit	**Step 6:** Mapping the flow (including geographical flow) and volume of products
Field visit	**Step 7:** Mapping the flow of information and knowledge
Field visit	**Step 8:** Mapping relationships and linkage between value chain actors
Field visit	**Step 9:** Mapping the enabling environment of the value chain
Field visit	**Step 10:** Market analysis
Field visit	**Step 11:** Mapping the gender responsiveness of the value chain

Based on Sanogo, 2010

Step 1: Mapping the core processes in the value chain

The first step is to distinguish the key processes of the value chain that consist of a maximum of six to seven major steps that the raw material undergoes before it reaches the end consumer (Sanogo, 2010).

Step 2: Identifying and mapping the main actors involved in these processes

This step deals with identifying the main actors and mapping their roles. The straightforward way to do this would be to categorize the actors according to their main roles within the value chain. However, depending on the level of sophistication desired in the mapping exercise, the actors could be further categorized into different sub-categories. For example, based on legal status or ownership, size or scale, income levels, gender and age, etc. (Sanogo, 2010)

Undertaking Steps 1 and 2:

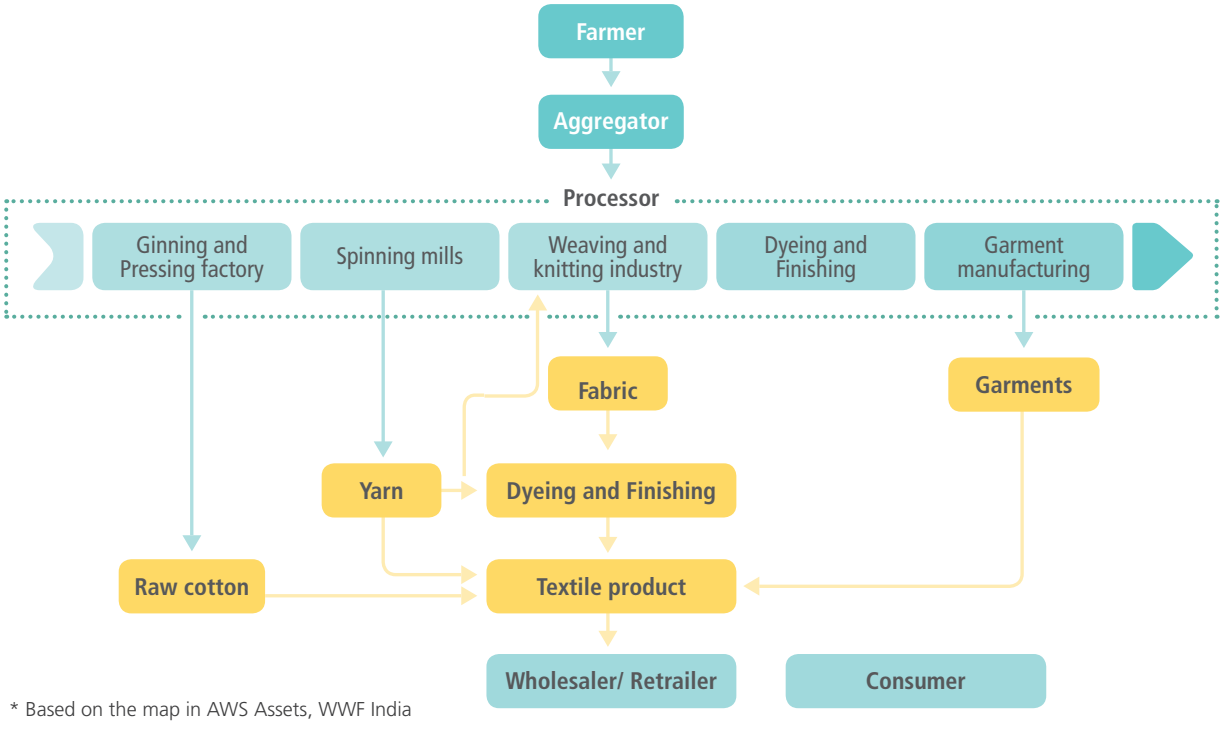
Based on secondary research, the toolkit user should be able to form an initial understanding of the core processes and the main actors involved in these processes. The user should consider the first two steps as iterative and should continue updating with information received from subsequent field visits.

Illustrative case: Zambia

The figure below shows an illustrative broad value chain map which can be obtained by combining steps 1 and 2 above. A detailed value chain map is illustrated in Figure 9.

Figure 6

Illustrative value chain map (overview)



* Based on the map in AWS Assets, WWF India

Step 3: Mapping the climate change risks and vulnerability

As detailed in section 2.3 of module B, when having an in-depth understanding of adaptive capacities in the agriculture sector it is important to apply intersectional approaches (encompassing gender). This would provide pathways to understand the linkage between social dimensions of identity (encompassing gender) and social institutions (formal and informal), which shape interactions between value chain actors, households, and agro-ecosystems (Thompson-Hall, Carr and Pascual, 2016).

Please refer to section 'Climate change risk and vulnerability analysis' in Annex 16 for probe areas.

Undertaking Step 3:

The user would need to interview a statistically significant sample size of actors at each node.

Step 4: Mapping the number of actors and jobs

In this step the user should quantify the number of actors within a sub-process, i.e. number of farmers, number of processors and so forth, as well as the jobs they create (Sanogo, 2010). Please refer to Annex 9 to see illustrative steps involved in determining the number of actors and jobs. Please refer to section 'Number of jobs created' in Annex 16 for questions pertaining to job creation. Table 14 below is an illustrative table to capture the data.

Table 14

Illustrative table to capture the data on number of actors and jobs

	Number of actors		Number of jobs created								
	Men	Women	Men	Women	Skilled	Semi-skilled	Unskilled	Family	Non-family	Full-time	Part-time
Producer											
Aggregator / processor											
Wholesaler / retailer											

Undertaking Step 4:

The calculation of the number of actors would entail targeted interviews with key stakeholders combined with secondary research. Ascertaining the number of jobs created by each actor would require the user to interview a statistically significant sample size of actors at each node.

Step 5: Financial analysis

The next step is to analyse the financial performance of the value chain. A financial analysis of a value chain can entail the study of both historic and current costs and margins. The former allows the user to determine if the value chain (or a particular process) has the potential to grow in future, while the latter enables the user to find out if the value chain (or a particular process) is accessible to a particular participant, and whether it is a good source of income for them (Sanogo, 2010). Since this step is being done when the value chain has already been selected, the toolkit will only include the process of studying actual costs and margins.

The financial analysis is carried out based on information gathered from each level of the value chain actor. Sample components of the analysis are shared below: (For details please refer to Annex 10)

- fixed and variable costs, including cost of losses;
- cost of investment / capital cost;
- revenue from sale;
- revenue from sale of by-products; and
- opportunity costs.

Please note that the level of sub-division of costs and revenues is dependent on the user, and components, such as inflation (in case of a long time-frame), depreciation and taxes could also be considered.

Opportunity costs are important for actors with limited resources who have to judiciously decide on the market / sector they invest their resources in. Apart from comparing revenues, costs and margins of value chains (different marketing channels and product chains), the potential for upscaling and the required investments should also be considered when calculating opportunity costs for actors (Smith *et al.*, 2008).

For the formulas to calculate costs and revenue, please refer to Annex 10. The format for capturing the analysed data is shared in section 'Gender-disaggregated financial analyses' in Annex 16.

Illustrative Zambia case

Table 15

Illustrative gender-disaggregated financial analyses (in USD) across the value chain

Men	Profit net unit	2.20	3.35	4.05
	Cost incurred per unit	4.40	6.60	9.95
	Revenue per unit	6.60	9.95	14.00
Stages of Value Chain		Producer level	Aggregator/ Processor	Wholesaler/ Retailler
Women	Profit net unit	2.10	3.25	3.70
	Cost incurred per unit	4.45	6.55	9.80
	Revenue per unit	6.55	9.80	13.50

Undertaking Step 5:

The user would need to interview a statistically significant sample-size of actors at each node.

Exercise 4:

A male farmer is involved in the production of tomatoes which are a perishable commodity. Consider his cost and revenue structure to be as follows:

- the land on which the farmer engages in production belongs to him;[14]
- he is paying an annual ten percent simple interest on a ten-year loan of USD 1 000;
- he had initially invested in two pieces of machinery at USD 500 apiece;
- for the first five months the farmer paid wages at USD 10 per month to ten labourers and for the remaining seven months, paid at USD 10 per month to 20 labourers;
- transportation costs total USD 300 for the entire year;
- in the first five months he sells 45 kg of tomatoes each month; and
- in the last seven months he sells 90 kg of tomatoes each month. His selling price was as follows:

Quantity sold (in kg)	Channel	Selling price per kg (in USD)
400	To aggregator	4
455	To wholesaler	5

Using the formulas in Annex 10, please calculate the total revenues, net income, net margin and breakeven point. Please refer to Annex 19 for answers.

Step 6: Mapping the flow (including geographical flow) and volume of products

The flow of tangible goods in a value chain, such as products, services or cash, can be mapped by following each stage the product goes through, from producer to end consumer. Mapping the volume of products (related to the flow of products), will provide an overview of the relative size of different channels in the value chain.

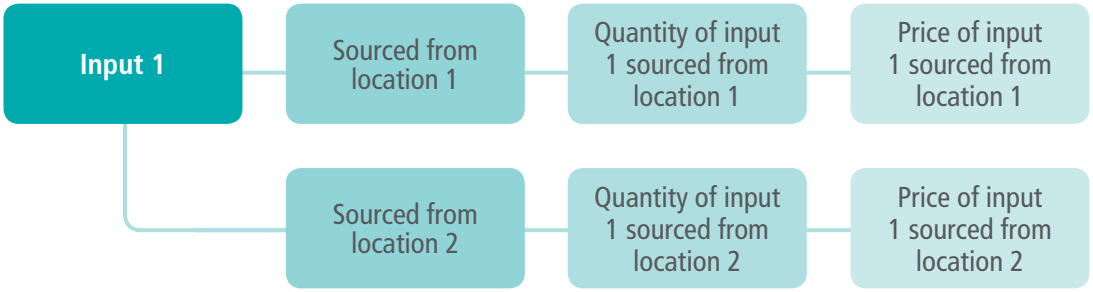
While the user could map the physical flow of the product only on a map of the region, if the geographical flow is combined with other dimensions, such as volume and margin (disaggregated by gender), it would highlight the local and regional differences (Smith *et al.*, 2008).

Please refer to section 'Product flow' in Annex 16 to see the information required. Figure 7 below is an illustrative output of the information captured in the said section.

14. If the farmer's land can be a source of rent, then the user could calculate the opportunity cost as well

Figure 7

Illustrative mapping of the flow and volume of products



Undertaking Step 6:

The user would need to interview a statistically significant sample size of actors at each node.

Exercise 5:

Assume that there are a total of 200 000 cotton producers in a region. These producers have similar socio-economic factors and technology and therefore can be described as a "representative producer" profile. The representative producer is endowed with 0.5 hectares (ha) of land and uses three inputs and factors apart from technology. Assume that technology is applied by proportionally adapting inputs and factors to available land and a proportional quantity of output is obtained (Bellu, 2013). Using the information in the table below, calculate the quantities of inputs and outputs used at farm level and at the cotton sub-sector level (Bellu, 2013).

Cultivation of 1 ha of cotton		
Input quantities per ha		
	Unit	Quantity
Labour	Person/month	5.00
Seeds	Tonne	0.5
Fertilizer	Tonne	0.8
Output quantities per ha		
Cotton	Tonne	2

Please refer to Annex 19 for the answer.

Step 7: Mapping the flow of information and knowledge

Mapping the flow of intangibles (such as information or knowledge) is more complicated than mapping the flow of tangibles, as the former might be bi/multi-directional. Analysizing the flow of intangible information can assist the user in determining whether a specific target group is participating in the exchange of information and knowledge (Sanogo, 2010). Please refer to section 'Flow of information and knowledge' in Annex 16 for a list of probe questions.

Figure 8

Illustrative mapping of the flow of information and knowledge

	Producer	Aggregator / Processor	Wholesaler/ Retailer	Consumer
Key tasks performed				
Nature of information required				
Nature of information received from the following upstream VCA (with reasons)				
Nature of information provided to the following downstream VCA (with reasons)				
Other sources of information				

Undertaking Step 7:

The user would need to interview a statistically significant sample size of actors at each node.

Step 8: Mapping relationships and linkage between different value chain actors

In a value chain, relationships can be inter-actors, i.e. producer and trader and/or intra-actors i.e. producer and producer. The nature of these relationships can be crucial in determining factors, such as bargaining power, and therefore assist the user in ascertaining the benefit and income for each actor (Sanogo, 2010).

Mapping relationships is an important step for a food value chain analysis (FAO, 2018c). The relationship between actors can be mapped in accordance with the following typologies:

- spot market relations – relationships which are created 'on the spot', i.e. actors negotiate and conclude their transaction on the spot;
- persistent network relations – relationships which are characterized by actors having a preference for transacting with each other repeatedly; and
- horizontal / vertical integration – this goes beyond the definition of a 'relationship' as the actors share the same owner, i.e. same organization deals with different processes in the value chain (Sanogo, 2010; Smith *et al.*, 2008).

Please refer to section 'Relationships between actors' in Annex 16 for a list of aspects that can characterize the relationship (Sanogo, 2010). Please refer to Table 16 for an illustrative table to map the aggregated representation (qualitative / quantitative) of the information received in Annex 16.

Table 16

Illustrative table to map relationships between actors

	Inter-actors									
	Relationship with buyers					Relationship with suppliers				
	D	S	P	IS	T	D	S	P	IS	T
Value chain actors										
Producer										
Aggregator / processor										
Wholesaler / retailer										

D – Duration of relationship

S – Switch cost

P – Power / Control

IS - Information shared

T - Trust

Undertaking Step 8:

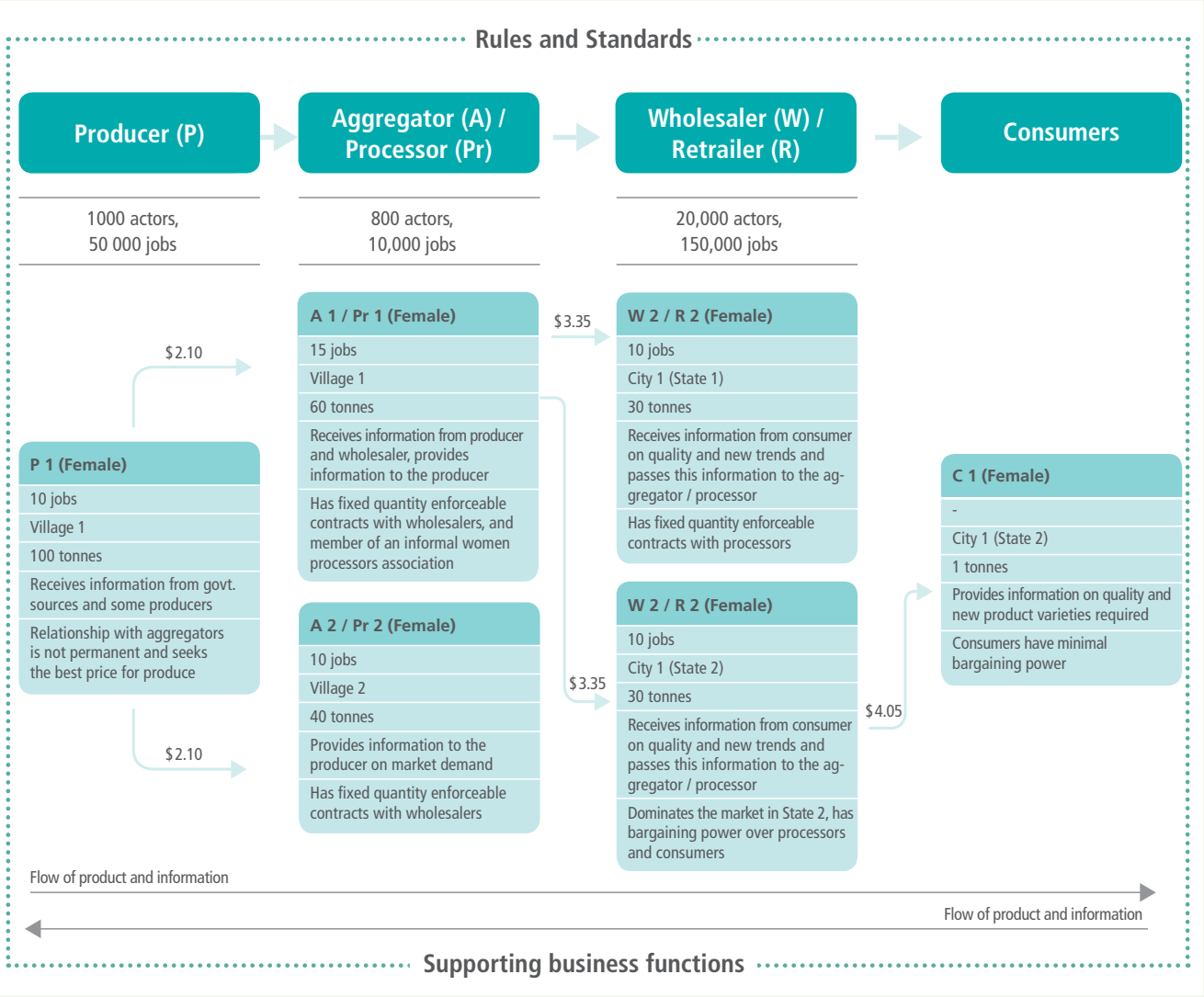
The user would need to interview a statistically significant sample size of actors at each node

Illustrative Zambia case

The figure below is an illustrative for a detailed market map which we obtained by combining steps 1, 2 and 4 to 8.

Figure 9

Illustrative detailed market map for Zambia



Step 9: Mapping the enabling environment of the value chain

The rules and regulations that govern a value chain (or parts of it) and the business services that feed into the value chain may provide crucial information regarding the value chain itself, thereby giving the user an overview of the potential to intervene outside the value chain (Sanogo, 2010). Rules and standards include land and property rights, natural resources, governance, infrastructure, gender, social norms, competition, consumer trend, and formal, informal and social organizations. Supporting functions / business services include input providers, extension services, market information, credit, savings, insurance, transportation, equipment, climate, research and others (Camagni and Kherallah, 2014).

Undertaking Step 9:

The toolkit integrates detailed select rules, standards and business services, such as consumer trend, climate and gender as part of the value chain analysis. Similarly, the user could include other dimensions in the value chain mapping and analysis.

As it is difficult to capture all of the governance and services issues in a fixed-format questionnaire, it is recommended that the user employs open-format and intensive interviews with key informants and focus-group discussions with the value chain actors, to generate the initial list of rules, standards and services (Smith *et al.*, 2008). Upon the development of a comprehensive list of rules, standards and services, the user can develop structured questions and coded answers (Smith *et al.*, 2008).

Amongst others rules, standards and supporting business functions, it is suggested that the user covers the constraints and opportunities pertaining to the following categories at each node of the value chain:

- market access
- technology and product development
- management and organization
- input supply
- finance
- policy; and
- operating environment (Lusby and Panlibuton, 2007)

For a list of illustrative questions, please refer to Annex 11.

Step 10: Market analysis

Market analysis, is the study of the market through different lenses, such as market size, market growth rate, market trends and profitability (Aaker, 2005). Conducting a market analysis would enable the user to identify the constraints and opportunities pertaining to expanding the market for the selected value chain. For a market analysis, this toolkit suggests a combination of demand-supply analysis, market survey of customers and a SWOT analysis.

- **Tool 1 – demand-supply analysis**

To conduct a demand-supply analysis, the user will have a comprehensive repertoire of end products, including sub-varieties, along with their positive/negative demand gaps. This will highlight the growth potential for the commodity. Please refer to Annex 12 for an illustrative format for capturing the demand-supply analysis.

Illustrative Zambia case

The following is the illustrative demand-supply analysis for the Zambia cotton value chain.

Table 17

Illustrative demand supply

Product / sub-product	Units of measurement	Demand (D)	Supply (S)	Gap (D-S)
Linters • Bandages • Swaps • Bank notes • Cotton buds • X-rays	—	—	—	—
Nature of information required	—	—	—	—
Cottonseed oil • Cooking product • Margarine • Emulsifiers • Cosmetics • Pharmaceuticals	1000 (MT)	 • 150 • 500 • 1100 • 80 • 55	 • 250 • 700 • 800 • 100 • 35	 • -100 • -200 • 300 • -20 • 20

Undertaking tool 1, step 10:

The user could complete this based on information from secondary research or through targeted interviews with key data providers such as, and in case of the example above, Cotton Association of Zambia, Cotton Board of Zambia, Zambia Cotton Ginners Association and District Farmers' Association, etc.

- **Tool 2: Market survey of consumers**

A market survey could be carried out to assess the commodity's market and to explore the potential for expanding the market in a climate-resilient and gender-responsive manner. The roll-out could be combined with consumer interaction as part of the value chain mapping and depending on the consumer's geographic location, the survey can be completed either online or in person.

Please refer Annex 13 for the illustrative market survey.

Undertaking tool 2, step 10:

It is recommended that the user undertake a market survey through interviews with a statistically significant sample size of end consumers.

Step 11: Mapping gender responsiveness

Gender-responsive value chain mapping follows the regular value chain analysis method, with the key addition being that for each level of analysis, gender-responsive indicators are used and gender-disaggregated information is collected (FAO, 2016b). This type of analysis makes women's work visible at each value chain node and can provide insight into the gender division of labour, how women and men participate, the specific tasks they perform, and how they interact with other actors (FAO, 2018c).

As part of the gender responsiveness analysis, it is crucial that the user collects information regarding social norms throughout a woman's life, as social norms overlap with development outcomes and determine her ability to create avenues for empowering herself and her community. Moreover, research on discriminatory social norms have illustrated the multiple ways that these discriminatory laws and practices may be a hindrance for a woman to access the resources required for her empowerment and thereby curtail her ability to emerge out of poverty (Oxfam, 2016a). For example, a female milk aggregator may have limited access to milk collection centres due to prevailing social norms, and therefore would only be able to supply a lower quality and reduced quantity of milk, as compared to her male counterpart whose access may not be limited due to social norms (FAO, 2018c).

To collect information regarding social norms and institutional practices, a conceptual framework is required. The base framework suggested in this toolkit is the *Harvard Gender Analysis Framework*, which was developed on the understanding that development activities impact women and men differently (Assefa and de Roo, 2015). The basis for selecting this framework was that the tools suggested it would allow the user to better understand some critical issues that include, but are not limited to:

- gender-disaggregated division of labour (ILO, 2018), the lack of which results in women's activities being overlooked or underestimated in a conventional "gender-blind" value chain analyses (FAO, 2016b); and
- limitations to women's power and agency, which subsequently become the underlying cause of women being unable to make use of economic opportunities (FAO, 2016b).

As is possible with any framework, the gender analysis framework also has some inherent limitations; accordingly, the data-collection tools have been modified for this toolkit (Oxfam, 1999; March, Smyth and Mukhopadhyay, 1999).

The following tools have been suggested to collect information:

- activity profile: useful for examining the gender-based division of labour (Assefa and de Roo, 2015). Please refer to Table 18 for an illustrative profile at the producer level. Please refer to section 'Gender responsiveness' in Annex 16 for the tool;

Table 18

Illustrative gender disaggregated activity profile

Activity profile					
No.	Activity	Who does the work			
		Men		Women	
1	Household tasks		Remarks		Remarks
1.1	Cleaning				
1.2	Fetching firewood / water				
1.3	Cooking and auxiliary activities				
1.4	Taking care of children				
1.5	Washing clothes				
2	Land preparation		Remarks		Remarks
2.1	Land clearance				
2.2	Ploughing				
3	Production		Remarks		Remarks
3.1	Seed selection				
3.2	Seed sowing				
3.3	Weeding				
3.4	Daily maintenance				
3.5	Spraying of defoliant				
4	Harvesting		Remarks		Remarks
4.1	Cotton picking				
4.2	Storing in modules				
5.	Post-Harvesting		Remarks		Remarks
5.1	Selling to the aggregator				
6.	Community involvement		Remarks		Remarks
6.1	Attendance at meetings				
6.2	Religious activities				
6.3	Recreation				
6.4	Community activities				

- Daily activity clock: allows the user to look at relative workloads between women and men over a 24 hour period (Assefa and de Roo, 2015). Please refer to section 'Gender responsiveness' in Annex 16 for the tool;
- Socio-political profile: presents a way to examine how men and women relate to each other and thereby provide an entry point to understand the underlying causes of a particular gender's subordination, if any (March, Smyth and Mukhopadhyay, 1999). Accordingly, this toolkit suggests a separate socio-political profile for men and women. Please refer to section 'Gender responsiveness' in Annex 16 for the tool;
- Influencing factors: identifies factors that shape the differences between men and women (ILO, 1998). Please refer to section 'Gender responsiveness' in Annex 16 for the tool; and
- Access and control profile: determines power relations and interests, i.e. analyses who has access to the resources available and who has the decision-making power (Assefa, de Roo, 2015). Please refer to Table 19 below for an illustrative gender-disaggregated questionnaire at the producer level. Please refer to section 'Gender responsiveness' in Annex 16 for the tool.

Table 19

Illustrative gender-disaggregated access and control questionnaire

Access and control questionnaire						
	Access			Control		
	Men	Women	Remarks	Men	Women	Remarks
Resources						
Land						
Fertilizer						
Seed						
Animal						
Farm machinery						
Training						
Credit						
Benefits						
Benefits from other sources of income						
Benefits from sale of cotton						

Undertaking Step 11:

The user would need to interview a statistically significant sample size of actors at each node.

4.2 VALUE CHAIN ANALYSIS

4.2.1 Identifying the target group and corresponding key climate change risks

As the user will be collecting primary data pertaining to the social background of participants, exposure, sensitivity and adaptive capacity based on a statistically significant sample size of value chain actors at each node, it is recommended to use a vulnerability matrix to identify the most vulnerable sub-group value chain actor at each node of the value chain.

The key steps in a vulnerability matrix are (Morchain and Kelsey, 2016):

- identification of key climate change related hazard / issue;
- assessment of exposure;
- assessment of sensitivity; and
- assessment of adaptive capacity.

The information pertaining to key climate-change related hazards would be based on the secondary data collected during the relevant steps of sub-sections 2 and 3 in module C.

Combining the exposure and sensitivity values will provide the user with the initial vulnerability values as seen in Table 20 (Morchain and Kelsey, 2016) below.

Table 20

Illustrative initial vulnerability values

		Sensitivity			
		Low	Medium	High	Very high
Exposure	Low	0	0	1	1
	Medium	0	1	2	2
	High	1	2	2	3
	Very high	1	2	3	3

Scoring Scheme:

3 – If either sensitivity or exposure is very high and the other parameter is high or above

2 – If either sensitivity or exposure is medium and the other parameter is high or above; or if both sensitivity and exposure are high

1 – If either sensitivity or exposure is low and the other parameter is high or above; or if both sensitivity and exposure are medium

0 – If either sensitivity or exposure is low and the other parameter is medium or below.

Result interpretation:

Score	Initial vulnerability
3	very high
2	high
1	medium
0	low

To determine the composite vulnerability value, this toolkit suggests including the adaptive capacity. See Table 21 (Morchain and Kelsey, 2016) for an illustrative composite of vulnerability values.

Table 21

illustrative composite of vulnerability values

		Initial vulnerability			
		Low	Medium	High	Very high
3 – (adaptive capacity)	Low	0	0	1	1
	Medium	0	1	2	2
	High	1	2	2	3
	Very high	1	2	3	3

Scoring Scheme:

3 – If either adaptive capacity or initial vulnerability is very high and the other parameter is high or above

2 – If either adaptive capacity or initial vulnerability is medium and the other parameter is high or above; or if both adaptive capacity and initial vulnerability are high

1 – If either adaptive capacity or initial vulnerability is low and the other parameter is high or above; or if both adaptive capacity and initial vulnerability are medium

0 – If either adaptive capacity or initial vulnerability is low and the other parameter is medium or below.

Result Interpretation:

Score	Composite vulnerability
3	very high
2	high
1	medium
0	low

Based on these values, the vulnerability matrix can be drawn for actors at each node of the value chain, such as producer, aggregator/processor, and wholesaler/retailer, disaggregated by social stratification, such as age, gender, and ethnicity. Please refer to Table 22 a) and b) (Morchain and Kelsey, 2016) for an illustrative vulnerability matrix at the producer and processor level respectively.

For an illustrative format of the vulnerability matrix, please refer to Annex 14.

Table 22a

Illustrative vulnerability matrix at the producer level

Resilience to a climate-change related risk or hazard / Social group		Increased temperature	Drought and low rainfall	Recurrent floods	Change in seasonal cycle	Phenological changes
Corporate farmer	Men	1	0	0	2	1
	Women	1	0	0	2	1
Medium scale farmer	Men	1	1	1	2	2
	Women	1	2	1	3	3
Subsistence farmer	Men	2	3	3	2	2
	Women	2	3	3	3	2
Landless labourer	Men	2	3	2	1	0
	Women	2	3	2	1	0

Table 22b

Illustrative vulnerability matrix at the processor level

Resilience to a climate-change related risk or hazard / Social group		Increased temperature	Drought and low rainfall	Recurrent floods	Change in seasonal cycle	Phenological changes
Large scale processor	Men	1	1	1	1	0
	Women	1	2	2	1	0
Small scale processor	Men	2	2	2	2	2
	Women	2	3	3	2	2

4.2.2 Identifying the value chain constraints

This sub-section requires the user to analyse the data collected in steps 4 – 9 in subsection 4.1, with particular attention paid to the target group identified in 4.2.1. This will enable the user to identify the key constraints inhibiting the target group from deriving the same or similar benefits as compared to other social groups participating in the value chain.

In certain cases, It will be important to split between feasibility and impact as it is important to see both what is possible based on the current situation and what would be the prospective impacts of interventions. (FAO, 2020).

4.2.3 Identifying market based constraints and opportunities

The toolkit recommends a SWOT analysis to identify the market based constraints and opportunities that are impacting or could impact the target group. The SWOT analysis will be fed by insights gathered from steps 9 and 10 (tools 1 and 2) in section 4.1, along with requisite secondary research. Please refer to Annex 15 for the illustrative format.

Illustrative Zambia case

The following table is an illustrative SWOT analysis for cotton value chain in Zambia.

Table 23

Illustrative SWOT analysis for cotton value chain in Zambia

Strengths	Weaknesses
High number of women wiling to undertake up-skilling training	High prices Poor quality
Strengths	**Weaknesses**
High demand for cottnseed oil in emulsifiers High demand for skilled labourers at the processor level	Consumers want eco-friendly products, but are not willing to be bear the price rise

4.2.4 Identifying the gender issues

To identify gender issues pertaining to the identified target group, the gender-disaggregated data collected should be analysed against pre-determined parameters identified by the user. Please refer to Table 24 below for an illustrative list:

Table 24

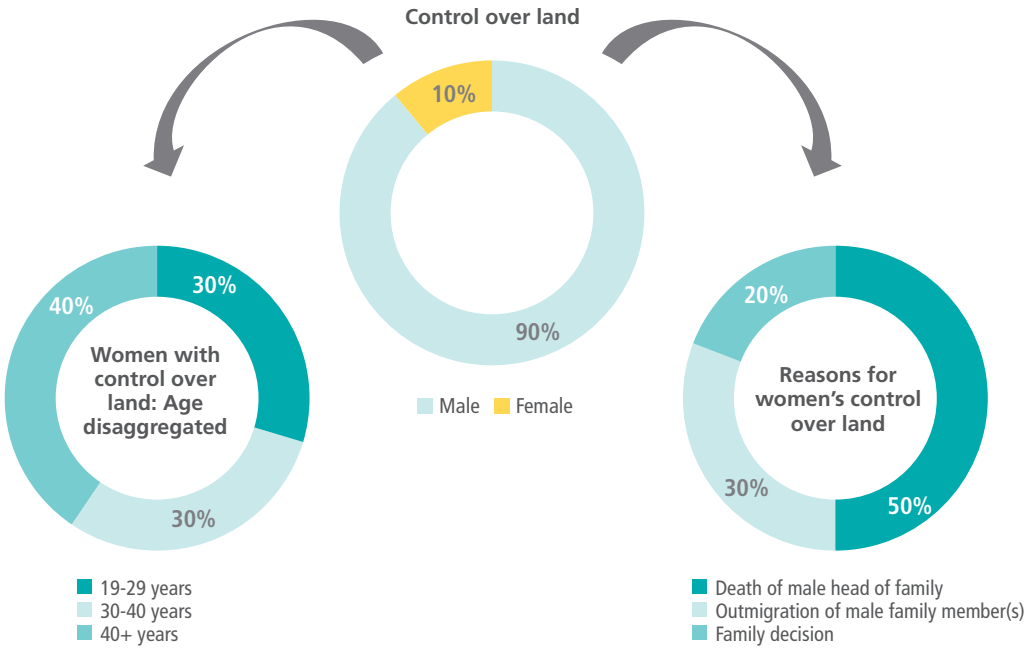
Illustrative list of parameters for gender analysis

List of parameters for gender analysis		
Producer		
No.	**Categories**	**Parameters**
1	Background	• Categorization by gender, age, religion, caste, income and education level
2	Gender roles	• Gender-disaggregated division of labour in household activities • How much time each gender spends on these activities • Gender-disaggregated division of labour for other activities, such as production, community involvement, etc.
3	Socio-political	• Comparison of women's involvement in decision-making at household, community and societal levels • Women's perceived self-image • Women's ability to coalesce to take advantage of her community's strengths • Factors that support / constrain a woman. Do these factors differ for men? If so, why?
4	Access to resources and control over benefits	• Gender-disaggregated access to resources in a household • Gender-disaggregated control over benefits, such as a woman's decision-making power on allocating household income
Aggregator / processor		
No.	**Categories**	**Parameters**
		•
Wholesaler / retailer		
No.	**Categories**	**Parameters**
		•
Consumer		
No.	**Categories**	**Parameters**
		•

Analysis of the gender-disaggregated data based upon pre-determined criteria would provide the user with insights as illustrated in figure 10 below.

Figure 10

Illustrative analysis of gender-disaggregated data



4.3 VALIDATING THE CONSTRAINTS AND OPPORTUNITIES

After conducting an analysis of key constraints and opportunities in subsections 4.2.1 – 4.2.4, the user should hold a workshop, with participants' representatives of the value chain.

The purpose of the workshop should be to validate the findings of the primary survey – *vis-à-vis* key climate change risks, constraints and opportunities pertaining to the value chain, the market and gender responsiveness. Validation of the constraints and opportunities is crucial as it would lead the user to ground-truth findings (Lusby and Panlibuton, 2007). Apart from validating the findings, the user can also utilize the same workshop for ideation of potential interventions across the short, medium and long term.

5. Developing and planning the interventions

To plan impactful interventions, the toolkit follows a modular approach with the subsequent sections focussing on identifying, assessing, prioritizing and designing the interventions, as well as the agencies for implementation.

Prior to developing the interventions, the user should note that small enterprises may face several constraints at the same time, and therefore to grow, they may need to overcome these constraints concurrently (Lusby and Panlibuton, 2007).

5.1 DEVELOPING CLIMATE CHANGE VULNERABILITY AND RISK INTERVENTIONS

This subsection follows subsection 4.2 and requires the undertaking of a climate change vulnerability and risk analysis. It further follows subsection 4.3, which validated the constraints and opportunities and led to ideation of potential interventions. Based on these two subsections, potential interventions are developed in this step.

While developing interventions, the user should be cognizant of the following three elements which are characterized as effective climate interventions:

- diversification – as a risk management strategy, a wider set of options with respect to increasing farmers' livelihood, farming and environmental management portfolios should be included;
- climate-proofing – at key stages of the value chain, specific interventions should be selected to make these stages more climate-resilient, resulting in livelihood and resilience benefits to the value-chain actors; and
- supply-chain efficiencies – waste-reduction or inventory-management measures that increase efficiency, deliver higher profitability (and therefore lead to higher adaptive capacity) to value chain actors and generate mitigation co-benefits (Vermeulen, 2015).

Please refer to Annex 17 for an illustrative format to capture the longlist of interventions.

Step 1 – The end product of this subsection would be interventions designed towards improving the climate resilience of the social group at each value chain node that is most vulnerable to climate change.

Case study III: Climate change adaptation in aquaculture – Viet Nam

As a result of a long coastline of 3 260 kilometres and over 3 000 islands, the majority of the Vietnamese population has been concentrated in coastal areas and low-lying deltas. To reap the benefits of its long coastal line and inland water surface, the government of Viet Nam selected aquaculture as one of the priority sectors for rural economic development and diversification. As early as 2010, 7.4 percent of the economically active population of the country was engaged in fishing, a percentage second only to Fiji's 18.4 percent, worldwide. Fishery exports also saw a tremendous growth from USD 1 billion in 2000 to USD 5 billion in 2010.

However, the population and economic assets concentrated in exposed coastal areas also made the country highly susceptible to climate change. In an assessment report released by the World Bank in 2007, Viet Nam had been ranked among the five countries most affected by climate change. It had been estimated that a 1 meter rise in sea level would partially inundate 7 percent of the agricultural land and 11 percent of the country's population.

The main aquaculture produce in Viet Nam is shrimp, which contributed to over USD 3 billion in fishery exports in 2016. Shrimp production is highly vulnerable to climate change due to its low tolerance towards rising sea levels, change in salinity, and low oxygen levels in the water. Increasing water temperatures and irregular rainfall pattern are also known to cause shrimp mortality. Furthermore, intensive and improved extensive shrimp production requires mass-scale mangrove clearance and a high amount of artificial feeding and chemicals, which has significantly negative impacts on the entire ecosystem and leads to coastline erosion.

To address the climate change risks associated with shrimp production, the country has taken several climate change adaptation measures. Some of these measures are mentioned below:

- Transitioning from cultured shrimp farming to mud crab farming has numerous benefits; mud crabs are more tolerant to salinity and oxygen changes in the water, they respond better to rising sea levels and are more resistant to common aquaculture diseases.
- Promoting ecosystem-based adaptation such as mangroves and markets through projects, helps transition from small-scale intensive and improved extensive shrimp farming to an ecologically sound method of shrimp farming. Shrimp and mangrove forests can co-exist and lead to salt level maintenance in the farm, aiding in protection from erosion.
- Super-intensive shrimp farming in greenhouses produces 300 tonnes per hectare per annum, which is 10 to 15 times higher than the traditional farming methods.

Shelton, C. 2014.

5.1.1 Addressing value chain based constraints

This step entails developing an intervention that addresses constraints and leverages opportunities in the selected social groups, as a result of their participation in the value chain.

Please refer to Annex 17 for an illustrative format to capture the longlist of interventions.

Step 2 – The end product of this subsection would be interventions which seek to address and leverage the value chain constraints / opportunities of the social group, at each value chain node, that are most vulnerable to climate change.

5.1.2 Linking to market-based opportunities and constraints

To ensure impact and sustainability of the proposed intervention, this step proposes the intervention to be 'market-based' (Lusby and Panlibuton, 2007). In this step, it is recommended that the user link the interventions developed so far, up to step 5.1.1, with appropriate market-based opportunities and constraints. Once linked, it is pertinent to identify existing providers of these interventions or identify existing agencies that can implement these interventions in the market.

Please refer to Annex 17 for an illustrative format to capture the longlist of interventions.

Step 3 – The end product of this subsection would be linking the interventions developed in 5.1.1 with appropriate market based opportunities.

5.1.3 Developing gender-responsive interventions

The purpose of this step is to integrate gender responsiveness into the developed interventions at the end of subsection 5.1.2.

The user should consider the following four forms of participation in the value chain, which men and women may experience differently.

Chain activities (men and women's types of activities)

- Chain actor: How can women be better seen and recognized?
- Activity integrator:
  - How can women have better choices regarding new activities and have greater control over the income they earn?
  - How can women gain skills and become more confident?

Chain governance (management of the chain)

- Chain partner: Which constraints to women's leadership need to be removed, so that they will be recognized as business partners?
- Ownership over the chain: How can women gain capacities and opportunities to take over leadership and link with chain actors? (Orr, Kee-Tui and Tsusaka, 2014).

Please refer to Annex 17 for an illustrative format to capture the longlist of interventions.

Step 4 – The end product of this sub-section would be gender-responsive interventions which seek to increase the climate resilience of the most vulnerable social groups, at each value chain node, by developing market-driven solutions to their value chain based constraints.

Case Study IV: Guatemala – coffee with character

Coffee is an important element of Guatemala's economy with the country being one of central America's top producers. UNDP and the Italian government's initiative to enhance coffee production in Guatemala is presently budgeted at USD 3 750 000. These organizations have curated multiple collective organizations and producers' associations that were earlier absent from the production cycle. This has encouraged the participation of women in the value chain.

One such association, led by a woman, has 140 members including 69 women. Women grow the coffee in contamination-free plots of land that meet the conditions for the wet processing method. Hence, the association has adopted the slogan, 'café con espiritu de muier' (coffee with a woman's soul).

Moreover, throughout the programme, the association has access to services and processes, such as the certification of Mayacret and Rainforest Alliance. This enables them, with other small producers, to meet a sustained demand and to export the produce. The inauguration of a coffee-processing and storage centre has further helped producers meet the processing requirements needed for the sustainability of production.

According to Sonia, who leads the 'coffee with a woman's soul' association, *"the activities of the Programme... are making us stronger and helping us open a window on our municipalities so that our 'coffee with a woman's soul' will be known in Guatemala and throughout the world."*

The Borgen Project, 2018.

5.2 ASSESSMENT OF POTENTIAL INTERVENTIONS

Once potential interventions are developed, they need to undergo a more rigorous assessment on parameters including:

- existing providers;
- market size and penetration;
- frequency of use;
- constraints to, and opportunities for, the provision and use of the intervention;
- satisfaction with existing interventions;
- awareness of existing interventions;
- proposed providers to target for interventions; and
- feasibility of the intervention, such as negative environmental externalities and coverage of the intervention's cost.(Lusby and Panlibuton, 2007)

The user will need to collect the information on the above parameters through secondary research and targeted interviews with providers and users of the interventions. The outcome of the information and its analysis would be an assessment report for each of the shortlisted interventions. (Lusby and Panlibuton, 2007)

Please refer to Annex 16 for an illustrative list of questions to be asked to the providers / users of the interventions.

5.3 IDENTIFYING THE ACTIVITIES FOR THE SELECTED INTERVENTIONS

Once the interventions have been determined and their assessments are completed, activities that will facilitate implementation need to be identified. This is followed by listing the barriers to implementation and strategies for overcoming these barriers. The activities should also be divided into three parts:

- public
- private
- public–private partnerships

The goals of the intervention must be identified at an early stage, so as to ensure that subsequent activities and discussions are aimed at meeting these goals. Below is an illustrative example of a capacity-building intervention, along with its target goals and means to overcome barriers to provision and usage of the intervention (Lusby and Panlibuton, 2007).

Intervention: Capacity building of women farmers to introduce them to modern farming practices and climate adapted technology

Objective: To increase the participation of women farmers using modern and climate adaptive farming practices and technologies.

Activities:

- develop standard training materials for women producers;
- develop database of resources capable of providing technical training;
- develop capacity of SHGs and producer organizations to expand training and demonstrations; and
- training of trainers.

Barriers to implementation:

- socio-cultural issues leading to low participation of women.

Strategies to overcome these barriers:

- awareness programmes in target geographies;
- increased number of female extension agents and training providers.

While identifying gender-responsive interventions, assessing them, and identifying corresponding activities, the user should ensure that the interventions are targeted towards addressing the root causes of gender-based inequalities, which includes the surrounding attitudes and norms that have allowed the inequalities to exist. For example, economic empowerment programmes targeted towards women may end up facilitating increased access to productive assets, and greater control over income for them but this may also challenge existing gender norms and power relations. Consequently, some communities, markets and household members can feel threatened by the changes which would subsequently increase the risk of violence to women, both in and outside of the household (Oxfam, 2016b).

5.4 VALIDATING THE INTERVENTIONS AND ACTIVITIES

After assessment of potential interventions, the user should hold a workshop with participants who are representative of the value chain.

The purpose of the workshop would be to validate the potential interventions being suggested, including constraints to its provision and use (Lusby and Panlibuton, 2007). This step is crucial as it would help the user to facilitate discussion and consensus on interventions. With a representative participant group, it would lead to interventions being demand-led. Upon completion of this part of the workshop, the user can make the required changes to the interventions, its activities and the intervention-specific assessment reports developed in subsection 5.2 (Lusby and Panlibuton, 2007).

5.5 PRIORITIZING OF INTERVENTIONS AND ACTIVITIES

This step helps to shortlist the interventions as per the users' objectives. The shortlisting of interventions is an activity that can be done via workshop with a focus group representative of the value chain. For the focus group, it is suggested to use a matrix that helps prioritize the interventions against two major criterion:

- impact of implementation[15]; and
- ease of implementation.

Interventions that fall within the pre-determined "attractive" range (highlighted below) are given highest priority (Lusby and Panlibuton, 2007) as illustrated in Table 25 below.

Table 25

Illustrative shortlisting matrix

Impact Ease of implementation	High	Medium	Low
High	Capacity building of women farmers on modern farming methods and climate adapted technology	Availability of research on measures to reduce soil erosion	
Medium	Access to climate-adaptive farm inputs		
Low	Access to climate finance		

Based on the table, the shortlisted interventions would be:

- capacity-building and skills-training for women farmers on modern farming methods and technology;
- access to climate-adaptive farm inputs; and
- availability of research on measures to reduce soil erosion.

In the same workshop, intervention providers for each of the interventions should be identified.

In this step, the user could face problems while having to prioritize between medium- and long-term adaptation plans *vis*-à-*vis* pressing short-term issues (Mimura *et al.*, 2014). One of the main reasons for this could be the target group's (especially producers) reluctance to look beyond their short-term needs. This potential concern area is illustrated in the case study shared below.

15. Impact can be measured on a number of factors such as environmental impact, number of beneficiaries

Case Study V: Farmers' perspective on climate change - Midwestern United States

Agriculture has been an important industry, both culturally and economically, in the Midwestern United States. Farmers from the Midwest region are among the world's leaders in producing high-yielding crops. Over the last several decades, the climate in this region has seen significant change – 10-15 percent increase in annual precipitation, warmer annual average temperatures and longer growing seasons. These changes are predicted to decline further in the future, leading to negative effects on the grain crop yields.

In a study conducted in the Midwest, farmers growing the most important agricultural crops (maize, soybeans and wheat), partook in 8 focus group discussions. A total of 53 farmers (with a mean farm size of over 1 000 acres and with 80 percent having over 20 years' farming experience) and one agri-business professional took part in the focus groups.

Results: The following was observed in this study:

- Farmers initially responded defensively, questioning whether climate change actually exists and highlighting how agriculture has reduced environmental problems and served society. Once it was made clear that the objective of the focus group was not to criticize them but to give them a voice in climate change adaptation discussions, their defensiveness diminished.
- Farmers did not view climate change as a problem or a significant challenge. They felt that just like weather, it is cyclical and a long-term phenomenon. Some of them could not distinguish climate from weather while many showed scepticism about human-induced climate change. Some remarked that climate change would, on the whole, prove more beneficial than detrimental.
- While the majority of the participants emphasized that they felt global climate change was not an issue, they did point out significant changes they had experienced on their farms related to climate and weather which have had tangible implications for their operations.
- While many farmers highlighted the changes in temperature, the majority felt that changes in precipitation had led to more consequential changes in their operations. The farmers voiced concern about heavy rain events and increasing water scarcity at the same time. Furthermore, the participants talked about more nuanced trends such as changes in wind patterns and wind force, and increased insect and pest issues (attributing to warmer temperature and changing precipitation patterns).
- Farmers struggled to formalize climate change adaptation, stating that "farmers always adapt". This indicates that they view climate change adaptation as similar to any other changes they need to make to stay viable. Farmers also noted that technology advancements (which included machinery, as well as crop genetics) are allowing them to adapt.
- Farmers work on short time horizons, unlike climate change scientists. One farmer shared, "I guess, if I could summarize, it doesn't matter what the weather is going to be 20 to 30 years from now. It only matters what it's going to be next year, and nobody can predict that."
- Even though the farmers expressed scepticism towards viewing climate change adaptation as a useful concept, many of them pointed out adaptation actions that they have implemented, such as investing in large farm equipment and more irrigation pivots, and using rain gauges and computer-based equipment to track weather.

- Farmers expressed a need for further climate information and guidance from extension professionals. They also expressed that reduced regulations and funding from the government would help them adapt.
- Farmers highlighted non-climate factors that caused them to change their operations, such as changes in competition, prices, and demand of commodities due to globalization. For example, they used to rotate corn, wheat, soybeans etc., but with increased prices of corn, they have had an economic incentive to plant corn continuously. Other factors included cost of inputs, technology changes and variable cost of credit.

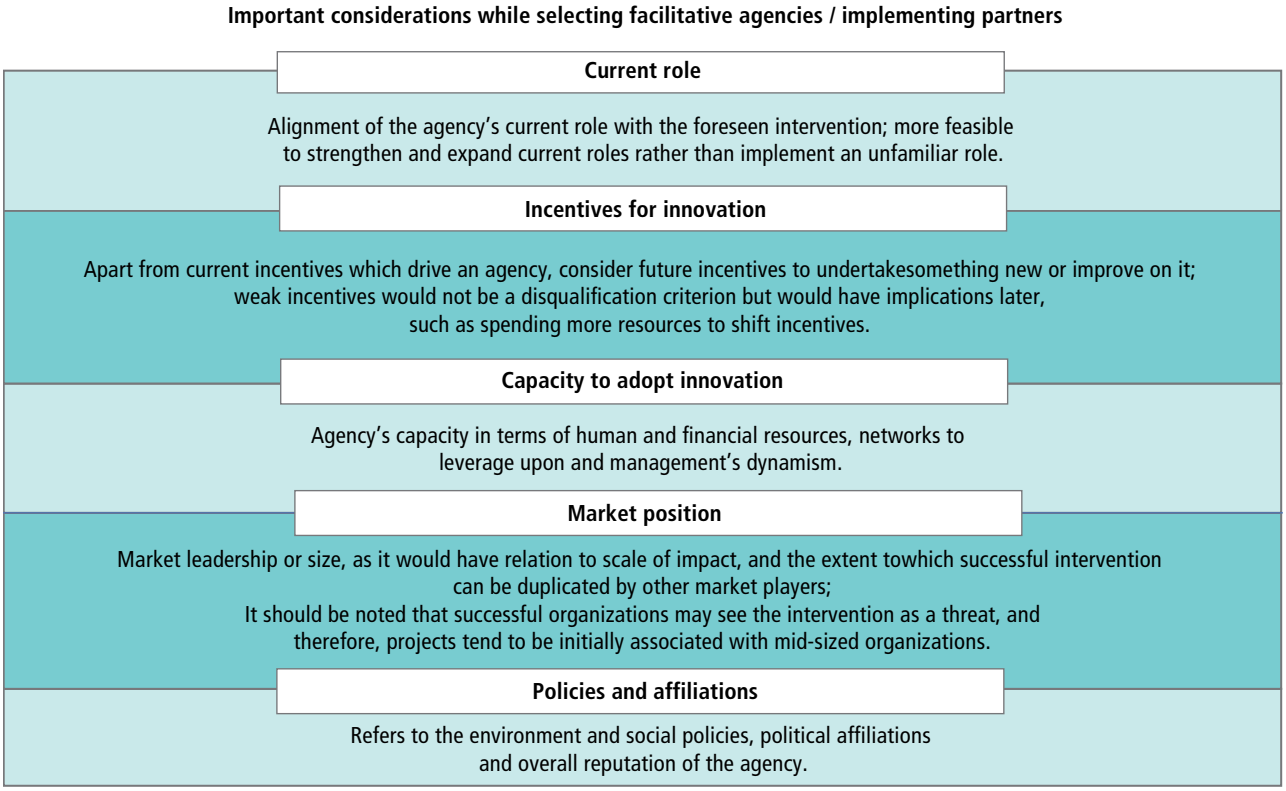
In conclusion, it has been observed that farmers in the Midwestern United States have been reacting to climate change and not proactively preparing for it as they feel that they are always able to adapt well. When it came to taking long-term climate-change adaptation measures, they did not view themselves as having great a deal of agency.

Sources: Doll, J., Petersen, B. & Bode, C. 2017.

5.6 IDENTIFYING FACILITATIVE AGENCIES FOR IMPLEMENTATION

Figure 11

Important considerations while selecting facilitative agencies / implementing partners



Source: Roudner, D. & Jenal, M. 2015.

With each of the potential intervention providers, it is important to discuss their willingness to carry out the activities and implement the interventions. Please note that before finalizing an agency, it is preferable to have more than one option at the end of the identification stage as:

- a safety net in the event that negotiations with one potential agency fails; or
- if an intervention is later discontinued / needs to be discontinued due to the poor performance of a particular agency (Hakemulder *et al.,* 2015).

It should be noted that the intervention provider does not need to be sustainable themselves. Their role is to implement interventions that result in sustainable solutions for the user vis-à-vis their objectives, while also providing synergies amongst different interventions taking place in the value chain[16]. Finally, all interventions should include an exit strategy that would describe how the facilitator would ensure that the interventions they are promoting would be sustainable in the market, without ongoing subsidies and support from consultants (Lusby and Panlibuton, 2007).

6. Monitoring and evaluation (M&E)

For M&E, using a results-based management (RBM) approach is suggested. It is defined by the United Nations Development Group as *"a management strategy by which all actors, contributing directly or indirectly to achieving a set of results, ensure that their processes, products and services contribute to the achievement of desired results (outputs, outcomes and higher level goals or impact). The actors in turn use the information and evidence on actual results to inform decision-making on the design, resourcing and delivery of programmes and activities as well as for accountability and reporting."* (UNDG, 2011).

As a lifecycle approach, RBM encompasses planning, monitoring and evaluation. The planning process requires the development of a results matrix. The matrix reflects strategic-level thinking across the board by synthesizing the essence of the intervention while clearly articulating the outputs, outcomes, and the agency responsible for monitoring the outcomes and subsequently measuring it. Accordingly, the matrix is essential to planning, implementing, monitoring, evaluating and subsequently, reporting (UNDG, 2011).

16. FAO has developed a tool for sustainable agribusiness value chains. Please refer to FAO, 2019d.

Definition of key terms

Goal / impact – positive and negative long-term effects on identifiable population groups produced by a development intervention, directly or indirectly, intended or unintended. These effects can be economic, socio-cultural, institutional, environmental, technological or of other types.

Outcomes – these represent changes in the institutional and behavioural capacities for development conditions that occur between the completion of outputs and the achievement of goals.

Outputs – changes in skills or abilities and capacities of individuals or institutions, or the availability of new products and services that result from the completion of activities within a development intervention, within the control of the organization.

Indicators – quantitative or qualitative variables that allow stakeholders to verify changes produced by a development intervention relative to what was planned.

Baseline – information gathered at the beginning of a project or programme against which variations that occur in the project or programme are measured.

Target – a particular value that an indicator should reach by a specific date in the future.

Means of verification – sources of information are the persons, beneficiaries or organizations from whom information will be gathered to inform initial baselines and measure results.

Assumptions – the variables or factors that need to be in place for results to be achieved. Assumptions can be internal or external to the particular programme or organization.

Risks – corresponds to a potential future event, fully or partially beyond control that may affect the achievement of results.

Role of partners – the responsibilities of the different partners.

Indicative resources – these reflect an estimate of the resources required – financial, human, technical assistance and knowledge – for a given programme or project.

NATURE OF TARGET SETTING REQUIRED

Though target setting includes several options such as soft / variable / hard targets, to set quantifiable targets with clear baselines, verification approach, accountability mechanisms and timelines for achievement, it is imperative to set hard targets.

MONITORING RESPONSIBILITY

The responsibility of monitoring outcomes can lie with a number of stakeholders, including but not limited to: country and sector; outcome-specific mechanisms / structures; multi-lateral agencies; and primarily, the implementing partners.

Sources: UNDP, 2011.

Table 26

Illustrative results matrix

Outcome and outputs	Indicators[17]					Achievements			
	Baseline	Overall target	Period 1 target	…	Period (n) target	Period 1	Period 2	… …	Period (n)
Intended goal / impact (1)									
Outcome 1: Increased women's economic empowerment at the producer level	% of women who receive wages for working on their family farms % of women who have control over the distribution of the household's economic resources	% of women who receive wages for working on their family farms % of women who have control over the distribution of the household's economic resources							
Output 1.1: Increase in women's income	USD 200	USD 800	USD 250		USD 800				

Source: Adapted from "Results Based Management Handbook: Harmonizing RBM concepts and approaches for improved development results at country level", October 2011, United Nations Development Group (UNDG).

17. The user should note that the indicators should be disaggregated by gender.

Means of verification	Risks and assumptions	Role of partners	Indicative resources
Intended goal / impact (1)			
Household-level data from economic surveys and interviews with women in target and control group	Risks – potential fall in exports of the product due to trade issues Assumptions – availability of adequately trained personnel		Financial resources – USD 100 000 Human resources – 20 technical advisors

An M&E plan also needs to be developed along with the results matrix. The plan is key to systematic data collection and subsequent assessment of progress and should:

- include elements of the results matrix, including indicators, baseline targets and means of verification;
- provide details on the data collection methods to be used, frequency of M&E and responsibilities; and
- be developed in consultation with stakeholders, such as implementing partners, government and beneficiaries, when possible.[18]

Key points for consideration:

- for effective monitoring it is crucial to have developed data systems along with regular collection of information;[19]
- an evaluation should be based on an experimental design, with a random selection of beneficiaries and a control group (The World Bank, 2015);
- a concurrent evaluation should be undertaken through a baseline, midline, and end line evaluation. A midline evaluation would allow for course correction, if required; and
- gender-disaggregated indicators should be used.

Please refer to Table 27 below for an illustrative guiding framework pertaining to the areas on which an evaluation reports, i.e. relevance, effectiveness, efficiency, impact and sustainability (UNDG, 2011).

Table 27

Illustrative guiding framework pertaining to relevance, effectiveness, efficiency, impact and sustainability

Evaluation scope		Evaluation focus	Evaluation indicators	Source of information
Relevance of project concept and design	Assessment of project relevance	Does the project clearly define its scope, boundaries and its beneficiaries?	Project document clearly mentions scope, boundaries and beneficiaries	Literature review: project document
		Are the project needs aligned with • needs of the beneficiaries • stakeholder expectations		
Effectiveness in implementation and management	Effectiveness of resource use	Assess the quality and timeliness of inputs and activities	Project work,-plan and resource-deployment have been prepared and documented	Monitoring reports and internal project planning documents

18. *Ibid.*
19. *Ibid.*

References

Aaker, D. 2005. *Strategic Market Management.* 2005. Hoboken, USA, John Wiley & Sons.

Adams, R., Hurd, B., Lenhart, S. & Leary, N. 1998. Effects of global climate change on agriculture: An interpretative view. *Climate Research*, 11(1): 19-30.

Amado, J.C., Adams, P. 2014. *Value Chain Climate Resilience: A guide to managing climate impacts in companies and communities.* Partnership for Resilience and Environment Preparedness (PREP).

American Society for Quality. 2018. *Multi-voting* [online]. Milwaukee, USA. [Cited 06 August 2018]. http://asq.org/learn-about-quality/decision-making-tools/overview/multivoting.html

Asian Development Bank. 2009. *Building Climate Resilience in the Agriculture Sector of Asia and the Pacific.* Mandaluyong, Philippines.

Assefa, B. & de Roo, N. 2015. *Manual on Gender Analysis Tool.* Capacity Building for scaling up of evidence-based best practices in agricultural production in Ethiopia.

Bagamba, F. & Dekens, J. 2014. Promoting an Integrated Approach to Climate Adaptation: Lessons from the coffee value chain in Uganda. In Daze, A. & Dekens, J. *Enabling Climate Risk Management Along Agricultural Value Chains: Insights from the rice value chain in Uganda.* Climate- Resilient Value Chains and Food Systems, June 2016. Winnipeg, Canada, International Institution for Sustainable Development.

Bammann, H. 2007. Participatory Value Chain Analysis for Improved Farmers Income, Employment Opportunities and Food Security. *Pacific Economic Bulletin* 22(3): 113-125.

Bellu, L.G. 2013. Value Chain Analysis for Policy Making: Methodological Guidelines and country cases for a Quantitative Approach. EASYPol Series 129. Rome, FAO. (also available at http://www.fao.org/policy-support/resources/resources-details/en/c/847473/).

Camagni, M. & Kherallah, M. 2014. *How to do Commodity Value Chain development projects.* Rome, International Fund for Agricultural Development (IFAD).

CARE. 2017. *Agriculture* [online]. [Cited 16 August 2018]. https://www.care.org/work/world-hunger/agriculture

Carr, E.R. & Thompson, M.C. 2014. Gender and climate change adaptation in agrarian settings: current thinking, new directions, and research frontiers. In Thompson-Hall, M., Carr, E.R. & Pascual, U. 2016. *Enhancing and expanding intersectional research for climate change adaptation in agrarian setting*, pp. 182–197. Stockholm, Kungl Vetenskaps Akademien.

Central Statistical Office. 2018. *Zambia Data At-a-Glance, Zambia Data Portal, Central Statistics Office [online].* Zambia. [Cited 12 September 2018]. http://zambia.opendataforafrica.org/

CGIAR Research Program on Climate Change, Agriculture and Food Security. 2013. *Weather index-based insurance: A tool for managing climate risk.* Washington.

Christian Aid. 2016. *Integrating gender into Inclusive Markets Development programmes.* Washington.

Coles, C., Keane, J. & Mitchell, J. 2009. *Trading Up: How a Value Chain Approach Can Benefit the Rural Poor.* COPLA Global: Overseas Development Institute.

Dasgupta, S. 2017. *From migration to livelihoods security and self-reliance through watershed development.* WOTR Centre for Resilience Studies (W-CReS).

Daze, A. & Dekens, J. 2016. *Enabling Climate Risk Management Along Agricultural Value Chains: Insights from the rice value chain in Uganda.* Climate-Resilient Value Chains and Food Systems. Winnipeg, Canada, International Institution for Sustainable Development.

Dinesh, D., Campbell, B., Bonilla-Findji, O. & Richards, M., eds. 2017. *10 best bet innovations for adaptation in agriculture: A supplement to the UNFCCC NAP Technical Guidelines.* Wageningen, Netherlands, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Dekens, J. Bingi, S. 2013. *Agro-Value Chain Finance and Climate Adaptation: The role of the banking sector.* Winnipeg, Canada, International Institute for Sustainable Development.

Doll, J., Petersen, B. & Bode, C. 2017. Skeptical but Adapting: What Midwestern Farmers Say about Climate Change *Weather, Climate and Society,* 9(4): 739-751.

FAO & UNDP. 2017. Integrating Agriculture in National Adaptation Plans: Kenya Case Study. Rome, Italy, FAO. 16 pp. (also available at http://www.fao.org/3/i8257en/I8257EN.pdf).

FAO. 2018. *Promoting gender-responsive adaptation in the agriculture sectors: Entry points within National Adaptation Plans*. Rome, FAO. (also available at http://www.fao.org/3/I8906EN/i8906en.pdf).

FAO. 2013. Value Chain Analysis for Policy Making Methodological Guidelines and country cases for a Quantitative Approach. (also available at http://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/885654/).

FAO. 2014a. Developing sustainable food value chains – Guiding principles. FAO 2014. http://www.fao.org/3/a-i3953e.pdf).

FAO. 2014b. The State of Food and Agriculture: Innovation in family farming. In: *Facts and Figures: Economic Empowerment* [online]. Rome. [Cited 6 August 2018]. http://www.unwomen.org/en/what-we-do/economic-empow- erment/facts-and- figures).

FAO. 2016a. Capacity Development, Strengthening individual and institutional capacities to adapt to climate change in Lao PDR. In: Addressing Agriculture, *Forestry and Fisheries in National Adaptation Plans (Supplementary guidelines)*. Rome, FAO.

FAO. 2016b. *Developing gender-sensitive value chains: Guidelines for practitioners*. Rome. (also available at http://www.fao.org/3/a-i6462e.pdf).

FAO. 2017a. Climate-Smart Agriculture. Sourcebook. (also available at http://www.fao.org/3/a-i7994e.pdf).

FAO. 2017b. *The impact of disasters on agriculture and food security. Addressing Agriculture, Forestry and Fisheries in National Adaptation Plans (Supplementary guidelines)*. Rome. (also available at http://www.fao. org/emergencies/resources/documents/resources-detail/en/c/1106859/).

FAO. 2018a. Climate-Smart Agriculture. Case Studies 2018. Successful Approaches from Different Regions. (also available at http://www.fao.org/in-action/kore/news-and-events/news-details/en/c/1175693/).

FAO. 2018b. Costs and Benefits of Clean Energy Technologies in the Milk, Vegetable and Rice Value Chains. (also available at http://www.fao.org/3/I8017EN/i8017en.pdf).

FAO. 2018c. *Developing gender-sensitive value chains: Guidelines for practitioners.* Rome. (also available at http://www.fao.org/3/a-i6462e.pdf).

FAO. 2018d. Sustainable food systems Concept and framework. (also available at http://www.fao.org/3/ca2079en/CA2079EN.pdf).

FAO. 2019a. Developing Sustainable Food Systems and Value Chains for Climate-Smart Agriculture. (also available at http://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b10-value-chains/chapter-b10-4/en/).

FAO. 2019b. Developing sustainable value chains for small-scale livestock producers. (also available at http://www.fao.org/sustainable-food-value-chains/library/details/en/c/1206427/).

FAO. 2019c. FAO's Sustainable Food Value Chains Knowledge Platform. (also available at http://www.fao.org/sustainable-food-value-chains/library/keyword-search/en/).

FAO. 2019d. Sustainable Agribusiness and Food Value Chains. (also available at http://www.fao.org/policy-support/policy-themes/sustainable-agribusiness-food-value-chains/en/).

FAO. 2019e. Sustainable Food Value Chains Knowledge Platform. (also available at http://www.fao.org/sustainable-food-value-chains/library/details/en/c/456603/).

FAO. 2019f. Sustainable food value chains. Online knowledge platform. (also available at http://www.fao.org/sustainable-food-value-chains/home/en/). The platform includes a community of practice.

FAO. 2019g. Towards sustainable bioeconomy: Lessons learned from case studies. (also available at http://www.fao.org/3/ca4352en/ca4352en.pdf).

FAO. 2020. (forthcoming). Value chain selection guidelines.

Fuhrer, J. 2003. *Agroecosystem response to combinations of elevated CO, ozone and global climate change*. Amsterdam, Elsevier

Government of Kenya. 2016. *Kenya National Adaptation Plan: 2015-2030.* Nairobi.

Greatrex, H., Hansen, J., Garvin, S., Diro, R., Blakeley, S., Le Guen, M., Rao, K. & and Osgood, D. 2015. *Scaling up index insurance for smallholder farmers: Recent evidence and insights.* Washington, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Habtezion, S. 2012. Gender and adaptation. Capacity development series: Africa, Training Module 2. In UNFCC, *Strengthening gender considerations in adaptation planning and implementation in the least developed countries.* Bonn, Germany, Least Developed Countries Expert Group.

Haggblade, S.J., Gamser, M.S. 1991. *A Field Manual for Subsector Practitioners -Tools for Microenterprise Programs: Nonfinancial Assistance Section.* Washington, The United States Agency for International Development (USAID).

Hakemulder, R. *et al.* 2015. *Value Chain Development for Decent Work: How to create employment and improve working conditions in targeted sectors.* Geneva, International Labour Organization (ILO).

Heltberg, R. & Bonch-Osmolovskiy, M. 2010. *Mapping vulnerability to climate change.* Washington, The World Bank.

Hinkel, J. 2015. Indicators of vulnerability and adaptive capacity: towards a clarification of the science–policy interface, *Glob Environ Chang* 21(1): 198–208.

IFAD. 2014.*Guidelines for Integrating Climate Change Adaptation into Fisheries and Aquaculture Projects.* Rome.

ILO, South-East Asia and the Pacific Multidisciplinary Advisory Team. 1998. *A Conceptual framework for gender analysis and planning.* Geneva.

ILO, 2018. *A conceptual framework for gender analysis and planning.* Geneva. [Cited 6 August 2018]. http://www.ilo.org/public/english/region/asro/mdtmanila/training/unit1/harvrdfw.htm

IPCC. 2018. Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield, eds. *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* Geneva, IPCC.

Iyengar, N.S. & Sudarshan, P. 1982. A Method of Classifying Regions from Multivariate Data. *Economic & Political Weekly*, 17(51): 2047+2049-2052.

Kaplinsky, R. & Morris, M. 2000. *A Handbook for Value Chain Research.* Ottowa, International Development Research Centre.

Kohli, R. & Teng, J. 2018. *Introduction to NAP and NAPA: Lecture Notes of the Massive Open Online Course National Adaptation Plans: Building Climate Resilience in Agriculture, Module 1: Introduction to climate change adaptation, agriculture and food security.* Rome, FAO. http://www.fao.org/3/I8597EN/i8597en.pdf

Kuntiyawichai, K., Plermkamon, V., Jayakumar, R. & Quan, V.D. 2015. *Climate Change Vulnerability Mapping for Greater Mekong Sub-Region.* Bangkok, United Nations Educational, Scientific and Cultural Organization (UNESCO), and Khon Kaen, Thailand, Khon Kaen University, Water Resources and Environment Institute (WREI).

Least Developed Countries Expert Group. 2015a. Adaptation, gender and women's empowerment. CARE International Climate Change Brief. In *Strengthening gender considerations in adaptation planning and implementation in the least developed countries.* Bonn, Germany, UNFCCC.

Least Developed Countries Expert Group. 2015b. *Strengthening gender considerations in adaptation planning and implementation in the least developed countries.* Bonn, Germany.

Lusby, F. & Panlibuton, H. 2007. *Value Chain Program Design: Promoting Market-Based Solutions for MSME and Industry Competitiveness.* Washington, United States Agency for International Development (USAID): Office of Microenterprise Development.

Malik, S.M., Awan, H. & Khan, N. 2012. Mapping vulnerability to climate change and its repercussions on human health in Pakistan. *Globalization and Health*, 8(31). doi:10.1186/1744-8603-8-31

March, C., Smyth, I. & Mukhopadhyay, M. 1999. *A Guide to Gender- Analysis Frameworks.* Boston, MA, Oxfam.

MGI. 2016. *Digital Finance for All: Powering Inclusive Growth in Emerging Economies.* New York City, USA.

Meybeck, A., Garcia, C., Wolf, J. & Karttunen, K. 2017. *Addressing Agriculture, Forestry and Fisheries in National Adaptation Plans - Supplementary guidelines,* Rome, FAO. (also available at http://www.fao.org/3/a-i6714e.pdf).

Ministry of Mahaweli Development and Environment. 2016. *National Adaptation Plan for Climate Change Impacts in Sri Lanka.* Battaramula, Sri Lanka.

Miller, C. & Jones, L. 2010. *Agricultural Value Chain Finance.* Rome, FAO.

Miller, C. 2011. *Agricultural Value Chain Finance Strategy and Design.* Rome, FAO. (also available at https://www.ifad.org/documents/38714170/39144386/Agricultural+value+chain+finance+strategy+and+design.pdf/1ae68ed6-4c3c-44f4-8958-436e469553bb.)

Miller, C., Saroja, V.N. & Linder, C. 2013. ICT uses for inclusive agricultural value chains. Rome, FAO. (also available at http://www.fao.org/3/a-aq078e.pdf.)

Mimura, N., Pulwarty, R.S., Duc, D.M., Elshinnawy, I., Redsteer, M.H., Huang. H.Q., Nkem, J.N. & Sanchez Rodriguez, R.A. 2014. Adaptation planning and implementation. In C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White, eds. *Climate Change 2014: impacts, adaptation and vulnerability*, pp. 869-898. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York City, USA, Cambridge University Press.

Mitchell, R., Mitchell, V., Driscoll, S., Franklin, J. & Lawlor, D. 1993. Effects of increased CO_2 concentration and temperature on growth and yield of winter wheat at two level of Nitrogen application. *Plant, Cell and Environment.* 16(5): 521-529.

Moore, T.G. 2008. Global Warming: The good, the bad, the ugly and the efficient. *Science and Society, EMBO Reports.* 9: S42-S45.

Morchain, D. & Kelsey, F. 2016. *Finding Ways Together to Build Resilience: The Vulnerability and Risk Assessment Methodology.* Boston, MA, Oxfam.

Nardone, A., Ronchi, B., Lacetera, N., Ranieri, M.S. & Bernabucci, U. 2010. *Effects of climate change on animal production and sustainability of livestock system.* Amsterdam, Elsevier.

Nutz, N. & Sievers, M. 2015. *A Rough Guide to Value Chain Development.* Geneva, International Labour Organization (ILO).

Olesen, J. & Bindi, M. 2002. *Consequences of climate change for European Agricultural productivity, land use and policy.* European Journal of Agronomy. Amsterdam, Elsevier.

Orr, A., Kee-Tui, S.H. & Tsusaka, T. 2014. *Gender Tools for Value Chain Analysis: Examples from Groundnuts in Eastern Province, Zambia*. Socioeconomic Discussion Paper Series. Patancheru, IN, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).

Oxfam. 1999. Monitoring & Evaluation From a Gender Perspective: A Guideline. 1995. In. C. March, I. Smyth, &and M. Mukhopadhyay. *A Guide to Gender- Analysis Frameworks.* Boston, MA.

Oxfam. 2009. *Introduction to Climate Change Adaptation: A Learning Companion.* Boston, MA.

Oxfam. 2016a. Social Norms Analysis. In: *The GEM+ Toolkit* [online]. Boston, MA. [Cited 21 August 2018]. http://gemtoolkit.org/wp-ontent/uploads/2016/05/Social_norms_analysis.pdf

Oxfam. 2016b. Violence against women. In: *The GEM+ Toolkit* [online]. Boston, MA. [Cited 21 August 2018]. http://gemtoolkit.org/toolkit/gender-based-violence/#

Pachauri, R. K., & Meyer, L. A. 2014. *Climate Change 2014: Synthesis Report.* Geneva, Intergovernmental Panel on Climate Change.

Philippine Commission on Women. 2009. "What is the GREAT Women Project?" National Machinery for Gender Equality and Women's Empowerment, accessed 17 August 2018. (also available at http://pcw.gov.ph/gwp/about)

Porter, J.R., *et al.* 2014. Food security and food production systems. In Field, C.B., *et al.* (eds.). *Climate Change 2014: Impacts, Adaptation, and Vulnerability,* Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Rome, FAO. (also available at https://www.ipcc.ch/report/ar5/wg2/.)

Quach, A. 2018. *Shrimp farming vulnerabilities and adaptation to climate change in Ca Mau, Vietnam.* Berlin, Researchgate.

Roudner, D. & Jenal, M. 2015. Summary of key insights from the discussion on 'Effective partnerships with the private sector'. Swiss Agency for Development and Cooperation in Hakemulder. ILO.

Sanogo, I. 2010. *How to Conduct a Food Commodity Value Chain Analysis?* Rome, World Food Programme (WFP).

Sarangi, S. 2018. Heat adaptability in livestock in the tropics: A scenario. *The Pharma Journal*, 7(3): 345-350.

Schneemann, J. & Vredeveld, T. 2015. Guidelines for Value Chain Selection: Integrating economic, environmental, social and institutional criteria. *Deutsche Gesellschaft für Internationale Zuasammenarbeit (GIZ) GmbH*, October 2015.

Senders, A., Lentink, A., Vanderschaeghe, M. & Terrillon, J. 2012. *Gender in value chains: Practical toolkit to integrate a gender perspective in agricultural value chain development.* Utrecht, Netherlands, Agri-ProFocus Learning Network.

Shukla, R., Chakraborty, A. & Joshi, P.K. 2017. Vulnerability of agro-ecological zones in India under the earth system climate model scenarios. *Mitigation and Adaptation Strategies for Global Change*, 22: 399-425.

SIDA. 2011. *Market Development in Swedish Development Cooperation.* Stockholm.

Sikka, A.K., Islam, A. & Rao, K.V. 2016. *Climate Smart Land and Water Management for Sustainable Agriculture.* Hoboken, USA, John Wiley & Sons, Ltd.

Smith, D., Cucco, I. & Cuna, L. *et al.* 2008. *Making Value Chains Work Better for the Poor: A Tool book for Practitioners of Value Chain Analysis.* Phnom Penh, Cambodia, Agricultural Development International.

The Borgen Project. 2018. 5 Coffee Industry Development Projects in Guatemala [online]. Seattle, Washington. [Cited 17 August 2018]. https://borgenproject.org/development-projects-in-guatemala/

The Climate Institute & Fairtrade. 2016. *A Brewing Storm: The Climate Change Risk to Coffee.* Washington.

The Springfield Centre. 2015. *The Operational Guide for the Making Markets Work for the Poor (M4P) Approach, Second Edition.* Bern, Swiss Agency for Development, and London, Cooperation (SDC) and UK Department for International Development (DFID).

The World Bank Group. 2016. *Making Climate Finance Work in Agriculture.* Washington.

The World Bank Group. 2011. Mobilizing Climate Finance. Paper prepared at the request of the G20 Finance Ministers, Preparation coordinated by the World Bank Group, in close partnership with the IMF, the OECD and the Regional Development Banks(RDBs). In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects.* Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, IPCC.

The World Bank. 2009. Gender in Agriculture: Sourcebook. In Makanza, M. & Reemer, T. *Gender Action Learning System: Practical Guide for Transforming Gender and Unequal Power Relations in Value Chains*, The Hauge, Oxfam Novib.

The World Bank. 2015. *International Development Association Project Appraisal Document on a Proposed Credit in the amount of SDR 47.2 million to the Republic of Zambia for a Girl's Education and Women's Empowerment and Livelihoods Project.* Report No: PAD1304. Washington.

Thompson-Hall, M., Carr, E. & Pascual, U. 2016. *Enhancing and expanding intersectional research for climate change adaptation in agrarian settings.* Stockholm, Kungl Vetenskaps Akademien.

UNDG. 2011. Results Based Management Handbook: Harmonizing RBM concepts and approaches for improved development results at country level. What is Results-Based Management? In: *United Nations Habitat* [online]. New York City, USA. [Cited 6 August 2018]. (also available at https://unhabitat.org/?rbm-handbook=1-1-what-is-results-based-management).

UNDP. 2011. *Climate Change in Least Developed Countries*. New York City, USA.

UNDP. 2016. *Provision of consultancy services to develop Toolkit for Value Chains Analysis and Market Development that integrates Climate Resilience and Gender sensitivity, for the National Adaptation Plan Global Support Programme (NAP-GSP).* New York City, NY.

UNDP & UNFCCC. 2019. *NDC Global Outlook Report.* New York City, USA.

UNDP, United Nations Women, Australian Aid., *et al.* 2015. *The Pacific Gender and Climate Change Toolkit: Tools for Practitioners*. Minneapolis, USA, SPC.

UNFCCC. 2007. *Impacts, Vulnerabilities and Adaptation in Developing Countries.* Bonn, Germany.

UNFCCC. 2011. *Fact sheet: Climate change science - the status of climate change science today.* Bonn, Germany.

UNFCCC. 2012. *National Adaptation Plans: Technical guidelines for the national adaptation plan process.* Bonn, Germany.

UNIDO. 2009. *Agro Value Chain Analysis and Development: The UNIDO Approach*. Vienna.

United Nations. 1992. *United Nations Framework Convention on Climate Change*. New York City, USA.

United Nations. 2018. *Concepts and definition* [online]. New York City, USA. [Cited 10 September 2018] (also available at http://www.un.org/womenwatch/osagi/conceptsandefinitions.htm).

Vermeulen, S. 2015. *How to do Climate change risk assessments in value chain projects.* Rome, International Fund for Agricultural Development (IFAD).

Vincent, K. 2010. *Mapping Climate Change Vulnerability and Impact Scenarios: A Guidebook for Sub-National Planners.* New York City, USA, United Nations Development Programme (UNDP).

Walter G., Post, E., Convey, P., Menzel, A. & Parmesan, C. 2002. Ecological responses to recent Climate Change. *International Journal of Science, Nature,* 416: 389-395.

Webber, C.M. & Labaste, P. 2010. *Building Competitiveness in Africa's Agriculture: A Guide to Value Chain Concepts and Applications.* Washington, The World Bank.

Zulu, P. 2018. *Country Presentation on Agricultural Policy – Zambia: Second National Agricultural Policy (SNAP)*. Zambia, Ministry of Agriculture – Zambia. Also available at https://www.wto.org/english/tratop_e/agric_e/presentation_zambia.pdf

Annex 1: decision 5/CP.17 and its annexure

DECISION 5/CP.17

National adaptation plans

The Conference of the Parties,

Recalling Article 4. Paragraph 4 and 9, and relevant Articles of the Convention.

Also recalling decision 1/CP.16.

Acknowledging the national adaptation planning can enable all developing and developed country Parties to assess their vulnerabilities, to maintsream climate change risks and to address adaptation,

Also acknowledging that, because of their development status, climate change risks magnify development challenges for least developed countries,

Recognizing the need to address adaptation planning in the broader context of sustainable development planning.

I. FRAMING NATIONAL ADPATATION PLANS

1. *Agrees* that the objectives of the national adaptation plan process are follows:
   a) To reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience;
   b) To facilitate the integration of climate change adaptation in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate;
2. *Also agrees* that planning for adaptation at the national level is a continuous, progressive and iterative process, the implementation of which should be used on nationally identified priorities, including those reflected in the relevant national documents, plans and strategies, and coordinated with national sustainable development objectives, plans, policies and programmes;
3. *Further agrees* that enhanced action on adaptation should be undertaken in accordance with the Convention, should follow a country-driven, gender-sensitive, participatory and fully transparent approach, taking into consideration vulnerable groups, communties and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional and indigenous knowledge, and by gender-sesitive approaches, with a view to integrating adaptation into relevant social, economic and environmental policies and actions, where appropriate;
4. *Agrees* that the national adaptation plan process should not be presciptive, nor result in the duplication of efforts undertaken in-country, but should rather facilitate country-owned, country-driven actions;

Annex to decision 5/CP.17

Initial guidelines for the formulation of national adaptation plans by least developed country Parties

I. INTRODUCTION

1. The elements described in paragraphs 2–6 below are indicative of the activities that can be undertaken in the development of national adaptation plans (NAPs). The planning of such activities will depend on national circumstances and should be determined by least developed country Parties.

II. ELEMENTS OF NATIONAL ADAPTATION PLANS

A. Laying the groundwork and addressing gaps

2. Activities undertaken under this element would be planned with a view to identifying weaknesses and gaps in enabling environments, and addressing them as necessary, to support the formulation of comprehensive adaptation plans, programmes and policies, through, inter alia:

(a) Identification and assessment of institutional arrangements, programmes, policies and capacities for overall coordination and leadership on adaptation;

(b) Assessment of available information on climate change impacts, vulnerability and adaptation, measures taken to address climate change, and gaps and needs, at the national and regional levels;

(c) Comprehensive, iterative assessments of development needs and climate vulnerabilities.

B. Preparatory elements

3. In developing NAPs, consideration would be given to identifying specific needs, options and priorities on a country-driven basis, utilizing the services of national and, where appropriate, regional institutions, and to the effective and continued promotion of participatory and gender-sensitive approaches coordinated with sustainable development objectives, policies, plans and programmes. Activities may include the following:

(a) Design and development of plans, policies and programmes by considering decision 1/CP.16, paragraph 14(a), to address the gaps and needs referred to in paragraph 2 above;

(b) Assessments of medium- and long-term adaptation needs, and, as appropriate, development needs and climate vulnerabilities;

(c) Activities aimed at integrating climate change adaptation into national and subnational development and sectoral planning;

(d) Participatory stakeholder consultations;

(e) Communication, awareness-raising and education.

C. Implementation strategies

4. Activities carried out as part of the implementation strategies would take into consideration the following:

   (a) Prioritizing work according to development needs and climate change vulnerability and risk;

   (b) Strengthening institutional and regulatory frameworks to support adaptation;

   (c Training and coordination at the sectoral and subnational levels;

   (d) Public dissemination of information on the national adaptation plan process, to be made available to the public and to the UNFCCC secretariat;

   (e) Considering other relevant multilateral frameworks and international programmes and initiatives, with a view to building on and complementing existing adaptation planning.

D. Reporting, monitoring and review

5. These activities, including national adaptation plan documents, could be included in national strategies and plans, as appropriate.

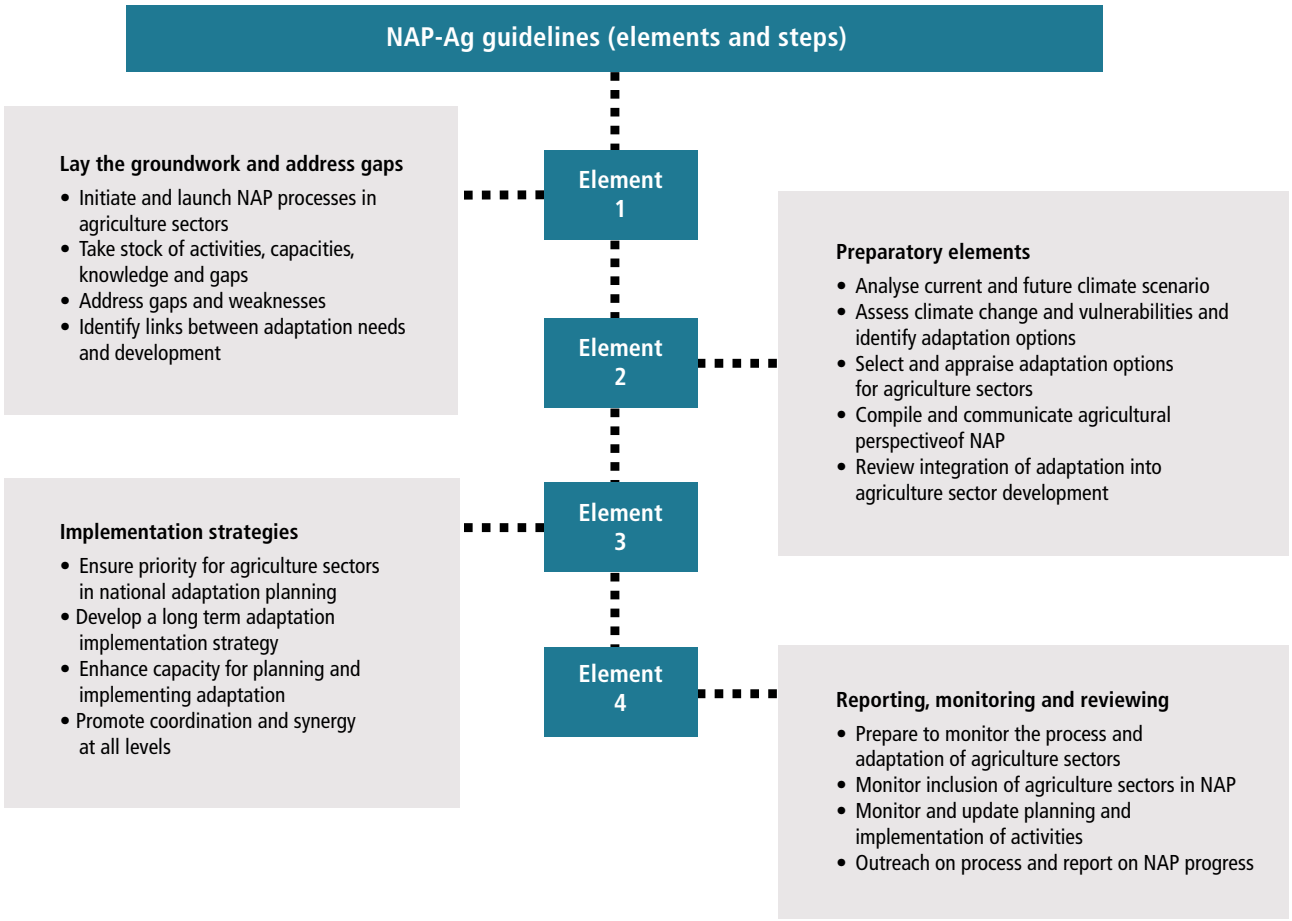
6. Under this element, Parties should undertake a regular review, at intervals that they determine:

   (a) To address inefficiencies, incorporating the results of new assessments and emerging science and reflect lessons learned from adaptation efforts;

   (b) To monitor and review the efforts undertaken, and provide information in their national communications on the progress made and the effectiveness of the national adaptation plan process.

Annex 2: NAP-Ag guidelines (elements and steps)

(Meybeck *et al.*, 2017)



Annex 3: Sample National Adaptation Plan

National Adaptation Plan – Sri Lanka

Sri Lanka has been striving to achieve an export-led growth for the economy, with agricultural exports contributing a significant share of foreign earnings. Besides this, the three major agricultural commodities (tea, rubber and coconut), as well as exports of spice crops, floriculture, aquaculture products, and herbal products have also grown.

The majority of Sri Lanka's export-oriented agricultural commodities are perennial in nature and are concentrated in wet zone areas, which renders them sensitive to changing patterns of weather and climate. Furthermore, the current production base is dominated by small-scale producers. Hence, adverse impacts of climate change on the above mentioned commodities can impact the livelihood of a significant section of the population.

High sensitivity to climate change and dependence of a large section of small producers on the sector makes it a vulnerable area that requires adaptation measures to cope with impending changes in the climate (Ministry of Mahaweli Development and Environment, 2016).

Sector Action Plan – Export Agriculture Sector

(Focus: tea, rubber, coconut, coffee, cocoa, spices, cashew and sugarcane)

Adaptation needs	Adaptation options	Actions	Responsible agencies	Key performance indicators
Enhance the resilience of export agricultural crops and agro-ecosystems against heat and water stress	A. Germplasm improvement	• Screen existing cultivars/ clones for heat and water stress • Introduce new cultivars/ clones - Heat tolerant - Drought tolerant - Flood tolerant • Develop grafted/bubbed plants with drought resistance properties	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI* *AFoU*	• Number of existing cultivars/ clones for heat and water stress • Number of new cultivars / clones introduced • Number of grafted/bubbed plants developed with drought resistance properties
	B. Improvement of farm and nursery management practices	• Improve the management of shade trees as a climate change adaptation measure - Conduct nursery and field trials - Develop recommendations and guidelines • Promote suitable operational and management techniques - Application of Anti-transpirents (rubber) - Drip irrigation (with the new expansions in the dry zone) - Mulching - Intercropping with spices	**MOPI** *TRI* *TBSL* *TSHDA* *RRI* *RDD* *CRI* *CDA* *CCB* *DEA* *SLCC* *SRI* *AFoU* *NIPM*	• Number of nursery and field trials conducted to improve the management of shade trees as a climate change adaptation measure • Number of guidelines developed to improve the management of shade trees as a climate change adaptation measure • Number of promotional workshops completed for promoting suitable operational and management techniques

Adaptation needs	Adaptation options	Actions	Responsible agencies	Key performance indicators
Enhance the resilience of export agricultural crops and agro-ecosystems against heat and water stress	B. Improvement of farm and nursery management practices	• Develop improved cropping system models for vulnerable areas/lands • Promote improved nursery and plant management practices - New soil mixtures - Use oil quality index - Use of machinery for replanting	**MOPI** *TRI* *TBSL* *TSHDA* *RRI* *RDD* *CRI* *CDA* *CCB* *DEA* *SLCC* *SRI* *AFoU* *NIPM*	• Number of improved cropping system models developed for vulnerable areas/land • Number of improved nursery and plant management practices promoted • Number of promotional workshops to promote improved nursery and plant management practices
		• Develop recommendations on best practices of pest and disease management through improvements in: - Shade tree management - Nursery management - Crop sanitation	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI* *AFoU*	• Number of recommendations developed on best practices of pest and disease management through improvements
	C. Monitoring and surveillance of pests and diseases	• Establish a surveillance programme for early detection of new diseases and pests • Develop a system forecasting risks of pest and diseases	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI*	• A surveillance programme established for early detection of new diseases and pests • A system forecasting risks of pest and diseases developed
Minimize the impact on export earnings due to erratic changes in precipitation	A Establishment of an efficient climate information management and communication system	• Develop a system for timely issuing of seasonal and short-term weather forecasts • Adjust calendar of operations with seasonal weather forecasts	**DM** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI*	• A system is developed for timely-issuing of seasonal and short-term weather forecasts • A calendar of operations is adjusted with seasonal weather forecasts

Adaptation needs	Adaptation options	Actions	Responsible agencies	Key performance indicators
Minimize the impact on export earnings due to erratic changes in precipitation	B. Improvements in cropping systems	• Promote sustainable cropping system practices for increasing the resilience of plantations and trees - Rainwater harvesting - Shade tree management - Agro-forestry and timber plantations - Cover crops - Contour drains - Land suitability assessment (e.g. 60% slope) - Soil and moisture conservation practices - Improvements in irrigation: nursery and new plantings - New planting techniques: root trainers - Improved soil organic matter: Bio-fertilizer development	**MOPI** *TRI* *TBSL* *TSHDA* *RRI* *RDD* *CRI* *CDA* *CCB* *DEA* *SLCC* *SRI* *AFoU* *NIPM*	• Number of money allocated/spent on promoting sustainable cropping system practices for increasing the resilience of plantations and trees • Number of sustainable cropping system practices promoted for increasing the resilience of plantations and trees • Number of promotional workshops conducted to promote sustainable cropping system practices for increasing the resilience of plantations and trees
	C. Initiating research studies to asses climate impacts	• Conduct research studies on - Crop physiology: heat and drought resistance - Physiology of flowering: Synchronizing of flower irregularities - Resistance cultivars - Inter cropping: banana, cocoa, cash crops, such as maize - Deep planting: at nursery and replanting levels - Cropping systems for climate resilience	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI* *AFoU*	• Number of research studies conducted and published • Amount of money allocated/spent on research studies
	D. Sector capacity development	• Develop research institutions' capacity for conducting research on tolerant cultivars/clones • Develop facilities necessary to undertake controlled environment research	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI* *AFoU* *NSF*	• Amount of money allocated/spent on developing research institutions' capacity for conducting research on tolerant cultivars/clones • Amount of money allocated/spent on developing facilities necessary to undertake controlled environment research
Minimize the risk of crop damage due to biological agents	A. Germplasm Improvement	• Screen existing cultivar/clones for pest and disease resistance • Develop pest and diseases resistant varieties	**MOPI** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI* *AFoU*	• Number of existing cultivars/clones screened for pest and disease resistance • Number of pest and diseases resistant varieties

Adaptation needs	Adaptation options	Actions	Responsible agencies	Key performance indicators
Enhance the resilience of export crops and agro-ecosystems to extreme weather events	A. Establishment of an efficient climate information management and communications system	• Develop a system for timely issuing of short-term weather forecasts • Strengthening the early warning systems	**DM** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI*	• A system is developed for timely issuing of short-term weather forecasts • Money allocated/spent on strengthening the early warning systems
	B. Improvement of disaster risk preparedness and management	• Identify and collect information on areas most vulnerable to flood and drought hazards • Prepare hazard vulnerability maps for all crops • Develop guidelines for management of extreme events in vulnerable areas	**DMC** *TRI* *RRI* *CRI* *DEA* *SLCC* *SRI*	• Number of areas identified and data collected on most vulnerable to flood and drought hazards • Number of plans developed for areas that are most vulnerable to flood and drought hazards • Number of guidelines developed for areas most vulnerable to flood and drought hazards (extreme events)
Minimize the impacts of sea level rise on export crops in coastal zones	A. Strengthening the monitoring of climate impacts	• Monitor regularly the development of salinity levels	**NARA** **CC&CRMD** *CRI* *SLCC* *DEA*	• Quarterly monitoring reports on development of salinity levels are published • Number of money allocated/spent on constructing salinity barrier to control sea water intrusions to agricultural lands • Number of salinity exclusive structures and salinity barriers to control sea water intrusions to agricultural lands constructed
	B. Development of protection structures	• Construct salinity exclusion structures and salinity barriers to control sea water intrusions to agricultural lands		

Annex 4: Comprehensive list of parameters for value chain selection

(Schneemann, J & Vredeveld, T. 2015; Senders *et al.,* 2012; UNIDO, 2009; Webber and Labaste, 2010; Bellu, 2013; Vermeulen, 2015).

Dimension	Suggested Indicators
Market Development	**Demand-side indicators**
	Volume and value of (local and export) market demand in the last 5 years
	Volume of unmet market demand
	Volume of consumption
	Potential for growth in domestic/international demand
	Price of products (and variations during the year)
	Share (percent) of the value chain/sector in GDP and export value
	Value added in the (sub) sector in the last 5 years
	Proximity to market
	Available evidence of tested and validated innovation
	Supply-side indicators
	Cost of production per unit and cost of inputs
	Labour intensity: number of persons employed in various value chain stages
	Available labour force (size, skills and education)
	Has (self) employment in the sector in the last 5 years increased, decreased or remained the same?
	Number and size (workers) of SMEs in the value chain, both formal and informal
	Availability of key inputs, resources, and skills
	Number of persons (M/F) (self) employed in the value chain (sector) and trends
	Volume of production
	Public and private investments in the value chain
	Existing physical infrastructure (communications and roads, storage facilities, distribution channels) and its impact on the productivity of the value chain/sector

Dimension	Suggested Indicators
Climate Change	**Vulnerability**
	Changes in weather patterns in the last 5 years
	Impact due to expected change in temperature across different climate change scenarios
	Impact due to expected change in precipitation across different climate change scenarios
	Impact due to expected change in frequency of extreme weather events
	Changes in annual yield (producer level)
	Lack of food storage and preservation facility (processor/aggregator level)
	Poor road and transport infrastructure (wholesaler/retailer level)
	Resilience (adaptation)
	Effective irrigation and water saving technologies (technological)
	Coastal infrastructure improvement such as sea-walls, flood and cyclone shelters (physical)
	Information options for early warning and response systems (social)
	Provision for disaster contingency funds and microfinance (economic)
	Disaster planning and preparedness (institutional)
	Sharing traditional, indigenous and local knowledge (educational)
Opportunity to promote gender equality	Gender-disaggregated control over equipment, assets, and sales income
	Ratio of female land-holding in the value chain
	Gender-disaggregated distribution of benefits across the value chain nodes
	Gender-disaggregated access to benefits of value chain development
	Gender-disaggregated control over benefits of value chain development
	Are there gender specific barriers to entry or participation in the selected value chain?
	Ratio of female participants in the value chain
Alignment with Government Policies	Number of government organizations ready to collaborate and invest
	Existence of freedom of association/collective bargaining regulations and laws
	List (and type) of relevant economic support programmes running and planned for
	Prospects for attracting public and/or private sector investment
	PPPs and joint ventures between government and private companies in the value chain
	Role of government as a market player or an implementing partner
	How does the value chain sector fit within the country's overall strategy for poverty reduction / building climate resilience / gender mainstreaming, etc.
	Will the selected value chain affect/promote policy changes, creating an enabling environment for private sector development?
	Schemes dedicated to the value chain

For more parameters related to institutional and social dimensions for value chain comparison and selection, please refer to the following document:

Schneemann, J. & Vredeveld, T. 2015. Guidelines for Value Chain Selection: Integrating economic, environmental, social and institutional criteria. Deutsche Gesellschaft für Internationale Zuasammenarbeit (GIZ) GmbH, October 2015.

For more parameters related to climate change resilience, please refer to the following document:

Pachauri, R.K. & Meyer, L.A. 2014. *Climate Change 2014: Synthesis Report.* Geneva, Intergovernmental Panel on Climate Change.

For more parameters indicating the extent of women empowerment and gender equality, please refer to the following document:

Senders, A., Lentink, A., Vanderschaeghe, M. & Terrillon, J. 2012. *Gender in value chains: Practical toolkit to integrate a gender perspective in agricultural value chain development.* Utrecht, Netherlands, Agri-ProFocus Learning Network.

For more parameters related to poverty reduction and pragmatic aspects of a value chain, please refer to the following document:

UNIDO, 2009. Agro *Value Chain Analysis and Development: The UNIDO Approach.* Vienna.

Annex 5: Illustrative list of climate change risks and opportunities

	Risk
Agricultural crops	• Reduced production of major crops, for example, wheat, rice, and maize, due to increased temperature in tropical and temperate regions (Pachauri and Meyer, 2014). • Alteration in seasonal activities, such as, flowering and fruiting periods due to phenological changes caused by changing weather patterns (Walter *et al.*, 2002). • Decline in grain size and nutrient use efficiency and increase in crop water consumption due to accelerated plant growth caused by hot weather (Fuhrer, 2003). • Crop failure due to decline in average rainfall (UNFCCC, 2007) and increased frequency of floods, heavy downpour and cloudburst (Pachauri and Meyer, 2014).
Fisheries and livestock[20]	• Reduced production of fisheries (including shrimp (Quach, 2018) due to marine species biodiversity loss, huge migration and redistribution caused by warming of ocean (Pachauri and Meyer, 2014). • Threat to sustainability of marine ecosystems due to ocean acidification caused by increased level of atmospheric oxygen (Pachauri and Meyer, 2014). • Loss of fisheries production caused by tropical cyclones triggered by climate change (UNFCCC, 2007). • Decline in quantity and quality of milk, egg and meat yield due to loss of livestock appetite caused by warmer weather (Nardone *et al.*, 2010). • Reduction in livestock production due to declining availability of forage caused by increased temperature (Adams *et al.*, 1998).
Land and water resources	• Reduction in agricultural land productivity due to soil salinization and sea-water intrusion caused by mean sea-level rise (UNFCCC, 2007). • Degradation and desertification of agricultural land due to reduced soil moisture and increased evapo-transpiration caused by increasing temperature (UNFCCC, 2007). • Decline in quantity and quality water resources due to altering hydrological system caused by melting ice sheets (Pachauri and Meyer, 2014). • Reduction in renewable surface water and ground water in dry sub-tropical regions caused by change in precipitation pattern (Pachauri and Meyer, 2014).

20. FAO developed a study on small-scale livestock value chains. Please refer to FAO, 2019b.

	Opportunities
Agricultural Crops	• Increased growth period for indeterminate crops, such as root-crops, due to warmer weather (Olesen *et al.*, 2002). • Increased productivity of coffee yield due to increased level of atmospheric CO_2 (The Climate Institute and Fairtrade, 2016). • Increased yield of wheat with higher CO_2 level keeping temperature and nitrogen level constant at low nitrogen level (Mitchell *et al.*, 1993). • Improved yield, resource use efficiency, and disease and pest resistance in C_3 crops* due to higher CO_2 concentration (Fuhrer, 2003).
Fisheries and livestock	• Increased incidences of cod fish appearance in colder region due to warmer weather (Moore, 2008). • Increased growth rate, food conversion efficiency and duration of growing season for selected farm fish species due to increased temperature in tropical and sub-tropical regions (IFAD, 2014).
Land and water resources	Expansion of suitable areas for crop cultivation in colder region above 40° north latitude (Moore, 2008; Olesen *et al.*, 2002) .

* C_3 crops are crops which uses C_3 mechanism for photosynthesis. That is, the first stable photosynthetic product is a three-atom carbon product. Examples of C_3 agricultural crops are rice, wheat, barley, soyabeans, cotton, potato etc. Whereas corn, maize, sugarcane etc. are a few examples of C_4 crops.

Annex 6: Illustrative tool for assigning weights to value chain selection criteria

Background nformation	
Stakeholder name:	
Organization and designation:	
Phone no:	
Email:	

According to your understanding, how important are each of these parameters for selection of a value chain? Please tick appropriate boxes in each row.

No	Selection criteria and parameters	Not important (1)	Slightly important (2)	Important (3)	Fairly important (4)	Very important (5)
Criteria 1						
Sub-criteria 1						
1	Parameter 1					
2	Parameter 2					
3	Parameter 3					
Sub-criteria 2						
4	Parameter 1					
5	Parameter 2					
6						
…	…	…	…	…	…	…
Criteria 2						
Sub-criteria 1						
1						
2						
3						
Sub-criteria 2						
4						
5						
…	…	…	…	…		
…	…	…	…	…		

Annex 7: Illustrative value chain selection matrix tool

No.	Selection criteria / parameters	Assigned weight	VC1		VC2		VC3	
			Score	Weighted score	Score	Weighted score	…	…
Criteria 1								
Sub-criteria 1								
1.	Parameter 1	W1						
2.	Parameter 2	W2						
3.	Parameter 3	W3						
Sub-criteria 2								
4.	Parameter 1	W1						
5.	Parameter 2	W2						
…	…	…	…	…	…	…	…	…
Criteria 2								
Sub-criteria 1								
…	…	…	…	…	…	…		
…	…	…	…	…	…	…		
Total		**100%**						

The data collected corresponding to each parameter needs be normalized on a scale of 0 to 100. The following formula may be used for normalization of the data:

$$\text{Score } (P_{ij}) = 100 \text{ X } \frac{\text{Value}(P_{ij}) - \text{Min}(P_{ij})}{\text{Max}(P_{ij}) - \text{Min}(P_{ij})}$$

Where:

Score (P_{ij}) is the calculated score for the i value chain corresponding to the j parameter;

Value (P_{ij}) is the value of data corresponding to the j parameter for the i value chain;

Min (P_j) is the minimum value for the data collected corresponding to the j parameter; and

Max (P_j) is the maximum value for the data collected corresponding to the j parameter.

Annex 8: Illustrative steps to map the number of actors and jobs

(Smith *et al.*, 2008)

Actor	Calculating the number of actors	Calculating number of jobs generated (family / hired, full-time / part-time, male/female)
• Farmers (producer)	• estimate number of farmers based on hectarage under each crop and yield (related to traded volumes); • cross check with district authorities for official figures; and • sales of key inputs sold by input providers at bottleneck points (e.g. seed).	• Through interviews with a statistically significant sample size of farmers
• Aggregators	• interviews with village leaders / community; • number of aggregators under each trader/wholesaler; and • estimate the total volume of sales and the typical volume per transport unit (trucks, motorbikes, carts, boats, etc.). Then estimate the number of people required per transport unit, the time required to transport, and the number of full-time equivalent this generates.	• Through interviews with a statistically significant sample size of aggregators
• Processors	• identify the number of processors in an area from official sources (e.g. registration certificates); and • identify the number of informal processors from key informant interviews such as government officials (involved in registration, tax collection, and distribution of utilities etc.), aggregators, processors and wholesalers.	• Through interviews with a statistically significant sample size of processors
• Wholesalers	• identify the number of wholesalers in an area from official sources (e.g. registration certificates); and • identify the number of informal wholesalers from key informant interviews, such as government officials *(involved in registration, tax collection, and distribution of utilities etc.)* processors, wholesalers and retailers.	• Through interviews with a statistically significant sample size of wholesalers
• Retailers	• based on the total traded volume of a product in a value chain and the average daily turnover of the sample retailers, the user can calculate how many retailers are involved.	• Through interviews with a statistically significant sample size of retailers

Annex 9: Illustrative template to calculate cost, revenue and margins

Costs		
A	Fixed cost	
	Rent	
	Interest on long term loans / interest on capital	
	Depreciation	
	…….	
B	Variable cost	
	Wages related to production	
	Losses	
	Transport	
	……..	
C	Cost of investment / capital cost	
	Land	
	Equipment	
Revenues		
D	Number of units sold	
E	Selling price per unit	
F	Income from other sources	

- Variable cost – costs that are dependent on the size of production, i.e. will increase or decrease with the sales level.
- Fixed cost – costs that are independent of the size of production, i.e. do not increase or decrease with the sales level.
- Cost of investment – costs that are required for the value chain actor to start his/her business. Comprehensive understanding of the investment costs are important for the calculation of depreciation* costs (Smith *et al.*, 2008).
- Calculation of depreciation – even though there are multiple ways of calculating depreciation, for the ease of calculation, it is suggested to use the straight-line method of calculation: depreciation per year = value at which the product was purchased / expected life of the product. For example, as a good practice, the life of a machine is considered as 10 years and of a car as 15 years. If the value of depreciation is negligible, the user may exclude it.

- Revenue = {(number of units sold * selling price per unit) + income from other sources}.
- As prices may change, the user should obtain prices in different markets for different products and during different seasons. For calculating average prices, these should be weighted (Smith *et al.*, 2008).
- Net income = revenues – variable – fixed cost
- Net margin = net income / number of units sold
- Breakeven point (number of units) = fixed costs / (selling price per unit – variable costs) (Smith *et al.*, 2008).

Annex 10: Illustrative questions for specified rules, standards and supporting functions

Market access

- What are your main constraints in accessing markets?
- In terms of sales / revenues, are there some markets (customer groups) which are better than others? Which ones?

Technology / product development

- Are there any recent steps you have taken to improve your products? Why? Why not?
- Are there any specific equipment / technological needs you have? How would they benefit you?
- Do some of your workers need additional training? In what skills?

Management / organization

- With respect to organization and management, what are your major needs?
- What additional management skills would help you grow your business?

Input supply

- With respect to input cost, quality and availability, what are your major needs?

Finance

- Have you ever taken out a business-related loan in the past?
- Which sources did you approach?
- What were the main obstacles you faced?
- To meet your financing needs, do you prefer formal sources or informal sources? Why?
- What measures would make it easier for you to use formal sources to meet your financing needs?
- With regards to your business, do you currently need additional financing? If yes, for what?

Government policies / regulation

- Which existing policies / regulations are beneficial to your business?
- Which existing policies / regulations are a hindrance to your business?
- Which policies / regulations, if formed, would be beneficial to your business?

Infrastructure

- In order to improve your business' growth and profitability, what are the most important infrastructure constraints you would like addressed (road / transport conditions, telephone service, electricity supply, crime / corruption, storage, etc.)?

Business membership organizations

- Are you a member of any organization, formal or informal, related to your business?
- What benefits do you / your business derive from membership of the organization?
- Which additional services would you require from the organization? (Lusby and Panlibuton, 2007)

Annex 11: Illustrative format for capturing the demand supply analysis

Product/ sub-product	Units of measurement	Demand (D)	Supply (S)	Gap (S1)
		D1	S1	(D1-S1)
Product 1	::::	::::	::::	::::
Product 2 Sub-variety 2.1 Sub-variety 2.2	::::	::::	::::	::::
Product 3	::::	::::	::::	::::

Annex 12: Illustrative market survey for consumers

Market Survey		
1	Age: Gender: Religion: Caste / ethnicity: Education:	
2.	**Climate change**	
2.1	Are you aware of climate related risks associated with the manufacturing / processing / wholesale of this product?[21]	Yes / No. If yes, please provide details.
2.2	Would you support the inclusion of climate-change adaptation measures in the value chain of this product?	Yes / No
2.3	As adaptation measures have a financial impact as well, would you be willing to pay a premium to purchase a climate-resilient product?	Yes / No
2.4	If yes to 2.3, what premium are you willing to pay as compared to the current price	__ %
3	**Market development**	
3.1	What different varieties of the end product do you purchase?	
3.2	What would prompt you to increase your purchase of this product? Please explain.	price ( ), quality ( ), variety ( ), other ( )
4	**Gender responsiveness**	
4.1	Are you aware of gender discriminatory practices involved in the manufacturing / processing / wholesale of this product?	Yes / No / NA
4.2	If no to 4.1, would you continue to purchase a product if you were aware of such practices in the value chain?[22]	Yes / No / NA
4.3	Would you be willing to pay a premium for products if its value chain was gender responsive?	Yes / No
4.4	If yes to 4.4,, what premium are you willing to pay as compared to the current price?	__ %

21. If the respondent is not aware of associated climate change risks, the surveyor should briefly inform the respondent about

22. If the respondent is not aware of associated gender discriminatory practices, the surveyor should briefly inform the respondent about the gender discriminatory practices and its impact on the value chain actors

Annex 13: Illustrative format for vulnerability matrix

Resilience to climate-change related hazards / issues Social group						
	Men					
	Women					
	Men					
	Women					
	Men					
	Women					
	Men					
	Women					

Annex 14: Illustrative format for SWOT analysis

Strengths	Weaknesses
::::	::::
::::	::::
Opportunities	**Threats**
::::	::::
::::	::::

Annex 15: Illustrative questionnaire for value chain actors

Social background

Nature of respondent: producer / aggregator / processor / wholesaler / retailer / consumer

Age:

Gender:

Religion:

Caste / ethnicity:

Education: none / neoliterate / primary / secondary / graduate / post-graduate / dropout

Marital status:

Number of children:

Farmer type: smallholder, commercial farmer

Business type: micro, small, medium, large

Climate change risk and vulnerability analysis

Source: Morchain, D. & Kelsey, F. 2016.

Probe areas	Probe topics	Response / outcome
Incidence of climate change	• Have you noticed any long-term shifts[23] in temperature or precipitation?	
	• If yes, what changes have been noticed? - increase in temperature - decrease in rainfall - increase in frequency of droughts - increase in frequency of flooding - other (please specify)	
Impact on daily activities	• Has there been any impact on how you go about your daily activities, such as fetching firewood / water?	
	• Have any other activities been impacted due to this change (e.g. having less time to take care of children at home as longer times are spent fetching water)?	
	• How have you tried to adapt to the change (e.g. taking children along with you to fetch water)?	

23. Surveyor: The word "Long-term" in the following questions means the last 1 or 2 decades (or if the value chain actor has been involved less than that, then since whenever she or he has been involved).

Probe areas		Probe topics	Response / outcome
Impact on value-chain related activities[24]	Exposure – expected impact of the hazard[25] - (To be rated from 0 – 3, with 3 indicating the highest impact)	• What is the extent to which you could be potentially affected / damaged by the occurrence of the hazard or issue? List the potential hazards / issues.	
Impact on value-chain related activities	Sensitivity – actual impact of the hazard **[26] (to be rated from 0 – 3, with 3 indicating the highest impact)	• What impact was there on the cultivation of crops? - fall in productivity / yield of the same crop - depletion of water sources - change in soil composition - increase in diseases / pests - higher moisture levels in crops - other (please explain) • What impact was there on the processing industry? greater investment required during transportation (for crop protection from heat, moisture, rainfall etc.) - greater investment required during storage (pre-processing and post-processing) for crop protection - need for improved / more advanced equipment - need for improved packaging of processed material - other (please explain) • What impact was there on wholesalers / retailers? i- mpact on sales – fewer sales of products geared for specific seasons (consumers buying fewer warm-weather clothes, for instance) - greater investment required during transportation - greater investment required during storage - Other (please explain)	

24. For each respondent, the surveyor will need to guide the respondents in deciding how to assess impact such as loss of production, incidence of disease, income levels, etc. In all cases the responses should be informed by anecdotal evidence from respondents.

25. Respondents should consider the present circumstances when deciding the exposure value and not past or future circumstances.

26. While eliciting responses for the sensitivity value, the surveyor should ensure consistency on the agreed period of time for i) each respondent for the particular node and ii) across the hazards / climate-change risks.

Probe areas	Probe topics	Response / outcome
Adaptive capacity (to be rated from 0 – 3. 0 – does not know, 1 – knows but not implemented, 2– knows and has implemented at a limited level, 3 – knows and has implemented extensively)	• Are you aware of any initiatives regarding climate-resilient agricultural initiatives in particular to this crop?[27]	
	• If yes, how did you come to know about the initiative?	
	• Are you implementing it?	
	• If yes, what difference have you noticed since the implementation?	
	• What initiatives are being used to adapt to the changes in weather from year to year?	
	• If implementing partially, what are the barriers to implementation of the remaining initiatives?	
	• If not implementing at all, what are the barriers to implementation?	
	• What sources of information would you / do you trust to receive information pertaining to adaptation initiatives?	

Number of jobs created

- How many people do you employ during season one[28] (disaggregated by age, gender, skill level, family / non-family, full-time / part-time, local / migrants)?
- If other family members work on the farm, factory or shop, etc.:
  - Do you pay your family member(s) for the work they do? / Are you paid for the work you do on the family farm / factory / shop? Why?
  - What would have been the opportunity cost of replacing a family member employed at the farm / factory / shop, or in any such other activity? / What would have been the opportunity cost of replacing you, a family member, employed at the farm / factory / shop, or in any such other activity?

27. Depending on the value chain and the geographical region, the user should prepare a comprehensive list of key climate-change adaptation initiatives which the value chain actor should be aware of.

28. Depending on the value chain and the geographical region, the user should prepare a comprehensive list of key climate-change adaptation initiatives which the value chain actor should be aware of.

Gender-disaggregated financial analyses

Men	Revenue			
	Net income			
	Net margin			
	Break-even point			
Stages of value chain		Producer level	Aggregator/ processor	Wholesaler/retailer
Women	Revenue			
	Net income			
	Net margin			
	Break-even point			

Product flow

Upstream				VCA in question		Downstream		
Input required	**Sourced from (district/ state/ country)**	**Quantity/ volume**	**Price**	**Value chain actor**	**Output sold**	**Sold to (district/ state/ country)**	**Quantity/ volume**	**Price**

Flow of information and knowledge

- What information do you require for all of the main tasks which you undertake in this process? Please note down all the tasks performed and the corresponding information required against them.
- What are the sources of the information you require?
- Do you seek information from upstream / downstream value chain actors? Why?
- What type of information do you seek from them?
- Is the information sought provided by the upstream / downstream value chain actors? Why?
- Do you provide any information to upstream / downstream value chain actors? Why?
- What type of information do you share with them?

Relationship between actors

Characteristics of the relationship	Probe question	Response / outcome
Duration of the relationship	• Do you have a preference for certain buyers and sellers? • What is the basis for the preference or the lack thereof?	
Ability to walk away from a contract / switch cost	• Do you form any contract with buyers and sellers? Why? • What is the nature of these contracts? • Have you ever broken a contract? Were there any resultant costs? What were they?	
Power and control	• In your relationship with the buyer and seller who has more power over decision-making? • Which factors contribute to you or them having more power?	
Information shared	• Is there any information-sharing between you and your buyers and sellers? • What is the nature of the information shared? • How often does information-sharing occur?	
Trust	• Do you trust your buyers and sellers? Why?	

Gender responsiveness

(Oxfam, 1999; March, Smyth and Mukhopadhyay, 1999; ILO, 1998; Assefa and de Roo, 2015)

Activity profile					
No	Activity	Who does the work			
		Men		Women	
1	Reproductive		Remarks		Remarks
1.1	Sub-activity 1.1				
1.2	Sub-activity 1.2				
2	Productive				
2.1	Sub-activity 2.1				
2.2	Sub-activity 2.2				
3	Community involvement				

Activity profile: illustrative probe questions for eliciting detailed responses for the 'remarks' column

1. Is this work the exclusive domain for your gender?

1.1 If yes, what are the reasons for exclusivity?

1.2 If no, do members of the other gender perform an equal amount of work for this activity or does it differ? Why?

2. Would you prefer that members of the other gender start to increase / decrease their involvement in this activity? Why?

2.1 What could motivate them to increase / decrease their involvement in this activity?

Daily activity clock		
Time	Daily activities	
	Men	Women
05:00		
06:00		
07:00		
08:00		
09:00		
10:00		
11:00		

Daily activity clock	
Time	**Daily activities**

	Men	Women
12:00		
13:00		
14:00		
15:00		
16:00		
17:00		
18:00		
19:00		
20:00		
21:00		
22:00		
23:00		
24:00		
01:00		
02:00		
03:00		
04:00		

Women's socio-political profile				
Women's socio-political position compared to men's	**Lower (worse)**	**About equal**	**Higher (better)**	**Remarks**
Women's participation in decision-making: • in the household • at community level • society at large				
Self-image of women in society				
Organizational capacity				
Other				

Men's socio-political profile				
Men's socio-political position compared to women's	**Lower (worse)**	**About equal**	**Higher (better)**	**Remarks**
Men's participation in decision-making: • in the household • at community level • society at large				
Self-image of men in society				
Organizational capacity				
Other				

Socio-political profile: illustrative probe questions for eliciting detailed responses for the 'remarks' column

1. What are the reasons that lead you to believe that your participation in decision-making / self-image / organizational capacity is lower / about equal / higher than the other gender?
2. Would you want a change in this position?

2.1 If no, why not?

2.2 If yes, why? What should the position look like?

2.2.1 Have you tried to make changes / been involved in external efforts for this change to happen? What were the results?

2.2.2 What would bring a change in the comparative positions?

Access and control questionnaire						
	Access			**Control**		
	Men	**Women**	**Remarks**	**Men**	**Women**	**Remarks**
Tangible resources						
1						
Intangible resources						
1						
Benefits						
Benefits from other sources of income						
Benefits from sale of commodity						

Access and Control: illustrative probe questions for eliciting detailed responses for the 'remarks' column

Access to resources

1. Do you have complete access to this resource? Please provide details.

1.1 If yes, which factors enable you to have complete access to this resource?

1.2 If no, which factors inhibit your complete access to this resource?

1.3 What would enable you to have greater / complete access to this resource?

Access to benefits

2. Do you have complete access to the benefits derived from the sale of the product and its by-product? Please provide details.

2.1 If yes, which factors enable you to have complete access to the benefits?

2.2 If no, which factors inhibit your complete access to the benefits?

2.3 What would enable you to have greater / complete access to the benefits?

Control over resources

3. Do you have complete control over this resource? Please provide details.

3.1 If yes, which factors enable you to have control?

3.2 If no, which factors inhibit your complete control?

3.3 What would enable you to have greater / complete control over this resource?

Control over benefits

4. Do you have complete control over benefits derived from the sale of the product and its by-product? Please provide details.

4.1 If yes, which factors enable you to have complete control?

4.2 If no, which factors inhibit your complete control?

4.3 What would enable you to have greater / complete control over the benefits?

Influencing factors						
	Supports		Remarks	Constraints		Remarks
	Men	Women		Men	Women	
Physical conditions						
Social conditions						
Community norms						
Economic conditions						
Institutional arrange-ments						
Political factors						
Other						

Influencing factors: illustrative probe questions for eliciting detailed responses for the 'remarks' column

1. Is this factor a support or constraint for you? Please provide details.
2. Does its function as a support or constraint vary across the different type of activities performed? For example: reproductive / productive / community involvement?
3. What makes this a supporting or constraining factor, particularly for your involvement in the value chain?
4. If it is a constraining factor, what interventions would be required for it to become a supporting factor for you?

Questions for the demand side (user) of the intervention (Lusby and Panlibuton, 2007)

- Are you using the proposed intervention? If not, what challenges do you foresee in using the proposed intervention?
- If yes, are you satisfied or not with the proposed intervention? Why?
- If dissatisfied with the intervention, what could be done to resolve the challenges faced (including what the intervention provider could do)?
- What aspects of the intervention / potential intervention are important to you?
- How did you get to know about the intervention?

Questions for the supply side (provider) of the intervention (Lusby and Panlibuton, 2007)

- What steps are involved / would be involved in providing the intervention to the target audience?
- What challenges do you / will you face in providing the intervention to the target audience?
- What support do you / would you require to address these challenges?
- How do you obtain information on the needs of the target audience?
- How do you reach out to your target audience?

Annex 16: illustrative format for developing and capturing the longlist of interventions

Value chain node	Most vulnerable social group	Step 1 – enhancing climate change resilience	Step 2 – addressing the value chain based constraints	Step 3 – linking to market based opportunities	Step 4 – integrating gender responsiveness

Annex 17: illustrative format for the results matrix

Outcomes and outputs	Indicators					Achievements			
	Baseline	Overall target	Period 1 target	…	Period (n) target	Period 1	Period 2	… …	Period (n)
Intended goal / impact (1)									

Source: *Adapted from "Results Based Management Handbook: Harmonizing RBM concepts and approaches for improved development results at country level", October 2011, United Nations Development Group.*

Means of verification	Risks and assumptions	Role of partners	Indicative resources

Annex 18: answers to the exercises

EXERCISE 1

Answer:

	Adaptive capacity index*[29]
Dist. 1	0.71
Dist. 2	0.32
Dist. 3	0.88
Dist. 4	0.25

Explanation:

Standard deviation GDP: 0.42

Standard deviation percentage of road density: 0.43

K: 0.21

Weighted GDP: 0.51

Weighted percentage of road density: 0.49

EXERCISE 2

Answer:

a) 12

b) 27

c) 12.69 %

Explanation:

a) The maximum differential between points allocated by ST1, ST2 and ST3 and the total points received is 44 (58 - 14). With maximum points which can be given by a stakeholder being 5, it would require at least 9 more stakeholders to allocate the remaining 44 points.

b) The minimum differential between points allocated by ST1, ST2 and ST3 and the total points received is 24 (32 - 8). As the minimum points which can be given by a stakeholder is 1, it would require, at most, 24 stakeholders to allocate the remaining 24 points.

c) [{260-(58+52+32+35+50)}/260]*100

29. * Please note that the numerical answers and explanation have been rounded.

EXERCISE 3

Answer:

a) 60

b) 2.4

c) 150

Explanation:

a) [(2-0.5)/(3-0.5)]*100

b) (0.04*60)

c) 66.67 = [100*{(X-50)/(200-50)}]

EXERCISE 4

Weighted average selling price = [{(400*4) + (455*5)} / 855] = USD 4 532

Fixed cost

Interest = (10% *1 000) = USD 100
Depreciation cost = {(500*2)/10} = USD 100

Variable cost

Transportation cost = USD 300
Labour cost = {(5*10*10) + (7*10*20)} = 500 + 1 400 = USD 1 900

a) Total Revenue = USD 3 875 = (855*4 532)

b) Net income = USD 1 475 = [3 875 - {(500+1 400+300) - (200)}]

c) Net margin = USD 1 725 = (1 475/855)

d) Breakeven point = 102 092 kg annually = [200/{4 532-(2 200/855)}]

EXERCISE 5

Answer

Cultivation of cotton at farm level		
Input quantities		
	Unit	Quantity
Labour	Person/month	2.5
Seeds	Tonne	0.25
Fertilizer	Tonne	0.4
Output quantities		
Cotton	Tonne	1

Cultivation of cotton at sub-sector level		
Input quantities		
	Unit	Quantity
Labour	Person/month	500 000
Seeds	Tonne	50 000
Fertilizer	Tonne	80 000
Output quantities		
Cotton	Tonne	200 000

Annex 19: Consideration of time and resource constraints

This toolkit recognizes that the user may face time and resource constraints (financial, human, etc.) which may hamper the ability to undertake value-chain mapping and analysis as suggested. In light of this, the following alternatives are suggested:

- **Module C, section 2, subsection 2.1 – Developing climate change vulnerability mapping for the region, and Module C, section 2, subsection 2.2 – Dividing the region under consideration into AEZs:**
  - the user can access existing studies which have:
    - mapped climate change vulnerability across different RCPs for the region of interest; and / or
    - mapped climate change vulnerability onto AEZs for the region of interest.
- **Module C, section 4 – Note on research and sampling methodology:**
  - the user could reduce the confidence level and confidence interval from 95 percent and 5 percent, to 90 percent and 10 percent respectively.
- **Module C, section 4, subsection 4.1 – Value chain mapping:**
  - steps 6, 7, 8 and 9 can be completed by way of targeted interviews with value-chain actors at each node; and
  - for tool 2 in step 10, the user may use existing market surveys, provided they cover the areas suggested in the sample market survey suggested in this toolkit.
- **Module C, section 4, sub-section 4.3 – Validating the constraints and opportunities, and Module C, section 5, sub-section 5.4 – Validating the interventions and activities:**
  - the user can combine the two workshops into a multi-day workshop and validate the constraints and opportunities, as well as add interventions and activities while completing subsection 5.4.

- **Module C, section 5, sub-section 5.2 – Assessment of potential interventions:**
  - some of the information for assessment can be collected during the value chain mapping itself. This will not only save time, it will reduce costs of other resources as well (Lusby and Panlibuton, 2007). In case the user is following this approach, it should be recognized that some constraints, and consequently the interventions, can only be identified during the data analysis stage; the user may still need to go back to the intervention provider and user. Even then, cost and time resources incurred by the user will be comparatively less than collecting information after completion of data collection.

Annex 20: The toolkit and National Adaptation Plans

The toolkit's design and key features of National Adaptation Plans

While developing the toolkit, cognizance was paid to the fact that NAP planning was envisioned as a continuous, progressive and iterative process with nationally identified priorities guiding the implementation. It was also recognized that the enhanced adaptation actions were envisaged to be based on the best available science along with appropriate traditional and indigenous knowledge, while following a country-driven, gender-sensitive (gender-responsive)[30], participatory and transparent approach (UNFCCC, 2012).

- **Country-driven:** usage of the toolkit would primarily be a country-driven process as the main users are envisioned to be policy makers, planners and implementers at local, regional or national level. Furthermore, the over-arching modular structure of the toolkit inherently acknowledges that in some cases, users may already have selected geographical areas or value chains for intervention. It therefore provides them with some flexibility to use the toolkit as appropriate to their situation.
- **Guided by nationally identified priorities:** the toolkit gives users the option, at multiple key decision points, to select parameters and assign weights to them based on the parameters' local, regional or national importance. The user is also empowered to prioritize interventions based on their objectives, select targets for the interventions and identify facilitative agencies for implementation. This would ensure that the process and its results are in line with local / regional / national priorities.
- **Adaptation actions based on science and traditional / indigenous knowledge:** the toolkit relies on data and models in developing climate-change vulnerability mapping for the entire region, initially under consideration, and subsequently dividing it per AEZs. Traditional / indigenous knowledge is also derived from value chain actors at all nodes and utilized to understand localized climate change risks and vulnerabilities, reasons for the markets inability to deliver for the target group, and gender-based constraints which might constrict the ability of a specific gender group to participate or reap equal benefits for their participation.
- **Gender-sensitive** (gender-responsive)*: Gender-responsiveness is one of the key dimensions of this toolkit. It is one of the determining criteria in the shortlisting and selection of the value chain. Subsequently, the results of the gender-analysis guide the development of climate-resilient market-development interventions.

30. According to the technical guidelines, the CoP agreed for adaptation to be gender-sensitive. However, UNDP and FAO have agreed on the usage of the term 'gender-responsive', and the toolkit and tools have been developed accordingly.

- **Transparent, continuous, progressive and iterative:**
  - The toolkit is designed to follow a transparent process which is reflected in the participatory approach, use of quantitative tools and efforts to minimize subjectivity, while using qualitative tools. As part of the participatory approach, the suggested tools call for engaging relevant sector experts at key points, particularly during the selection of geographical regions for intervention, as well as the selection of value chains. It also calls for extensive stakeholder interactions to identify climate vulnerabilities, and market- and gender-constraints across the selected value chain. Finally, the toolkit places emphasis on engaging with the intervention users and providers while assessing potential interventions on various parameters;
  - Even though the toolkit follows a modular approach to its sections, some key sections build upon each other. For example, the identification of potential interventions in section 5 is inextricably linked to the value-chain analysis in section 4. However, within each section, the toolkit follows a progressive approach with steps and subsections building onto each other; and
  - The M&E framework, which is guided by the results matrix, allows the user to continuously monitor the implementation of interventions, and if required, use the tools to iteratively re-design the interventions.

Scaling the value chain approach

As a value-chain approach (and its analysis) is inherently scalable, accordingly, even if the initial focus of the exercise is on a single agricultural commodity, the user can apply the approach to a few, or all, of the agricultural commodities in a region (Coles, Keane and Mitchell, 2009). Therefore, if a value chain analysis is undertaken for a sector or a sub-sector using the methodology and tools suggested in this toolkit, it will make available to the user, at the sectoral / sub-sectoral level, climate change risks and vulnerabilities, market based constraints and opportunities and gender based constraints. Additionally, it will also lead to the articulation of key barriers to implementation of potential interventions, and strategies to overcome them.

Consequently, the sector- / sub-sector-specific NAP is developed to include adaptation needs, adaptation options, actions (divided across short-, medium- and long-term), responsible agencies and key performance indicators for local, regional and national levels (Ministry of Mahaweli Development and Environment, 2016; FAO and UNDP, 2017; Government of Kenya, 2016).

At the same time, a sector / sub-sector M&E framework would enable the user to monitor the implementation of the interventions, with the iterative nature of the framework allowing the user to make any necessary adjustments as required. The suggested end-line evaluation would provide insights into the NAP with respect to its relevance, effectiveness, efficiency, impact and sustainability, while also recommending strategies for future NAPs.

Value chain analysis informing national adaptation planning

Example of how the value-chain analysis can inform NAP

Value chain analysis

As part of stakeholder interactions, while undertaking the climate-change risk and vulnerability analysis at producer level in a drought prone area, a male farmer (stakeholder) shared that he was initially advised to undertake drip irrigation. The method had produced the expected results at the time of implementation.

A statistically significant sample size of farmers was interviewed and a number of farmers informed about the benefits they would receive upon using drip irrigation methodology. The user, following the methodology suggested in the toolkit, interviewed the intervention providers as part of the "Assessment of potential intervention" found in section 5.2 of the toolkit. Upon interviewing, the user learned that the initial intervention was appropriate to the climate change risk and vulnerabilities identified. He also learned that the intervention was successful (as drip irrigation can improve the use of dwindling irrigation water). Moreover, the providers had assessed the interventions on several parameters and consulted with multiple stakeholders (including the intervention users) prior to implementing it.

Results of value chain analysis informing the adaptation planning process

The analysis would inform the adaptation-planning process multi-fold as it would share:

- the underlying risk with the policy maker, i.e. prevalence of drought;
- adaptation options and actions which would have been assessed by stakeholders at multiple stages; and
- lessons learned – the importance of putting the potential interventions through a rigorous assessment process.

Source: Asian Development Bank. 2009.

The results of the value chain analysis can feed into the adaptation planning process in the following ways:

- provision of the geographical regions and the agricultural commodities for which adaptation planning is required;
- rigorously assessed potential interventions across the short-, medium- and long-term;
- indicative resources required and key performance indicators for M&E purposes;
- means of implementation (facilitative agencies); and
- key lessons learned covering the strengths and weaknesses of existing interventions and how they, and their delivery, can be improved.

Annex 21: Financing the value chain and climate change adaptation measures in it

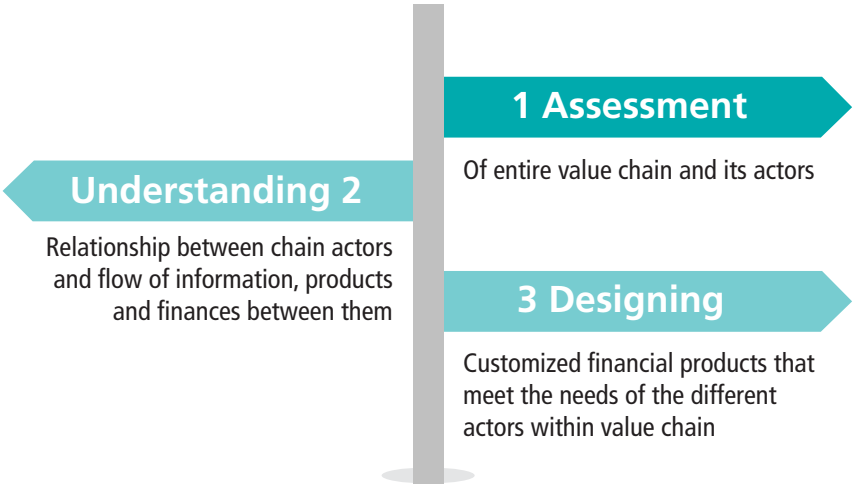
Agriculture value-chain financing

"The flow of funds to and among the various links within a value chain comprise what is known as value chain finance." (Miller and Jones, 2010) Agricultural value-chain finance includes financial flows between value chain actors, such as buyers or input suppliers, as well as from financial institutions into the chain, or a combination of both (Miller and Jones, 2010).

Agriculture value chain finance approach

A value chain finance (VCF) approach involves providing financial services and products based on business relationships between various actors in the value chain (The World Bank Group, 2016). The approach incorporates a thorough assessment and understanding of the entire value chain, which includes the relationship between activities and value chain actors, financing relationships, physical and informational flows, and the subsequent design of customized financial products to cater to the needs of the different value chain actors (The World Bank Group, 2016).

The figure below represents an effective approach to agricultural value-chain finance.



Climate Finance and its role in agriculture value chain

"Climate finance refers to the flow of capital from both public and private sources that support and finance climate-smart investments and aim to achieve climate change adaptation objectives." (The World Bank Group, 2016) Accordingly, adaptation financing refers to deployment of resources to support climate-resilient development (The World Bank Group, 2016). The financing for adaptation can be done using a range of international and domestic, public and private financing mechanisms, and can take various forms, for example, loans and grants (The World Bank Group, 2016).

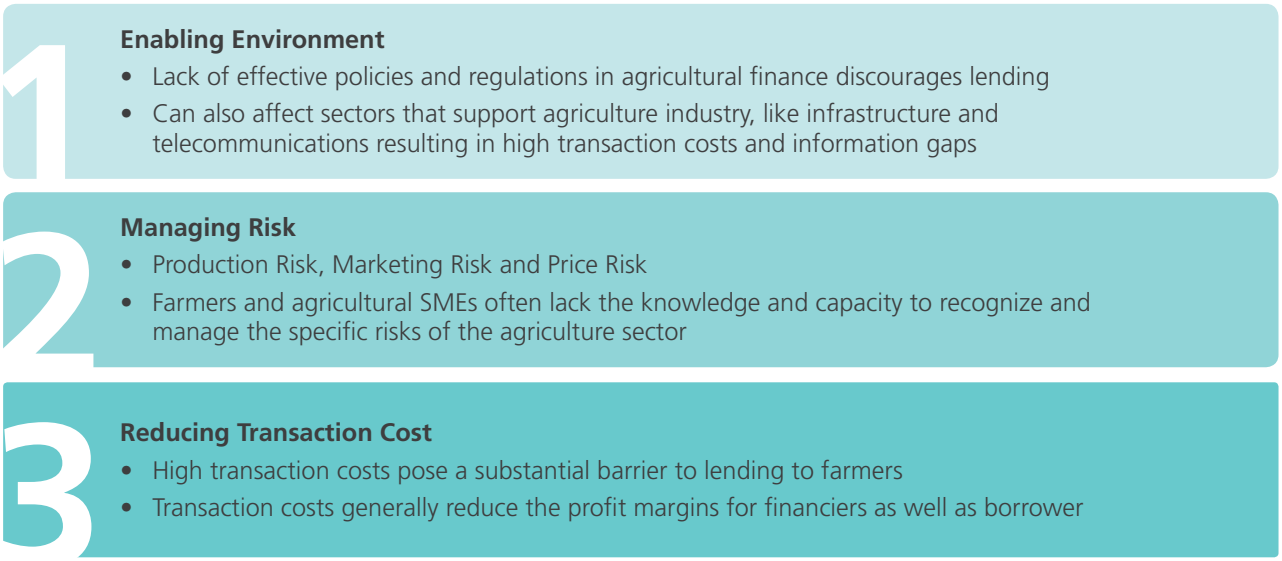
In the context of agriculture value chains, climate finance can come from the following sources:

- public capital: government budgets;
- public financial intermediaries, such as bilateral aid agencies, climate funds, and multilateral, bilateral, and national development finance institutions;
- private financial intermediaries, such as commercial financial institutions, private equity, venture capital, infrastructure funds, and institutional investors; and
- private capital: households, private national and multinational companies, and project developers (The World Bank Group, 2016).

Consequently, climate finance can be utilized to implement or add value to the following processes and practices that aid in climate change adaptation of the value chain:

- infrastructure and asset development;
- technological process optimization;
- institutional and behavioural change or reinforcement;
- integrated natural resources management, such as for watersheds and coastal zones;
- financial services, including risk transfer;
- information systems to support early warning and proactive planning; (Porter *et al.*, 2014) and
- research and development.

The flow of climate finance into the agricultural value chain can be facilitated by taking three steps: i) improving the enabling environment; ii) managing risk and iii) reducing transaction costs. The figure below showcases these points along with impediments in their implementation (The World Bank Group, 2016):



Each of the three steps are illustrated with an example below:

- **Improving the enabling environment**
  - **Creating rural credit-rating agencies and bureaus –** A major hurdle faced by financiers when lending to smallholders is the dearth of information on past credit records of the borrowers to evaluate their creditworthiness. Climate finance can be used to create credit bureaus in rural regions which can provide financiers with up-to-date information about the potential borrower, not only on their past credit record, but also rate them on their ability to adapt to climate change. Credit-rating knowledge would greatly enhance lenders' confidence in extending loans and thus open up the market at the bottom of the pyramid. For the borrower, this could act as motivation to take steps to make themselves or their business credit-worthy (The World Bank Group, 2016).

Case study VI: Credit bureaus for the rural poor - Ecuador

Following a banking crisis in the preceding decade, in 2003, the Ecuador government allowed for the establishment of private credit bureaus and the sharing of borrower data. To enable the inclusion of the most vulnerable populations residing in rural areas, a pilot project called SERVIR was launched in 2005.

Prior to this, micro-lenders were not required to share the information of borrowers. The project began with 10 micro-lenders, non-governmental organizations and cooperatives coming together. The bureau's Credit Report was selected as partner, facilitated by Red Financiera Rural (RFR). RFR also provided training on how to diagnose micro-lender processes, data, and technological systems.

Results: Between 2004 and 2006

- Micro finance institutions portfolio volumes increased by 53 percent
- Clients increased by 33 percent
- The average loan amount increased from USD 1 800 to USD 2 400
- Credit default rates (1 day) decreased from 41 percent to 10 percent

A key factor in Credit Report's success was the unique access to data on borrowers which resulted in better market coverage and informed lending decisions.

Sources: The World Bank Group. 2016.

- **Managing risk**
  - **Guarantees –** instruments that facilitate risk-sharing, i.e. a part of the risk is transferred from the financier to a third party (not the borrower). Guarantees result in lowering of risk for the lender, thus, encouraging lenders to expand financing in agriculture. A well-designed guarantee scheme can encourage financial institutions to lend more to the agriculture sectors as it reduces their perception of risk. The benefit of this could trickle down the agri-value chain with reduced collateral requirement and more favourable loan terms for value-chain actors (The World Bank Group, 2016).

Case Study VII: Finance through credit-guarantee services in Ethiopia

Ethiopia is the number one coffee exporter in Africa. However, loan approvals were difficult as banks in Ethiopia perceived coffee co-operatives as a high-risk, high-cost segment as the cooperatives were relatively weak and poorly managed, and coffee sector borrowers were often limited by price volatility and other fiscal constraints.

To overcome this hurdle, Rabobank Rural Fund set up a credit guarantee scheme, amounting to USD 2.25 million, to enable banks to use guarantees as an alternative to collateral. A risk-sharing agreement between Common Fund and Rabobank Foundation agreed to cover half of any losses incurred as a result of lending provided to farmers. Moreover, Rabobank International Advisory Services also provided technical assistance to banks to train cooperatives on financial literacy and corporate governance.

Of the 42 cooperatives identified, 22 were selected to take part in the scheme. The scheme provided working capital loans totalling over USD 700 000, to 11 cooperatives.

Result:

- The credit guarantee scheme enabled the 11 cooperatives to receive loans directly from the bank for the first time in their history
- The loan recovery rate stood at 98 percent at the closing of the first phase of the scheme.

Sources: The World Bank Group. 2016.

- **Reducing transaction costs**
  - **Mobile financial services –** with the rapid penetration of mobile phones and reduction in mobile tariffs due to competition between mobile network operators in developing countries, use of financial services via mobile devices has increased tremendously (MGI, 2016). Financial institutions (FIs) and mobile network operators offer a wide range of services including loans, savings, money transfers, insurance and knowledge extension services (lowering search transaction costs) (The World Bank Group, 2016). The services can be accessed through multiple channels like electronic accounts (wallets) and over-the-counter (OTC) transactions, which do not require the user to have an account (The World Bank Group, 2016).

Case Study VIII: Impact of ICT on transaction cost for farmers in Dambulla, Sri Lanka

The objective of the study was to estimate the search cost of information* as a percentage of the total cost incurred by smallholder farmers during the crop life cycle, i.e. from crop selection to sale. The study also analysed the potential reduction of these costs if they were to use information and communication technology (ICT) tools in obtaining such information.

A total of 314 farmers, growing four different crops – onions, chillies, tomatoes and brinjals – were included in the survey. Questionnaires were used to capture all costs (direct and transaction) incurred during the farming season, from crop selection to sale of produce.

Results:

- It was found that for the given set of farmers, transaction costs (including search cost) were 15.2 percent of the total cost incurred during the entire chain – crop selection, seeding, land preparation, growing, harvesting, packaging and selling.
- It was found that on average, a farmer made 24 visits during the different stages of the agricultural value chain. If half of these visits were replaced by phone calls, the search cost would reduce by 33 percent, besides saving precious time.

** Search cost is defined broadly as the costs including, and associated with, information-based transaction costs that can be reduced by using alternative sources such as ICTs for obtaining the same information.*

Source: Ratnadiwakara, D., de Silva, H. & Soysa, S. 2008.

An insight into agriculture value-chain finance-instruments

Traditionally, the following 16 financial instruments are used in agriculture value chain finance. These have been classified into five categories as shown in the table below (Miller, 2011):

Category	Instrument
A. Product financing	• trader credit • input-supplier finance • marketing and wholesale company finance • lead-firm financing
B. Receivables financing	• trade-receivables finance • factoring • forfeiting
C. Physical asset collateralization	• warehouse-receipts finance • repurchase agreements (repos) • financial leasing (lease–purchase)
D. Risk mitigation	• insurance • forwards contract • futures
E. Financial enhancements	• securitization instruments • loan guarantees • joint-venture finance

The instruments listed in the table above include both traditional forms of credit and more complex instruments that are used in highly developed agriculture value chains. These tools cover the entire spectrum of the value chain, with the tools being applicable to small farmers, wholesalers, traders and agro-industries (Miller and Jones, 2010).

To enable these financial instruments to work in the context of climate-change adaptation, value addition and innovative thinking are required. The subsequent subsection provides a list of some innovative approaches that have been implemented in varied agricultural scenarios.

Innovations in agriculture value-chain financing that supports climate change adaptation

While the provision of agriculture finance that supports climate adaptation remains low (Dekens and Bingi, 2013), some innovative finance models have been tested and/or successfully implemented across the globe (UNDP, 2011). Please refer to the table below for examples. It is observed that many of these models make use of ICT, mainly to reduce financial transaction costs and improve access (Dekens and Bingi, 2013).

Tool	Facilitation of climate finance<?>	Benefits	Result<?>	Example
Weather indexed insurance (WII)	Risk reduction + reduced transaction cost	Lower transaction cost and saves valuable time for farmers in case of weather calamity	Lower risk	Kenya Case Study: Input-linked weather insurance
Processor finance	Enabling environment + risk reduction	Lowers risk for lending institution thereby promoting credit disbursal	Access to credit	Agave farming model in Mexico
ICT	Lower transaction cost	Weather, market, input, finance-related information in real time in local language	Information access	NAFIS in Kenya
Research & development	Enabling environment + risk reduction + lower transaction cost	Drought – pest resistant hybrids, cross-breed livestock, sensor technology and big data, drone technology for precise mapping and operations	Better climate, stress resistance, efficient resource utilization	Crop adaptation to climate change in Tanzania
Infrastructure development	Risk reduction	Efficient water use technologies,water storage structure and rain water harvesting, forest restoration to stabilise land slopes / limit erosion	Lower risk of crop/ livestock loss in case of weather extremities	WOTR Project in India

- **Weather indexed insurance –** Though insurance coverage for agriculture is an existing concept, the approach used by traditional insurers is less efficient and more resource-consuming (Greatrex *et al.*, 2015). Consequently, innovations in insurance are required to make it more attractive to the borrower and increase its adoption amongst the agriculture community.

  Index based insurance is one such innovation, with weather index insurance being linked to an index, such as rainfall, temperature and humidity, etc. For this method, the insurance amount is automatically paid out if any of the index (weather element) breaches the pre-defined limit. In case of weather indexed insurance, the index data can be automatically gathered from the meteorological department, thus saving time and effort and lowering transaction costs (CGIAR, 2013).

Case study IX: Kenya case study: input-linked weather insurance – Syngenta Foundation and UAP Insurance

Many farmers in LDCs lack the affordability and access to insurance products. To increase the adoption of crop insurance among farmers in Kenya, UAP insurance and the Syngenta Foundation for Sustainable Agriculture, launched an affordable weather insurance product named 'Kilimo Salama' (Kiswahili for 'safe farming').

Farmers buying agri-inputs from local dealers could get insured simply by scanning a barcode affixed to a product. Moreover, the farmers were required to pay only half the premium, with Kilimo Salama's agribusiness partners paying the remaining half, making the insurance affordable for the wider population. In case of weather extremities, the farmers receive pay-outs via mobile transfer. Pay-outs are calculated based on data from solar-powered, local weather stations, which regularly update rainfall quantities and weather conditions near individual farms.

Results:

- farmers covered in 2009 (Year 1) = 200
- farmers covered in 2010 (Year 2) = 12 000

The success led Syngenta to launch a similar 'Kilimo Salama Plus' scheme that provided insurance for a variety of crops including wheat, beans, potatoes, and sorghum.

Sources: The World Bank Group. 2016.

- **Processor finance –** In this scheme, the financing body does not finance the primary producer. Instead, it lends monies to the processor who procures from the producers. The processor, with better risk-taking capacity, in turn finances the producers. This arrangement turns out advantageous for all the parties involved. For the bank, loaning to a processor is a safer bet than loaning to farmers, while the processor is in a better position to understand the exact requirements of the farmers (Miller and Jones, 2010).
- **Information and communication technology (ICT) tools –** Some ICT innovations include SMS messages via mobile phones to provide farmers with weather forecasts, government contacts, and information on recommended chemicals and pests (Miller, Saroja and Linder, 2013). Technology like the Local Language Speech Technology Initiative (LLSTI) can convert text-based information on crops, livestock, market prices, inputs, disease outbreaks, and weather reports into audio in local language (Miller, Saroja and Linder, 2013), which can be easily understood by even illiterate farmers.

- **Research and development –** Research and development can allow the user to understand the impact of climate change on agriculture and allied sectors, and enable them to find ways to adapt. For example, in the case of crops, varieties that are more tolerant to water stress can lower the risk of crop losses in case of insufficient rainfall (Dinesh *et al.*, eds., 2017). Similarly, in the case of livestock, it has been observed that certain cattle breeds in Brazil maintain a lower rectal temperature compared to others, a trait which could be crucial in improving heat tolerance, animal welfare and productivity in hot climates (Sarangi, 2018).
- **Infrastructure development –** Developing infrastructure in agriculture for climate change adaption consists of interventions that require the creation (or modification) of physical infrastructure. This can include the creation of water-saving structures like farm ponds and check dams, soil erosion control activities like farm bunds and afforestation (Sikka, Islam and Rao, 2016).

Case study X: watershed development in Satechiwadi, Maharashtra (India)

The Watershed Organization Trust (WOTR) is a non-profit organization that helps villages in India deal with water scarcity, using innovative social and technical interventions through a participatory approach. The organization is particularly known for its efforts in creating water storage structures like watersheds.

Satechiwadi is a small village at the foothills of the Sahyadri range in Ahmednagar district of Maharashtra. Due to its location on the leeward side, the village experiences low rainfall, averaging 450 mm, which usually falls in the months of June to November. As a result of water scarcity and poor quality of topsoil, many villagers were forced to abandon agriculture.

With the efforts of WOTR, a watershed was constructed to which resident villagers contributed with labour. Other interventions like farm bunding and drainage line treatments were undertaken simultaneously. The villagers were also taken on nearby exposure visits to witness the benefits of participatory watershed development.

Results:

- With availability of water throughout the year, post watershed development, Satechiwadi has moved from negligible agricultural involvement to full scale organic farming;
- The increase in yield has been to the tune of 50 percent to 100 percent for some crops, according to farmers;
- The majority of the farmers have switched to organic farming resulting in better price realization, as well as improved soil conditions; and
- The cropping pattern has changed, with farmers growing cash crops like tomatoes and onions. Previously, only crops such as pearl millet, sorghum, wheat and rice were sown due to water scarcity.

Source: Dasgupta, S. 2017.




Integrating agriculture in National Adaptation Plans

This publication was made possible by the Integrating Agriculture In National Adaptation Plans (NAP-Ag) Programme, led by the Food and Agriculture Organization of the United Nations and the United Nations Development Programme, with generous support from the International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The programme supports Least Developed Countries (LDCs) and developing countries to identify and integrate climate adaptation measures in the agriculture sectors (crops, livestock, forestry, fisheries and aquaculture) into relevant national planning and budgeting through the formulation and implementation of NAPs. The contents are the responsibility of the authors and do not reflect the views of the Food and Agriculture Organization of the United Nations, United Nations Development Programme, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) or UN Member States.

Food and Agriculture Organization of the United Nations
www.fao.org/in-action/naps
FAO-NAPs@fao.org | Julia.Wolf@fao.org

United Nations Development Programme
www.adaptation-undp.org/naps-agriculture
Rohini.Kohli@undp.org

Germany's Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)
www.bmu.de/en
International Climate Initiative (IKI)
www.international-climate-initiative.com

Supported by:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

based on a decision of the German Bundestag

ISBN 978-92-5-133192-7

9 789251 331927

CB0699EN/1/09.20