HELVETAS
Swiss Intercooperation

Guideline - Assessing Climate Risks and Vulnerabilities in Market Systems

Kathmandu and Zurich

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HELVETAS Swiss Intercooperation is a Swiss association devoted to development and cooperation. It works towards the elimination of the causes of marginalisation and promotes solidarity with the poor in the south and the east. Its mission is to actively contribute to the improvement of the living conditions of the economically and socially disadvantaged people in Asia, Africa, and Latin America. Currently, it runs programmes of co-operation in over 30 countries including Nepal.

Through publications, it contributes to the generation of knowledge and the process of learning through sharing on development and co-operation.

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Part I : Introduction and Concepts

Context

In recent years, the consideration of climate risks[1] in market systems development has gained increasing importance. The Stern Report[2] argues that "climate change is the greatest and widest-ranging market failure ever seen, as in most markets, the effect of this market dysfunction falls most on those least able to take action to escape its consequences".

While HELVETAS Swiss Intercooperation's rural economy programmes have been effective in reducing poverty, climate variability and change pose an increasing threat to the achieved development gains. Thus, there is an increasing awareness that for many contexts in which the organization works, applying a systematic risk and vulnerability approach is required to secure development gains due to climate variability and change. Considering this fact, HELVETAS Swiss Intercooperation started to systematically conduct climate risk and vulnerability assessments in market systems development projects. Examples where current and potential risks and vulnerabilities were analysed are the livestock project in Georgia (2012), the horticulture project in Armenia (2013) and the cacao project in Honduras (2013)[3] . As a result of these first experiences, HELVETAS Swiss Intercooperation country offices have shown increasing interest for a guideline on how to address climate risks and vulnerabilities in market systems and following a market systems development approach.

Box 1: Some Key Definitions

Market system: A multifunction, multi-player arrangement comprising the core function of exchange by which goods and services are delivered and the supporting functions and rules which are performed and shaped by a variety of market players (Springfield Centre 2015).

Market Systems Development/Making Markets Work for the Poor: A systemic approach that attempts to understand and overcome the failure of market systems to serve the needs of the poor. Contrary to projects with a direct approach, meaning that implementing agencies provide or support services directly to the poor, a market systems development approach considers projects as facilitators. Their role is to stimulate permanent actors to perform key functions in the system, creating benefits for the poor, which last beyond the project's end (Springfield Centre 2015).

Market system change: A change in the way core functions, supporting functions and rules perform, that ultimately improves the terms of participation of the poor within the market system (Springfield Centre 2015).

Value chain: Describes the full range of activities that are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use. This includes activities such as design, production, marketing, distribution and support services up to the final consumer (and often beyond, when recycling processes are taken into account). The term 'value chain' refers to the fact that value is added to preliminary products through combination with other resources. As the product passes through several stages of the value chain, the value of the product increases (ILO[4]).

Adaptation to climate change: In human systems, the process of adjustment to actual or expected climate and its effects, which seeks to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC 2014).

1 Risk is a combination of hazard, degree of exposure and vulnerability. The combination/overlap of these three defines the level of climate risk.
2 Stern Report (2006). The Economics of Climate Change.
3 The projects of Armenia and Georgia are financed by the Swiss Agency for Development and Cooperation; the one in Honduras by SECO and Chocolats Halba/Coop. The projects are implemented by HELVETAS Swiss Intercooperation alone or with partners.
4 Study on market system and disasters prepared by Action for Enterprise for SDC. Available at: http://www.actionforenterprise.org/drr1.pdf

Climate risk: Climate risk in agriculture represents the probability of a defined hydro-meteorological hazard affecting the livelihood of farmers, livestock herders, fishers and forest dwellers. Risk refers to a probability that can be estimated from prior information, while uncertainty applies to situations in which probability cannot be estimated (FAO 2013).

Climate resilient pathways: Climate-resilient pathways include strategies, choices and actions that reduce climate change and its impacts. They also include actions to assure that effective risk management and adaptation can be implemented and sustained (IPCC 2014).

Climate risk and vulnerability assessment: The systematic evaluation of risks associated with climate variability and change to development activities (IPCC 2014).

Disaster Risk Management aims to systematically avoid (prevent) and limit (prepare/mitigate) disaster risks with regard to loss in lives, social, economic and environmental assets of communities and countries. Disaster risk management is the application of policies, processes and actions to prevent new risks, reduce existing risks and manage residual risks contributing to the strengthening of resilience (UNISDR 2015).

Maladaptation: Actions that may lead to increased risk of adverse climate-related outcomes or increased vulnerability to climate change, now or in the future (IPCC 2014).

Source: HELVETAS Swiss Intercooperation (2016)

To the best of HELVETAS Swiss Intercooperation's knowledge, the projects in Georgia and Armenia were among the first explicit attempts to coherently integrate climate change and disaster risk management in market systems development. Although there have been various projects labelled as market systems development with adaptation to climate change and disaster risk management as crosscutting topics, they rather use a direct project approach, meaning that projects provide or support services directly to the poor and do not take on a "solely" facilitation role (c.f. Box 1 – key definitions). Moreover, actors involved in market development and/or climate change and disaster risk management projects are often functioning in individual realms with little knowledge sharing and collaboration[5].

Based on these first experiences from the risk and vulnerability assessments in different sub-sectors and countries, a methodology for integrating issues of climate risks and vulnerabilities into **market systems** was developed. It addresses the areas of climate risks, analysing their **systemic causes and possible responses** within the market systems. The methodology is presented in this Guideline.

The **direct outcome of the Guideline** is a set of possible adaptation to climate change and disaster risk management measures. Given the climate vulnerabilities in many developing countries and the fact that most poor communities are highly dependent on climate-sensitive sectors (e.g. agriculture, forestry), the present Guideline is an effective instrument to better understand how climate change already affects and will further impact different sub-sectors, what kind of **proactive, preventive or preparatory measures** can reduce risks and eventually contribute to climate resilient development; in other words, the Guideline is an **effective instrument to support the shift from a reactive to a proactive attitude.**

An important feature of the Guideline is that measures, both for adaptation to climate change and disaster risk management, are identified and implemented by market actors and not by projects. Further, climate risk and vulnerability assessment are applied to all functions in the market system that could face climate risks, not only at the production level which has been the main focus of attention in the past.

Ideally, risk analyses should be conducted in a systematic manner at an **early stage of designing and planning** in order to avoid unintended negative impacts on interventions (maladaptation) and eventually contribute to resilience and sustainability at the local level. Reality is often different and such analyses are often conducted at a later stage.

5 https://assets.helvetas.org/downloads/topicsheet_climatechange_01_en.pdf

Box 2: Four Key Facts About The Guideline

- **Demand-driven:** The Guideline was developed based on first hands-on experience in ongoing market system projects. Firstly, risk and vulnerability assessments in market systems were conducted. Recognizing the complexity of such risk and vulnerability analysis in market systems, project planners and managers within HELVETAS Swiss Intercooperation began asking how they could systematically integrate risk reduction and adaptation to climate change into market systems. The Guideline was developed to respond to this need.
- **Joint-effort:** The Guideline was developed by a pool of experts at the Advisory Service Department at HELVETAS Swiss Intercooperation in Switzerland and the country programme of Nepal.
- **Not a new tool, builds on existing approaches/tools:** It is important to underline that the Guideline is not a new tool, but builds on existing tools and approaches in adaptation to climate change and market system development. Thus, this Guideline supports practitioners interested in bringing these two approaches – market systems development and the adaptation process – together.
- **Flexible:** The Guideline allows practitioners to apply and adjust the Guideline to their local context and needs.

Source: HELVETAS Swiss Intercooperation (2016)

The Guideline was applied in Nepal in various sub-sectors (i.e. coffee, banana, sweet oranges, walnuts, macadamia, medicinal and aromatic plants, riverbed vegetables and charcoal), revised and adjusted based on the different field applications and now shared with a wider audience. The Guideline and the results from first applications in Nepal were presented in 2016 at a learning event on Integrating Disaster Risk Reduction into Market Systems in Switzerland organized by HELVETAS Swiss Intercooperation on behalf of the Swiss NGO DRR Platform. It was also introduced during a regional workshop on Climate Change and Value Chains in Ecuador, organized by the regional knowledge platform ASOCAM.

Relevance and Application of the Guideline

The **overall objective** of the present Guideline is to identify the most **climate-resilient sub-sectors** in a given context and to **determine the potential impacts and relevant measures in the field of adaptation to climate change and disaster risk management to further increase resilience in market systems.**

The Guideline can be applied in the following exemplary (not exclusive) cases:

- Actors identify best options for the selection of the most resilient sub-sectors.
- Actors adapt their involvement in a market system based on climate risk resilience.
- Actors determine options to make a sub-sector more climate resilient.
- Actors understand the impacts of climate change on natural resource based sub-sectors in the short term (1 to 5 years) and mid-term (6 to15 years).

It is important to underline that the Guideline is not a new tool, but builds on existing tools and approaches in adaptation to climate change and market systems development. Thus, this Guideline supports practitioners interested in bringing these two approaches – market systems development and the adaptation process – together. This also means that the present Guideline is not an introduction to climate change, disaster risk management or market system development. Concepts linked to these two approaches are hence not particularly explained in detail in this Guideline. For further clarity, the documents listed in Box 3 can be consulted (c.f. reference list at the end of the publication).

Box 3: Key References

Climate Change

- CRiSTAL - Community-based Risk Screening Tool, Adaptation and Livelihoods, especially the user's guide (iisd, IUCN, SEI, Intercooperation).
- The assessment reports of the Intergovernmental Panel on Climate Change, especially the 5th Assessment Report of Working Group II on Impacts, Adaptation and Vulnerability.
- CEDRIG - Climate, Environment and Disaster Risk Reduction Integration Guideline (SDC 2016).
- Guidance on Assessing Vulnerability, Impacts and Adaptation to Climate Change (PROVIA 2014).

Market Systems Development

- The Operational Guide for the Making Markets Work for the Poor Approach, 2nd Edition (Springfield Centre 2015).
- A Synthesis of the Making Markets Work for the Poor Approach (Springfield Centre 2008).
- Perspectives on the Making Markets Work for the Poor Approach (Springfield Centre 2015).
- Specific Market Systems Development Websites (Springfield Centre).

Source: HELVETAS Swiss Intercooperation (2016)

Target Audience of the Guideline

The Guideline shall **help (small-scale) businesses, both private and public, in better understanding climate risks and opportunities in their sub-sector,** in identifying where emerging market opportunities exist and developing a comprehensive climate risk management approach that shall be part of the enterprise.

The main **causality of change** is that all actors involved in the market system (governmental, non-governmental and private sectors) shift from a reactive to a proactive attitude towards **an integrative management of climate risks with a long-term perspective** by using prevention, preparedness and adaptation measures (short to long-term). This implies that they have a better understanding about adaptation to climate change and disaster risk management. Moreover, the involved actors in the market system not only contribute **in economic terms, but do not cause any harm to the environment through unsustainable practices** (e.g. increased use of fertilizers and pesticides).

The Guideline has particularly been elaborated for **natural resource-based market systems,** but can of course be applied and adopted to other sectors and contexts. Moreover, the Guideline has a particular focus on **climate-related risks and vulnerabilities** due to the fact that climate-related risks have particular negative impacts on natural resource-based market systems (c.f. scope of risks in Annex 1). We recognize that there are other drivers of risks too, such as financial or market related. However, other tools exist to tackle them.

Climate Change and Natural Resource-Based Market Systems

A market system is built up of varied sets of functions (core, rules and supporting) undertaken by different players (private sector, government, representative organisations and civil society). The core functions, or the value chain, are located at the centre of the system. These core functions expressing transactions (i.e. demand and supply of goods and services) are dependent on and influenced by a number of support functions and rules and regulations.

Climate change and climate variability is one such influencing function which has become over the past decade an increasing threat to natural resource-based market systems. Natural systems are extremely vulnerable to climate change and variability. This is particularly the case for **agriculture** as it depends on natural weather conditions. Farmers have to cope with changes that occur from one year to the next (climate variability) and with long-term trends such as progressive drying or warming trends (climate change), causing shifting boundaries in the agro-ecological zoning.

Throughout history, people have had to adjust to climate variability and cope with climatic extremes. However, data indicates that there is an increase in the unpredictability of events such as changes in the distribution and quantity of rainfall and changes in temperature and extremes in different parts of the world. In other words, the increase of variability in climate – shortened rainy season, irregular rainfall, lack of rainfall during the rainy season, heavy rainfall within a few days, changes in temperature and heat waves – occurring today is expected to accelerate further. In addition to the increase in frequency and intensity of extreme events, there are also long-term changes in temperature and precipitation.

According to the 5th Assessment Report of the Intergovernmental Panel on Climate Change, *'major future rural impacts expected are linked to food security, agricultural incomes, including shifts in production areas of food and non-food crops across the world'* (IPCC 2014).

While long-term trends (in temperature or precipitation) are important, it is increasingly realised that seasonal variability and extremes have a larger effect on agriculture. Crops are highly sensitive to extreme daytime temperatures of 30°C or above. If high temperatures occur at a critical moment of plant development, the results can be devastating. Higher temperatures eventually reduce yields of desirable crops while encouraging weed and pest proliferation. Similarly, changes in precipitation patterns increase the likelihood of short-run crop failures and long-run production declines and lower incomes in vulnerable areas. For further information on climate change and agriculture, see HELVETAS Swiss Intercooperation topic sheet *Climate Change and Agriculture*[6].

To conclude, many small-scale producers are already coping with degraded and weakened natural resource systems. They often lack knowledge about potential options for adapting their production systems and have limited assets and risk-taking capacity to access and use technologies and financial services. It is therefore important to **apply a climate risk and vulnerability approach in natural resource-based market systems** and hence to take **proactive and planned** rather than reactive actions. This will contribute in the long-term to climate resilient market systems. Adapting to climate change is unavoidable and hence limiting the effects of climate change is imperative for sustainable development.

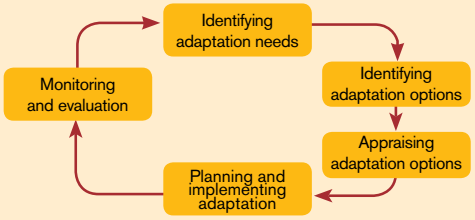
6 https://assets.helvetas.org/downloads/topicsheet_climatechange_01_en.pdf

The Guideline at a Glance

The Guideline combines two approaches:

- The adaptation process
- The market systems development project cycle

Figure 1: Adaptation Process and the Market System Development Project Cycle

	Adaptation to Climate Change Process	Market Systems Development Project Cycle
Approach	 The present adaptation to climate change process is based on the OECD guidelines "mainstreaming adaptation to climate change in development cooperation" (2008) and the PROVIA's guideline on assessing vulnerability, impacts and adaptation to climate change (2014).	
Tools[7]	• CRiSTAL (Community-based Risk Screening Tool, Adaptation and Livelihoods • CEDRIG (Climate, Environment and Disaster Risk Reduction Integration Guideline) • PROVIA (Guideline on Assessing Vulnerability, Impacts and Adaptation to Climate Change) • Participatory Appraisal Tools	Market systems development provides an overall framework in which various tools can be applied. More information can be found in the Operational Guide[8]
Phases	• Identify the adaptation needs - risk and vulnerability assessment • Identify adaptation to climate change/ disaster risk management options • Prioritise and choose the best adaptation to climate change/ disaster risk management measures and integrate them in the logframe[9] • Plan and implement adaptation to climate change/ disaster risk management measures • Develop a monitoring and evaluation system or add monitoring and evaluation indicators to the existing one.	• Setting the strategic framework • Understanding market systems • Setting the vision • Facilitating systemic change • Measuring results

Source: HELVETAS Swiss Intercooperation (2016)

7 Only the risk and vulnerability tools which are particularly used by HELVETAS Swiss Intercooperation are listed here.

8 https://beamexchange.org/resources/167/

9 Integrating the disaster risk reduction and adaptation to climate change measures directly in the logframe is an additional step which has been conducted by HELVETAS Swiss Intercooperation.

This joint approach leads to the following two modules A and B with a series of eight steps:

MODULE A) Risk and Vulnerability Assessment of Sub-Sectors and their Prioritisation at the Design and Planning Stage

1. Map core functions, support functions and roles/regulations in the selected market system
2. Identify current and potential future hazards, impacts and current coping strategies
3. Identify vulnerability of each function to climate risks
4. Identify most resilient sub-sectors based on a scoring matrix'

MODULE B) Identification and Implementation of Climate Adaptation and Disaster Risk Management Measures

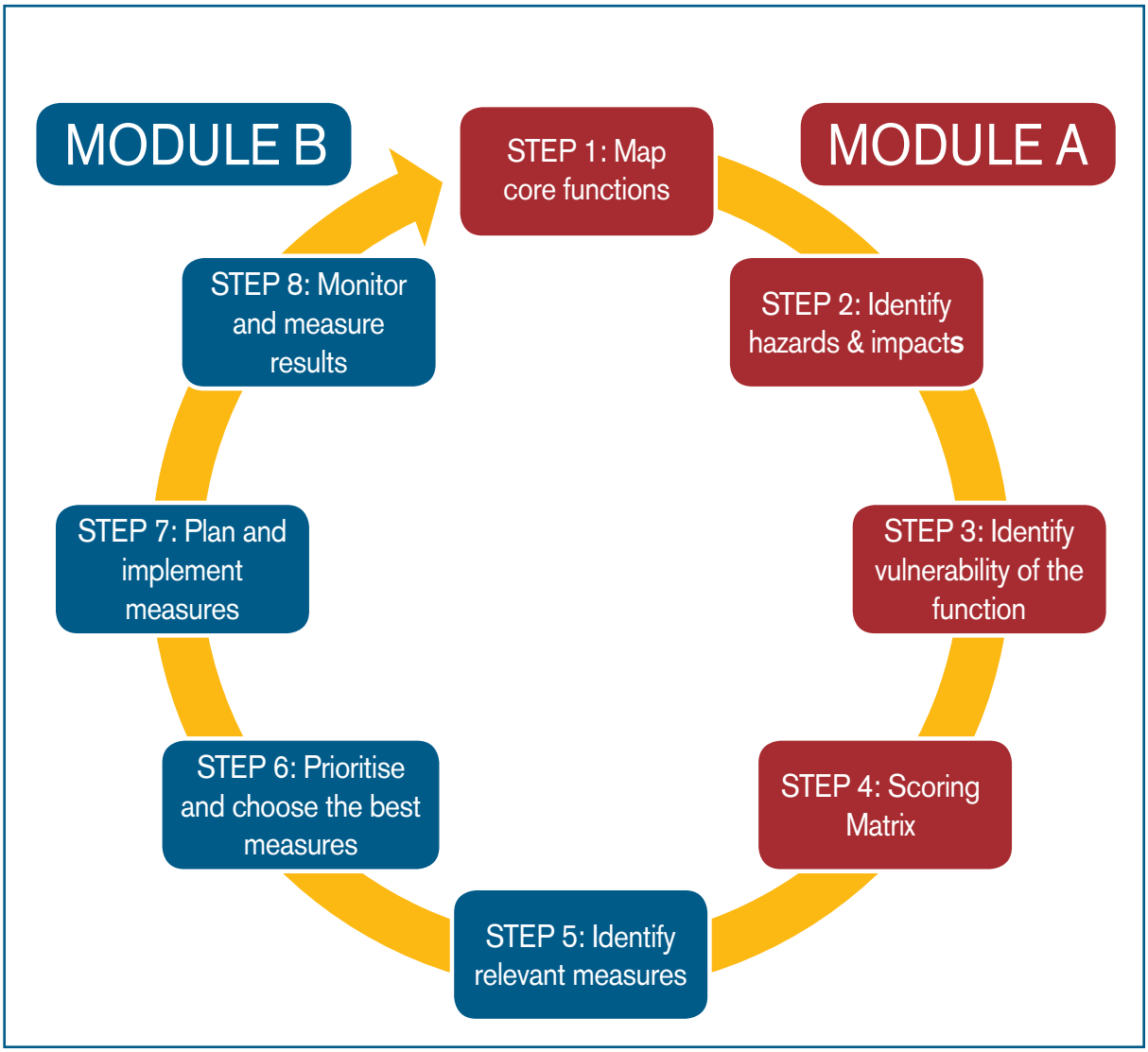
5. Identify possible climate adaptation and disaster risk management measures
6. Prioritise and choose the best/most appropriate measures
7. Plan and implement the selected measures
8. Monitor and measure results

MODULE A launches an analysis of the wider and broader market system that contains a value chain, i.e. the core functions of a market system. This is then followed by an analysis of the different functions and their vulnerability to current and potential climate risks. In case several sub-sectors are assessed, the most resilient systems with highest economic growth potential, poverty relevance and most resilient to climate change can be identified. With the support of **MODULE B,** most appropriate measures for adapting to climate change and managing disaster risk will be identified, resulting in increased climate resilience of the sub-sector in a given context.

The approach follows **the logical coherence of a systemic approach to development** trying to find **systemic causes of market failure.** In particular when it comes to defining the intervention, the activities have to be selected and formulated so that the actors within the system implement them and the project only facilitates and does not intervene directly. It is also important to underline that these selected measures shall not be stand-alone interventions, but well embedded and in line with the ongoing activities of the project/programme.

The Guideline shall take users through a series of steps in a systematic way with the overall goal to identify a set of adaptation and disaster risk management options. The information needed for the analyses relies on a combination of **primary information** gathered through participatory methods (such as stakeholder consultations and project team discussions) and **secondary information gathered through desk-based research.** In particular, when it comes to climate change and potential future trends, it is important to use secondary data at the national and/or regional level to ensure that potential future trends are considered in the analysis. In reality the adaptation process may not be linear, but will rather require refinement through iteration.

Figure 2: 8-STEP Approach Towards Climate Risk Resilient Sub-Sectors



Source: HELVETAS Swiss Intercooperation (2016)

Part II : The Guideline - 8-STEP Approach Towards Climate Risk Resilient Sub-Sectors

The 8 steps shall be conducted in a **participatory manner** where staff and key actors involved in the market system shall participate where appropriate. It is important to note that this is not a linear process, but may be organised in an iterative manner based on the established information.

From the first applications, we do **not recommend working directly** with the **tables** presented for each step **in the field,** rather to keep them in mind and ask the necessary questions to fill in the information afterwards. Depending on the stakeholders involved, it might be recommended to do the exercises not in one go, but throughout a time period of several weeks. It is also not recommended to conduct all the different activities with all the stakeholders; it might make sense to do certain activities with some selected key informants. However, it is not possible to generalise when to use which group of stakeholders, this highly depends from project to project and its context. In certain cases, it also makes sense to consider secondary data information.

Each step described in the present Guideline consists of a **short introduction** with the **objective** followed by a **description of the Instructions.** Reference in regard to time is also given; however, here again this highly depends on the context. For reference and support, **a complete analysis of the coffee sub-sector in Nepal,** where the eight steps were followed, can be found in Annex 2. In all steps, it is indicated with whom the activity has been conducted.

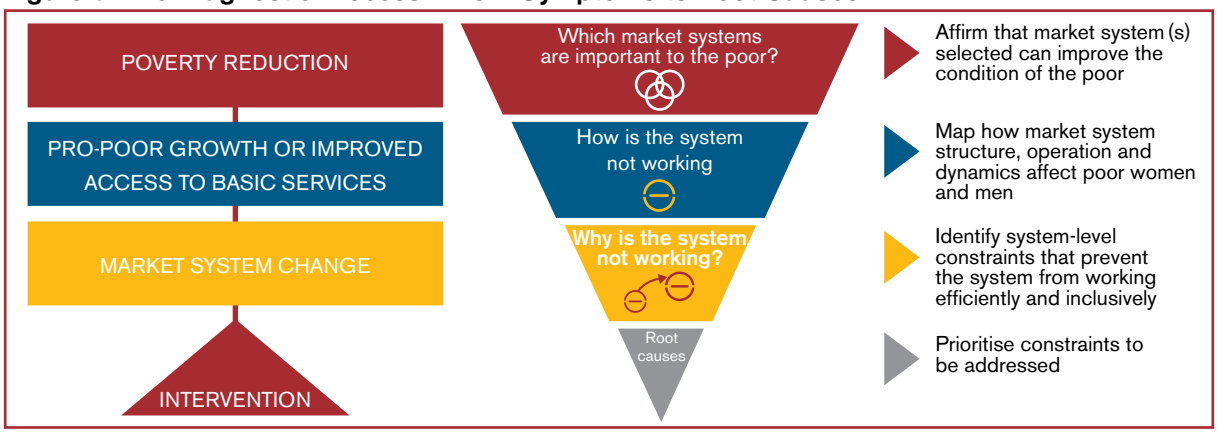
When it comes to the **time dimension,** we recommend considering a time horizon from short - (1 to 5 years) to mid-term (6 to 15 years) when conducting the different assessments. However, some measures identified can of course have long-term impacts.

MODULE A Risk and Vulnerability Assessment of Sub-Sectors and Their Prioritisation

STEP 1: Map Core Functions, Support Functions and Roles/Regulations in the Selected Market System

As said earlier, a market system is built up of different functions with the core functions, or the value chain, at the centre. These core functions expressing transactions (i.e. demand and supply of goods and services) are dependent on and influenced by a number of support functions and the rules and regulations. The proper understanding of the different functions and their interaction support the identification of root causes for market failures, which is at the heart of the market systems development approach. This approach therefore proposes a diagnostic process that is illustrated in the triangle diagram **from symptoms to root causes** (Figure 3).

Figure 3: The Diagnostic Process - From Symptoms to Root Causes



Source: The Operational Guide for Making Markets Work for the Poor Approach (2014)

STEP 1 analyses the core functions, support functions and roles/regulations in the selected market system.

Objective: To understand the relevant functions in a market system and how the system is working

Time requirement: Three to four hours if the team has already an in-depth understanding; if this not the case, more time is needed.

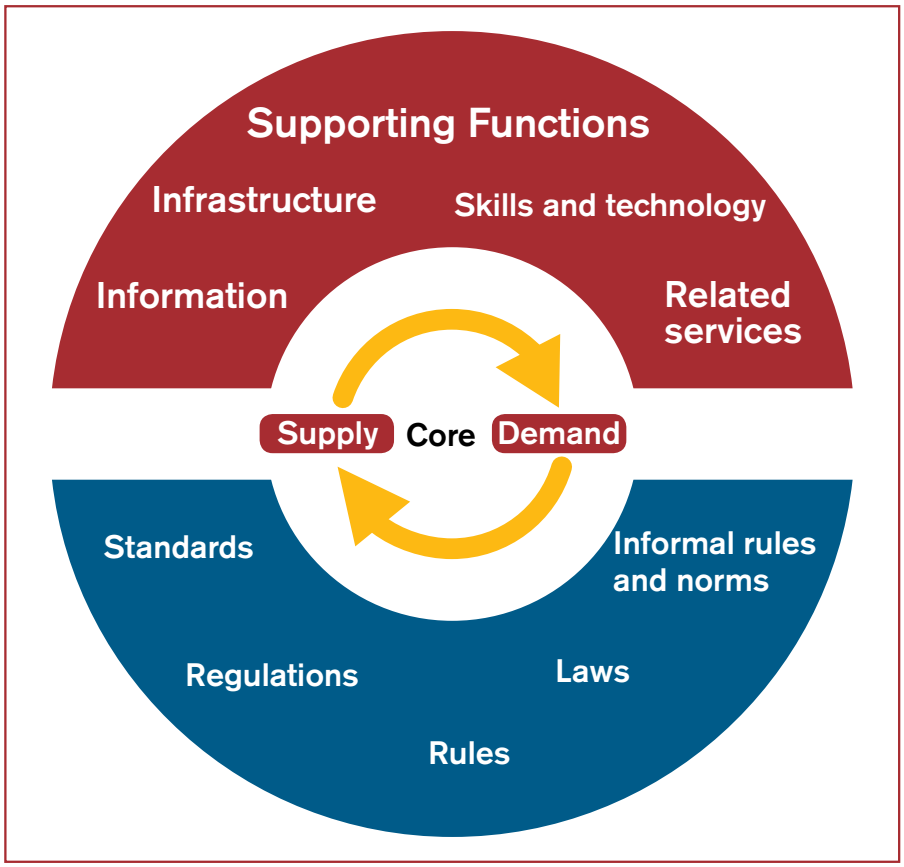
Instructions:

1. Identify within the selected market system the **relevant functions** including **core functions** (i.e. value chain), **support functions** and **relevant rules/regulations.**
2. Map them in the form of a graphic representation of a market system-a 'doughnut' (see Figure 4).

This could be done in the form of workshops and meetings with relevant stakeholders, key informants and key actors in the system. As this is a crucial step, it is important to take enough time for this process. Existing market systems analyses can be used directly and only need to be updated to ensure latest information.

For further information on market systems analysis, see the operational guide for making markets work for the poor.

Figure 4: The Market System Presented as "Doughnut"



Source: The Operational Guide for Making Markets Work for the Poor Approach (2014)

STEP 2: Identify Current and Future Hazards, Impacts and Current Coping Strategies

Climate risks, as shown above, have major impacts on natural resources including market systems. For this reason, it is important to identify both current and potential future hazards and their impacts to better understand what the adaptation needs are in the selected market system. Risk and vulnerability assessments are the first step towards planned adaptation and disaster risk management.

STEP 2 includes the following analyses:

- Identification and prioritisation of current and future hazards in the market system (STEP 2a, Table 1);
- Detailed climate risk analysis (STEP 2b, Table 2);
- Optimal activity related to hazard and crop seasonal calendars (STEP 2c, Table 3).

Objective: To identify **current and future hazards, impacts** and **current coping strategies** applied by the community members together with the producers and the communities.

STEP 2a: Identification and prioritisation of current and future climate relevant hazards in the market system

Regarding the identification of current and future hazards, particular attention needs to be paid to the fact that it is likely that a particular hazard may appear to have no immediate negative impacts and therefore assessed as 'irrelevant'. However, it could have significant impact in the future. For example increased dry climate may not appear to be of immediate threat but could result in forest fires in the future.

Therefore, in STEP 2a and 2b, particular attention needs to be given to possible potential impacts. Secondary information from scientific sources can be useful, especially studies on future impacts (impact studies) relevant for your location and/or sectors.

Objective: To identify the main **current and future hazards affecting the market system.**

Time requirement: Two to three hours

Instructions:

1. List all **possible hazards occurring in the market system** (c.f. Table 1 might be helpful for identifying and organizing the different types of hazards).
2. Discuss in your group which **hazard** has an **influence** in any part of the market system. Ensure that your discussion includes all functions in the **market system.**
3. Based on literature and expert knowledge, **rate the relevant hazard types** using the following ranking and mention whether it is a **current and/or potential hazard**.

0 = not relevant	1 = lowest priority	2 = medium priority	3 = highest priority

4. The **highest ranked hazards** serve as basis for further discussions with various stakeholders for further **prioritisation** according to their knowledge. Their prioritisation is then added in another column (see Table 1).
5. Mark the **hazards** with the **highest score** (look at all columns) and transfer them to Table 2.

Table 1: Identification of Most Relevant Hazards in the Market System

Hazard Type	Hazard Sub Type	Specific Hazard			Prioritisation			
					Facilitator	Group 1	Group 2	Group 3
Natural	Meteorological	Changing temperature						
		Changing humidity						
		Storm	Tropical storm					
			Extra-tropical storm					
			Convective storm	Derecho				
				Hail				
				Lightning/thunderstorm				
				Rain				
				Tornado				
				Sand/dust storm				
				Winter storm/blizzard				
				Storm surge				
				Wind				
		Extreme Temperature	Cold wave					
			Heat Wave					
			Severe winter condi-tions	Snow/ice				
				Frost/freeze				
		Fog						
	Hydrological	Flood	Coastal flood					
			Riverine flood					
			Flash flood					
			Ice jam flood					
		Landslide	Avalanche (snow, debris, mud-flow, rock fall)					
		Wave action	Rogue wave					
			Seiche					
	Climatological	Drought	Drought					
		Glacial lake outburst						
		Wildfire	Forest fires					
			Land fire: brush, bush, pasture					
	Biological	Epidemic	Viral diseases					
			Bacterial diseases					
			Parasitic diseases					
			Fungal diseases					
			Prion diseases					
		Insect infestation	Locust/Grasshopper/Other insects					
		Animal accident						

Source: HELVETAS Swiss Intercooperation (2016) based and adapted from the disaster classification EMDAT

Explanation

Prioritisation: 0 = not relevant; 1 = lowest priority; 2 = medium priority; 3 = highest priority;
C = current; P = potential

Practical recommendations by the authors: While testing the Guideline, the initial prioritisation was done by the facilitator followed by discussions with three different stakeholder groups, i.e. coffee promotion team of HELVETAS Swiss Intercooperation, members of a coffee cooperative and representatives of a district coffee cooperative union) (c.f. Group 1, Group 2 and Group 3 in Table 1).

STEP 2b: Detailed risk assessment[10]

Objective: Identify the **impacts of each hazard** in terms of frequency and intensity and the corresponding coping strategy applied by the community.

Time requirement: Three to four hours

Instructions:

1. Discuss the **frequency and intensity** of each hazard
2. Discuss observed **trends**
3. Discuss how the **hazard will change under climate change** (anticipated changes in frequency and intensity)
4. Identify the **various impacts** each hazard has on **different aspects of the market system.** From the list of impacts, select the three most important impacts per hazard.
5. Identify the **current coping strategies** implemented by the community

10 http://www.emdat.be/guidelines

Table 2: Detailed Risk Assessment - Identification of Major Hazards, Impacts and Coping Strategies

Hazards	Intensity[1]	Frequency[2]	Observed Trends[3]	Future Trends[4] Possible Evolution Under Climate Change	Impacts	Severity[5] (expressed in % and indicating which part of the market system is affected)	Current Coping Strategies	Is the strategy sustainable? If not , why?

Source: Modified by HELVETAS Swiss Intercooperation from the CRiSTAL tool

Explanation

[1] Frequency: How often does a hazard occur (e.g. once or more a year, every 2-4 years, every 10 years, less frequent)?
[2] Intensity: How "strong" is the hazard when it occurs (e.g. low, medium, high, very high)?
[3] Observed Trends: Do the community members observe a change? Is there a trend?
[4] Future trends: Is there a trend in observations? In addition to the observations of community members, information gathering from scientific sources is recommended.
[5] Severity can be determined through criteria such as: type of impact and degree of losses, % of district affected, damage of physical facilities, damage by geographical coverage and social impact as a result of disaster/hazards.

STEP 2c: Comparison of hazard and crop calendars (additional activity)

Objective: To identify critical months where the market system can be disrupted due to the occurrence of a hazard.

Time requirement: One hour

Instructions:

1. Use the lists of hazards identified in Table 1.
2. The participants shall then indicate **when** the **hazards occur and their intensity** (normal/very heavy).

x = normal	xx = (very) heavy

3. Identify **key moments** in the **value chain** and allocate it to **specific months** such as: seeding period, harvesting period, pests and diseases, market arrivals, processing, transportation and consumption.
4. When the two calendars are completed, **compare** the **hazard calendar** with the **crop calendar** and **identify the critical/risky periods** during the year.
5. **Compare** the **critical periods** with other important **market functions.**

Table 3: Hazard and Crop Seasonal Calendar

Hazard	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar												

Crop Seasonal Calendar	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar												

Source: Modified by HELVETAS Swiss Intercooperation from Participatory Appraisal Tools

STEP 3: Identify the Vulnerability of Each Function to Climate Risks

Market systems functions are affected by a multitude of impacts: economic impacts may lead to changing prices, increased demand, changing tariffs; political impacts may change rules; whereas environmental impacts may change the production and the processing environment as well as influencing prices. Climate risks are included in these environmental impacts and may have either a positive or a negative impact on different market systems functions: increased temperatures may lead to an expansion of suitable production areas, change suitability of a processing methodology, reduce productivity of a plant or increase in precipitation may lead to yield losses, or the introduction of different crops more tolerant to floods.

Table 4: Relevant Questions for the Analysis of the Market System (STEP 1)

Market Systems Analysis
What is the **core transaction** (value chain stages)?
What are the **relevant supporting functions** and rules?
Who are the relevant players performing **functions/setting rules**?
Which **supporting functions and rules** hinder the system from working for the poor the most?

Source: The Operational Guide for the Making Markets Work for the Poor Approach (2014)

Now in STEP 3, each function will be evaluated on its vulnerability to climate risks.

Objective: To understand the potential impact of anticipated climate risks on a market system.

Time requirement: Two hours

Instructions:

1. List all climate risk relevant market functions as shown in Table 5 below.
2. Identify the **relevant climate risks** (hazards) and add some **remarks on the impacts** (e.g. observations regarding impacts in the past.)

Table 5: Determine Climate Risk Relevant Functions

Climate Risk Relevant Market Functions (see STEP 1)		Relevant Climate Risk (hazard) (see STEP 2)	Remarks on Impacts
Core			
Support			
Rules/ Regulations			

Source: Modified by HELVETAS Swiss Intercooperation from the Operational Guide for the Making Markets Work for the Poor Approach 2014

Repeat STEP 1 and 3 if you have several sub-sectors. In case you have one sub-sector, but in different regions, it is important to conduct STEP 2 for all geographical regions as local conditions may differ.

STEP 4: Identify Most Resilient Sub-Sectors Based on a Scoring Matrix

The scoring matrix shall be conducted for all possible sub-sectors under discussion. Going through the analysis allows you to understand better the different impacts each sub-sector has on poverty reduction, **economic outcomes** and **achieving systemic change,** but also how the sub-sector is affected by the changing climate.

Objective: Identify the most climate resilient sub-sectors.

Time requirement: Two hours

Instructions:

1. Rank the **potential** of **each sub-sector** relative to the other sub-sectors using the following criteria:

1= lowest	2= second lowest	3= second highest	4= highest

2. Optional: Additional categories with criteria can be added, for instance, if more emphasis is required on the ecological dimension.
3. **Add up all of the scores** for each sub-sector **and enter the number** in the corresponding box on the total score row.

Table 6: Scoring Matrix

Category	Criteria	(Weighting)	Sub-Sector		Remarks
			Sub-Sector A	Sub-Sector B	
Poverty Reduction Potential	Number of households engaged in the sector				
	Severity of poverty facing those engaged in the sector				
	Potential for participation of women in the sector				
	Potential for participation of youth in the sector				
	Possibility for the target group to improve income / access to jobs				
Economic Growth Potential	Previous growth trajectory (last 5 years)				
	Forecast for growth in the next 5 - 10 years				
	Import substitution potential				
	Export potential				
	Level of competitiveness				
Potential to facilitate systemic change	Level of consistency with public/national priorities, government interest				
	Private sector interest				
	Presence of potential lead firms				
	Availability of partners/champions with leverage				
	Availability and capacity of service providers				
Climate change	Negative impacts of future climate trends				
	Positive impacts of future climate trends				
	Likely investment costs in risk reduction relative to actors' annual income and capital stock				
	Investment horizon: by when are the climate impacts expected to be felt? By when should the risk reduction or adaptation investments be made? How long are the benefits expected to last?				
	Flexibility: is the option flexible (does it allow for switching to other alternatives that might be preferable in the future once more is known about the changing climate)				
Further considerations					
TOTAL					

Source: Modified by HELVETAS Swiss Intercooperation from the Operational Guide Making Markets Work for the Poor Approach (2014)

Practical recommendations by the authors: Although most of the scoring matrix use a weighing factor, we have decided not to do so for this analysis, as we do not want to influence the analysis by giving priority to certain criteria.

Once the analysis has been done and the scores are given for each sub-sector, it is important to discuss the final result among the participants and decide if the sub-sector with the highest score is really the most adequate for implementation when it comes to poverty reduction.

Once it becomes clear from the scoring matrix which sub-sectors are most sound, both from an economic and a climate perspective, **move on to MODULE B** where you identify, Prioritise and implement the most appropriate and efficient adaptation to climate change and disaster risk management measures.

MODULE B – Identification and Implementation of Climate Adaptation and Disaster Risk Management Measures

STEP 5: Identify Possible Adaptation to Climate Change and Disaster Risk Management Measures

Having selected the most promising sub-sectors in MODULE A, now in MODULE B the most appropriate climate adaptation and risk management measures shall be identified, implemented and measured.

In STEP 5, all possible options shall be identified, independent of cost and feasibility. Do also think about options to be implemented by private and public actors. Remember that the project shall only facilitate these options as explained earlier. It is also highly recommended to analyse the motivation of the private and public actors to implement these measures; otherwise, there is a risk of undermining sustainability. In other words, the purpose is to brainstorm and identify all possible actions. In the next step, climate adaptation and disaster risk management measures will be Prioritised (based on a set of criteria) and the most suitable measures chosen.

Objective: Identify all options for climate adaptation and disaster risk management.

Time requirement: Two to three hours

Instructions:

1. Take the results of the risk assessment (STEP 3) and add an additional column for possible adaptation to climate change and disaster risk management options (see Table 7).
2. Brainstorm to **identify all possible types** of **climate adaptation** and **disaster risk management options.** This step should include all actors that may be implementing the selected adaptation measures.

Table 7: Identify Climate Adaptation and Disaster Risk Management Options

Climate Risk Relevant Market Functions (see STEP 1)	Relevant Climate Hazards (see STEP 2)	Remarks on Impacts	Climate Adaptation and Disaster Risk Management Measures
Core	Transferred from STEP 3, Table 5		☐
			☐
			☐
Support			☐
Rules/ Regulations		-	☐

Source: Modified by HELVETAS Swiss Intercooperation from the Operational Guide Making Markets Work for the Poor Approach (2014)

Box 4: Selection of Adaptation Options

It is important to underline that **climate adaptation is place and context specific** and no single adaptation strategy will meet the needs of all communities in one particular region. There might be options that work in one location but not necessarily in another.

In Annex 3, there is a summary table of some adaptation options related to practices in the field of agriculture, livestock, agroforestry and water management. Some of the measures in the table such as the research and introduction of new varieties require some long-term investment and ownership by national entities. When it comes to longer-term measures, it is also important to think in terms of new and/or adjusted legislation and policies (transformational adaptation).

Last but not least, although adaptation measures in agriculture and livestock help farmers to improve their livelihoods by reducing their vulnerability to climate variability, it is always linked to uncertainty and risk, even when good management practices are implemented. Events such as climatic hazards (e.g. droughts, floods, hail and frost) and the spreading of diseases and pests can cause immense crop failure, livestock mortality and loss of incomes of small-holder farmers. As climate is expected to increase the frequency and intensity of climatic hazards, **risk insurance** has become a potential option to reduce the impacts of such catastrophic events.

In Bolivia, for instance, in a disaster risk and adaptation programme (financed by the Swiss Agency for Development and Cooperation) HELVETAS Swiss Intercooperation has introduced some micro-insurance schemes. Farmers growing potatoes in the highlands, implemented improved management practices and were compensated for their losses due to extreme climatic events. As a result, about 50 percent of the participating farmers were able to improve their incomes[11].

The following references of adaptation options will also be useful:

- Climate Change Policy 2011
- Local Adaptation Plan of Action Framework 2011
- National Adaptation Programme of Action 2010
- United Nations Framework Convention on Climate Change:
  - Local coping strategies database[12]
  - Database for ecosystem-based approaches[13]
- CEDRIG (page 28 onward)[14]
- World Overview of Conservation Approaches and Technologies (WOCAT)[15]

Source: HELVETAS Swiss Intercooperation (2016)

11 For more information, see: Topic sheet on climate change and agriculture at https://www.helvetas.org/search.cfm?uXnavID=1243&uSearchterm=climate+change+and+agriculture#downloads or http://www.rrd.com.bo/
12 https://unfccc.int/adaptation/knowledge_resources/databases/items/6996txt.php
13 https://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/6227.php
14 https://www.shareweb.ch/site/Disaster-Resilience/Tools-Training/Documents/52_CEDRIG_Part_II_Handbook_EN_Print.pdf
15 www.wocat.net

STEP 6: Prioritise and Choose the Best/Most Appropriate Measures

After the brainstorming of possible measures, STEP 6 identifies and chooses the most promising measures in the field of adaptation to climate change and disaster risk management.

STEP 6 consists of the following analyses:

- STEP 6a: the process of prioritizing the most appropriate climate adaptation and disaster risk management measures; and
- STEP 6b: the analysis of the selected measures in the market system. In other words, to take the decision on which measures to finally take and hence to implement.

STEP 6a: Prioritisation of adaptation to climate change and disaster risk management options

For the prioritisation, a set of criteria shall support you in this process. You are free to add other criteria and/or replace the proposed ones.

Objective: Select the best/most appropriate measures in climate adaptation and disaster risk management based on a set of criteria and an analysis of the market system.

Time requirement: One and a half hours

Instructions:

1. Use Table 8 with suggested criteria to **identify the most promising measures** in the field of climate adaptation and disaster risk management.
2. Discuss in your group if you agree with the **suggested criteria** or if you would like to delete/add other criteria
3. Take each option and **analyse** it according to the criteria by **giving the following score**:

0= not effective	1= effective	2= very effective

4. **Options with highest scores** in all criteria shall be preferred.

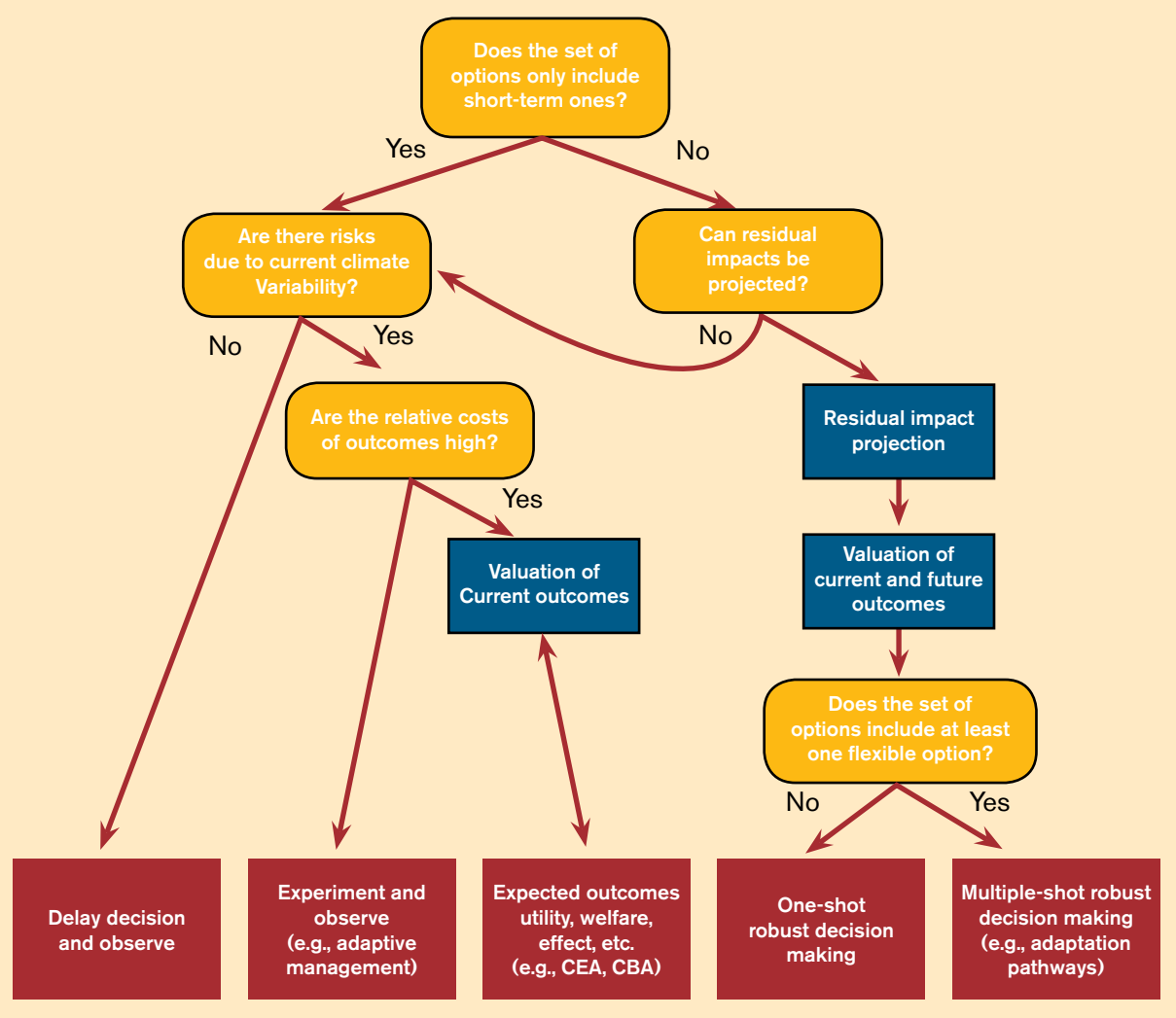
Table 8: Prioritisation of Most Appropriate Climate Adaptation and Disaster Risk Management Measures

	Effectiveness in Enhancing Resilience	Cost	Feasibility	Sustainability	Further Criterion?	Overall Evaluation (total)
Transferred from STEP 5, Table 7 → Possible adaptation and risk management options	*Explain how effective the option is enhancing resilience and score with (0) not effective, (1) effective, (2) very effective*	*Explain how costly the option is and score with (0) high cost (1) medium cost (2) low cost*	*Explain how feasible the option is to implement and score with (0) not feasible (1) feasible (2)very feasible*	*Explain how sustainable the option is and score with (0) low (1) medium (2) high*	*Explain and score the options to the criterion of your choice accordingly*	*Make an overall assessment of the option with regard to the outcome of the criteria scoring. Cost/benefit shall be taken into consideration*

Source: CEDRIG Handbook (2012)

Figure 5 might be helpful in the prioritisation process of climate adaptation and disaster risk management measures in order to have more clarity on the type of options (short-term versus long-term option).

Figure 5: Choosing Climate Adaptation and Disaster Risk Management Measures



Source: PROVIA Guideline on Assessing Vulnerability, Impacts and Climate Adaptation (2014)

STEP 6b: Analysis of the selected measures in the market system

After prioritising the most promising adaptation to climate change and disaster risk management options, it is important to reflect each option in the market systems analysis (i.e. in the Doughnut). This helps to see where the potential measures fit into supporting functions and rules that have already been identified in the market system; and where the identified options call for specific supporting functions and rules.

We highly recommend that this analysis is done for each potential measure or for a particular group of measures sharing the same characteristics.

Objective: Identify the specific supporting functions and rules.

Time requirement: Two hours

Instructions:

1. Use the following 'doughnut' analysis of STEP 1 where you identified the specific supporting functions and rules.
2. Take a **selected measure** and relate it to your **market system** and ensure that it responds to the needs identified in the market analysis in STEP 1.

STEP 7: Plan and Implement Selected Measures

After having identified the best climate adaptation and disaster risk management measures, an **action plan** on "how to implement these measures" needs to be developed. As mentioned at the beginning, actor engagement is crucial. At this particular stage, **agreement on roles and responsibilities** is key and fundamental for successful implementation. This agreement should be led further by a complete understanding of incentives to implement the measures to foster long-term sustainability. This assessment should be guided by the **sustainability matrix** and the **corresponding questions 'who does what and who pays'** (Table 9).

Objective: Get agreement on the roles and responsibilities for the identified measures in climate adaptation and disaster risk management.

Time requirement: Two hours

Instructions:

1. Take the functions from the market systems analysis from STEP 5, Table 7; use only the measures with the highest score.
2. Fill out the table by **answering the questions.** Ideally, make the **distinction** between **immediate** and **long-term measures.**

Table 9: Sustainability Matrix (Action Plan)

Functions	Activities to Implement Climate Adaptation and Disaster Risk Management Measures	Immediate		Long-term		Necessary Interventions (including actors)
		Who will do it?	Who will pay?	Who will do it?	Who will pay?	
Transferred from STEP 5, Table 7 → Possible Climate adaptation and risk management options	Transferred from STEP 5, Table 7 → Possible adaptation and risk management options					

Source: Modified by HELVETAS Swiss Intercooperation from the Operational Guide for the Making Markets Work for the Poor Approach (2014)

STEP 8: Monitor and Measure Results

Monitoring and results measurement is key to successful market systems development projects. To identify results that are sustainable and scalable a functioning monitoring and results measurement system is required. This system is critical to effectively and efficiently manage projects. It provides important evidence with regard to what works and what does not, which supports decision making in facilitating changes. In other words, the system helps projects answer the question: **Are events unfolding in the way that projects assumed they would?**

In the climate context, monitoring and measuring results is critical. Monitoring and evaluation has two main purposes: to **assess if the process goes as planned** and to **review the effectiveness of the measures.** This gives a clear understanding of what works and what does not. As adaptation is often planned amid uncertainty and with incomplete knowledge, it is crucial to monitor adaptation activities as they are implemented and make adjustments if necessary (adaptive learning). This also gives space for identifying good practices and measures that are suitable for scaling up and/or if new strategies are necessary to include.

In adaptation to climate change, the State has hence an important role in monitoring impacts, especially when it comes to mid- and long-term measures. Therefore, the establishment of a monitoring and evaluation system and its indicators should be a joint effort of governments, project implementers and donors.

Box 5: Monitoring and Evaluating Climate Measures

When it comes to the development of an adaptation-relevant monitoring and evaluation system, the following steps are widely acknowledged and applied:

- **STEP 1:** Define the adaptation context – vulnerability, impacts and adaptation tools (e.g. present Guideline);
- **STEP 2:** Identify factors that contribute to adaptation: capacities, adaptation actions and sustainable development;
- **STEP 3:** Develop a hypothesis for each outcome;
- **STEP 4:** Create a theory of change;
- **STEP 5:** Choose indicators and set a baseline;
- **STEP 6:** Use existing monitoring and evaluation tools.

Adaptation activities are often more complicated to evaluate for several reasons:

- Difficult to separate development and adaptive capacities as vulnerability is shaped by multiple and historic causes in marginalized communities
- Implementation time frames are too short (adaptation projects have longer time horizons than is usual for development projects). Among others this might require different kinds of indicators.
- Specific challenge: monitor changes in natural systems; e.g. effects of a managed natural pasture on the hydrological cycle of a watershed.
- As adaptation activities often occur within a broader context, it is recommended to integrate them into existing monitoring and evaluation framework rather than creating its own.

Source: Experiences from the Climate Adaptation Project in Peru, HELVETAS Swiss Intercooperation (2014); PROVIA (2013)

STEP 8 supports the user in establishing results chain and a measurement plan.

Objective: Identify whether the selected measures are effective and efficient in a practical and credible way.

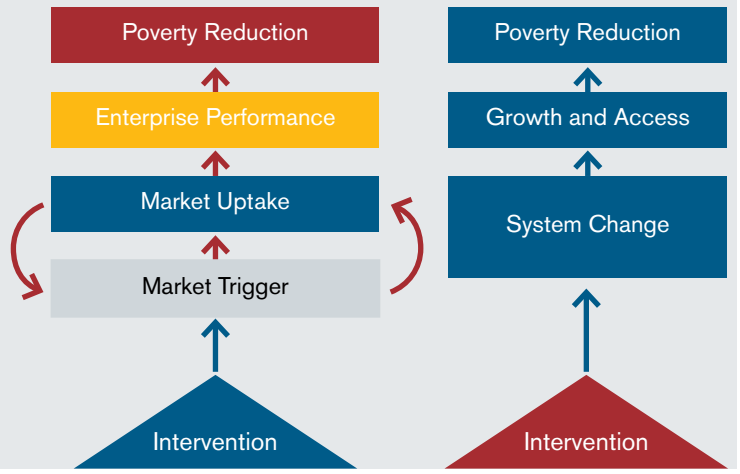
Time requirement: From several hours to several days.

Instructions:

1. Prepare a **results chain** for each **proposed intervention** using adequate research and analysis to show the logic and the hypothesis of change.
2. Assign specific and relevant **quantitative and qualitative indicators** for each box in the results chain.
3. **Collect and use information** for appropriate and relevant indicators using a mix of methods.

Table 10: The Results Chain

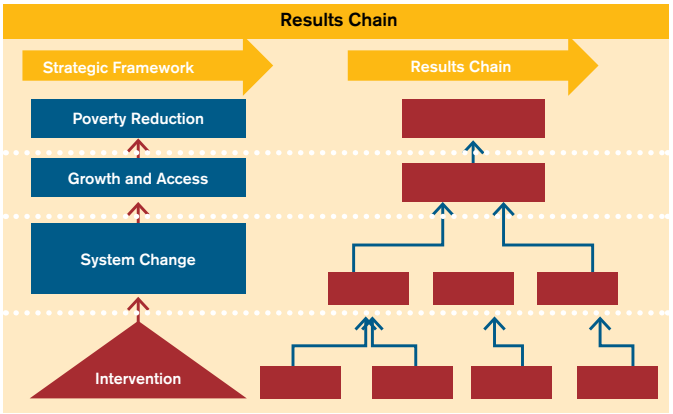
Additional income, additional employment	Poverty Reduction
Improved performance, products, productivity, profit of target enterprises	Enterprise Performance
Response of market actors: adopt, adapt, expand, respond	Market Uptake
Output of an intervention that will influence the market	Market Trigger
Entry point, the market actor with which you intervene Intervention = time bound set of activities for an intended change	Intervention



Source: Training material M4P, HELVETAS Swiss Intercooperation (2015)

See Annex 2 for Results Chain and Measurement Plan for Coffee Sub Sector.

Table 11: Results Chain and Measurement Plan



Measurement Plan					
Box in Results Chain	Indicator	Definition	Definition	Tools	Time
Box 1					
Box 2					
Box 3					
Box 4					
Box 5					
Box 6					

Source: Training material M4P, HELVETAS Swiss Intercooperation (2015)

Concluding Remarks

The Guideline **Assessing Climate Risks and Vulnerabilities in Market Systems,** developed by HELVETAS Swiss Intercooperation, is the result of joint approach bringing adaptation to climate change and market systems development together. The Guideline shall orientate and help practitioners to bring in a risk perspective in market systems development projects and to identify the most climate resilient sub-sectors in a given context.

The Guideline is not a new tool, but builds on existing tools in the field of market systems development and climate adaptation and disaster risk management. It identifies current and potential climate risks and vulnerabilities in market systems in a systematic way and thereby supports practitioners in identifying most appropriate measures for climate adaptation and disaster risk management under the changing conditions.

Climate adaptation and disaster risk management measures are place and context specific and no single strategy will meet the needs of all communities in one particular region. **A sound understanding of the causes and effects of climate change is required for innovative and efficient solutions.** Risk and vulnerability assessment are the first crucial step toward a better understanding of the local context.

The direct outcome of the assessments is a **set of possible climate adaptation and disaster risk management measures.** The main causality of change is that all actors involved in the market system (governmental, non-governmental and private sectors) shift from a **reactive to a proactive attitude.** In short, the Guideline promotes a proactive and preventive attitude towards an integrative management of climate risks in market systems with a long-term perspective.

The application of the Guideline in Nepal on a number of sub-sectors (e.g. coffee, banana, sweet oranges, walnuts, macadamia, medicinal and aromatic plants, riverbed vegetables and charcoal) has confirmed the usefulness of such a guideline at various levels. For instance, based on the assessment done on coffee and banana sub-sector, at present the country team in Nepal is **following up the results and applying** some of the proposed measures in the selected sub-sectors to provide benefits and reduce the adverse impacts in the short-term. Longer-term perspective requires more incremental and transformative changes (e.g. shift to higher altitudes in the case of coffee, adjustment of policies). The application of the Guideline has **contributed to some sound analysis and recommendations** for each sub-sector in a given context in Nepal.

From the analysis it can also be concluded that the practise and application of different measures at the same time is key to diversifying and minimizing risks in a specific market system. Last but not least, from the different options identified, it has become clear there is **no 'one size fits all'** approach. **Measures** may **change from location to location,** but also **throughout time,** measures might need to be adjusted and adapted. A constant monitoring is crucial to ensure the effectiveness of selected measures and may require adjustments of measures. Hence adaptive learning in market systems development is key and requires practitioners to constantly reflect and take in a critical perspective to ensure that activities contribute to climate resilient development.

Given the climate vulnerabilities in many developing countries and the fact that most poor communities are highly dependent on climate-sensitive sectors (e.g. agriculture, forestry), the present **Guideline has the potential to be applied in other countries and contexts.** It serves as an effective instrument to better understand how climate already affects and will further impact various sub-sectors besides helping to see what kind of proactive, preventive or preparatory measures can reduce risks. Eventually it can contribute to climate resilient development. The Guideline is an **effective instrument to support the shift from a reactive to a proactive attitude.**

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  CEDRIG light:

  https://www.cedrig.org/sites/default/themes/cedrig/img/CEDRIG_Light_EN.pdf

  CEDRIG strategic:

  https://www.cedrig.org/sites/default/themes/cedrig/img/CEDRIG_Strategic_EN.pdf

  CEDRIG operational:

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- Springfield Centre (2015). The Operational Guide for Making Markets Work for the Poor

  English: https://beamexchange.org/resources/167/

  French: https://beamexchange.org/resources/650/

  Spanish: https://beamexchange.org/resources/651/

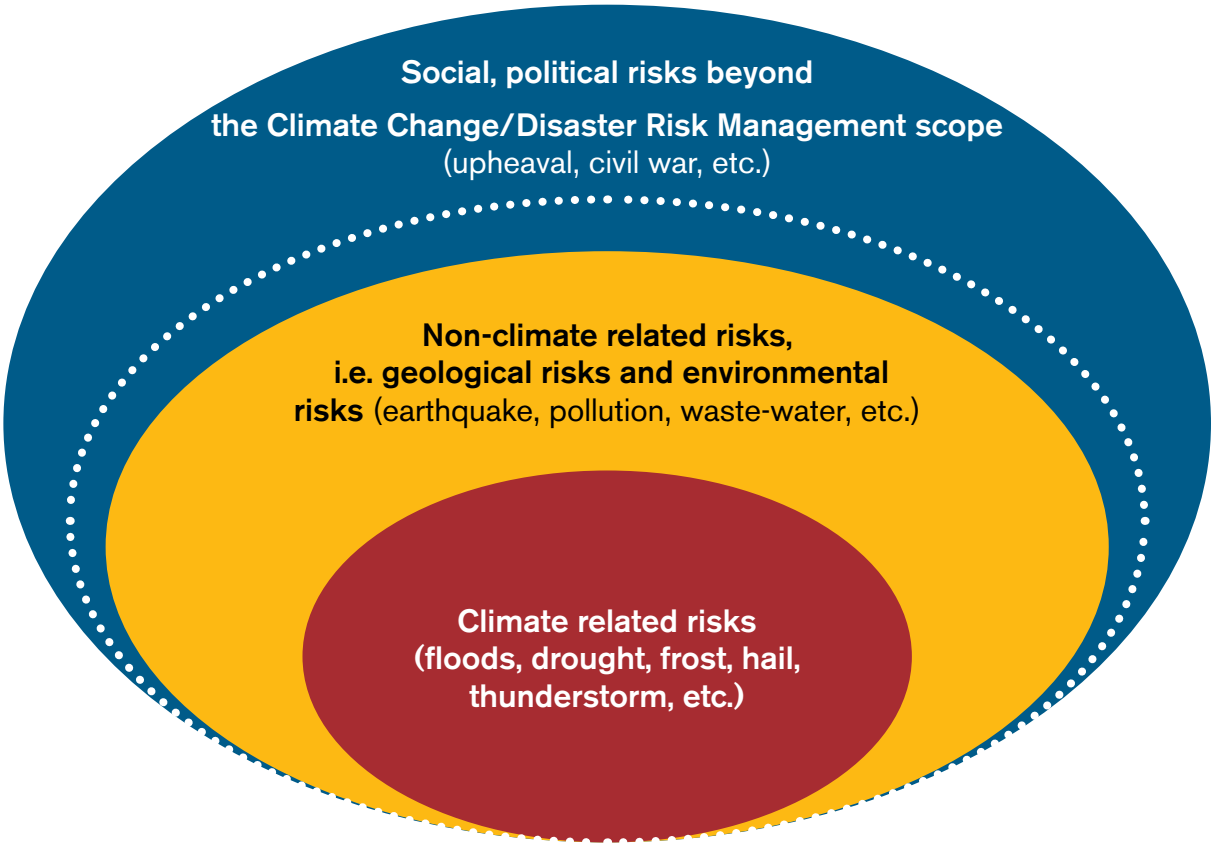
Annexes

Annex 1: Define the Scope of Risks

Risk can be limited to climate-related risks, or one can define them in a broader sense where non-climate and environmental risks (e.g. earthquake, pollution, waste) or even social risks are included. When applying a market system approach, it might be wished to look at all potential risks within a system. On the other hand, this is sometimes not realistic for one single project intervention and one wants to look at a set of defined risks.

While defining the scope of risks, it becomes clear what and how the project intervenes and what is beyond the context of any project intervention.

Figure 6: Scope of Risks

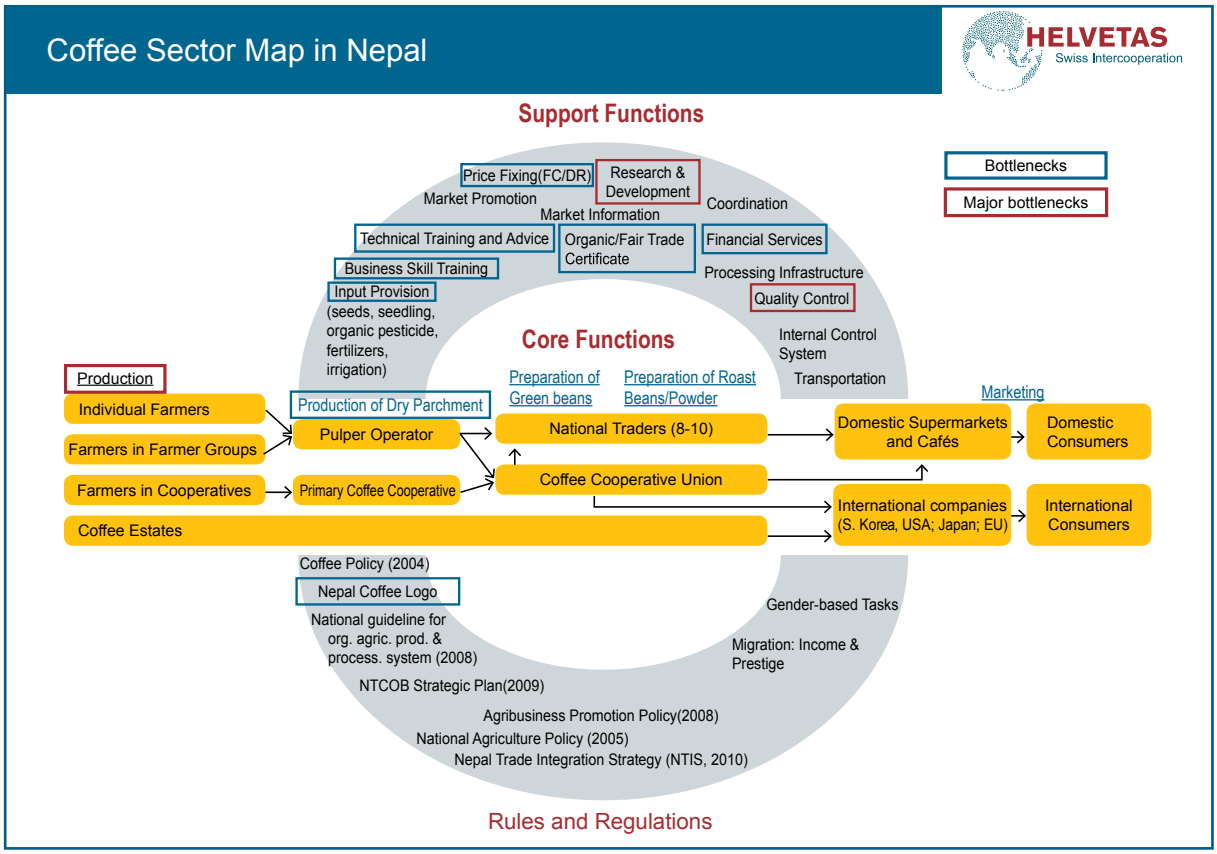


Source: HELVETAS Swiss Intercooperation (2016)

Annex 2: The Detailed Analysis of Coffee (the 8-STEP approach applied)

STEP 1: Map Core Functions, Support Functions and Rules/Regulations in the Selected Market System

Results **(Figure 4) :** Coffee sector map in Nepal (see below)



Source: HELVETAS Swiss Intercooperation (2015)

Process: The coffee sector map in Nepal was developed by the Coffee Promotion Programme team in collaboration with a market systems development expert in the process of a coffee sub-sector analysis.

STEP 2: Identify Current and Future Hazards, Impacts and Current Coping Strategies

Results STEP 2a (Table 1) : Identification of Most Relevant Hazards in the Market System

Hazard Type	Hazard Sub Type	Specific Hazard			Prioritisation			
					Facilitator	Group 1	Group 2	Group 3
Natural	Meteorological	Changing temperature						
		Changing humidity						
		Storm	Tropical storm		0			
			Extra-tropical storm		0			
			Convective storm	Derecho	0			
				Hail		2	1	1
				Lightning/thunderstorm		1	1	1
				Rain		1	1	1
				Tornado	0			
				Sand/dust storm	0			
				Winter storm/blizzard	0			
				Storm surge	0			
				Wind		1	1	1
		Extreme Temperature	Cold wave			1	1	1
			Heat Wave			1c/2p	1	1
			Severe winter condi-tions	Snow/ice	0			
				Frost/freeze		2	3	1
		Fog						
	Hydrological	Flood	Coastal flood		0			
			Riverine flood			1	1	1
			Flash flood			1	1	1
			Ice jam flood		0			
		Landslide	Avalanche (snow, debris, mud-flow, rock fall)			1c/2p	1	1
		Wave action	Rogue wave		0			
			Seiche		0			
	Climatological	Drought	Drought					
		Glacial lake outburst			0			
		Wildfire	Forest fires			1c/2p	1	1
			Land fire: brush, bush, pasture			1c/2p	1	1
	Biological	Epidemic	Viral diseases			1	1	1
			Bacterial diseases			1c/2p	1	1
			Parasitic diseases			1	1	1
			Fungal diseases			3	2c/3p	1c/2p
			Prion diseases		0			
		Insect in-festation	Locust/Grasshopper/Other insects			3	1c/3p	2
		Animal accident				1	1	1

Source: HELVETAS Swiss Intercooperation (2016)

Explanation

Prioritisation: 0 = not relevant; 1 = lowest priority; 2 = medium priority; 3 = highest priority;
C = current; P = potential

Results STEP 2b (Table 2): Hazards, Impacts and Coping Strategies

Hazards	Intensity[1]	Frequency[2]	Observed Trends[3]	Future Trends[4] Possible Evolution Under Climate Change	Impacts	Severity[5] (expressed in % and indicating which part of the market system is affected)	Current Coping Strategies	Is the strategy sustainable? If not , why?
Increasing temperature	Maximum temperature increasing at 0.05° C/year (1976-2005); minimum temperature at 0.03° C / year).		Coffee farmers observed increasing temperature since their childhood; based on data analyses a general increasing trend in temperature has been found; farmers in many areas observed increasing temperatures based on observations of plants and animals	Average annual temperature will increase by 1.7°C to 2.6°C by the year 2050; higher increments in Western and Central Nepal than in Eastern Nepal	Higher humidity, coffee less suitable in lower areas/ more suitable in higher areas (–altitude shift); requires change in management	100%; particularly in lower lying areas (about 25%) (below 1000 meters)	• Provision of shade with shade plants and their proper management • Mulching/ moisture management practices • Proper plantation planning (slope, orientation, elevation)	Yes
Changes in precipitation (decrease and drought)	Increased precipitation in most of the country (except Western evelopment Region)		Coffee farmers observed decreasing precipitation since their childhood; Eastern, central, western and far western regions showed an increasing trend in annual precipitation while most of the Mid Western Development Region observed a decreasing annual precipitation trend; droughts were not observed; water availability decreased as shown by springs drying up and lower yields	Annual precipitation will increase by 4% to 8% (up to 120 mm more per year) by the year 2050; increase in monsoon and post-monsoon precipitation and decrease in winter precipitation	Loss in production; increased occurrence of insect pests	100%; particularly south facing slopes; earlier and more affected	• Provision of shade with proper species of shade plants and their proper management • Irrigation/ moisture management practices e.g. cradle pits • Water harvesting • Mulching • Discourage planting in south facing land	Yes

Hazards		Intensity[1]	Frequency[2]	Observed Trends[3]	Future Trends[4] Possible Evolution Under Climate Change	Impacts	Severity[5] (expressed in % and indicating which part of the market system is affected)	Current Coping Strategies	Is the strategy sustainable? If not , why?
Increasing humidity		-	-	Farmers observed increasing trends, however no data could be found	No mention in the relevant literature, but assumed to get higher with increasing temperatures	Increased occurrence of fungal diseases	100%; particularly in north facing slopes and areas with too much shade	• Proper plantation planning (slope, orientation, elevation)	Yes
Fungal diseases	Coffee Leaf Rust	Depending on districts: some districts have not observed (Nuwakot, Palpa, Gulmi, Sindhupalchowk), while others are already heavily affected (Lalitpur, Kaski, Syangja and Kavre)	High frequency observed in districts with reported attacks	Increasingly coffee leaf rust has become an issue	Directly related to increasing temperature and humidity, therefore expected increase in fungal disease occurrence	Can wipe out total coffee production in an area as has happened in Sri Lanka.	100%; particularly in north facing slopes and areas with too much shade	• Removal of (burning) infected leaves and parts • Application of cattle urine based liquid manure • Application of Bordeaux Mixture[16] • Planting resistant varieties. • Shade management	Yes
	Mould in processed coffee (parchment, green beans)	Depending on the moisture content on the parchment and air circulation in the storage	Depends on processing management	Increasing trend in poorly managed storage and increasing issues of inconsistent quality.	Directly related to increasing temperature and humidity, therefore expected increase in fungal disease occurrence	Can render a consignment useless	100%; high moisture content (> 13 % moisture in parchment), and damp store; use of plastic bags for packing parchment	• Proper drying of parchment (11-12% moisture) • Good storage (aeration, avoid physical contact to moist wall, temperature regulation) • Jute bag used for packing parchment.	Yes

16 **Bordeaux mixture** (also called BordoMix) is a mixture of copper(II) sulfate (CuSO4) and slaked lime (Ca(OH)2) used as a fungicide. It is used in vineyards, orchards and gardens to prevent infestations of downy mildew, powdery mildew and other fungi (Wikipedia).

Hazards		Intensity[1]	Frequency[2]	Observed Trends[3]	Future Trends[4] Possible Evolution Under Climate Change	Impacts	Severity[5] (expressed in % and indicating which part of the market system is affected)	Current Coping Strategies	Is the strategy sustainable? If not , why?
Insect infestations	White Stem Borer	Depending on elevation zones (more affected in low lying plantations) Heavily affected districts : Gulmi, Kaski, Lalitpur, Palpa)	High frequency observed in districts with reported attacks	Increasing infestation, reducing production and productivity, becoming national issue.	Directly related to poor management of infested plants, shade, moisture and nutrients, expected to increase in areas where water is scarce; expected increase in white stem borer infestation with increasing temperature	Can wipe out coffee production on large scale (e.g. drastic loss in production in Lalitpur, Gulmi and Palpa)	100 % wipe out of orchard in poorly managed plantation, as experienced in Gulmi and Palpa.	Precaution: • Provision of shade with shade plants and their proper management • Irrigation/ moisture management • Nutrient management Management: • Immediate removal or burning of affected parts/ plants • Scrubbing of main trunk and use of mud and cattle dung paste	Yes, but needs to be rigorously implemented to be effective

Source: Results, HELVETAS Swiss Intercooperation (2016)

1 Practical Action (2005) Temporal and Spatial Variability of Climate Change Over Nepal (1976 - 2005); SSMP (2010) Climate Change in the Mid Hills of Nepal – Fact or Fiction?.From a Farmer's Perspective

2 Ranjitkar et al.(2015) Projected climate change impacts on climatic suitability and geographical distribution of banana and coffee plantations in Nepal; Government of Nepal (2010) National Adaptation Programme of Action.

Process: The following table is the result of a combination of activities: Firstly, the author excluded the irrelevant climate hazards based on her/his understanding of the sub-sector. With the help of different stakeholder groups the author prioritised the most important climate hazards. The prioritised climate hazards, their impacts and coping strategies are discussed based on the stakeholder discussions, experts' inputs and literature.

Results STEP 2c (Table 3): Comparison of Hazard and Crop Calendars

Hazard	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar	P	M	F	C	B	J	A	S	B	A	K	M
Precipitation – High amounts				X	X	X	XX	X	X	X		
Precipitation – Low amounts	XX	XX	X								X	XX
Temperature - High				X	XX	XX	X	X	X			
Temperature - Low	XX	X										XX
Insect infestation				X	XX				X	XX		
Fungal diseases			X	X			X	X				
Crop	J	F	M	A	M	J	J	A	S	O	N	D
Local Calendar	P	M	F	C	B	J	A	S	B	A	K	M
Seeding in nursery		X	X									
Planting of seedlings						X	X					
Harvesting	X	X	X									X
Pulping	X	X	X									X
Hulling			X	X	X							

Source: Results, HELVETAS Swiss Intercooperation (2016)

Explanation:

Nepali Calendar: **P**oush, **M**agh, **F**algun, **C**haitra, **B**aisakh, **A**saadh, **S**hrawan, **B**hadau, **A**soj, **K**artik, **M**angshir

x= "normal"; xx= very strong

STEP 3: Identify Vulnerability of Each Function to Climate Risks

Results (Table 5): Market functions and climate risks (see below)

Climate Risk Relevant Market Functions (see STEP 1)		Relevant Climate Risk (hazard) (see STEP 2)	Remarks on Impacts
Core	Production	Increased temperature; decreased precipitation and drought; increased humidity; fungal diseases; insect infestation	Reduced yield per plant; increased mortality of plants; lower quality of fresh cherries Shift in production area: shifting altitudinal belt; overall expected reduction in production area
	Pulping	Increased temperature; increased humidity; fungal diseases; insect infestation	Changed processing management
	Storage	Increased temperature; increased humidity; fungal diseases	Increased chances of fungal diseases (mould)
Support	Seedling production	Increased temperature; decreased precipitation and drought; increased humidity; fungal diseases; insect infestation	Increased mortality of seedlings
Rules/ Regulations	-	-	-

Source: Results, HELVETAS Swiss Intercooperation (2016)

Process: The climate risk relevant market functions were identified in consultation with the Coffee Promotion Programme expert team.

STEP 4: Identify Most Climate Resilient Value Chains Based on a Scoring Matrix

Results (Table 6): Climate relevant market functions

Category	Criteria	Weighting	Sub-Sectors		Remarks
			Coffee	Banana	
Poverty Reduction Potential	Number of households engaged in the sector		1	2	Commercial farmers only
	Severity of poverty facing those engaged in the sector		2	1	Short production cycle enables poor people to produce on leased land
	Potential for participation of women in the sector		1	2	Banana is more labour intensive
	Potential for participation of youth in the sector		2	1	Due to short production cycle banana is more investment friendly
	Possibility for the target group to improve income / access to jobs		2	1	
Economic Growth Potential	Previous growth trajectory (last 5 years)		2	1	
	Forecast for growth in the next 5-10 years		1	1	
	Import substitution potential		2	1	Large quantities of banana is currently imported from India
	Export potential		1	2	Coffee is mainly produced for export markets
	Level of competitiveness		1	2	Coffee has very good market potential
Potential to facilitate systemic change	Level of consistency with public/ national priorities, government interest		1	2	Coffee is a crop mentioned in the National Trade Integration Strategy
	Private sector interest		1	2	
	Presence of potential lead firms		1	2	
	Availability of partners/champions with leverage		1	2	More capacity of local resource persons available for coffee
	Availability and capacity of service providers				
Climate change	Negative impacts of future climate trends		2	1	Changing climate produces lower quality of coffee
	Positive impacts of future climate trends		2	1	Positive impacts of future climate trends
	Likely investment costs in risk reduction relative to actors' annual income and capital stock		2	1	
	Investment horizon: by when are the climate impacts expected to be felt? By when should the risk reduction or adaptation investments be made? How long are the benefits expected to last?		2	1	Banana provides return after 15 months while coffee returns take 4-5 years
	Flexibility: Is the option flexible ? (does it allow for switching to other options that might be preferable in the future once more is known about the changing climate)		2	1	
Further considerations					
TOTALS			29	27	

MODULE B – Identification and Implementation of Adaptation and Disaster Risk Management Measures

STEP 5: Identify Possible Adaptation to Climate Change and Disaster Risk Management Measures

Results (Table 7): Possible adaptation to climate change and disaster risk management measures

Climate Risk Relevant Market Functions (see STEP 1)		Relevant Climate Risks (see STEP 2)	Remarks on Impacts	Adaptation to Climate Change and Disaster Risk Management Measures
Core	Production	Increased temperature; decreased precipitation and drought; increased humidity; fungal diseases; insect infestation	Reduced yield per plant; increased mortality of plants; lower quality of fresh cherries Shift in production area: shifting altitudinal belt; overall expected reduction in production area	• Varietal selection and research • Intercropping • Proper shade tree management/shade tree plantation • Moisture management/ rain water harvesting • Altitude shift (above 1000 meters)
	Pulping	Increased temperature; increased humidity; fungal diseases	Changed processing management; decreased fermentation duration, Increased chances of fungal diseases (mould)	• Improved pulping facilities such as clean water for washing • Improve drying system with clean drying yard: drying table • Appropriate storage facility (i.e. well ventilated room, prevent dampness and odour)
	Storage	Increased temperature; increased humidity; fungal diseases	Increased chances of fungal diseases (mould)	• Appropriate storage facility (i.e. well ventilated room, prevent dampness and odour)
Support	Seedling production	Increased temperature; decreased precipitation and drought; increased humidity; fungal diseases; insect infestation	Increased mortality of seedlings	• Priority to onsite nursery development • Shift in altitude (above 1000 meters)
Rules/ Regulations	-	-	-	-

Source: Results, HELVETAS Swiss Intercooperation (2016)

Process: The possible adaptation to climate change and disaster risk management measures were identified in a stakeholder meeting involving government, civil society and private sector stakeholders substantiated by the Coffee Promotion Programme experts.

STEP 6: Prioritise and Choose the Best/Most Appropriate Measures

Results (Table 8): Possible adaptation to climate change and disaster risk management measures

	Effectiveness in Enhancing Resilience	Cost	Feasibility	Sustainability	Further Criterion?	Overall Evaluation (total)
Transferred from STEP 5 –Possible adaptation and risk management options	Explain how effective the option is in enhancing resilience and score with: (0) not effective, (1) effective, (2) very effective	Explain how costly the option is and score with: (0) high cost (1) medium cost (2) low cost	Explain how feasible the option is to implement and score with: (0) not feasible (1) feasible (2) very feasible	Explain how sustainable the option is and score with: (0) low, (1) medium (2) high	Explain and score the options to the criterion of your choice accordingly	Make an overall assessment of the option with regard to the outcome of the criteria scoring. Cost/benefit considerations shall be taken into account.
Varietal selection and research	2	0	1	2	1 This option definitely needs to be taken up in the medium to long run, but may face major hurdles in terms of financing	Sum: 6, Priority if finance resource can be identified
Intercropping	1	2	2	2	2 Farmer can easily adopt the practice.	Sum: 9 , Priority for CoPP
Proper shade tree management/shade tree plantation	2	2	2	2	2 Shade management has been a major thrust for years and needs continuation	Sum: 10, Priority for CoPP
Moisture management/rain water harvesting	1	1	2	2	2 Coffee has generally been promoted on marginal land, which often does not have access to irrigation water. In-situ moisture management and water harvesting technologies need to be further promoted through technical service providers	Sum: 8, Priority for CoPP in collaboration with the Integrated Water Resources Programme

	Effectiveness in Enhancing Resilience	Cost	Feasibility	Sustainability	Further Criterion?	Overall Evaluation (total)
Altitude shift (above 1000 meters)	2	2	1	3	2 Shift in altitude up to frost free zone	Sum: 9, Priority for CoPP and TPSD
Improved pulping facilities such as clean water for washing, drying facilities	1	1	2	2	2 Improvement of drying facilities (pre –drying table and drying floor) Alternative processing method (semi washed) in water scarce area.	Sum: 8, Priority for TPSD
Appropriate storage facility (i.e. well ventilated room, prevent dampness and odour, use jute bag for packing)	2	1	2	2	2 Storage facilities to be upgraded in all pulping centers	Sum: 9, Priority for TPSD and Revive Coffee
Priority to onsite nursery development	2	2	2	2	2 Priority should be given to develop onsite nursery.	Sum: 10, Priority for TPSD
Shift in altitude (above 1000 meters)	1	2	1	2	2 Nursery development should get priority to 1000+ altitude.	Sum: 8, Priority for CoPP and TPSD

Source: Results, HELVETAS Swiss Intercooperation (2016)

Process: The scoring was conducted in consultation with the Coffee Promotion Programme expert team

STEP 7: Plan and Implement Selected Measures

Results (Table 9): Sustainability matrix with Prioritised adaptation measures

Functions	Activities to Implement Adaptation to Climate Change and Disaster Risk Management Measures	Immediate		Long-term		Necessary Interventions (including actors)
		Who will do it?	Who will pay?	Who will do it?	Who will pay?	
Production	Implement varietal selection and research	NARC	TPSD/GoN/ NARDF	NARC	GoN /NTCDB	Development of a research plan (NARC); Implementation of research plan (NARC and NTCDB)
	Promotion of intercropping	Technical service providers	NTCDB	Technical service providers	Primary coffee cooperatives Estates	Documentation of potential technologies (CoPP/ NTCDB/DADO/CTDS); Mobile phone based extension system development (CoPP); Capacity development of technical service providers (CoPP/TPSD/NTCDB/ CTDS)
	Promotion of proper shade tree management/shade tree plantation	Technical service providers	NTCDB	Technical service providers	Primary coffee cooperatives Estates	
	Promotion of moisture management/rain water harvesting technologies	Technical service providers	Primary coffee cooperatives Estates	Technical service providers	Primary coffee cooperative Estates	Circulation of guidelines for (mandatory) shift in coffee plantation (NTCDB)
	Altitude shift (above 1000 meters)	Primary coffee cooperatives from technical service providers	Primary coffee cooperatives with subsidies from NTCDB	Primary coffee cooperatives	Primary coffee cooperatives	Circulation of guidelines for (mandatory) shift in coffee plantation (NTCDB) Reorientation of technical service providers (NTCDB)
		Estates with support from technical service providers	Estates	Estates with support from technical service providers	Estates	

Pulping	Improved pulping facilities such as clean water for washing, drying facilities	Primary coffee cooperatives	TPSD	Primary coffee cooperatives	Primary coffee cooperatives	Present specifications for the facility (CoPP) Facilitate access to finance (CoPP)
		Estates	Estates	Estates	Estates	
	Appropriate storage facility (i.e. well ventilated room, prevent dampness and odour, provision of jute bag)	Primary Coffee Cooperatives from technical service providers	Revive Coffee in earthquake affected districts, TPSD	Primary Coffee Cooperatives	Primary Coffee Cooperatives with credits from banks and finance institutes	Present specifications for the facility (CoPP) Facilitate access to finance (CoPP)
		Estate with support from technical service providers	Estates with credits from banks and finance institutes	Estates	Estates with credits from banks and finance institutes	
Storage	Appropriate storage facility (i.e. well ventilated room, prevent dampness and odour, jute bag packing)	District Coffee Cooperative Union	TPSD	District Coffee Cooperative Union	District Coffee Cooperative Union with credits from banks and finance institutes	Present specifications for the facility (CoPP) Facilitate access to finance (CoPP)
		Traders	Traders with credits from banks and finance institutes	Traders	Traders with credits from banks and finance institutes	
Seedling production	Priority to onsite nursery development	Primary coffee cooperatives	Primary coffee cooperatives	Primary coffee cooperatives	Primary coffee cooperatives	
		Estate	Estate	Estates	Estates	
	Shift in altitude (above 1000 meters)	Estates with support from technical service providers	Estates	Estates with support from technical service providers	Estates	Circulation of guidelines for (mandatory) shift in coffee plantation (NTCDB) Reorientation of technical service providers (NTCDB)

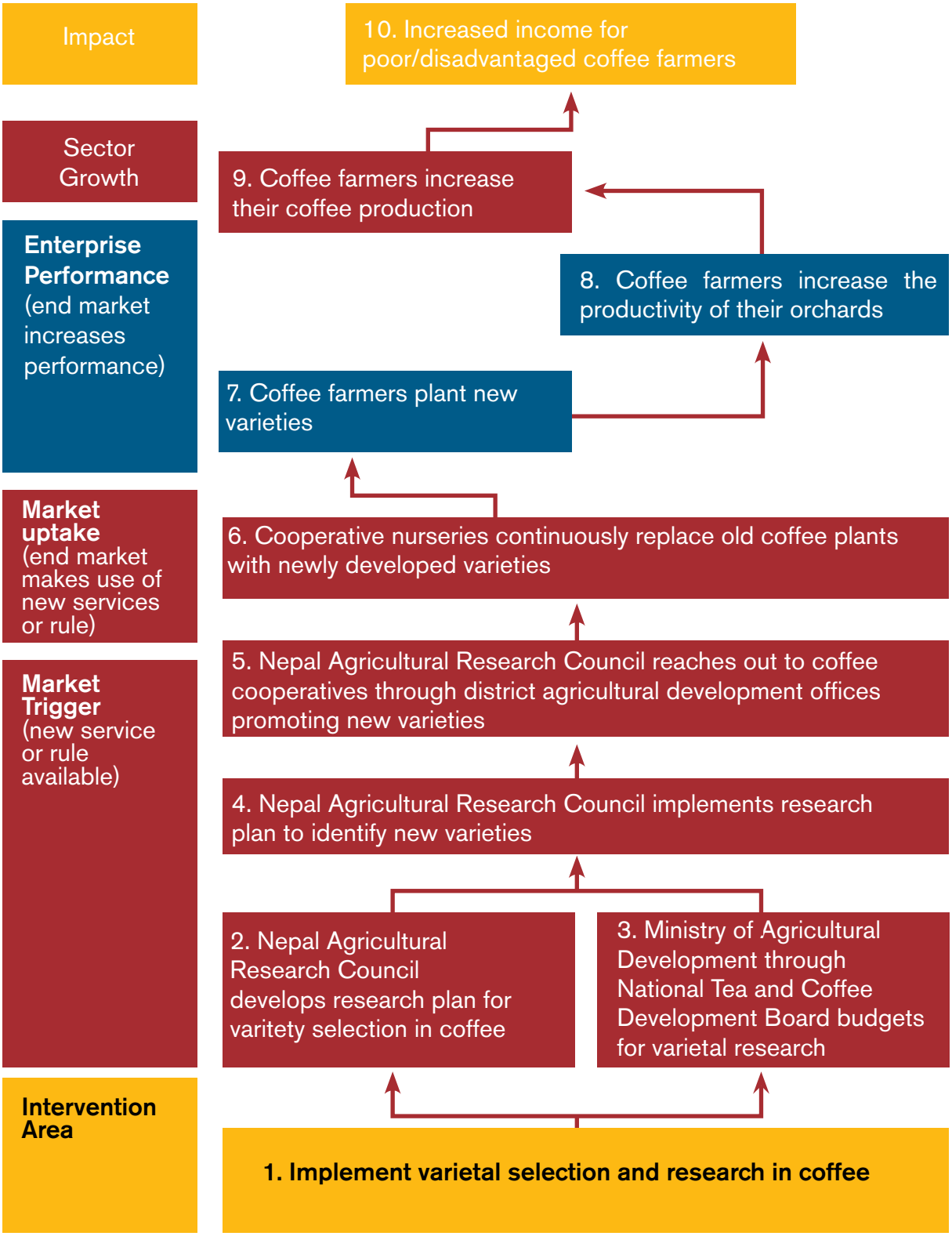
Source: Results, HELVETAS Swiss Intercooperation (2016)

Process: The sustainability matrix was developed in consultation with the Coffee Promotion Programme expert team. It still has to be discussed with relevant stakeholders.

STEP 8: Monitor and Measure Results

Results chain (Table 10) for the value chain of coffee - for the outcome implement varietal selection and research in coffee

Nepal Coffee Sector Climate Change Intervention Logic



Source: HELVETAS Swiss Intercooperation (2016)

Measurement Plan (Table 11)

Indicator	Indicator	Baseline	Tools	Time	Remarks
-	-	-	-	-	-
The annual plan of NARC includes a plan for varietal research on coffee		No research planned	Review of NARC annual plan	Annually in June	
The Ministry of Agricultural Development sets aside NPR 10,000,000 annually		No budget	Review of Government budget	Annually in June	
NARC implements a research project for varietal selection	Documented progress	No project	Review of NARC annual report	Annually in July	
NARC presents research results regularly to 12 district agriculture development offices	Communications (meetings and publications)	0	Review of NARC annual report	Annually in July	
Number of primary coffee cooperative nurseries in 12 districts that plant an increasing number of saplings of new varieties annually	Cooperatives	0	Review of district coffee cooperative unions' annual report	Annually in July	
Number of farmers that plant the promoted, new varieties	Women and men (disaggregated)	0	Review of district coffee cooperative unions' annual report	Annually in July	
Increased coffee orchard productivity	Tonnes of coffee per hectare	0.6	Review of district coffee cooperative unions' annual report	Annually in July	National productivity of coffee is reported as 300 kg green bean per hectare, whereas CoPP working districts have 600 kg green bean per hectare.
Increased coffee production	Tonnes of coffee	133	Review of district coffee cooperative unions' annual report	Annually in July	Total production in CoPP 12 districts is 215 tonnes green bean of which 62 percent was produced by the Cooperative members which becomes 133 tonnes green bean as base.
Increased coffee farmers' income	Nepali Rupees	8303	Review of district coffee cooperative unions' annual report	Annually in July	
Note					
Total National Production is 463.5 tonnes green bean for year 2015					

Annex 3: Summary Table of Adaptation Options

Adaptation Option (Practice)	Main Objective	Technical Requirement	Advantages of Adoption (in addition to the direct positive impact)	Disadvantages of Adoption	Mitigation Benefits	Disaster Risk Management Benefits
Manure, compost, and mulching	To increase organic matter content in soils	Available biomass (e.g. twigs, leaves)	Higher water-holding capacity	-	Enhance carbon sink in soil	
Conservation agriculture	To achieve sustainable and profitable agriculture	• Minimum soil disturbance (zero/minimum tillage) • Permanent soil cover (crop residue or live mulch) • Crop rotation or intercropping	Decreased soil erosion, increased water infiltration. Conserves, improves and makes more efficient use of soil, water and biological resources.	Requires careful management practices to be successful	Enhance carbon sink in soil	Reduce flash flood risks
Use of crops and varieties adapted to current climatic conditions	• To minimize effects of drought and other extreme climatic events • To minimize the negative impacts on seasonal variability		Increase in yields and reduced losses			
Establishment of seed banks, seed production groups and small seed enterprises	To assure that seeds are (geographically and monetarily) available and accessible to farmers					
Development of adapted seeds (to future climatic conditions)	• To minimize effects of drought and other extreme climatic events (in the future) • To minimize the negative impacts on seasonal variability (in the future).	Research to develop new varieties	Increase in yields and reduced losses	Investment process of around 10-year time		
Integrated Pest Management	To control pests in a sustainable way	Good knowledge of crop system.	Reduce the use of chemicals			
Livestock Water Productivity	To increase water-efficient livestock production					

Source: HELVETAS Swiss Intercooperation (2016)

Adaptation Option (Practice)	Main Objective	Technical Requirement	Advantages of Adoption (in addition to the direct positive impact)	Disadvantages of Adoption	Mitigation Benefits	Disaster Risk Management Benefits
Good grazing management practices	To maintain long-term productivity of pastures	Assess pasture (area, vegetation, users)	• Increased biodiversity of rangeland • No bush encroachment • Better organization among rangeland users • Reduces soil erosion	Appropriation of the rangeland of nomadic communities if their representatives are not included in the development of the management plan	Enhance carbon sink in soil	Reduce flash flood risk
Planting palatable species, weeding, planting trees	To increase vegetation cover in grazing land / range land	Permanent control of grazing and browsing (time and intensity)	• Regeneration of additional income • Revival of certain species		Enhance carbon sink in soil	Reduce flash flood risk
Agroforestry/agro-silvo-pastoralism	To increase productivity and income	• Choose tree species that do not compete against crops and are adapted to site conditions. • Land-use management system combining trees/ shrubs, crops and/or livestock	• Favourable micro-climate and permanent cover • Decreased soil erosion • Improved soil structure • Increased infiltration • Enhanced fertility and biological activity of soils	Possible competition between trees and food crops for space, sunlight, moisture and nutrients, potentially reducing crop yields.	Enhance carbon sink in soil	
Underground water tanks and channels	To collect rain, snow melt and underground water	• Good knowledge of geology and topography of sites	• Greener watersheds • Increased conservation knowledge	High construction costs and higher sedimentation (due to excavation of rocks)		Reduce flash flood risk
Sustainable irrigation systems	To improve water use efficiency	• Materials and costs to install system	• Avoid soil erosion through irrigation	Installation costs and potential risk of salinisation	Conservation of soil carbon	Reduce flash flood risk
Water user associations	To supply irrigation water in equitable and efficient manner	• Technical knowledge • Good governance				
Construction of trenches and bunds	To reduce runoff, soil erosion and flash flood risks	• Resources and construction materials	• Increased fodder production • Cash earnings for families	Soil disturbance, sedimentation and loss of productive land (due to excavation)	Reduce loss of carbon soil	Reduce flash food risks
Planting grasses, shrubs and trees	To maintain a high vegetative cover Improvement of grazing land/rangeland vegetation	• Fast-growing, deep-rooted, nitrogen-fixing, wind-resistant plant species that are suited to local climate; rotational grazing, managed high-intensity grazing, mob grazing or bunch grazing	• Production of subsistence or income-generating crops (cash crops)		Enhance carbon sink in soil	Reduce flash food risks

Source: HELVETAS Swiss Intercooperation (2016)

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