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**MICROCLIMATE MANAGEMENT AS AN OPTION FOR DEALING WITH  
CLIMATE CHANGE IN ZAMBIA**

**- An analysis of the governance in rural areas and farmers' choices -**

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## ABSTRACT

Microclimate management (MCM) is a group of interventions on the ground based on managing the interaction between microclimate components and aimed at smoothing local climate variability. In rural areas in Zambia, global warming is threatening the agricultural sector, this is the reason why the adoption of microclimate management on the part of farmers can play a fundamental role in smoothing the effects of climate change by increasing agricultural resilience to local climate variability. However, efforts conducted by the Zambian government over the years in fighting the environmental crisis have been highly inconclusive and many farmers still conduct conservative farming, consisting in significantly unsustainable agricultural practices. Therefore, it is questioned whether treating MCM as an option to deal with climate change can be feasible in Zambia, and whether its implementation can be upheld by a solid governance and farmers' support. Current literature discusses the environmental benefits deriving by MCM, the significance to strengthen the landscape governance, and the way farmers perceive climate change. This thesis aims to fill the gap in knowledge by analysing MCM as a strategy to deal with climate change from a governance point of view, by studying the governance concerning a specific field, i.e., MCM, in the landscape governance system, and by focusing on farmers' response to strategies such as MCM in the agricultural sector. Hence, the aim is to understand whether improving MCM is a feasible option for dealing with climate change in rural areas in Zambia, by assessing the governance status concerning MCM and local farmers' willingness to apply the intervention. The methods are based on the 10 building blocks approach, whose content offers the basis to draw specific criteria for the assessment of the governance concerning MCM, and on the analysis of 52 questionnaires compiled by local farmers, which are designed to evaluate their willingness to apply MCM. The results confirm that improving MCM is a feasible option to deal with climate change in the area and recommendations are finally built on the reflection of the analysis, contributing to help Zambian institutions and organisations active in the field to improve the process of adoption and implementation of sustainable strategies such as MCM. The research also succeeds in filling the gaps in knowledge regarding the study of MCM under a governance point of view. Furthermore, it offers a method to assess the governance system concerning the improvement of a sustainable strategy such as MCM and gives inputs for the analysis of farmers' response towards the adoption of interventions to deal with climate change.

**Key-concepts:** *Microclimate management, sustainable strategy, governance, farmers' willingness, Zambia.*

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# 1 INTRODUCTION

In an epoch of continuous debate around the topic of climate change, technical and governmental actions must be joint to challenge global warming and its major consequences. However, their integration is not always effective, and global climate change remains unchallenged.

## 1.1 CLIMATE CHANGE AND THE POTENTIAL ROLE OF MICROCLIMATE MANAGEMENT

Agriculture is among the sectors with the highest risk of impact of climate change (Mendelsohn, 2008) and temperature rise has been notably affecting crop yields worldwide (Guido et al., 2021). In challenging this phenomenon, people are joining efforts in promoting sustainable strategies to increase the resilience of the agricultural sector against the temperature rise. However, ways to control this phenomenon at a large scale are difficult to implement, driving the attention towards interventions aimed at influencing temperature trends at smaller scales. Furthermore, vegetation and crop yields seem to be more sensitive to the variations of local climate conditions, determined by temperature trends at a micro-scale, rather than by the regional ones (Mendelsohn, 2008; Zellweger et al., 2020). In this regard, addressing and understanding the concept of microclimate management becomes fundamental (Ismangil et al., 2016; Zellweger et al., 2020).

The term *microclimate* refers to the interlinkage between shapes and characteristics of the landscape at a vertical scale up to 100 metres. Specifically, the main determinants of microclimate are soil, air and wind characteristics, whose interactions influence local climate at a micro-scale, responsible to regulate in turn plant growth, biota life, and local weather patterns (Ismangil et al., 2016). *Microclimate management*, on the other hand, refers to the anthropogenic interventions in the landscape that can steer the interaction between microclimate determinants. Amongst them, the most common interventions are micro-dams, terraces, and infiltration trenches, which all aim to buffer water retention in the soil, altering soil characteristics and local temperature (Ismangil et al., 2016). Due to its potential to boost or reduce the temperature rise in a determined area, MCM offers the opportunity to strengthen local climate resilience and thus challenge climate change (Zellweger et al., 2020).

Because of its relevance, Solidaridad Zambia, an international civil society organisation (CSO) advocating to increase smallholders' livelihood, is currently working to engage local farmers in rural areas in Zambia in a learning process about MCM practices at a local level. Specifically, the intent of Solidaridad is to enhance the climate resilience of the agricultural sector in Zambia by recognizing and treating MCM as an adaptation strategy against climate change.

## 1.2 CLIMATE CHANGE IN ZAMBIA AND THE RESPONSE OF THE ZAMBIAN GOVERNMENT

Zambia is a landlocked high plateau in the south of Africa, dominated by humid subtropical and tropical climate characteristics (Musonda et al., 2020). In the last years, extreme weather events, such as anomalous dry conditions, erratic rainfall, and frequent floods, have occurred increasingly often around the country as a consequence of climate change, causing serious repercussions on rural areas, leading farmers to deal with decrease and damage of arable lands, crop yields and farm settlements (Musonda et al., 2020). Because of this concern, the government of the Republic of Zambia has been focusing for more than a decade now on

designing and implementing adaptation strategies to cope with climate change, aiming to enhance climate resilience in the agricultural sector and to raise its adaptive capacity (Funder & Mweemba, 2019). Amongst these interventions, there are strategies targeted to reduce greenhouses gas emissions, and activities conducted at a local level aimed at the engagement of farmers in evolving agriculture towards a more sustainable, climate resilient phase integrated into regenerative agriculture and conservative farming (Kabechani et al., 2016; Kobwe et al, 2022).

### 1.3 PROBLEM DEFINITION

Despite its intentions, the Zambian government is still far away from achieving the goal of a climate resilient agricultural sector. The Climate-Smart Agriculture Investment Plan (World Bank, 2019) underlines, indeed, how “the agricultural sector is characterised by low-productivity, unskilled subsistence agriculture” (p. 2) and poor crop variety, all factors that can be overly sensitive to environmental and climatic crisis (Hertel & Rosch, 2010), and the attempts of the Zambian government to implement strategies against climate change are still erratic (Romdhani et al., 2018). This persistent failure in efficiently addressing the issue of climate change is aggravated by other existing issues that undermine the adaptive capacity to the phenomenon, such as lack of information, low credit to citizens and inadequate economic assistance (Ianchovichina & Lundstrom Gable, 2009; Mulenga 2020). It is thereby questionable whether the intent of Solidaridad to treat MCM as an opportunity in Zambia in enhancing agricultural climate resilience is reachable. In this regard, the support of a solid *governance*, i.e., the specific exercise of directing and overseeing “the day-to-day practical actions of management” at a political, social, economic, and administrative level (Rogers & Hall, 2003; Kusters et al., 2020, p. 2), plays a crucial role in fulfilling the intent of Solidaridad. Contrarily, the inefficiency of the governance system, which can translate into a poor management of the resources and infrastructures, lack of communication between stakeholders, inadequate knowledge on the matter etc., can become a fundamental barrier in achieving an effective and consistent approach to develop and improve MCM in the agricultural sector (OECD, 2017). Therefore, it must be questioned whether the governance system in rural areas in Zambia can be considered as supportive and sufficiently efficient in treating MCM as a strategy to deal with local climate variability.

Furthermore, a significant part of local farmers in Zambia are still practising the so-called *conventional agriculture*, bound to highly unsustainable techniques based on the use of chemical herbicides and fertilisers, heavy irrigation, and tillage (Kapungwe, 2012; Pelletiera et al., 2020). It must also be questioned whether farmers can be prone to investing in learning and applying MCM interventions, abandoning their known and familiar practices.

Because of these reasons, a deeper analysis on the governance status in rural areas for the operation of MCM and on the way local farmers respond to shifting from habitual practices to MCM interventions is needed to determine whether Solidaridad can effectively succeed in its intent.

### 1.4 PREVIOUS RESEARCH AND KNOWLEDGE GAP

Current literature focuses on the benefits deriving from MCM interventions, the significance to develop a solid governance for the management of the landscape, and farmers’ perception regarding climate change.

It can represent significant inputs of reflection for this thesis and below is described:

- Ismangil et al. (2016) well describe the phenomenon of microclimate, classifying how it can be managed with related specific interventions in the agricultural sector. The aim of their work is to underline the significance of developing MCM to deal with climate variability. This research is used to deeply understand the concept of MCM, its origin and its benefits. However, this paper focuses on MCM using a technical approach, discussing uniquely natural effects and natural response. It lacks in considering implications derived by human interaction with MCM and in specifying necessary governance aspects for the implementation of MCM, such as the status of infrastructures to monitor microclimate variables or yet, the necessary level of awareness and appreciation of the applicants regarding the matter.

- Kusters et al. (2020) highlight the significance to reinforce the landscape governance system in countries of the Global South. Specifically, in their study the authors develop a set of new indicators for the assessment of the governance in rural areas, they implement the assessment on a series of case studies, and finally, they build recommendations for the improvement of the landscape governance system. This research is helpful to deeply comprehend the significance to create and reinforce a solid governance system in rural areas. However, it proposes a generalised framework whose assessment does not address a specific target, e.g., dealing with climate change by improving MCM, offering an overview of the governance status without any particular concern to a certain matter.

- Guido et al. (2021) focus their research on a survey partially conducted on smallholders in Zambia to analyse their perception towards climate change in rural areas. The outcome of the research states that the climatic phenomenon is leading firstly to a destabilisation of farmers' knowledge and beliefs on traditional weather forecast and secondly to a general distrust for new agricultural techniques that differ from farmers' traditional practices. This research gives interesting inputs for the analysis of Zambian local farmers' perception towards climate change and towards the application of innovative technologies (as it can be MCM). However, this study focuses particularly on the perceived accuracy/inaccuracy of weather forecasts and its influence on farmers' trust towards the implementation of innovative sustainable technologies, such as climate-smart agriculture. However, it fails in assessing other significant variables that can affect farmers' perception towards these agricultural practices, such as the role that values and cultural background (indigenous knowledge) play in influencing their farming choices, or the level of trust towards the institutions that promote this kind of interventions.

### 1.5 AIM AND RESEARCH QUESTIONS

Due to the current complications in Zambia to deal with climate change and to ensure stability and durability to the agricultural sector, this research aims to comprehend whether MCM can be a feasible option to challenge local climate variability in rural areas in Zambia. The intention is to build recommendations to improve MCM by clarifying potential elements that affect its development for governmental institutions and for Solidaridad as a representative of the organisations active in strengthening sustainability in those areas. To fulfil the aim of this research, the following research question (RQ) is answered: **Is improving MCM a feasible option for dealing with climate change in rural areas in Zambia?**

The term *improvement* is here defined as the efficiency of MCM in challenging local climate variability by ensuring its systematic implementation and durability over time. While the *feasibility* is assumed to depend on the status of the governance concerning MCM in rural areas and on the local farmers' willingness to apply MCM. The main question is then addressed along the line of the following sub-questions (SQs):

**SQ1:** What is the status of the governance concerning MCM in rural areas in Zambia?

**SQ2:** Are local farmers willing to apply MCM in rural areas in Zambia?

SQ1 is answered by assessing the governance status concerning MCM in rural areas using assessment criteria drawn on the base of an interdisciplinary method called *10 Building Blocks (BB) approach*. While SQ2 is answered through a qualitative analysis computed through questionnaires on local farmers. Finally, the RQ is answered according to the outcomes of SQ1 and SQ2, which satisfy one of the following hypotheses (Hs):

H<sub>0</sub>: Improving MCM is not a feasible option for dealing with climate change.

H<sub>1</sub>: Improving MCM is a feasible option for dealing with climate change.

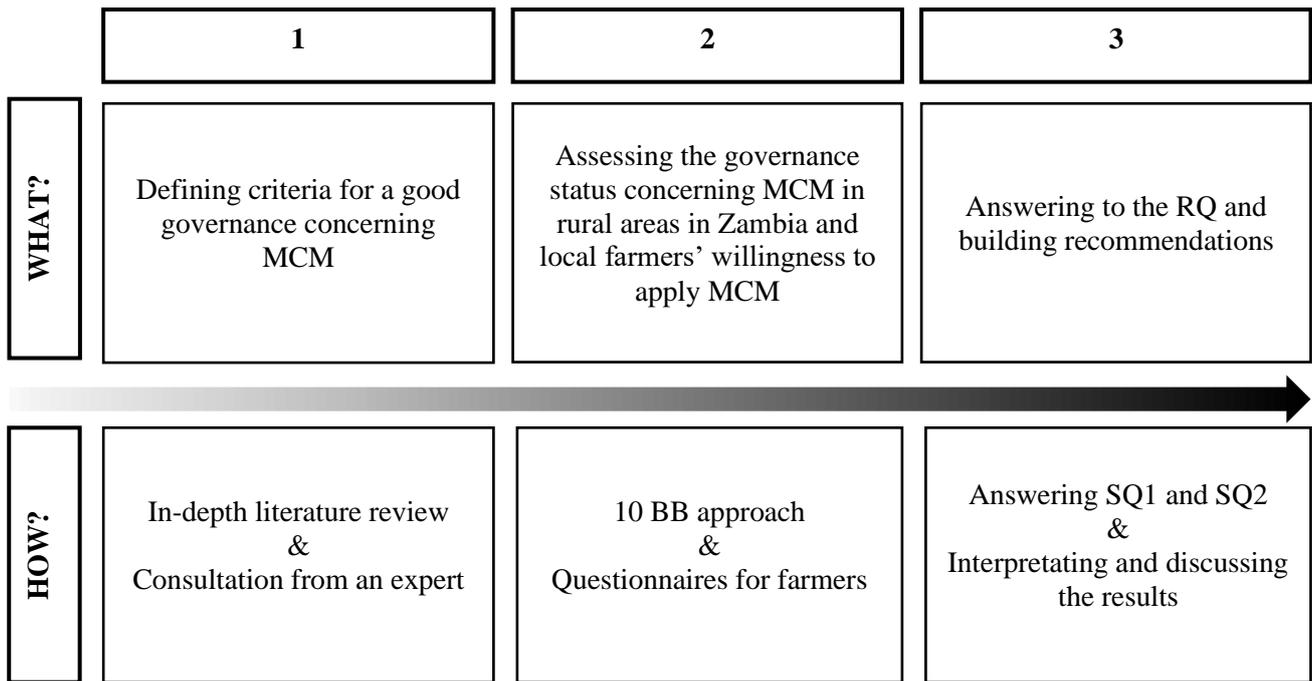
The null hypothesis, i.e., H<sub>0</sub> is rejected when the governance concerning MCM in rural areas in Zambia is *good*, i.e., its overall perceived quality is positive, and when local farmers are willing to apply MCM. In this case, the H<sub>1</sub> will be accepted, in as much as the analysis confirms that MCM is a feasible option to challenge climate variability in those areas.

In summary, this analysis contributes to highlighting the opportunity to treat MCM as a strategy to face climate change, helping improve the process of adoption and implementation of sustainable interventions such as MCM in Zambia. Furthermore, the research fills the gaps in knowledge regarding the study of MCM under a governance point of view, offering a method to assess the governance system concerning the improvement of a sustainable strategy such as MCM. Lastly, it gives inputs for the analysis of farmers' response towards the adoption of sustainable strategies to deal with local climate variability on the ground.

## 1.6 RESEARCH FRAMEWORK

Scheme 1 represents the research framework of the thesis, where three main steps are identified to solve the main question "Is improving MCM a feasible option for dealing with climate change in rural areas in Zambia?".

The first step regards the definition of the criteria for *good* governance concerning MCM. This phase is conducted through in-depth literature review and consultation from an expert in the field of MCM. Second step consists of assessing the governance status concerning MCM in rural areas in Zambia and local farmers' willingness to apply MCM. This step is solved using the 10 BB approach where questionnaires and interviews both addressed to experts in the field are designed and conducted, and through the analysis of questionnaires compiled by Zambian farmers. Third and last step regards answering the RQ and building recommendations, by solving the SQs and by clarifying and identifying contiguous strategies to improve MCM in rural areas in Zambia.



*Scheme 1 Research framework. Three steps are identified along the black arrow, that indicates the timeline of the analysis. Object of analysis (What?) and method of analysis (How?) are specified per each step.*

## 1.7 OUTLINE OF THE THESIS

Following this chapter, the research is guided by clarifying the terminology used in this research (i.e., the *10 BB approach*) and by defining the criteria necessary for the assessment of the governance status concerning MCM. Then, methods and data collection of the analysis are explained in chapter 3. Afterwards, results from the analysis are described and represented for SQ1 and SQ2 respectively in chapter 4 and chapter 5. Chapter 6 offers discussion and interpretation of the results, limitations of the research, and inputs for its further development. Lastly, conclusions are drawn in chapter 7, where the RQ is answered, and recommendations are offered.

## 2 CRITERIA TO ASSESS THE GOVERNANCE CONCERNING MCM

### 2.1 INTRODUCTION

In this chapter, the criteria for the assessment of the status of the governance concerning MCM are drawn. Section 2.2 introduces the approach used to draw the criteria, i.e., the *10 building blocks approach*, while section 2.3 indicates the operationalization of the assessment criteria.

### 2.2 THE 10 BUILDING BLOCK APPROACH

The method designed by Van Rijswick et al. (2014) and called *10 Building Blocks approach* is used in this research as a framework to build the criteria for the evaluation of the governance status concerning MCM. This approach seeks to assess the interdisciplinary nature of water governance and its *soundness*. Assuming that the term *sound* is equivalent to the term *good*, the approach permits to evaluate whether the governance concerning MCM in rural areas in Zambia can be defined as *good* or *not good*.

This approach is based on the analysis of 10 building blocks aimed at identifying and analysing main gaps in the water governance system of a certain context, in order to underline weaknesses and strengths and build recommendations for its improvement. This framework looks at the *interdisciplinary knowledge* of water governance, where various factors are under analysis and equally emphasised, and it underlines how the status of the governance not only depends on the frame of policies, but on multiple aspects touching upon scientific, social, administrative, and engineering disciplines (Dai et al., 2022). Because of the holistic nature of the approach that permits to identify all-encompassing potentialities and limitations in a governance system, the 10 BB approach is chosen in this thesis as a base to draw criteria for the assessment of the governance status concerning MCM. In this thesis, the criteria are designed in such a way that if at least half of them are satisfied, the governance is assessed as *good*.

In-depth literature review is conducted to get insight on the content of each BB and on useful information to define the assessment criteria concerning MCM. The search strategy is applied using databases such as *Scopus*, *Nature*, *Google Scholar*, *WorldCat*, and *ResearchGate*. Journals, articles, published books and grey literature are reviewed.

A consultation with an expert in the field of MCM development is integrated to ensure consistency in the analysis and adding value to the definition of the criteria.

Identity and professional occupation of the expert can be found in Appendix 1.

### 2.3 DEFINITION OF THE CRITERIA

In this section, each BB is briefly introduced, whose content helps define the criteria for the analysis. For each block a table is built where the key-concepts of each BB are summarised and assessment criteria are defined.

#### 2.3.1 System knowledge

Knowledge represents the base on which behaviours, regulations and policies are built. It is reasonable, then, to begin defining the criteria starting from this block.

Van Rijswick et al. (2014) define water system knowledge as the union between natural resources and anthropogenic interventions in nature. A fundamental aspect from a “microclimate perspective” in this regard is ensuring that the focus is on the local scale as much as “creating awareness of the issue” (van Woesik, personal consultation, 2022). Therefore, the first aspects to consider in relation to MCM are sufficient knowledge, or rather awareness, on the interaction between local climate conditions and effects on crop productions and on the anthropogenic interventions to smooth local climate variability, which are sustainable strategies in this specific case.

It must be considered that a lack of transparency in sharing information can be a real issue to encounter, especially in developing countries. Because of this risk, Dai et al. (2022) suggest including the robustness of information in the analysis of the block. Besides, Lemos (2014) emphasises the fundamental role of usable, meant as publicly founded, scientific knowledge on addressing societal issues and supporting policy making. Therefore, available data must be robust, open, and accessible.

Lastly, the delivery of the information (i.e., efficient communication) plays a fundamental role in the block of system knowledge. In fact, Lemos (2014) explores strategies to guide potential users on the use of knowledge, amongst which is good communication.

The assessment criteria of this block are summarised in table 1.

*Table 1 Definition of the assessment criteria of the system knowledge. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCK KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
1. Knowledge regarding climate characteristics of the area.	a. Local institutions are sufficiently aware of local climate variability in rural areas in Zambia.
2. Knowledge of effects and impacts on landscape on the part of climate variability, and action (investments) strategies.	b. Local farmers are sufficiently aware of local climate variability and its effects on crop production in rural areas over time.
3. Knowledge regarding prevention measures against climate change.	c. Zambian local farmers are sufficiently aware of strategies and interventions in the ground that can deal with local climate variability.
4. Usability and robustness of knowledge.	d. Information that can be gathered on local climate characteristics and local geological characteristics is based on robust data.
5. Efficiency in the communication.	e. Information regarding local climate variability is open and accessible by local farmers.
	f. Information regarding local climate variability is open and accessible by researchers of research institutes/companies/university.
	g. The communication between institutional bodies and local communities is efficient.

### 2.3.2 Values, principles, and policy discourses

Together with the knowledge, values and principles are key aspects that shape people’s behaviour, perception, and their way of managing and regulating things. Therefore, analysing which values and principles are at the base of a determined society, as it can be a smallholders' community in rural areas, and the extent to which they influence smallholders’ choices is fundamental for a governance system. In this regard, Groenfeldt & Schmidt (2013) state the values are “cultural standards that give intrinsic or extrinsic worth to subjects, objects, or behaviour, and which delimit the sphere of moral consideration” (p. 1). Without them, the governance loses its competence on clinching or implementing a determined institutional pathway and when they are ignored, governance norms are not guided by their referent. Therefore, the acknowledgment and recognition on the part of institutions and policy makers of local values and principles appears to be fundamental.

Afterwards, values and principles must be defined in the policy discourses, that constitute the narrative on which an issue is shaped in the policy making. The narrative is indeed essential as much as understanding the issue itself (Groenfeldt & Schmidt, 2013). Therefore, the integration in the policy discourses of the values, principles and the cultural background of the actors interested in the matter is fundamental to both understand the substance of the issue and integrate all points of views and needs for its resolution.

Table 2 shows the assessment criteria defined for this block.

*Table 2 Definition of the assessment criteria of values, principles, and policy discourses. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCK KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li>1. Knowledge of values and principles of smallholders’ communities concerning natural resources and environment.</li> <li>2. Inclusion of values, principles, and viewpoints of different stakeholders in the policy making process.</li> </ol>	<ol style="list-style-type: none"> <li>a. Values, principles, and cultural traditions of local communities in rural areas influence their way of approaching the work in the field (and in shaping smallholders’ attitude) and/or adopting new interventions in the field are known by local institutions.</li> <li>b. Values, principles, and cultural traditions of local communities in rural areas influence their way of approaching the work in the field (and in shaping smallholders’ attitude) and/or adopting new interventions in the field are considered and integrated in the local policy discourses.</li> </ol>

### 2.3.3 Stakeholders’ involvement

In a governmental process, as much as in any decision-making or managerial process, the grade of participation, inclusion of public, private, and semi-private actors are core factors that deserve careful consideration. Defining *stakeholder* as “someone having an interest in a particular solution, even if this interest is not recognized or acknowledged by others” (p. 36), their involvement helps to increase

transparency and fluency in the entire policy making process, enhancing legitimacy and accountability (Wehn et al., 2018). Therefore, the analysis must focus on the degree of representativeness of stakeholders in the policymaking and on their degree of participation. Van Rijswick et al. (2014) define *representativeness* as the rank of opportunities for the stakeholders to take part in the process of decision-making and it can be proposed as the degree of inclusiveness. *Participation*, instead, denotes how much the voice of each stakeholder is heard and embedded in the process of decision-making and how much impact each actor has on the outcomes. Its evaluation can derive from the analysis of the influence that stakeholders have on “shaping opinions and [on] the realisation of outcomes” (Van Rijswick et al., 2014, p. 732).

Morrison (2003) also stresses on the significance to involve the public stakeholders explaining a series of actions that must be conducted during every process of decision-making. Within these actions are an openly and transparently welcoming to a wide representation of the public, strengthening accessibility to the process and developing a common vision that permits to prioritise a certain direction where acting. Lastly, the author also insists on the significance of effective communication to the public in gaining support during the process of decision-making.

Table 3 indicates the assessment criteria defined for this block.

*Table 3 Definition of the assessment criteria of the stakeholders’ involvement. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCK KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<p><b>1.</b> Stakeholders’ representativeness and participation in the decision-making process for rural areas and for agricultural sector:</p> <ul style="list-style-type: none"> <li>- Completeness of representativeness.</li> <li>- Grade of accessibility to the process.</li> <li>- Responsiveness to all interests.</li> <li>- Equality in treating different stakeholders.</li> </ul> <p><b>2.</b> Effective communication to the public.</p>	<p><b>a.</b> Local farmers are involved in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.</p> <p><b>b.</b> External organisations that work at a field level in promoting new strategies to deal with local climate change in a sustainable way are included in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.</p> <p><b>c.</b> The communication between external organisations operating in the field that claim for the promotion of adaptation strategies against local climate variability is efficient in Zambia.</p> <p><b>d.</b> The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is accessible by all stakeholders.</p> <p><b>e.</b> Stakeholders’ involvement in the process of decision-making regarding the management of</p>

	<p>landscape, environmental resources and the agricultural sector is equitable.</p> <p><b>f.</b> The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is responsive to all stakeholders’ interests.</p>
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#### 2.3.4 Trade-offs

After defining the content on which a governance is conceived, acceptable trade-offs between different objectives are fundamental for the implementation of a good governance.

Usunier et al. (2011) focus their research on analysing trade-offs between economic and social targets in corporate management. In their study, trade-offs between economic and social objectives in the corporate business are meant as a compromise between economic, legal, ethical, and discretionary goals of multiple stakeholders. Thus, it is significant to look deeply into the integration of policy targets that ensure a common direction of acting.

The assessment criterion of this block is defined in table 4.

*Table 4 Definition of the assessment criterion of trade-offs. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCKS KEY CONCEPT</b>	<b>ASSESSMENT CRITERION</b>
<b>1.</b> Integration of political targets.	<b>a.</b> Environmental targets decidedly fall within the principal political targets of local institutions.

#### 2.3.5 Authorities, responsibilities, and means

Van Risjwick et al., (2014) refers to this BB as the assessment of the management of property rights, the authorities’ role in charge of its administration and the different authorities’ means on the management of property rights. Its assessment criteria are listed in table 5.

First of all, as Arnwine (2002) suggests, defining authorities play a fundamental role in the governance process. The presence of a legislative authority above the process of decision-making confers major legitimation to the formulation and application of regulations (Baldwin et al., 2013). In the case of this thesis, it is fundamental to identify which are legislative authorities on top of the decision-making process regarding MCM in rural areas. Furthermore, there must be a proper identification of allocation of responsibilities within the parties involved “to ensure that everyone knows what to expect from them” (Arnwine, 2002, p. 20).

Once authorities and responsibilities are defined, it is important to assess their *means of operation*. They relate to *participative* and *integrative* capacity of the public domain. The former is meant as supporting a deliberative, aggregative, consultative, and decisional relationship between authorities and the society (d’Albergo & Moini, 2007). The latter refers to the efficiency in coordinating different actors (or policy

departments) and emphasising multiple policy fields (Van Risjwick et al., 2014; Al-Saidi & Elagib, 2017).

As well as authorities and responsibilities, also the property rights must be properly defined and registered. Property rights are described as exclusive social relations that tie a titleholder to the resource (Van Risjwick et al., 2014), which can coincide with land title on the part of farmers. In this thesis, two main types of property rights or ownership are introduced under the suggestion of van Woesik (personal consultation, 2022). The properties rights considered are the private, where the titleholder is a private individual or private corporation, and collective (or *traditional*), where the property is private and is owned by a group.

Table 5 lists the assessment criteria related to this block.

*Table 5 Definition of the assessment criteria of authorities, responsibilities and means. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCKS KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li><b>1.</b> Clearness in the definition of the authorities and their responsibilities.</li> <li><b>2.</b> Definition and administration of property rights in rural areas (allocation of property rights, responsibility, and authorities around the property rights).</li> <li><b>3.</b> Problems authorities' resolution and attitude toward public domain in a participative and integrative way</li> </ol>	<ol style="list-style-type: none"> <li><b>a.</b> Local authorities and their responsibilities regarding the management of landscape, environmental resources and the agricultural sector are known and well defined.</li> <li><b>b.</b> The authorities act in a participative and integrative way while challenging environmental-related issues.</li> <li><b>c.</b> Ownership of lands (land titles) are well defined and registered.</li> <li><b>d.</b> Collective ownerships of lands (collective farmlands) are well defined and registered.</li> </ol>

### 2.3.6 Regulations and agreements

Baldwin et al. (2013) deepened into the definition of good governance, suggesting that due processes must be guaranteed through fairness, accessibility, and openness in the formulation and implementation of the regulations. The sixth building block, therefore, aims at assessing regulations and the agreements by evaluating their appropriateness, their legitimacy, their degree of flexibility, and their transparency.

Furthermore, whenever there is a lack of information for a regulator to address an issue and reach a stable judgement, the necessity of expertise' opinion is significant (Baldwin et al., 2013). Consequently, the occurrence of experts' consultation is another factor under analysis.

Significant factor pointed out by van Woesik (personal consultation, 2022) of good governance concerning MCM is enabling cooperation between communities that must be supported by governance policies built on a bottom-up approach. Ouyang et al. (2020) state indeed that a prevalence in top-down approaches not only impedes an equitable engagement of stakeholders in the decision-making, but also increases "resentment if certain dimensions of state-mandated measures are unfavourably interpreted" (p. 3). Therefore, regulations and agreements must ensure balance between these two approaches.

Lastly, Dai et al. (2022) express their consideration stating that coherence between spatial planning and

water and landscape management regulations is a key-factor in the assessment of the governance soundness, together with the coherence between the governance and the regulations regarding health, agriculture, energy, and industry. Therefore, coherence and coordination within diverse policies are key factors in the analysis.

Table 6 offers the assessment criteria of this block.

*Table 6 Definition of the assessment criteria of regulations and agreements. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCKS KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li>1. Guarantee of appropriateness, legitimacy, and flexibility.</li> <li>1. Occurrence of expertise consultation for administration and regulations and agreements when is needed.</li> <li>2. Balance between bottom-up and top-down approaches.</li> <li>3. Coherency and coordination between diverse policies planning.</li> </ol>	<ol style="list-style-type: none"> <li>a. Regulations and agreements concerning the management of rural areas are in general appropriate, legitimate, and flexible when necessary.</li> <li>b. Policies regarding the management of private land tenures in rural areas are transparent and appropriate.</li> <li>c. Agreements between non-private actors (municipal, regional, or state) and private landowners are appropriate and legitimate.</li> <li>d. Experts' consultation usually occurs in the governance of the agricultural sector to achieve environmental targets.</li> <li>e. In general, bottom-up and top-down approaches in the governance of rural areas are balanced.</li> <li>f. Generally, diverse policies are coherent and coordinated to find the most effective resolution for the implementation of sustainable strategies (e.g., MCM) to deal with local climate variability.</li> </ol>

### 2.3.7 Financial means

Financing governance is certainly fundamental for any kind of initiative, activity, and development. Assessing whether there are available fundings for the development of adaptation strategies and the administration of finances is the core of this block. Specifically, due to the great significance played by “creating awareness” for a correct development of MCM (van Woesik, personal consultation, 2022), the analysis focuses on available fundings in relation to the promotion of sustainable strategies, research, and awareness campaigns.

Furthermore, integrating environmental targets into institutional financing criteria would improve the finding of financial means necessary for the implementation, for example, of MCM (OECD, 2020). This integration must be then considered.

Lastly, more knowledge regarding financial means, their function and their requirements would permit serious dialogue between stakeholders and institutions (IUCN, 2018). In this regard enhancing communication channels with financial institutions to gather information and support is then essential.

The assessment criteria for this block are defined in table 7.

*Table 7 Definition of the assessment criteria of financial means. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

BUILDING BLOCKS KEY CONCEPTS	ASSESSMENT CRITERIA
<ol style="list-style-type: none"> <li>1. Fundings to support the promotion of sustainable strategies, research, and awareness campaigns.</li> <li>2. Communication of stakeholders with financial institutions.</li> <li>3. Environmental targets (improving MCM/dealing with climate change) are part of the financial criteria of local institutions.</li> </ol>	<ol style="list-style-type: none"> <li>a. The communication channel with financial institutions is accessible and opened to all stakeholders.</li> <li>b. There are sufficient available fundings to pursue environmental targets (promoting sustainable strategies to deal with local climate change in rural areas).</li> <li>c. There are sufficient available fundings dedicated to promoting research regarding local climate variability.</li> <li>d. There are sufficient available fundings to develop and implement awareness campaigns of environmental issues and adaptation strategies in rural areas.</li> <li>e. Financial institutions in Zambia are efficiently introducing the challenge of local climate variability in their primary financial criteria.</li> </ol>

### 2.3.8 Infrastructure system

In this thesis, the infrastructure system is defined as the “collection of technologies and systems to support governing activities” (Johnston, 2022, p. 1). It is preferable to use this definition and title for this block, slightly deflecting from the original description given by van Rijswick et al. (2014), where focus concentrates on the analysis of service-level agreements between consumer and provider. The infrastructure system concerning MCM pays specific attention to implementing and maintaining a correct weather monitoring analysis, being the core of an efficient MCM. In doing so, information technology on the local weather monitoring system must be studied and assessed.

Lastly, careful attention must be paid to the economic means regarding investments destined to infrastructures, due to the critical role played by financial investments in ensuring the procurement and an effective maintenance of the infrastructures (Corfee-Morlot et al., 2012).

The criteria for the assessment of this block are listed in table 8.

Table 8 Definition of the assessment criteria of the infrastructure system. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.

<b>BUILDING BLOCKS KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li>1. Sufficient cost-effectiveness analysis regarding the creation and/or renovation of MCM infrastructures</li> <li>2. Sufficient monitoring systems and data used for the maintenance and monitoring of the MCM interventions</li> <li>3. Sufficient financial funding and policies for MCM intervention in the field.</li> </ol>	<ol style="list-style-type: none"> <li>a. Gathering data related to local climatic and geological features in rural areas is easy.</li> <li>b. Local weather monitoring systems work efficiently.</li> <li>c. The number of local weather stations working efficiently in rural areas is sufficient.</li> <li>d. Financial means for maintaining monitoring local weather stations are sufficiently available.</li> </ol>

### 2.3.9 Enforcement

Enforcement is a process that becomes fundamental after the definition of problems and establishment of goals. The enforcement consists in enhancing legitimacy and credibility of regulations and agreements as well as avoiding conflicts. The enforcement, as suggested by van Rijswick et al. (2014), occurs through the enforceability of rules and agreements, which is easily implemented whenever regulations and agreements are supported by shared values and principles. In general, enforceability is influenced by factors already addressed and considered in previous blocks, such as precision in the allocation of responsibilities, clarity and transparency of norms and standards, the objectives set and the presence of efficient communication channels. While stakeholder acceptance and perceived corruption are factors that fall exclusively in the block of enforcement, becoming the focus of its assessment. Furthermore, van Woesik (personal consultation, 2022) suggests how “levels of enforcement in place” can constitute a barrier or a strength in implementing campaigns in cooperation with farmers. Therefore, “regulations enforceable by public and or private parties, and the agreements between these two parties” are suggested to be under analysis.

Table 9 lists the assessment criteria related to this block.

Table 9 Definition of the assessment criteria of the enforcement. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.

<b>BUILDING BLOCKS KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li>1. Support by stakeholders’ acceptance, shared values, and principles of legislative and governmental spheres.</li> <li>2. Perceived corruption.</li> <li>3. Enforceability of regulations and agreements between different parties.</li> </ol>	<ol style="list-style-type: none"> <li>a. Agreements between non private actors (municipal, regional, statal) and private landowners can be easily enforced.</li> <li>b. Local farmers are not confronted with any form of corruption that could intimidate their trust in the process of policy making.</li> <li>c. Legislative and governmental spheres are supported by stakeholders’ acceptance.</li> </ol>

### 2.3.10 Conflict prevention and resolution

The last building block relates to the prevention and resolution of conflicts between different parties. Mechanisms to prevent conflicts are analysed in relation to sharing natural resources, because “if the community decides to harvest water, or dig a big bounce, then the water must be allocated. Maybe there can be conflicts related to that” (van Woesik, personal consultation, 2022) and in the context of collective farmlands, where taking responsibilities on the management of the farmland can be critical.

Furthermore, van Rijswijk et al. (2014) specify the significance to identify and select an independent mediator, arbiter or court who presides over possible conflicts and that can enforce the final ruling.

Table 10 shows the assessment criteria defined for this block.

*Table 10 Definition of the assessment criteria of conflict prevention and resolution. On the left-hand column the key-concepts of each BB are listed, while the assessment criteria are defined on the right-hand column.*

<b>BUILDING BLOCKS KEY CONCEPTS</b>	<b>ASSESSMENT CRITERIA</b>
<ol style="list-style-type: none"> <li>1. Sufficient conflict prevention and resolution mechanisms in place.</li> <li>2. Presence of a mediator.</li> </ol>	<ol style="list-style-type: none"> <li>a. Mechanisms to prevent conflicts related to sharing natural resources (water resources, lands, etc.) are efficient.</li> <li>b. Mechanisms to prevent conflicts between farmers in collective farmlands are efficient.</li> <li>c. In case of conflict, there is a mediator (or a court), and it works efficiently to solve the conflict.</li> </ol>

## 2.3 CONCLUSION

After defining the criteria, they are then applied in the assessment of the governance status concerning MCM in rural areas in Zambia together with the assessment of farmers’ willingness to apply MCM using the methods described in the following chapter.

## 3 METHOD OF ANALYSIS

### 3.1 INTRODUCTION

In this chapter, a step-by-step description of the approach used to solve main objectives of the research is offered by explaining methodology and data sources related to SQ1 in section 3.2 and SQ2 in section 3.3.

### 3.2 ASSESSING THE STATUS OF THE GOVERNANCE CONCERNING MCM

The criteria drawn in the previous chapter are used to assess the governance status concerning MCM in rural areas in Zambia, answering SQ1. The assessment is conducted through 26 questionnaires and 13 semi-structured interviews, both addressed to experts in the field of development of sustainable interventions in the agricultural sector, landscape and natural resources management, governance, climate change and local climate variability in Zambia. The experts are involved in the process using the so-called *snowball effect*, i.e., asking each participant to include other experts in the analysis.

In Appendix 1, their name, professional occupation, contact channel, and contribution in the research are listed.

Specifically, the questionnaire for experts is designed with the aim to assess experts' opinion on the governance of rural areas in Zambia specifically concerning the development of sustainable strategies such as MCM. It is constructed in 14 sections, of which the first 13 are used to solve SQ1, while the last one is used to gather information on farmers' behaviour and willingness to apply MCM. The introductory section starts with asking general background information and privacy preferences of the participant. This section is followed by 10 sections (2-11) dedicated each one respectively to a BB, where the assessment criteria of the BB and questions to gather deeper information on the matter are proposed. Lastly, sections 13 and 14 focus on general questions related to the implementation of adaptation strategies in rural areas in Zambia and factors that shape farmers' willingness to apply MCM. The sections are composed of open questions and by multiple-choice questions under the form of statements (coincident with the assessment criteria of the 10 BB) about which the recipient is asked to give an opinion between 5 categories or not stating any opinion, with possibility to further elaborate the answer.

In Appendix 2, the 26 compiled questionnaires and the model are given.

After the compilation of the questionnaires, data collected from the multiple-choice questions are transcribed and elaborated in Microsoft Excel, where the categories of opinions are transposed into levels of perceived quality as table 11 explicates. To simplify the interpretation of the results, a further step is conducted in Microsoft Excel to obtain only two main categories of perceived quality, i.e., *positively perceived* and *negatively perceived*. The results are then represented through graphs.

Assuming that the perceived quality represents the status of the governance, the analysis from the experts' opinions offered the possibility to qualitatively assess the governance status concerning MCM in rural areas in Zambia.

In appendix 2, more details regarding the elaboration of data in excel are offered. Contrarily, the information gathered from the open questions are organised in Nvivo software in sublevels of

information. Each level of information coincides with each assessment criteria.

Table 11 List of categories of opinions and correspondent levels of perceived quality.

Category of opinion	Level of perceived quality
Strongly agree	Strongly positive
Agree	Positive
Neutral	Neutral
Disagree	Negative
Strongly disagree	Strongly negative

The experts' interviews are conducted with the aim to deeply understand the perception towards the governance concerning MCM in rural areas in Zambia. The semi-structured questions address topics such as:

- Identification of major barriers and drivers at a governance level in implementing sustainable strategies such as MCM in rural areas.
- The assessment criteria of the 10 BB.

Keywords used in the interviews are *farmers, government, Zambia, interventions, microclimate, climate change, agriculture, support*.

Appendix 2 offers the full transcription of the 13 interviews.

The duration of the interviews varies between 30 to 45 minutes and data are partially elaborated and organised in sub-levels coincident with the assessment criteria of the 10 BB using Nvivo software.

### 3.3 ASSESSING LOCAL FARMERS' WILLINGNESS TO APPLY MCM

Data from 52 questionnaires compiled by local farmers out of 61 delivered with help of Solidaridad Zambia are used to define the factors that account for farmers' willingness to apply MCM in rural areas in Zambia. Demographic and economic characteristics of the participants are shown in table 12.

Table 12 Demo-economic characteristics of participants to the questionnaires compiled by farmers.

Demo-economic characteristic	% of the participants
Men	67%
Women	33%
Age between 21 and 35 years old	35%
Age between 36 and 50 years old	38%
Age older than 50 years old	21%
Private landowners	48%
With availability of labours	31%
With a land smaller than or equal to 10 hectares	71%

The questionnaire is designed with the aim to analyse their willingness to apply MCM and to determine which factors are perceived more influencing and more limiting in terms of farmers' MCM adoption. Defining the thesis as *explorative research*, i.e., it acquires the knowledge to build the methods and the analysis to solve research and sub-questions of the thesis along the research itself, the content for the questionnaire draws inspiration from the information gathered from the answers of section 14 of the questionnaires compiled by the experts and from the interviews. Appendix 3 offers brief clarification of the information just mentioned.

The questionnaire is subdivided in 5 main sections below briefly described:

1. Introduction and general information: This section focuses on gathering data related to demographic characteristics of the farmer.
2. Local climate variability awareness: This section focuses on understanding the level of impact of local climate variability on the crop production perceived by the farmers.
3. Agricultural interventions in practice: After briefly introducing the definition of MCM, the section aims to comprehend the level of past or current adoption of sustainable interventions of MCM in use by the farmer. The interventions proposed are 22 in total and they are based on the research conducted by van Woesik (2021).
4. Willingness to invest in MCM: This section wants to understand whether farmers are willing to apply MCM in the future and to analyse driven factors for the adoption of MCM.
5. Reasoning on factors' that affect farmers' choices: This section aims to understand farmers' perception towards certain socio-economic and governance factors that could influence farmers' behaviour.

The questionnaire is composed of open questions, closed questions, and multiple-choice questions for which the same approach used in the questionnaires for experts is used (proposing 6 categories of opinions).

Appendix 2 shows the model and the 52 questionnaires compiled by local farmers.

Again, all data of the questionnaires is organised and elaborated in Microsoft Excel. The results are represented through graphs.

Appendix 2 offers more details on the elaboration of data in Microsoft Excel.

### 3.4 CONCLUSION

The above-mentioned methods are applied to answer SQ1 and SQ2, necessary to solve the main objective of the research. The outcomes of the analysis are carefully illustrated in the following chapters.

## 4 RESULTS ON THE STATUS OF THE GOVERNANCE CONCERNING MCM

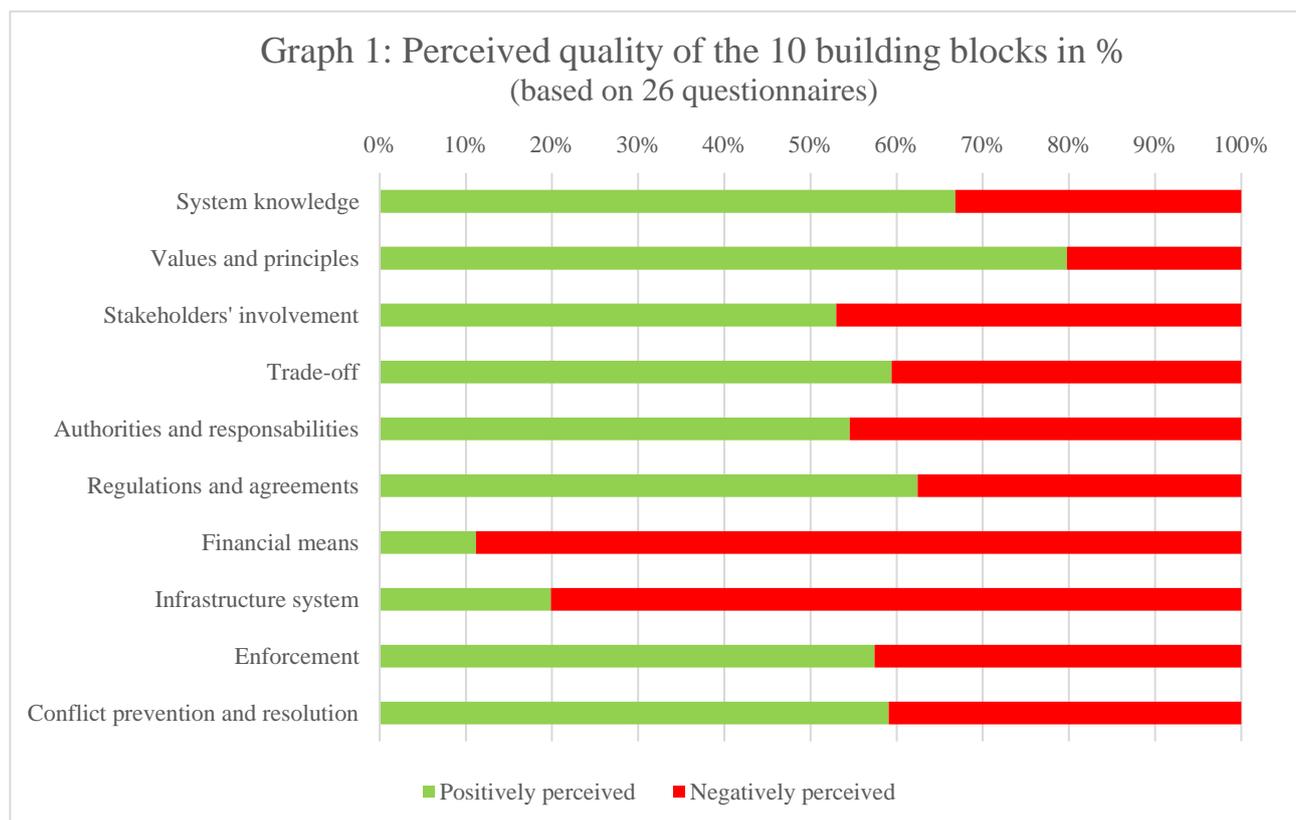
### 4.1 INTRODUCTION

This chapter presents the results regarding the assessment of the governance status concerning MCM in rural areas in Zambia based on experts' opinion. Section 4.2 offers an overview of the perceived quality of the 10 BB obtained from the multiple-choice questions of the questionnaires compiled by the experts. The section is followed by a brief description of the main findings for each BB (sub-sections 4.2.1 - 4.2.10), resulting from the analysis of the questionnaires compiled by the experts and the interviews.

Detailed information and data regarding each assessment criteria of the 10 BB gathered during the analysis are offered in Appendix 4.

### 4.2 OVERVIEW OF EXPERTS' PERCEPTION ON THE QUALITY OF THE 10 BB

Results from the analysis of the multiple-choice questions from the 26 questionnaires from experts are organised in graph 1, which offers an overview of the experts' perception on the quality of the BB.



*Graph 1 Overall results in % of the perceived quality of the 10 building blocks based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

First and foremost, graph 1 shows that the overall perceived quality of the 10 BB is positive, because most of the BB are perceived as positive.

In detail, graph 1 indicates that the most positively perceived blocks are values and principles, and system knowledge, respectively with 80% and 67% of positive perception. While the blocks of financial means and infrastructures systems are clearly the least positively perceived, whose values are respectively 11% and 20%. Over 55% of positive perceptions are in decreasing order regulations and agreements (62%),

conflict prevention and resolution, and trade-offs (both with 59%), enforcement (57%) and authorities and Means (55%). Lastly, stakeholders' involvement barely surpasses 50% of positive perception, reaching 53%.

#### 4.1.1 Perceived quality of the system knowledge

The status of the system knowledge is assessed by analysing three main categories of criteria, which are awareness of local climate variability and adaptation strategies, characteristics of information regarding local climate and geological characteristics, and finally, efficiency of communication between local institutions and farmers. The results are shown in graph 2.

Analysing graph 2, the former category is visibly the most positively perceived by the experts in terms of quality, most of them stating that local institutions and local farmers' awareness (respectively with 84% and 87% of positive perception) is highly driven by the experience of local climate variability at a field level. However, they also highlight a basic lack of scientific knowledge that limits the level of awareness, especially in relation to the variability of local weather patterns, leading farmers to highly rely on indigenous knowledge. Farmers' awareness of strategies to copy local climate variability (such as MCM) (with 70% of positive perception) is also perceived as sufficient and it bases on farmers' experience and on indigenous knowledge. Nonetheless, experts claim a general lack of knowledge regarding the use of technologies and tools to implement sustainable interventions, and limited capability to recognize the general benefits deriving from the implementation of sustainable strategies at a social and economic level. Lastly, some experts state the adoption of strategies does not necessarily imply that local farmers are aware of the matter. Regarding the category of characteristics of information, i.e., its robustness, openness, and accessibility, the first does not have a distinct positive or negative perception (50%); however, experts agree in considering its level as poorly appropriate due to scarce, even absent, support of inadequate equipment and infrastructures to collect and process data. Openness and accessibility to local farmers are slightly negatively perceived (reaching 57% of negative perception). In fact, while the former is considered as generally sufficient, experts claim a high limitation of the latter caused by lack of equipment, bureaucracy, and language barriers. Contrarily, openness and accessibility to researchers is decidedly considered as positive in terms of quality (with 76%), of which experts, however, underlines a difficulty in accessing data and information due to unavailability of channels besides those that are of the government. Lastly, the communication between local institutions and local farmers is clearly the most negatively perceived aspect of this BB (with a positive perception only of 37%). Experts highlight some of the challenges that impede communication to be efficient. Amongst them are a lack of resources to communicate (human resources, infrastructures, technology amongst farmers), difficult mobility and limited financial capacity. Furthermore, the information package is usually inappropriate because it does not consider language and illiteracy barriers. Experts also state that there is a general confusion regarding the implementation of sustainable strategies on the parts of both farmers and extension officers, partially due to a limited expertise on agriculture held by government officers. Lastly, experts state that the inefficiency of the communication is strengthened by a limited understanding of the matter on the part of local farmers, who often dispute the information delivered due to the perceived imprecision of available data and a general erraticism in receiving information.

**Graph 2: Perceived quality of the system knowledge in %**  
(based on 26 questionnaires)

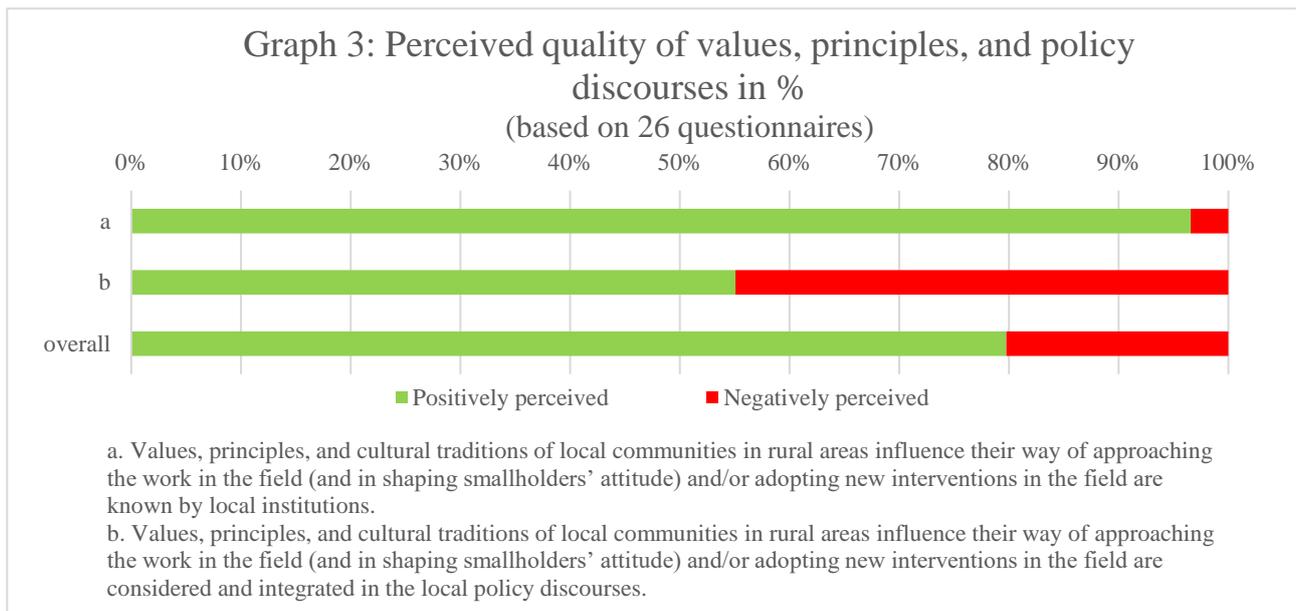


- a. Local institutions are sufficiently aware of local climate variability in rural areas in Zambia.
- b. Local farmers are sufficiently aware of local climate variability and its effects on crop production in rural areas over time.
- c. Zambian local farmers are sufficiently aware of strategies and interventions in the ground that can deal with local climate variability.
- d. Information that can be gathered on local climate characteristics and local geological characteristics is based on robust data.
- e. Information regarding local climate variability is open and accessible by local farmers.
- f. Information regarding local climate variability is open and accessible by researchers of research institutes/companies/university.
- g. The communication between institutional bodies and local communities is efficient.

*Graph 2 Results in % of the perceived quality of the system knowledge based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.2 Perceived quality of values, principles, and policy discourses

Experts perceive this BB as the most positive in terms of quality, overpassing 50% of positive perception in the assessment of both criteria of the block, as it is shown in graph 3. The most positively perceived criterion in terms of quality regards to the acknowledgment on the part of local institutions of the cultural heritage at a local scale that shapes farmers’ behaviour in the agricultural sector (97% of positive perception). The other criterion relates to the integration of the cultural heritage in the local policy discourse, and it generates different opinions amongst experts, reaching only 55% of positive perception, much lower than the previous criterion. On the one hand, experts focus on the respect given by local institutions towards the traditional chief, recognized as a significant local authority in villages, strengthening the idea that local institutions really integrate cultural heritage in the management of rural areas. On the other hand, experts are concerned about the influence of donors’ interests in the agricultural sector in drawing policies and of which experts claim their frequent lack of alignment with local culture and traditions. Lastly, experts accuse failure in integrating indigenous knowledge in the policy discourses, because they are usually designed at a national level, basing uniquely on scientific knowledge and expertise.



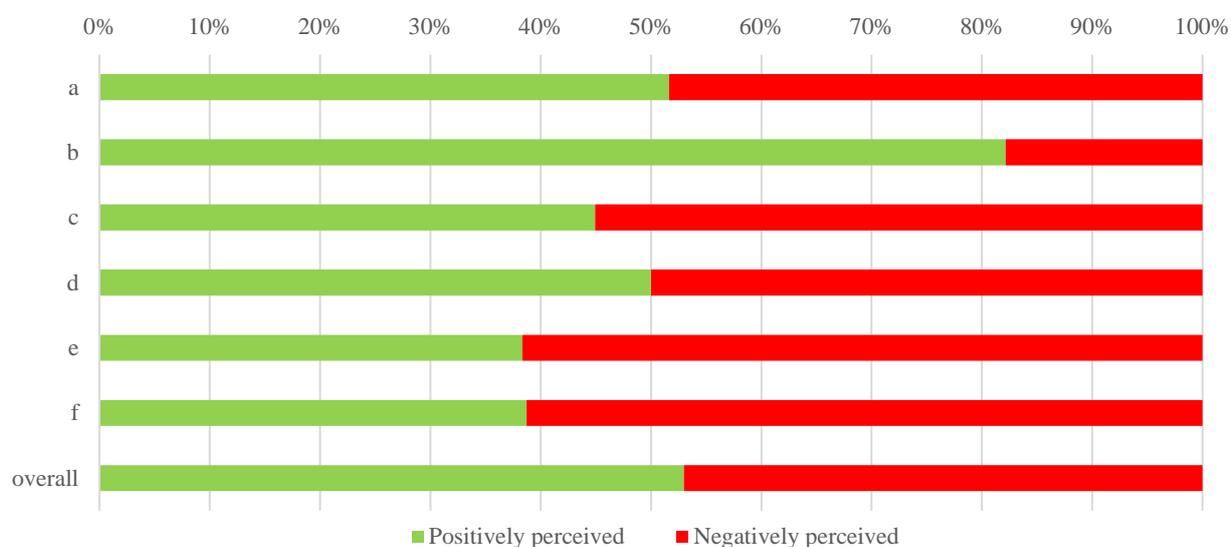
*Graph 3 Results in % of the perceived quality of the values, principles, and policy discourses based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.3 Perceived quality of the stakeholders' involvement

As graph 4 shows, this BB is slightly overall positively perceived in terms of quality, where only two criteria out of seven have a positive perception above 50%.

These two criteria are related to the involvement of local farmers and to the inclusion of external organisations (e.g., Solidaridad) in the decision-making process in rural areas, respectively 52% and 82% positively perceived. Significant concerns, however, arise on the first criterion, where most of the experts claim an incapability of local farmers to organise themselves to higher their voice in influencing policies and decisions. Doubts also arise on the efficiency of the governmental institutions in guaranteeing farmers' inclusion in the process. Contrarily, below 50% of positive perceived quality is the criterion regarding the efficiency of communication on the part of external organisations in promoting sustainable strategies (45%), the equity of stakeholders' treatment in the decision-making process and responsiveness to all stakeholders' interests (respectively 38% and 39%). On the former, experts raise many concerns, amongst which are a lack of cooperation between external organisations, that plays the role of impeding factor in reaching common goals, and which sometimes is even transposed in competition within the organisation themselves. Furthermore, experts claim an inefficiency of communication between these organisations and governmental bodies, considered oftentimes forced. Equity and the responsiveness to all stakeholders' interests are perceived as negative mostly due to three main aspects. Firstly, a visible higher involvement of major donors and big corporations in the decision-making process, which leaves local farmers aside from influencing decisions at a local level, Secondly, a high influence of traditional leaders over single farmers in the process, and lastly, a low engagement of extension officers. Finally, the criterion of accessibility to the process of decision-making is perceived as neutral, since the overall negative and positive and the positive perceived quality appears the same in percentage, nullifying each other.

**Graph 4: Perceived quality of the stakeholders' involvement in %**  
(based on 26 questionnaires)



- a. Local farmers are involved in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.
- b. External organizations that work at a field level in promoting new strategies to deal with local climate change in a sustainable way are included in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.
- c. The communication between external organizations operating in the field that claim for the promotion of adaptation strategies against local climate variability is efficient in Zambia.
- d. The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is accessible by all stakeholders.
- e. Stakeholders' involvement in the process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is equitable.
- f. The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is responsive to all stakeholders' interests.

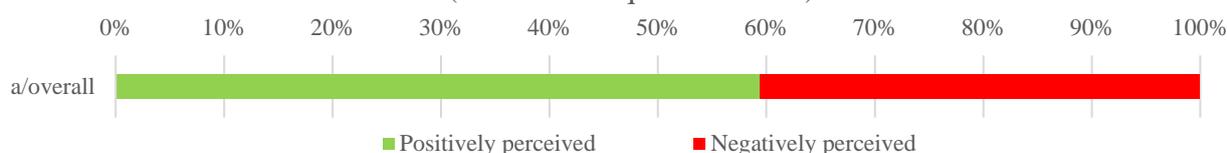
*Graph 4 Results in % of the perceived quality of the stakeholders' involvement based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.4 Perceived quality of the trade-offs

Graph 5 indicates the results related to the trade-offs, which are perceived as positive in terms of quality, reaching 59%.

Particularly, around the criterion on the inclusion of environmental targets into main political targets of local institutions, experts generally highlight the efforts conducted by the government in dealing with issues such as climate change and local climate variability, recognised especially by the high promotion of

**Graph 5: Perceived quality of the trade-offs in %**  
(based on 26 questionnaires)



- a. Environmental targets decidedly fall within the principal political targets of local institutions.

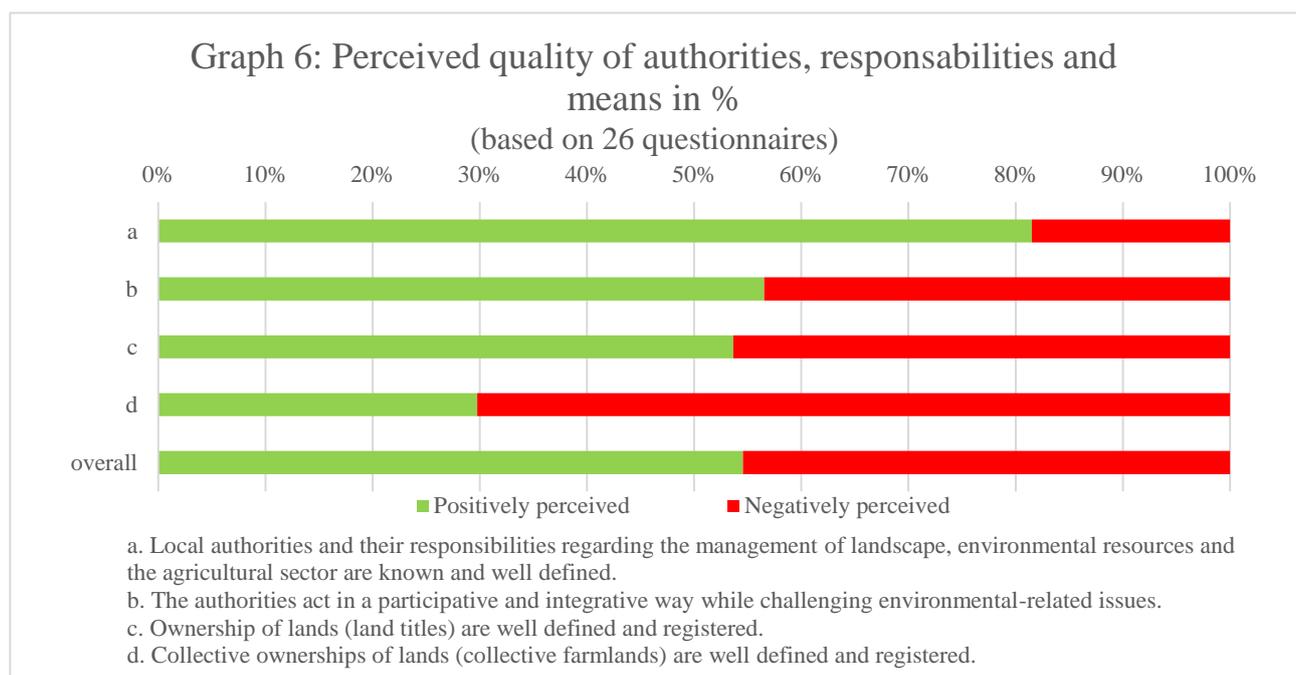
*Graph 5 Results in % of the perceived quality of the trade-offs based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

sustainable interventions in the agricultural sector and by the government commitment towards the implementation of green-based solutions. However, experts accuse environmental targets to be just “on paper”, due to the incapability of the government and local institutions to properly define a policy direction aimed at addressing environmental-related issues, and to the design of the targets at a national level, missing local focus.

#### 4.1.5 Perceived quality of authorities, responsibilities, and means

Authorities, responsibilities, and means are an overall positively perceived block, overpassing 50% of positive perceived quality. Graph 6 indicates the distinction between the positive perceived criteria and the negative ones.

The higher criteria in terms of perceived quality relates to the recognition and definition of local authorities and their responsibilities (82%), although experts concern about an existent mismatch between traditional leaders and local institutional authorities, due to farmers’ attitude to respond to the village chief at first. Furthermore, also the jurisdicative capability of the government to intervene in the activities of external organisations is put in doubt, underlining a lack of authoritativeness on the part of governmental institutions. Following, the criterion related to the participative and integrative acting of authorities in challenging environmental-related issues also present some concerns on the part of experts, although it is positively perceived (with a percentage of 57%). Amongst these concerns are firstly, the use of a top-down approach in rural areas at the expenses of the bottom-up approach; secondly, the external organisations and major investors’ high influence in the management of the areas; thirdly, the lack of accountability of certain institutions that work in the environmental sector and lastly, the governmental inefficiency in dealing with minor agricultural crop productions (e.g., cotton). Moreover, from the interviews, the issue related to the



*Graph 6 Results in % of the perceived quality of authorities, responsibilities and means based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

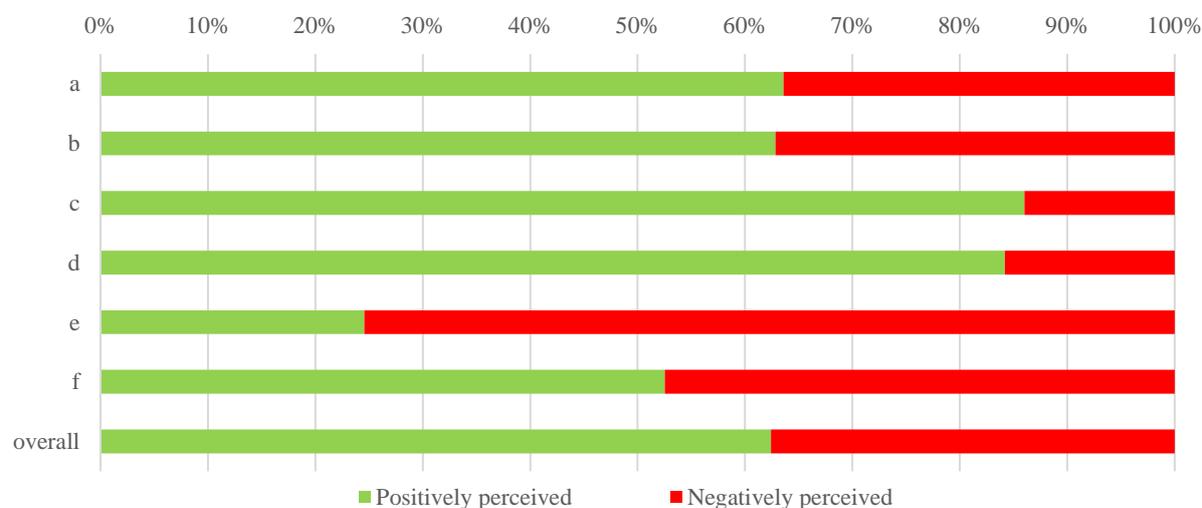
coordination between different departments is also discussed, because it affects the integrative acting and efficacy of authorities' mandate. The last two criteria regard the definition and registration of private and collective land tenures. While the former is positively perceived, with a percentage of 54% of positive perception, the latter is clearly negatively perceived, with a perceived quality of 30%. In fact, private land tenures are perceived as well defined and mostly registered, while the collective tenures, i.e., properties in the customary system (traditional lands) do not present any land title, and land borders are not defined.

#### 4.1.6 Perceived quality of regulations and agreements

Graph 7 shows the results related to the perceived quality of regulations and agreements, whose criteria are mostly over 60% of positively perceived quality.

In detail, the first criterion shown in graph 7 regards the appropriateness, legitimacy and flexibility of regulations and agreements concerning the management of rural areas and it is positively perceived (64%), however, it also represents focus of discussions within the experts, whose concerns concentrate on many aspects. Amongst which are the inappropriateness of the government in favouring the market of chemical fertilisers produced by big corporates, which is controversial in relation to the promoted policy direction of the government towards a *greener economy*, i.e., a management of the economic sector based on the safeguard and conservation of the natural environment. Another issue regarding the inappropriateness of regulations regards the lack of farmers' consultancy at a ground level and the failure in integrating the indigenous knowledge in the design of policies. More perceived as illegitimate, instead, is the occurrence of perceived corrupt practices in implementing certain policies and a perceived facilitation of major corporations' interests in the phase of policy drafts. Contrarily, no significant comments arise on the two criteria related to the policies regarding the management of private land tenures, whose transparency and appropriateness is perceived as positive (63%), and on the legitimacy and appropriateness of agreements between non-private actors and private landowners, highly positively perceived (86%), of which only concern is a lack of properly legally bounded agreements that can occur. The criterion related to the occurrence of experts' consultation also holds a high percentage of positively perceived quality (84%), although some experts doubt about the consistency of this phase and its occurrence in specific sectors. Highly negatively perceived is the criterion regarding the balance between bottom-up and top-down approaches in governing rural areas (with only 25% of positive perceived quality), where a predominance of use of top-down over bottom-up approach is clearly highlighted in both questionnaires and interviews. Experts, indeed, reason about a lack of farm assessments, limited participatory capacity buildings and limited decentralised decision-making process, that do not permit an appropriate farmers' consultation at the base, undermining the balance between the two approaches. These factors start from the design of policies, perceived as failing in integrating traditional knowledge, and in satisfying specific local needs. Lastly, the criterion related to the coherency and coordination between diverse policies in finding effective resolution is slightly positively perceived (53%). From the interviews, experts often introduce the problem of a lack of integrative approach encountered in both the design of strategy plans and the coordination of different departments dealing with the issue of local climate variability.

**Graph 7: Perceived quality of regulations and agreements in %**  
(based on 26 questionnaires)



- a. Regulations and agreements concerning the management of rural areas are in general appropriate, legitimate, and flexible when necessary.
- b. Policies regarding the management of private land tenures in rural areas are transparent and appropriate.
- c. Agreements between non-private actors (municipal, regional or statal) and private landowners are appropriate and legitimate.
- d. Experts' consultation usually occurs in the governance of agricultural sector to achieve environmental targets.
- e. In general, bottom-up and top-down approaches in the governance of rural areas are balanced.
- f. Generally, diverse policies are coherent and coordinated to find the most effective resolution for the implementation of sustainable strategies (such as microclimate management) to deal with local climate variability.

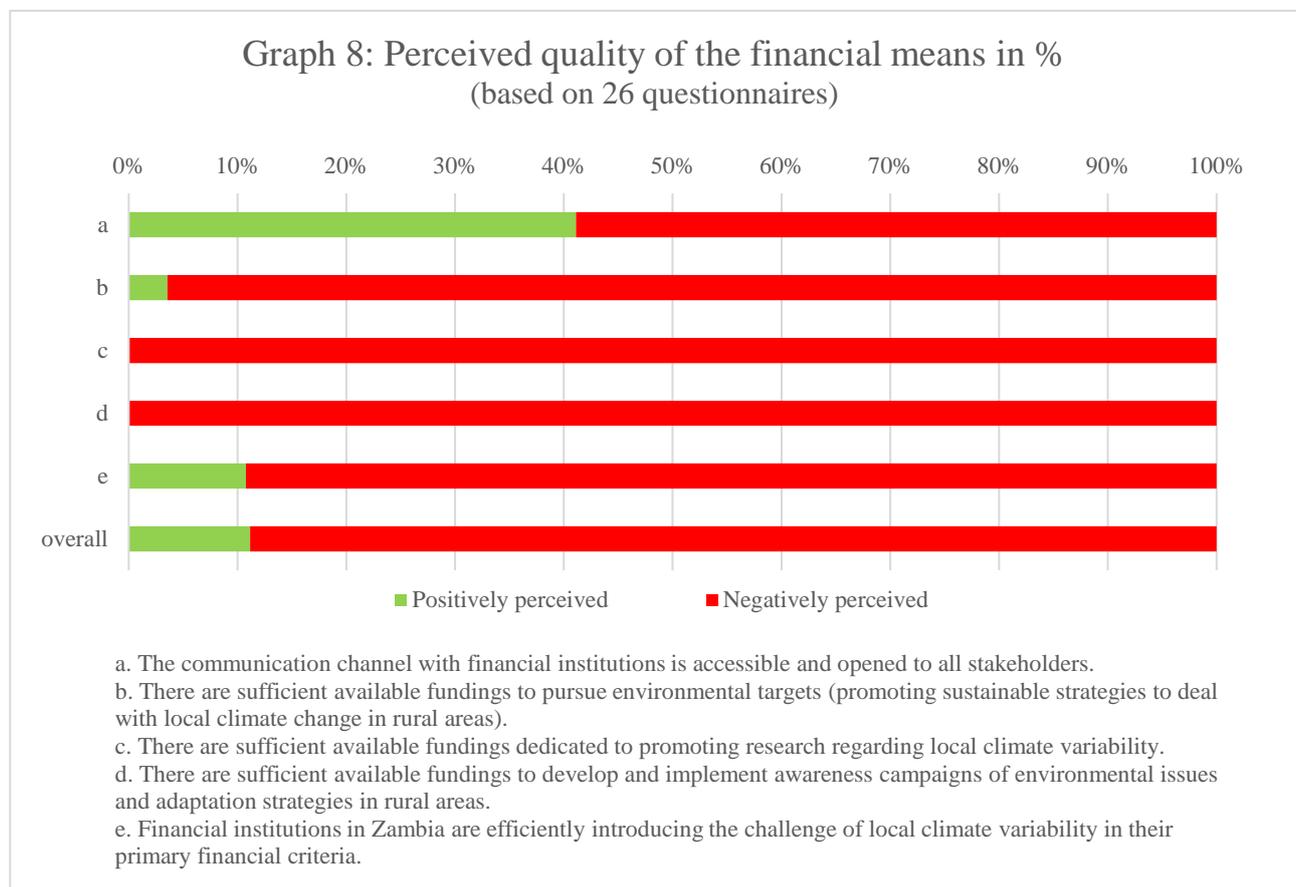
*Graph 7 Results in % of the perceived quality of regulations and agreements based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.7 Perceived quality of financial means

Financial means is the most negatively perceived BB in terms of quality, and all its criteria are placed under 50% of positive perception, as graph 8 clearly depicts.

The first criterion visible in graph 8 is the highest in terms of positive perceived quality, reaching 41%, and it relates to accessibility and openness of the communication channels with financial institutions. In this regard, concerns focus on difficulties for farmers to access information regarding financial procedures, and limitations derived by high interest rate and collateral requirements tied to the fundings. Hereafter, criteria regarding availability of fundings to pursue environmental targets, to develop awareness campaigns and to conduct research are all extremely negatively perceived in terms of quality, where the former holds a percentage of only 4% of positive perceived quality, while the others 0%. Main reasons explained by the experts are the inadequacy and erraticism of governmental financial investments and insufficient national budget. Specifically, experts underline the significant contribution of external donors (e.g., EU, big corporations etc.) in providing most of the fundings to promote and implement sustainable strategies in the agricultural sector. This occurrence is perceived as a limiting factor in conducting sustainable plans and programs in rural areas, due to the clear facilitation in promoting specifically located, short-term programs based exclusively on donors' interests and objectives. Lastly, also the criterion regarding the efficiency in introducing the challenge of local climate variability in the prime targets of financial institutions is poorly

perceived (11%) and many concerns arise on this matter. Amongst them is the significant role played by big corporations in providing fundings to develop certain sectors, e.g., the agricultural one, which again contradicts the intention of the government to move towards a greener economy. Furthermore, experts often complain about the government inefficiency in developing fundable proposals and in managing the financial budget for the agricultural sector. In particular, they drive the focus on the management of the Farmer Input Support Program (FISP), an institution that is highly negatively perceived by the experts, who accuse the deployment of more than half of the annual agricultural budget towards its maintenance. This inefficiency is considered as a limiting factor not only because it diminishes fundings to implement sustainable strategies in rural areas, but also because it undermines the willingness of external actors to invest in rural areas. Lastly, other issues raised from the analysis are the limited capability of the government in risk management at a local level and the poor management of subsidies, on which concerns focus on a lack of delivery of subsidies based on local characteristics and on crop production diverse from maize.



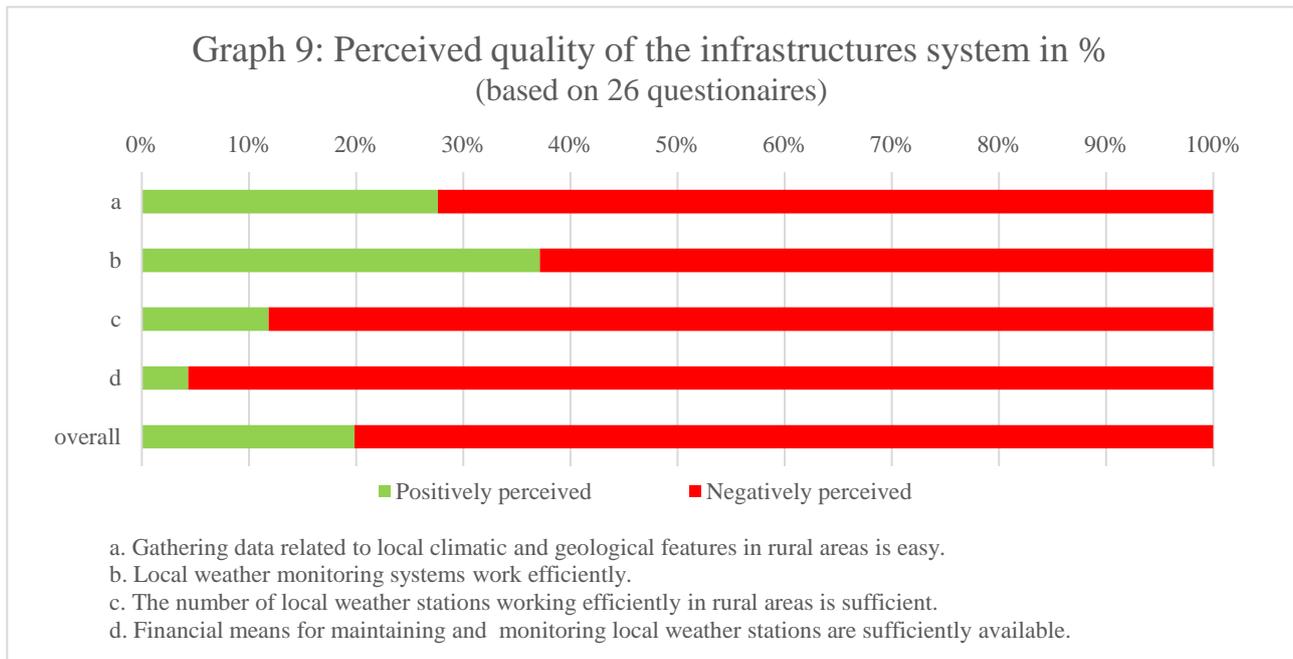
*Graph 8 Results in % of the perceived quality of the financial means based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.8 Perceived quality of the infrastructure system

Infrastructure system is the second most negatively perceived BB in the overall ranking and its criteria do not surpass 40% of positively perceived quality. Graph 9 shows the results.

In detail, the first criterion that appears in graph 9 relates to the ease in gathering data of local climatic and geological features, whose percentage of positively perceived quality reaches only 28%. The main

concern is tied to the lack of appropriate infrastructures that limit the process of gathering data at smaller scales. Contrarily, the highest positively perceived criterion in terms of quality is related to the efficiency of the local weather monitoring system (37%), although experts complain about the outdated equipment, inappropriate technologies (e.g., the internet connection) in certain areas, and infrastructure limited space distribution, all factors that reduce the overall efficiency of the system. Following, the last two criteria are placed below 20% of positively perceived quality, and they relate to the number of local weather stations (12%) and to the availability of finances to maintain and monitor local weather stations (4%).



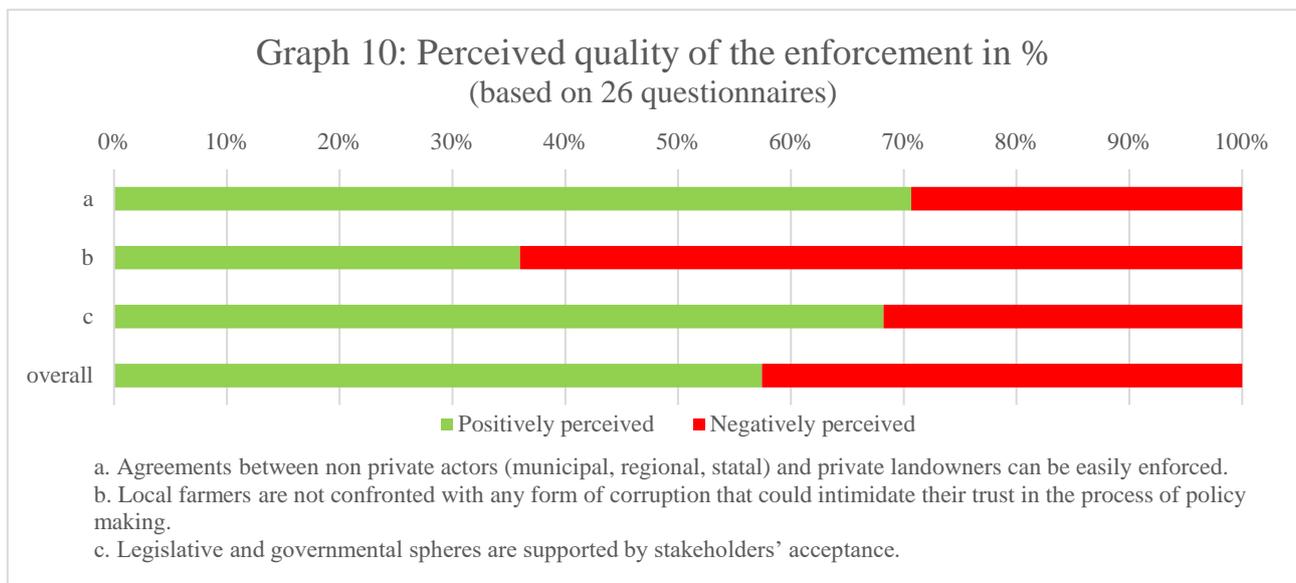
*Graph 9 Results in % of the perceived quality of the infrastructure system based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.9 Perceived quality of the enforcement

As graph 10 indicates, the BB of the enforcement is overall positively perceived and is assessed through three criteria regarding enforcement of agreements between non private actors and private landowners, perceived corruption, and stakeholders' support and acceptance towards the governmental bodies.

The first criterion is the most positively perceived of this BB, reaching 71% of positive perception, although experts present some doubts, especially in relation to enforcement in case of the customary land tenures. In fact, in this case the traditional governance, for which the enforcement is led by the traditional law (bylaw), contrasts the process of enforcement itself. Furthermore, the design of policies at a national level, being difficult to implement at a local level, is perceived as a weakening factor in the enforcement phase. The second criterion relates to any possible form of perceived corruption that can intimidate farmers' trust in the policy making, which reaches only 36% of positively perceived quality, and on which two significant considerations arise. Firstly, corruptive dynamics occur mainly in areas with high value resources. Secondly, any form of perceived inducement on the part of the government can compromise the objectivity of the farmers in participating in the decision-making process, which is seen as a form of corruption. The last criterion relates to the stakeholders' acceptance towards governmental bodies, which seem to be decidedly

positively perceived (68%). However, experts raise three main concerns in this regard. Firstly, farmers rely on and support the traditional governance at first, strengthening the contrast between this and the institutional governance. Secondly, farmers nourish a general distrust towards the information delivered by local institutions, due to the frequent low robustness and high erraticism in the retrieved data. Finally, farmers lack a full comprehension on the matter of sustainable interventions, undermining their acceptance towards their implementation and promotion.

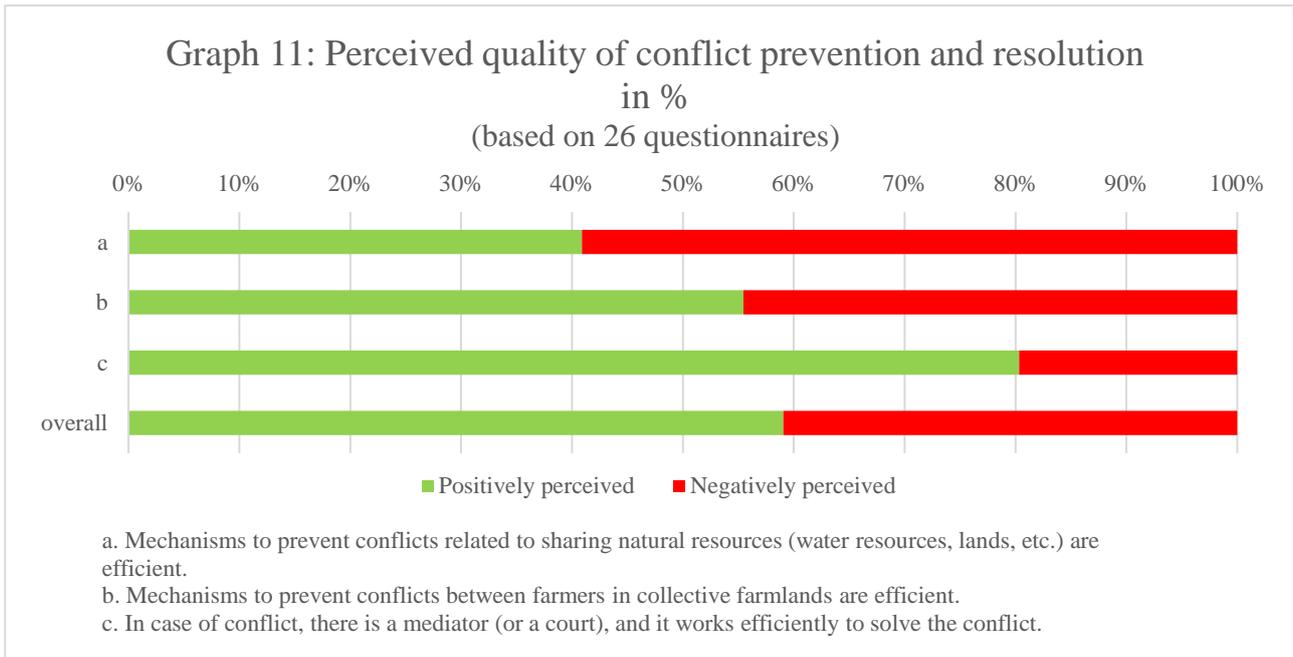


*Graph 10 Results in % of the perceived quality of the enforcement based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

#### 4.1.10 Perceived quality of conflict prevention and resolution

The last BB under analysis relates to conflict prevention and resolution, that experts perceived overall as positive, as graph 11 shows.

The lowest criterion in terms of positively perceived quality regards the mechanisms to prevent conflicts generated from sharing natural resources, whose quality is below 50% of positive perception (41%). Its inefficiency is highlighted by the experts through a series of examples of expropriation of natural resources on the part of big companies at the expense of local communities, that have been poorly addressed by the government. Following, the criterion regarding mechanisms to prevent conflicts between farmers in the customary lands is barely considered as good (with 55% of positive perceived quality). In fact, experts complain about the origin of the enforcement process, which bases uniquely on the traditional bylaws, limiting, or even muting, the power of local government authorities to intervene, and consequently, to prevent and/or solve any conflict. Lastly, the highest criterion in terms of positively perceived quality, reaching a percentage of 80%, regards the availability and efficiency of a mediator in solving existing conflicts, of which experts explain the capability of local leaderships and traditional courts as a mediator in solving conflicts. Perceived issues focus on the ineffectiveness of local institutional courts and on the high costs of their usufruct.



*Graph 11 Results in % of the perceived quality of conflict prevention and resolution based on the multiple-choice questions of the 26 questionnaires compiled by experts.*

## 4.2 CONCLUSION

Concluding this chapter, it is possible to affirm that the governance status concerning MCM in rural areas in Zambia can be assumed as *good*, because of the predominant positive perceived quality of the 10 BB. Insight and interpretation of the results above illustrated are discussed in chapter 6, together with the findings shown in the following chapter.

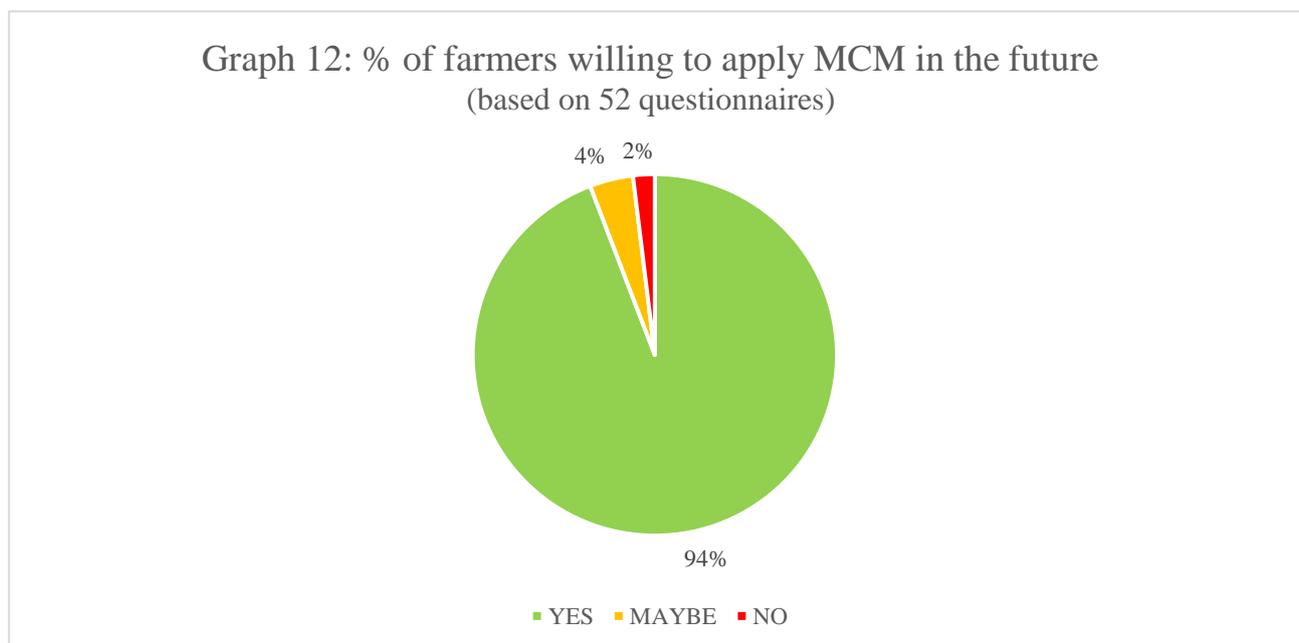
## 5 RESULTS ON LOCAL FARMERS' WILLINGNESS TO APPLY MCM

### 5.1 INTRODUCTION

In this chapter, the results from the analysis of local farmers' willingness to apply MCM are offered. Specifically, section 5.2 presents the results deriving by the answers of the questionnaires compiled by local farmers to the question "Are you willing to apply or continue to apply MCM interventions in the future?", followed by the explanation in section 5.3 of the main findings regarding farmers' perception towards demographic, socio-economic and governance factors that account for farmers' willingness to apply MCM.

### 5.2 LOCAL FARMERS' WILLINGNESS TO APPLY MCM

Considering that all participants have already applied MCM in the past with an average of 25% of applied interventions over the overall 22 proposed, graph 1 illustrates the results regarding farmers' willingness to apply MCM in the future.



Graph 12 Results in % of the farmers willing to apply MCM in the future based on 52 questionnaires compiled by local farmers.

The results show that 94% of the applicants confirm to be willing to apply these interventions in the future, while 4% do not know. Finally, 2% state they are not willing to apply MCM in the future.

### 5.3 INSIGHT ON FACTORS THAT SHAPE LOCAL FARMERS' WILLINGNESS TO APPLY MCM

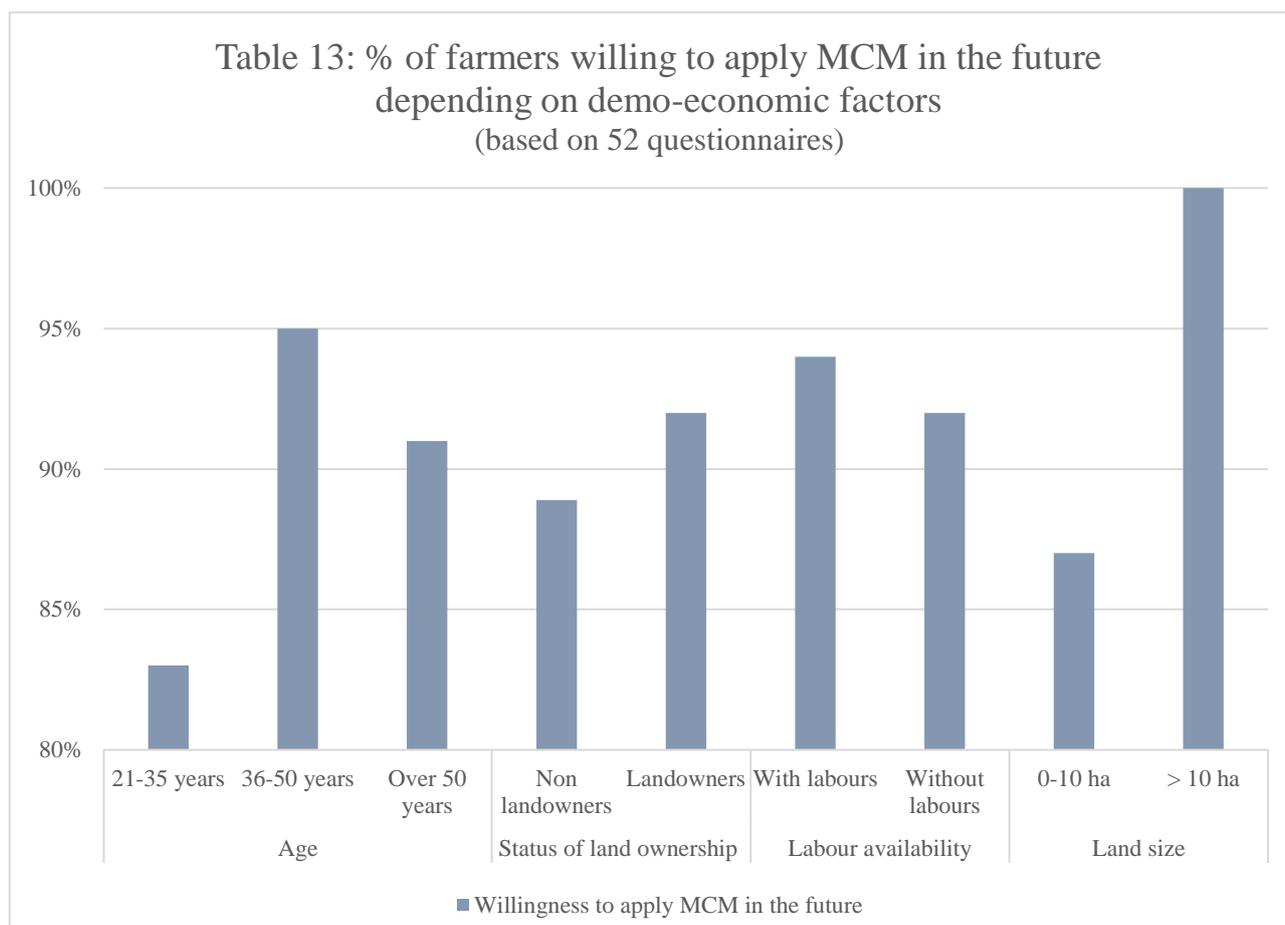
Results shown in graph 13 represent an insight on the analysis of the willingness to apply MCM, where focus is given to demographic and economic characteristics of the participants. Specifically, there are 4 main categories of demo-economic characteristics, each one with different sub-categories, and these are age, status of land ownership, labour availability, and land size. The results are below listed and described:

1. **Age:** Farmers of age between 36-50 years are the most willing to apply MCM, with a percentage of 95%, while the youngest category of farmers appears to be in the least percentage (83%). Lastly, the eldest category of farmers surpasses 90% (specifically 91%).

2. **Status of land ownership:** The total percentage of landowners who are willing to apply MCM in the future is 92%, higher than the percentage of farmers who do not own proper land and still want to apply the interventions, which is 89%.

3. **Labour availability:** Farmers without labours and willing to apply MCM are in percentage 92%, lower than the percentage of farmers willing to apply MCM and who have availability of labours, which is 94%.

4. **Land size:** While farmers with smaller lands (0-10 ha) willing to apply MCM in the future are in percentage 87%, farmers who work in bigger lands (major than 10ha) are all willing to apply MCM in the future, reaching 100%.

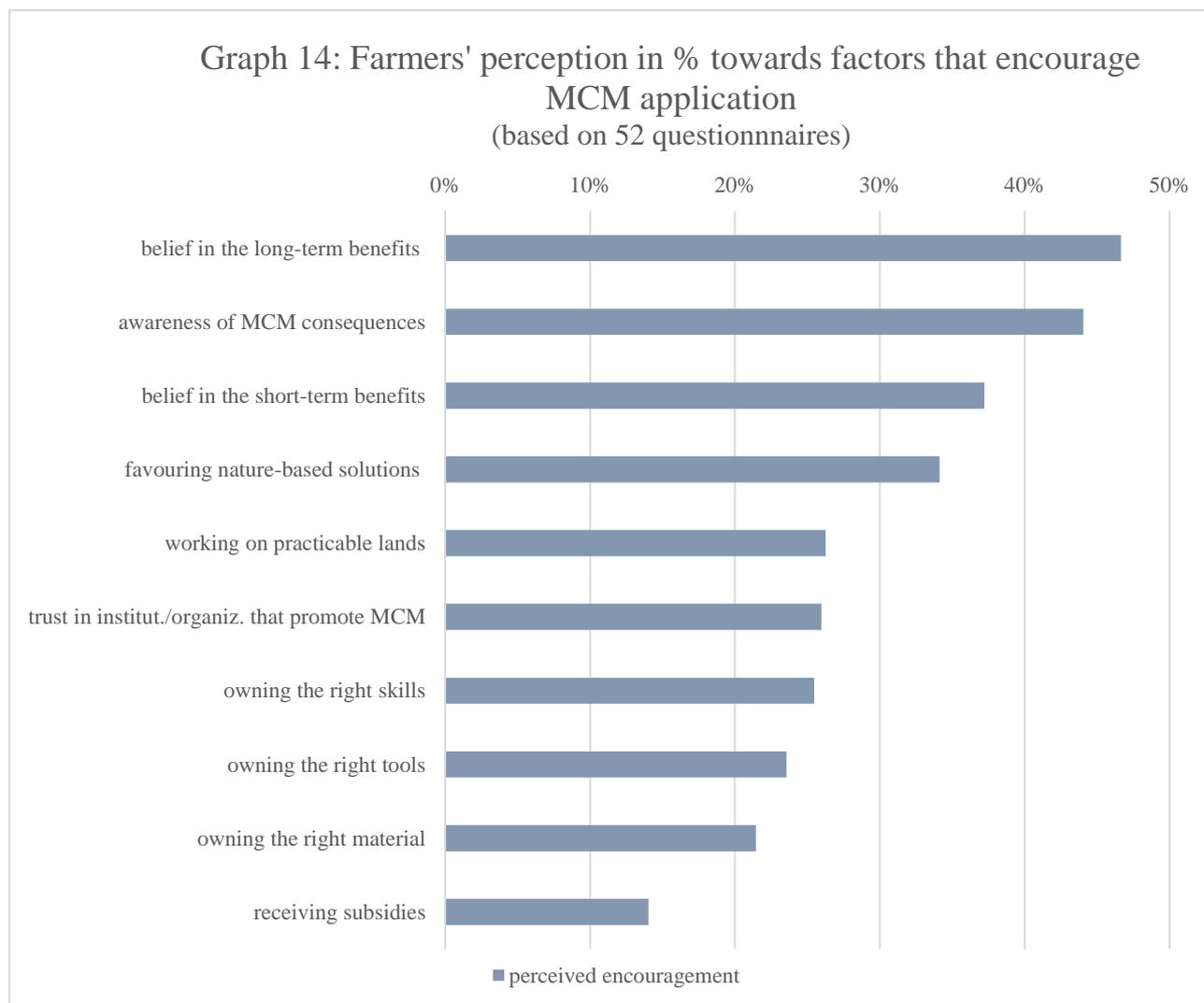


*Graph 13 Results in % regarding farmers' willingness to apply MCM in the future depending on demo-economic factors and based on 52 questionnaires compiled by local farmers.*

Graph 14 offers an overview on farmers' perception towards possible factors that encourage the application of MCM interventions.

The highest perceived encouraging factor regards the benefits that MCM brings in the long-term (47%), followed by the awareness of the consequences that MCM can have on crop production (44%). The belief in the short-term benefits of MCM application and favouring nature-based solutions are also significant perceived encouraging factors, although in less measure than the first ones (respectively 37% and 34%). Then, working on a practicable land (26%), the trust in the institution/organisation that promotes sustainable interventions (26%), owning the right skills (25%), tools (24%) and materials (21%) are perceived as less

significant encouraging factors in applying MCM. Lastly, receiving subsidies for the implementation of MCM intervention seems not to play a significant role in terms of applying MCM, holding the lowest percentage in terms of perceived encouragement (14%).

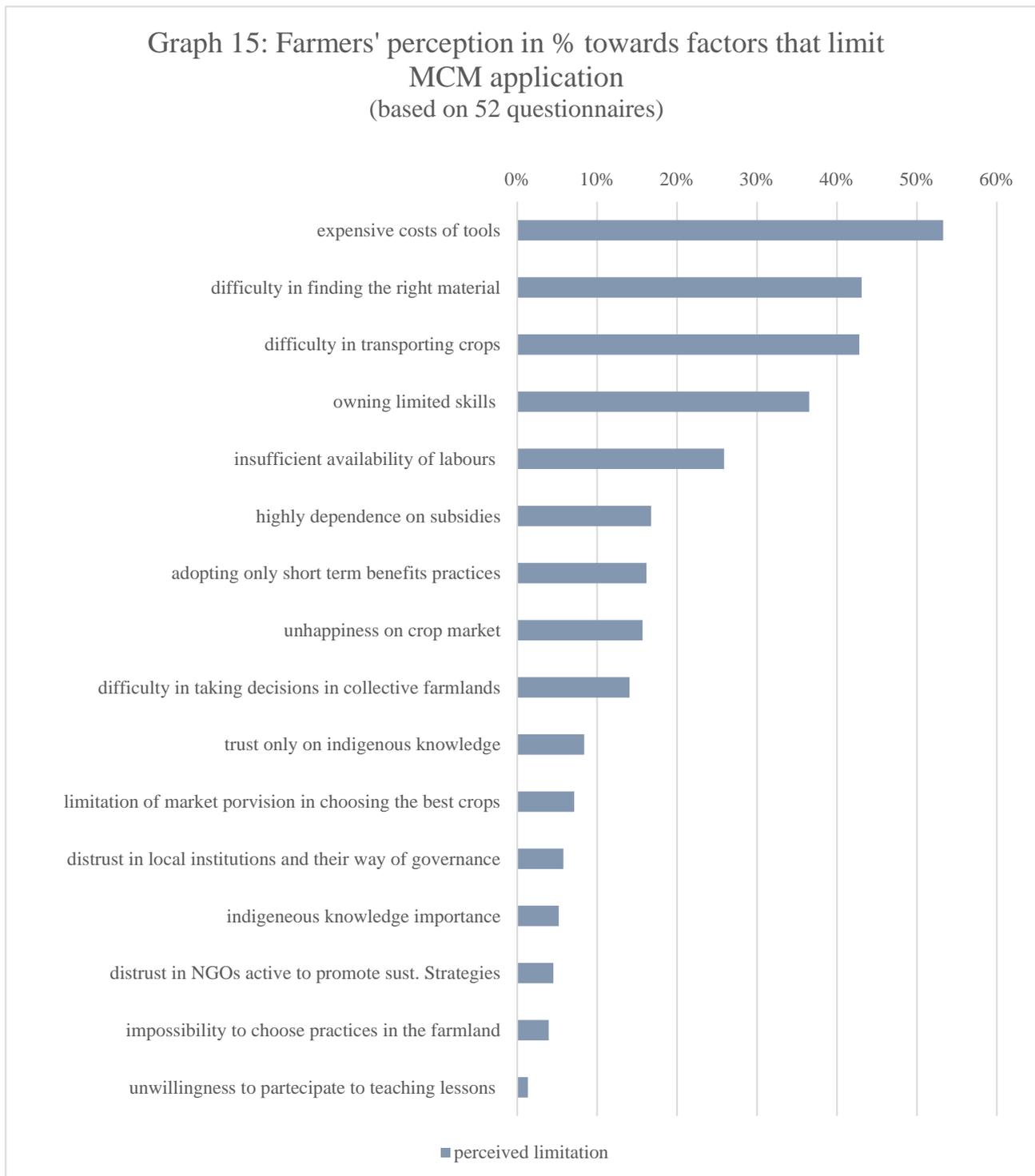


*Graph 14 Results in % related to the farmers' perception towards possible factors that encourage their application of MCM and based on 52 questionnaires compiled by local farmers.*

Contrarily, graph 15 shows the results regarding farmers' perception towards possible factors that limit the application of MCM.

The highest perceived limiting factors in terms of applying MCM regard respectively the expensive costs of tools, over 50% of perceived limitation (54%), the difficulty to find the right material to implement certain agricultural practices and to transport crops (both 43%) and the limitation of skills to manage agricultural interventions (37%). Below 30% of perceived limitation are the unavailability of labours to adopt certain sustainable interventions (26%), the high dependence on government subsidies, the choice of only practising interventions with short-term benefits and the unhappiness of crops market (all three with 16% of perceived limitation), followed by the difficulty to take choices in collective farmlands (14%). Below 10% of perceived limitations in terms of applying MCM are trusting only on farmers' indigenous knowledge (8%), the limitation of market provision in choosing the best crops (7%), the distrust in the local institutions

and their way of governing rural areas (6%). The importance played by the indigenous knowledge in managing farmlands choices and the distrust in NGOs active to promote sustainable interventions (such as MCM) at a field level reach both 5% of perceived limitation. Lastly, the least limiting perceived factors in terms of applying MCM are the impossibility to choose practices in the farmlands (4%), and the unwillingness to participate in teaching lessons regarding the adoption of sustainable strategies such as MCM (1%).



*Graph 15 Results in % related to the farmers' perception towards possible factors that limit their application of MCM and based on 52 questionnaires compiled by local farmers.*

#### 5.4 CONCLUSION

Concluding the chapter, it is possible to assume that local farmers are willing to apply MCM interventions, specifically farmers in the age between 36 and 50 years, private landowners, with availability of labours and with the opportunity to work in lands with a size bigger than 10ha. Furthermore, the most perceived encouraging factor in terms of applying MCM regards the belief in the MCM long-term benefits, while the most perceived limiting factor is the expensive costs of tools. The results can be now discussed and interpreted in the following chapter.

## 6 DISCUSSION

### 6.1 INTRODUCTION

In this chapter, interpretation of the results and general reflections are presented in section 6.2, followed by the explanation in section 6.3 of main limitations found during the research phase. Lastly, inputs for further analysis on the matter are proposed in section 6.4.

### 6.2 INTERPRETATION OF THE RESULTS AND GENERAL REFLECTIONS

From the first results of the assessment of the governance status, a criterion that looks highly positively perceived in terms of quality is the overall awareness of local climate variability and sustainable strategies. Experts often state that this awareness is dictated by the experience in the field and, especially regarding local farmers, by the indigenous knowledge. A participant in the analysis states that local farmers “are looking for solutions themselves. They feel the impact of climate change, and they want better solutions to be able to adapt their farming” (Anonymous 3, personal interview, 2022). The same expert, however, continues by saying “they do not leverage the full potential of such practices”. In fact, while awareness of local climate variability is not put in doubt, the real problem concerns awareness of adaptation strategies. It should be questioned whether the acknowledgment of the existence of certain practices and its pure application at a field level implies the full understanding of its implications. So, the question arises: why do farmers not leverage the full potential of these practices?

Shula (personal interview, 2022) suggests, indeed, that the problem regards an “inefficiency in delivering the message and getting a wrong approach”. This “wrong approach” can be interpreted in three different forms: firstly, as the ineffectiveness of the institutions to own and consequently transmit a message with an holistic overview; secondly, the incapacity of institutions to offer the appropriate time and tools for the farmer to acknowledge and fully understand the acquired information; thirdly, the persistence on the part of the institutions to transmit a message that is not perceived as owned by the recipient, contrarily, it originates from external sources.

The first interpretation relates to a lack of a holistic overview regarding the information itself and its way of being delivered. Again, Shula states that if “the message is just targeting the environment and it doesn't look at the socio-economic dimensions, then it may not fly” (personal interview, 2022). It suggests that the issue starts from the management of information, which lacks not only a holistic overview, but an actual holistic approach at a governance level. More in detail, the way sustainable plans are currently being promoted are designed on the base of a perceived unidimensional target, without clearly embedding environmental and socio-economic dimensions all together. Consequences of this failure in addressing issues with an integrative approach are found in the highly negative perceived coordination between different departments, incapable of facing the same problem from different perspectives but same approach. It is also found in the scarce coherency and coordination of diverse policies, often “rather narrow in focus” (Shula, personal interview, 2022) missing harmonisation in finding the most effective resolutions.

The second interpretation regards the incapability of institutions to give appropriate time and

instruments to farmers to digest the delivered information and adopt it in their daily routine. Mooya (personal interview, 2022) argues that “the biggest part of that time (training time) is a mind change. It's a mind shift. People need to understand where we are coming from, where we are, and where we'll be going”. This statement suggests not only the importance of the way the message is delivered, but also the need of sufficient time for the recipient to comprehend the intervention, to live it and, finally, integrate it daily. It is significant, in this regard, considering the life span of most of the ongoing (or just past) projects promoted by external players (such as EC, UN etc.), which usually lasts between 2 and 5 years, leaving many uncertainties when it comes to its end. Although these projects bring investments in the agricultural sector and innovative technologies to farmers, their time-limited life span raises a question: “And then?”. In fact, once the project comes to an end, the future of these innovations is uncertain. Chilinya (personal interview, 2022) states that at the end of a project, external players “will go and leave no capacity at the local level for farmers to sustain the project. [...] Once the funding ends, people forget about these practices, and they go back to the usual ways of doing agriculture”. There is a need for sufficient time, but also a need of giving the right tools and material for ensuring sustainability, also from the financial perspective. Farmers have to pay for every new technology deriving from a project, and the government does not economically support farmers who invest in sustainable interventions (Mooya, personal interview, 2022). The uncertainty connected to these time-limited projects risks strengthening an “issue of trust” (Anonymous 4, personal interview, 2022) on the part of farmers, who spend their resources for strategies that have no capacity building to be practised afterwards. Consequently, the financial impacts due to the limited capability development to maintain the practices may be detrimental to the support of MCM.

The third interpretation relates to the perception of owning the information. Remarkable in this regard is the answer given by Shula (personal interview, 2022) to the question “What makes a message credible and appropriate for you?”, to which he replies “For me, it must have been tested and validated in our circumstances. Not just picking something from the textbook, because it has worked in Brazil, then it will in Zambia. No, you need to adapt to it”. What usually happens regarding communication, decision-making and promoting new intervention plans is a failure in “focusing on the real causes of the issue” (Mubanga M., personal interview, 2022), i.e., the real drivers at a local level, local available resources and characteristics and needs of local production and development. This is a symptom of a governance fully designed and implemented at a higher level, that offers information and decisions far away to be perceived as community lead and community owned. The reason is well explained by the results regarding the perception towards the development of bottom-up approaches, which is highly negative. This factor brings farmers not to fully comprehend certain actions and interventions.

Besides the above-mentioned interpretations, a factor that can affect the delivery of the message and lead to inefficiency of the system is the so-called “powers game at the table” played by the government and the big corporations responsible mostly for producing chemical fertilisers. This factor is evident when looking at the analysis of the stakeholders’ involvement, where many experts complain about the high influence that big corporations have on the decision-making process in rural areas. It is also clear in the

regulations and agreements, specifically in the “leniency” of the government in supporting corporate production of chemical fertilisers (Anonymous 3, personal interview, 2022). However, the significance of this occurrence lies in the confusion that this biased situation generates amongst farmers and local communities in general. In fact, although farmers are called to adopt nature-based solutions and increase sustainability in their agricultural practices, they are also indirectly encouraged to use chemical fertilisers, which is controversial at all effects to the official direction towards a *greener economy* and agriculture. This biased situation generates confusion in getting the message at a local level, that inevitably leads to a failure in recognizing the target and the direction in managing the agricultural sector. Unsurprisingly, Litaba Wakun'uma (personal interview, 2022) states that “there is a lack of conscious decision in directing policies and decision-making (when) looking towards enforcing the greener side of agriculture”. This is not confirmed, however, by the results from the analysis of farmers’ willingness to apply MCM, that shows how farmers highly perceive factors such as awareness of MCM benefits as the most encouraging one for MCM application. A reason could be the fact that all participants of the questionnaire have been applying MCM in their farmlands, leading to the assumption that they already saw and lived benefits deriving from its implementation, strengthening their awareness and willingness to adopt. It further confirms how farmers are willing to apply MCM and sustainable strategies, and how the real issue relies on the way MCM and other strategies are governed.

This lack of solidity in the governance is also visible when looking at the enormous contribution deriving by the annual financial budget towards FISP, defined by Shula (personal interview, 2022) as “a defeat for farmers’ role as a catalyst for bottom-up approaches”. In fact, this institution is highly considered as inappropriate, and even unbeneficial, used to obtain farmers’ consensus while offering a fake instrument of engagement for farmers to the policy change (Muma, personal interview, 2022). Furthermore, its primary task in giving subsidies is catalysing farmers’ production almost uniquely towards maize, limiting the availability of crop market. Regarding this general inefficiency of financial deployment, unsurprisingly the receipt of subsidies is shown to be the lowest perceived encouraging factor in applying MCM on the part of local farmers, while the most perceived limiting factors are the expensive costs of tools, owning the right tools and the right materials. It must be questioned whether a more appropriate management of the financial budget on the basis of these results, e.g., the development of cheaper tools upon large scale adoption, would strengthen the development of sustainable strategies such as MCM.

Another factor that promotes the implementation of MCM interventions amongst farmers is working on big land size. It is plausible to assume that those farmers also have availability of right tools, right materials and maybe labours to implement certain agricultural practices. It is then put in doubt the effectiveness to involve smallholders’ farmers in the adoption of MCM, because they might find it too expensive and unprofitable.

Lastly, the result showing how private landowners are more prone to apply MCM than the no-owners (assumed to be part of the customary system) suggests another consideration. In fact, the phase of leaving the customary system obtaining a land title and becoming then a statal (therefore private) landowner is possible,

“however, it's expensive for most people” (Chilinya, personal interview, 2022). It might be questioned then whether the facilitation of this process would encourage the adoption of sustainable strategies and MCM.

### 6.3 LIMITATIONS OF THE RESEARCH

It is fundamental to specify the limitations encountered in the research to justify possible inaccuracies and to build inputs for further research.

One of the main limitations of the research is a lack of a specific assessment method for the analysis of local farmers' willingness to apply MCM, evident in the questionnaire for farmers, whose design proves to be at times confusing. Consequently, its findings need further elaboration and high interpretation during the analysis, risking offering inadequate outcomes that do not tie to the flow of the overall research. Furthermore, due to the explorative approach used, certain questions in the questionnaires, especially the ones for farmers, are not sufficiently efficacious in getting the expected quality of the results. The terminology in both questionnaires is also sometimes not specific, causing possible misunderstandings. An example is the term “collective farmland” instead of “traditional/customary farmland”, as it is more specific and appropriate in the case of Zambian rural areas.

Focus on MCM is sometimes misused, due to a lack of knowledge regarding this topic on the part of people involved in the research and/or the approach used to gather information, often too generalised. In this regard, it must be considered that the 10 BB approach, on which the assessment criteria used in this analysis build on, focuses specifically on water-related issues, while this research investigates a broader sphere concerning sustainable development. In doing so, the framework is often highly interpreted; this hard adaptability, together with an original overlap of information and elements within the BB, often challenge the manageability to locate data from the analysis into specific blocks. Furthermore, the definition of the assessment criteria often fails in determining specific and precise aspects for the assessment of each BB, risking then generalisation and misinterpretation on the part of experts during the process of analysis. In this regard, another limitation is assuming that the perceived quality of the 10 BB coincides with the status of the governance. It cannot be considered objective, rather an interpretation that offers a qualitative point of discussion on which reflections and recommendation can be built.

Other relevant limitations relate to the number of participants in the compilation of the questionnaires and a possible *snowball recruitment* tied to the delivery and compilation of the questionnaires, especially regarding farmers. Both factors can lead to sampling a group that is not representative of the general rural population of Zambia.

### 6.4 INPUTS FOR FUTURE RESEARCH DEVELOPMENTS

This thesis can represent a useful and interesting input to develop further research on the matter.

Specifically, focus could delve into farmers' perception on the status of the governance in rural areas concerning the promotion and implementation of sustainable strategies such as MCM, in order to gain insight into the matter also from a farmers' perception (and not only from experts' opinion).

Regarding farmers' willingness to apply MCM, building and using a specific and detailed assessment

method for the analysis would offer greater robustness and solidity to the outcomes as well as simplification in reading the results. It is highly recommended to define a series of factors that account for the willingness to apply MCM on which the assessment can be built. The integration of diverse demo-economic characteristics could also be integrated in the analysis, e.g., access to the internet connection/radio, to get a clearer overview into more various and specific barriers in implementing MCM.

The differentiation in the analysis of experts' perception based on their job (e.g., governmental employer Vs external player) can be an interesting evaluation of the bias that can be probably generated from the qualitative analysis.

Regarding the approach used, i.e., the 10 BB, it is a good guide regardless of the cross-disciplinary challenges, and that it can potentially be further developed to cover a wider sustainability sphere. A more precise definition of the assessment criteria, where aspects of the 10 BB under assessment are deeply addressed, would avoid possible misunderstanding in their reading on the part of experts, helping obtain more specific and robust results. Also, comparing assessments of a same governance system using different approaches (e.g., the 10 BB) is encouraged to specifically determine strengths and weaknesses of each method and build recommendations for eventual improvements.

Lastly, for incrementing efficiency in performing the research, a nontrivial suggestion is to conduct research, especially the ones with high involvement of different actors, *in situ* instead of remotely to avoid complications tied to the long-steps process of delivery and receipt of questionnaires/surveys.

## 6.5 CONCLUSION

Concluding, the interpretation of the results and consequent reflections are essential material to write conclusions in the following chapter, where the research question is answered and recommendations are given. While limitations and further opportunities for the research can be considered valuable recommendations and suggestions for researchers interested in this topic.

## 7 CONCLUSIONS

### 7.1 INTRODUCTION

This chapter concludes the thesis answering the RQ in section 6.2. Recommendations to governmental institutions and to Solidaridad to improve MCM in rural areas in Zambia are finally offered in section 6.3.

### 7.2 IS IMPROVING MCM A FEASIBLE OPTION FOR DEALING WITH CLIMATE CHANGE IN RURAL AREAS IN ZAMBIA?

The results obtained from the analysis of this research show that the status of the governance concerning MCM in rural areas in Zambia is overall good as much as local farmers appear to be decidedly willing to apply MCM. These outcomes validate the H<sub>1</sub> introduced in chapter 1, for which improving MCM is a feasible option for dealing with climate change in rural areas in Zambia.

### 7.3 RECOMMENDATIONS

The analysis offers significant findings regarding the governance concerning MCM and certain factors in shaping farmers' willingness to apply MCM in the area under study. Their interpretation and discussion help understand some aspects why more attention is worthwhile. On them, the following recommendations are drawn to offer the opportunity for eventual progress in improving MCM in rural areas in Zambia.

#### 7.3.1 Recommendations for governmental institutions

The first recommendation is enhancing a bottom-up approach in designing policy strategies in order to strengthen adaptability of projects and sustainable plans to local characteristics and local needs and avoid one-size-fits-all plans. Participative capacity building as much as decentralisation of the various level of governance structure must be enlarged and reinforced to permit a greater farmers' engagement in the decision-making regarding the management of the agricultural sector.

Secondly, it is fundamental to create and offer a holistic, multidimensional overview of the benefits that green-based solutions and green infrastructures (i.e., MCM) can bring to the community, not only from an environmental point of view, but also social and economic ones. It is recommended to focus the policy discourses on the concept of sustainability in its broad sense, emphasising the link between the diverse sectors and enhancing cooperation within Ministries.

It is also necessary to improve the deployment of the financial budget in order to increase efficiency in the agricultural sector attracting then external actors in further investments. In doing so, financial means should not be addressed to outdated agricultural institutions, become an instrument of selfish profits such as FISP, or to subsidies that appear to be useless, even unbeneficial, in terms of strengthening the implementation of sustainable interventions. Contrarily, financial investments should aim to increase the number of extension officers, who play a fundamental role in connecting farmers and governmental institutions and in spreading knowledge regarding the adoption of sustainable strategies. Regarding financial means, it is recommended to encourage local farmers in applying sustainable interventions at a field level through economic incentives, emphasising a difference in treatment towards farmers who take responsibility

against the issue of climate change. More funding is also needed to strengthen the local weather system, which is essential in developing nature-based solutions in rural areas. The improvement of the local weather data in terms of collection and robustness would also increase farmers' trust and acceptance to the messages and data delivered by the government.

It is also significant to permit an easy accessibility of this information; in doing so, basic knowledge regarding the use of technology, such as the internet, needs to be spread amongst farmers. The accessibility must be improved also amongst researchers and institutions in general, to avoid possible issues related to lack of transparency and to strengthen collaboration between departments.

Another recommendation is providing a bigger crop market for two main reasons. Firstly, to permit the development of climate resilient crops (e.g., legumes) besides maize to challenge local climate variability, and secondly, to limit the influence of big corporations in the agricultural sector, mainly responsible for the provision of chemical fertilisers necessary for the maize production.

### 7.3.2 Recommendations for Solidaridad

Farmers are aware of the effects of local climate variability on their crop production, and they perceive sustainable strategies and nature-based solutions as promising interventions to deal with climate change. The issue relies on the way they perceive the arrival and the instauration at a local level of new short-term external projects that demand farmers to adopt diverse, maybe unknown, practices. It is essential to bridge a sense of ownership and acceptability of the proposed sustainable interventions. In doing so, plans must come from the field level, starting from understanding problems that arise from the assessment on the ground rather than from ideas originating from external parties or technocrats. Strategies must be locally contextualised, their implementation must be designed and adapted on farmers' way of doing agriculture, specifically based on their production, on their necessities and on their desires. Furthermore, it is essential to accompany the process with strengthening sustainable capacity buildings for the prosecution of the strategy in the long-term to offer farmers solid independence and stability in implementing the interventions also after the end of the project itself.

## 8 REFERENCES

- d'Albergo, E., & Moini, G. (2007). Political consequences of participative practices in an urban context : two case studies in Rome. *Métropoles*. doi:10.4000/metropoles.492.
- Al-Saidi, M., & Elagib, N. (2017). Towards understanding the integrative approach of the water, energy and food nexus. *The Science of the total environment*. 574. 1131-1139. doi:10.1016/j.scitotenv.2016.09.046.
- Arnwine, D. L. (2002). Effective governance: the roles and responsibilities of board members. *Proc (Bayl Univ Med Cent)*. 2002 Jan;15(1):19-22. doi: 10.1080/08998280.2002.11927809.
- Baldwin, R., Cave, M., & Lodge, M. (2013). Understanding Regulation: Theory, Strategy, and Practice. doi:10.1093/acprof:osobl/9780199576081.001.0001.
- Corfee-Morlot, J., Marchal, V., Kauffmann, C., Kennedy, C., Stewart, F., Kaminker, C., & Ang<sup>i</sup> G. (2012). Towards a Green Investment Policy Framework: The Case of Low-Carbon, Climate-Resilient Infrastructure. *OECD Environment Working Papers*, 48, OECD Publishing, Paris. doi:10.1787/5k8zth7s6s6d-en.
- Dai, L., Dieperink, C., Wuijts, S., & van Rijswijck, M. (2022) Assessing the soundness of water governance: lessons learned from applying the 10 Building Blocks Approach, *Water International*, 47(4), 610-631. doi:10.1080/02508060.2022.2048487.
- Funder, M., & Mweemba, C. E. (2019). Interface bureaucrats and the everyday remaking of climate interventions: Evidence from climate change adaptation in Zambia. *Global Environmental Change*, 55, 130–138. doi:10.1016/j.gloenvcha.2019.02.007.
- Groenfeldt, D. & Schmidt, J. (2013). Ethics and Water Governance. *Ecology and Society*. 18(1): 14. doi:10.5751/es-04629-180114.
- Guido, Z., Lopus, S., Waldman, K., Hannah, C., Zimmer, A., Krell, N., Knudson, C., Estes, L., Caylor, K., & Evans, T. (2021). Perceived links between climate change and weather forecast accuracy: new barriers to tools for agricultural decision-making. *Climatic Change*, 168(9), 2-22. doi:10.1007/s10584-021-03207-9.
- Hertel, T. W., & Rosch, S. D. (2010). Climate change, Agriculture, and Poverty. *Applied Economic Perspectives and Policy*, 32(3), 355 – 385. doi:10.1093/aep/ppq016.
- Ianchovichina, E., & Lundstrom Gable, S. (2009). Inclusive Growth Analytics: Framework and Application (March 1, 2009). *World Bank Policy Research Working Paper*, 4851. doi:10.1596/1813-9450-4851.
- Ismangil, D., D. Wiegant, Eyasu Hagos, F. van Steenbergen, M. Kool, F. Sambalino, G. Castelli & E. (2016). Managing the Microclimate. *Practical Note Spate Irrigation*, 27. doi:10.13140/RG.2.2.1511078409.
- IUCN. (2018). Following the money for sustainable landscape management. IUCN National Committee of The Netherlands.

- Kabechani, A., Deka, B., & Sambo Mwila, B. (2016). National Policy on Climate Change. Unlocking Zambia's Potential. *Policy Monitoring and Research Centre (PMRC) publications*.
- Kapungwe, E. (2012). Traditional farming practices and wastewater irrigation farming in peri urban Zambia. *The Indonesian journal of geography*, 44, 104-120. doi:10.22146/indo.j.geog,2393.
- Kokwe, M., Chama, T., Pali, P., & Ramasamy, S. (2022). Enhancing climate resilience in the farming systems with crop diversification in Zambia – Farmer participatory field trials for demonstration of good practices and co-learning. Rome, FAO. doi:10.4060/cb9134en.
- Kusters, K., De Graaf, M., Buck, L., Galido, K., Maindo, A., Mendoza, H., Huu Nghi, T., Purwanto, E., & Zagt, R. (2020). Inclusive Landscape Governance for Sustainable Development: Assessment Methodology and Lessons for Civil Society Organizations. *Land* 2020, 9, 128. doi:10.3390/land9040128.
- Johnston, E. (2010). Governance Infrastructures in 2020. *Public Administration Review*, 70, S122–S128. doi:10.1111/j.1540-6210.2010.02254.x.
- Lemos, M. C. (2014). Usable climate knowledge for adaptive and co-managed water governance. *Current Opinion in Environmental Sustainability*, 12(48), 48–52. doi:10.1016/j.cosust.2014.09.005.
- Mendelsohn, R. (2008). The Impact of Climate Change on Agriculture in Developing Countries. *Journal of Natural Resources Policy Research*, 1(1), 5-19. DOI:10.1080/19390450802495882.
- Morrison, K. (2003). Stakeholder involvement in water management: Necessity or luxury?. *Water Science & Technology*, 47(6), 43-51. doi:10.2166/wst.2003.0354.
- Mulenga, M. (2020). The Business Enabling Environment-Economic Development Nexus, The Zambian Context. *American Journal of Economics* 2020; 10(5): 284-292. doi:10.5923/j.economics.20201005.03
- Musonda, B., Jing, Y., Iyakaremye, V., & Ojara, M. (2020). Analysis of Long-Term Variations of Drought Characteristics Using Standardized Precipitation Index over Zambia. *Atmosphere*, 11(12), 1268. doi:10.3390/atmos11121268.
- OECD. (2017). A Framework for the Governance of Infrastructure. in *Getting Infrastructure Right: A framework for better governance*, OECD Publishing, Paris. doi:10.1787/9789264272453-4-en.
- OECD. (2020). Framework for SDG Aligned Finance. OECD Publishing, Paris.
- Ouyang, J., Zhang, K., Wen, B., & Lu, Y. (2020). Top-Down and Bottom-Up Approaches to Environmental Governance in China: Evidence from the River Chief System (RCS). *International Journal of Environmental Research and Public Health*, 17, 7058. doi:10.3390/ijerph17197058.

- Pelletiera, J., Ngomac, H., Masond, M. N., & Barrett, C. B. (2020). Does smallholder maize intensification reduce deforestation? Evidence from Zambia. *Global Environmental Change* 63 (2020) 102127. doi:10.1016/j.gloenvcha.2020.102127.
- Rogers, P., & Hall, A., W. (2003). Effective Water Governance. *Technical Committee Background Papers No.7, Global Water Partnership (GWP)*. Stockholm.
- Romdhani, A., Coll Besa, M., Scott, D., & Bharwani, S. (2018). Zambia's adaptation to climate change. The conflicting discourse within policy documents reflects a country's challenges in addressing both adaptation needs and economic development. *Stockholm Environment Institute*.
- Van Rijswijk, M., Edelenbos, J., Hellegers, P., Kok, M., & Kuks, S. (2014). Ten Building Blocks for Sustainable Water Governance: An Integrated Method to Assess the Governance of Water. *Water International*, 39(5), 725-742. doi:10.1080/02508060.2014.951828.
- Usunier, J., Furrer, O., & Furrer-Perrinjaquet, A. (2011). The perceived trade-off between corporate social and economic responsibility: A cross-national study. *International Journal of Cross Cultural Management*, 11(3), pp. 279–302. doi: 10.1177/1470595811413102.
- Wehn, U., Collins, K., Anema, K., Basco-Carrera, L., & Lerebours, A. (2018). Stakeholder engagement in water governance as social learning: lessons from practice. *Water International*, 43(1), 34-59. doi:10.1080/02508060.2018.1403083.
- Van Woesik, F. M. (2021). An Assessment Tool for Microclimate Management to Enhance Ethiopian Crop Production. *StudentThesis Utrecht University*.
- World Bank. (2019). Zambia Climate-Smart Agriculture Investment Plan : Analyses to Support the Climate-Smart Development of Zambia's Agriculture Sector. *World Bank, Washington, DC*. © World Bank. doi.org/10.1596/31383.
- Zellweger, F., De Frenne, P., Lenoir, J., Vangansbeke, P., Verheyen, K., Bernhardt-Römermann, M., & van Calster, H. (2020). Forest microclimate dynamics drive plant responses to warming. *Science*, 368(6492), 772-775. doi:10.1126/science.aba6880.

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## APPENDIX 1: EXPERTS INVOLVED IN THE RESEARCH

This appendix specifies the name, the professional occupation, the contact channel, and the type of collaboration (in case of interview, also the day when it took place) per single expert/collaborator involved in the analysis. The information is listed in table 13.

Experts who state the preference not to be referred in this thesis are indicated as Anonymous at the end of table 13.

*Table 13 List of participants to the research. Name, professional occupation, contact channel and type of collaboration are specified.*

<b>WHO</b>	<b>ROLE/JOB</b>	<b>REACHED THROUGH</b>	<b>WHAT</b>
Chanda Chibuye, Valerie	Regional Programme Manager at We Effect	Conor Donal's network	interview (2022, May 5)
Chilinya, Vladimir	Country coordinator at FIAN International Zambia	Conor Donal's network	questionnaire & interview (2022, May 17)
Chisanga Mubanga, Fiona	Environmental consultant for Sustainable Ecosolutions Limited	Linkedin	questionnaire
Kabisa, Mulako	Research Associate at Indaba Agricultural Policy Research Institute	LinkedIn	questionnaire
Kasaro, Cosmas	Agricultural officer for Ministry of Agriculture	Conor Donal's network	questionnaire & interview (2022, May 16)
Kubi, Francis	Agricultural Engineering and soil scientist for Ministry of Agriculture	Wesley Litaba's network	Questionnaire
Litaba Wakun'uma, Wesley	Food Systems Policy and Advocacy specialist at ANOF	Conor Donal's network	questionnaire & interview (2022, May 16)
Mendelsohn, Stephanie	New business development and Head of Impact at Grounded	Thekla Teunis's network	questionnaire

Miga, Wilfred	Program officer at PELUM Zambia	Conor Donal's network	questionnaire
Mofya, Vincent	Solidaridad Fruit and Veg program manager	Conor Donal's network	questionnaire
Mooya, Dennis	Agricultural officer for Ministry of Agriculture	Conor Donal's network	interview (2022, May 19)
Moyo, Chrispin	Senior Agricultural Specialist at Ministry of Agriculture	Conor Dolan's network	questionnaire
Moyo, Trust	Development Facilitator for Agriculture and Natural Resources Management at World Vision	Francis Kubi's network	questionnaire
Mpande, Brenda	Environmental and Social Safeguards Officer for CIFR	Ivwananji Tembo's network	questionnaire
Mubanga, Kabwe	Director of Climate Change Policy and Integrated Research	LinkedIn	interview (2022, April 14)
Mubanga, Musamba	Livelihoods and Climate Change Adaptation Programme Specialist at Caritas Zambia	Conor Donal's network	interview (2022, May 18 May)
Muma, Emmanuel	Trade Policy Specialist at Center for Trade Policy and Development	Conor Donal's network	questionnaire & interview (19 May 2022)
Musonda, Natasha	Agriculture and Livelihood District Technical Officer for DAI	Anonymous 3's network	questionnaire
Mwamba, Sydney	Executive Director at PMRC	Anonymous 3's network	questionnaire
Mwasi, Douglas	Agricultural and livelihood projects coordinator at CRS	Conor Donal's network	interview (2022, May 4)

Namonje-Kapembwa, Thelma	Researcher at IAPRI, PhD Student at University of Leeds	ResearchGate	questionnaire
Nkandu, Ishmael	Project Officer (Agriculture) at Oxfam Zambia	Conor Donal's network	questionnaire
Shula, Reynolds	National Project Manager for FAO Zambia	Conor Donal's network	questionnaire & interview (2022, May 13)
Singongi, Mwenda	Head of Forestry Department at the government of the Republic of Zambia	Conor Donal's network	questionnaire
Sinyange, Joy	Land Management & Conservation Agriculture at Ministry of Agriculture	Chrispin Moyo's network	questionnaire
Sishekan, Makweti	Environmental Law and Social Safeguards Specialist for the Zambia Institute of Environmental Management	Ivwananji Tembo's network	questionnaire
Siwale, Friday	Solidaridad Fruit and Veg program manager	Conor Donal's network	questionnaire
Takam Tiamgne, Xavier	PhD Student, Natural Resources Management at the University of Zambia	LinkedIn	interview (2022, April 13)
Tembo, Ivwananji	Environmental Social Safeguard Officer at Zambia Institute of Environmental Management	LinkedIn	questionnaire
van Woesik, Femke	Program Manager at MetaMeta, expert in MCM	Conor Dolan's network	Consultation for the definition of the assessment criteria (2022, April 5 April)
Anonymous 1	Researcher and consultant for University of Zambia	-	questionnaire

Anonymous 2	Senior agricultural officer for Ministry of Agriculture	-	questionnaire
Anonymous 3	Agricultural office-farm manager for Ministry of Agriculture	-	questionnaire & interview (2022, May 23)
Anonymous 4	Officer at WeEffect	-	interview (2022, June 3)

## APPENDIX 2: QUESTIONNAIRES, INTERVIEWS TRANSCRIPTION AND DATA ON EXCEL

Appendix 2 offers viewing and consultation of all data collected and elaborated during the analysis.

Specifically, by clicking on the following [link](#), a folder on DropBox is opened where the reader can have access to:

- 1\_Questionnaires compiled by experts: It contains 26 questionnaires compiled by the experts and the questionnaire model.
- 2\_Interviews transcriptions: It contains the transcription of the 13 interviews with experts used for the assessment of the governance concerning MCM in Zambia and the transcription of the consultation with Femke van Woesik for the validation of the assessment criteria.
- 3\_Questionnaires compiled by farmers: It contains the 52 questionnaires compiled by local farmers used in the analysis, the questionnaires received that are not used in this thesis due to the excessive data missing in the compilation and the questionnaire model.
- 4\_Data collection and elaboration on Excel: It contains the Excel sheet regarding the collection and elaboration of both the data from the questionnaires compiled by farmers and the data from the questionnaires compiled by experts.

## APPENDIX 3: EXPERTS’S OPINION ON FARMERS’ BEHAVIOUR AND WILLINGNESS TO APPLY MCM

This appendix offers the information gathered from the interviews with experts and from the section 14 of the questionnaires compiled by experts. The analysis regarding willingness to apply MCM draws inspiration from this information. The information is organised in table 14.

*Table 14 Insight on the perceived influencing factors in shaping farmers’ willingness to adopt/invest in/apply MCM based on experts’ opinion with further explanation.*

<b>Perceived influencing factors in shaping farmers’ willingness to adopt/invest in/apply MCM on the part of experts</b>	<b>Further explanation</b>
<b>Appreciation</b> of the information/approach (“appreciation of the value of the practices” (Anonymous 3) and ability to realise benefits in the future)	Appreciation is fundamental also for social and cultural acceptability. As Reynolds Shula says: “there's no lack of interest. The issue is with development workers, <b>engaging</b> farmers, <b>causing them to understand</b> what the approach is about, <b>showing the benefits</b> that it brings”. By this he means that “if you engage the chiefs, the local leaders, and then the farmers and explain that this is the landscape. If we did this, these are the benefits. Each one has their own piece of land; your contribution is this”.
<b>Interaction</b>	“You have to explain what the advantage is of using and for you to explain that you have to be on the ground” (Anonymous 4).
<b>Awareness campaigns</b>	Especially well designed (“Campaigns through Method and Result demonstrations can strongly shape local farmers' willingness since they play a role in their mind sets. Investing in more sustainable strategies will be out of their own conviction and not through a “bait” like subsidies.” (Francis Kubi) and they must be “within the local cultural context” (Fiona Chisanga Mubanga).
<b>Delivery of the message</b>	Reynolds Shula states that even if benefits are visible, but “the message, the entry point, the approach is not good”, the results will be poor. Chrispin Moyo suggests the “use of various media platforms, especially radio and TV, in local languages, to reach out to many farmers including those in remote areas. The radio and TV programmes can run quizzes on microclimate management and offer small prizes to farmers who show good knowledge of the subject.” Furthermore, it is important to insist on demonstration plots and the way they are conducted.
<b>Trust in the message/information received</b>	It is important that they trust in the institutions and in the people who bring information/data. For example, if local farmers reckon that climate data are not representative (based on the of the experience they have at a microclimate level), this

	<p>occurrence impede them to appreciate this information (“if you don’t even know what is really going on here in our microclimate, why should I listen to you and trust on the technology that should help me improving microclimate (Anonymous 3)). It is also important to have access to useful information (scientific knowledge and “capacity building on financial literacy” (Francis Kubi), i.e., knowledge on financing strategies).</p>
<p><b>Having “pioneers who may be lead farmers”</b> (Reynolds Shula)</p>	<p>“It’s normal that normally farmers learn much better by seeing what the other farmers are doing” (Reynolds Shula). Friday Siwale suggests the “involvement of traditional leaders”.</p>
<p><b>Collective action</b></p>	<p>Communities where farmers agree on adopting collective actions (potholing or “they’re in a group to work on a particular field at a particular time and set up (interventions) aligned to recommended practices” (Valerie Chanda Chibuye)) and farmers can be more willing to invest in sustainable practices because they overcome the problem of labour constraints.</p>
<p><b>Alignment with local practices, customary bylaws and chiefs’ influence</b></p>	<p>“We find that those (Northern part of the country) are doing the traditional and they use that to preserve the forest to preserve nature. So, it has been very effective to mitigate climate change.” (Vladimir Chilinya). The indigenous knowledge is a significant factor that shapes farmers’ behaviour. “I know that the government pushes for conservation farming practices in all chiefdoms. But at the end of the day, I think the chief also has quite a lot of influence on the land utilisation and choices but then the smallholder farmers peak or not peak.” (Valerie Chanda Chibuye).</p>
<p><b>Incentivizing production (subsidies), provision of market and fair trade</b></p>	<p>Availability/provision of market (ex. growing soybeans/cassava/legumes/millet instead of maize because it is more climate resilient etc. There must be room in the crop market for farmers who are willing to switch from a stable and secure crop to another, because farmers “will only produce something they know they are going to sell” (Kabwe Mubanga)). “If you incentivize the production by attaching not just subsidies, but also markets, you can easily encourage these farmers to even start producing crops that will help them, for instance, legumes” (Kabwe Mubanga).</p>
<p><b>Financial subsidies</b></p>	<p>“Some farmers are working efficiently with the carbon credit projects by planting trees in their landscapes as in exchange for money” (Friday Siwale). However, “subsidies should be used with caution in that it may bring in dependence syndrome. Example if strategies are implemented through a project. Once the project comes to an end implies the end of subsidies and is likely to mark the end of farmers investing their time</p>

	implementing. However, a well-planned weaning plan must be put in place.” (Francis Kubi). Stephie Mendelsohn highlights the importance of giving financial incentives and financial viability, that is more than just subsidies, since “they can never be long term.”
<b>Infrastructure support and transportation</b>	“Financing netting to infrastructure around <b>transportation</b> might actually improve the conditions for managing the microclimate sector” (Kabwe Mubanga).
<b>Age</b>	Old farmers must be convinced that innovations “makes business sense [...] (For them) seeing is believing them” (Reynolds Shula). Therefore, their appreciation and conviction is shaped on learning and seeing from other farmers and seeing tangible benefits/profitability. With young farmers there are more chances to “discuss conceptually”. However, landowners are mostly the eldest, so they take decisions.
<b>Control of lands and land rights</b>	If farmers own the lands, they are more willing to adopt sustainable land use to protect the soil (so, limiting cutting down trees or applying too many chemical fertilisers (Valerie Chanda Chibuye), contrary to the farmers who rent a land for a time-limited season (because they are not willing to invest money and energy for a long-term benefit). The “Timeframe for the return in terms of the benefits to the farmer using the land” is also very important (Valerie Chanda Chibuye) and it is strictly related to the land rights (a owner will have a longer timeframe to invest than one who rent, who has only a season to obtain profits).
<b>Population density</b>	In areas where population density is very high, farmers own or manage small-scale pieces of land, and they are more willing to treat the land more carefully, adopting sustainable practices for example. But if the population density is very low, landowners have large-scale lands and they have the “luxury” of owning more than one field, so they can also be less careful on ploughing lands etc. (Valerie Chanda Chibuye). Dennis Mooya states that “farmers are willing to adopt certain practices that help them in their longer term”, using the example of how farmers are dealing with “prolonged dry spills rainfall variability”, highlighting how farmers “have changed their way they prepare their land”. In fact, they are realising that they have to minimise the soil, letting vegetation grow, creating “good permanently planting stations” to increase moisture harvesting and a challenging period of prolonged stress. However, he also states that there is a difference in implementing certain activities within small and large-scale lands. Because, in the case just proposed, it is easier to implement it in small-scale lands, since chemical herbicides for

	vegetation would be less, and the manual labour to spread would not be necessary.
<b>Labour availability</b>	“Households who have labour available are more willing to invest.” (Valerie Chanda Chibuye).
<b>Manual labour and costs management</b>	On small scale lands, certain practices require less manual labour and therefore, less costs.
<b>Visible profitability</b>	<p>Farmers need to see the <b>profitability</b> deriving from the implementation of certain innovations (profitability not only in terms of money, but also in terms of innovation/technology impact on the effects of climate change, there must be <b>tangible benefits</b> related to the technology. “Local farmers are willing to invest in sustainable interventions that also guarantee increased production and continuous production over time” (Ishmael Nkandu) and “they learn a lot by observation” (Francis Kubi).</p> <ul style="list-style-type: none"> <li>● Tangible benefits can be shown combining a MCM practice to reduce the effect of local climate variability with a farming practice (e.g., minimum tillage to disturb the soil where the farmer will plant (Kabwe Mubanga)).</li> <li>● Next to profitability, another factor that comes up is <b>insurance</b> (Kabwe Mubanga)</li> <li>● Douglas Mwasi states that “the willingness or the drive to invest, is a function of what they’re going to realise in terms of either soil fertility, or maybe reduced effect of climate change, or profitability”.</li> </ul>

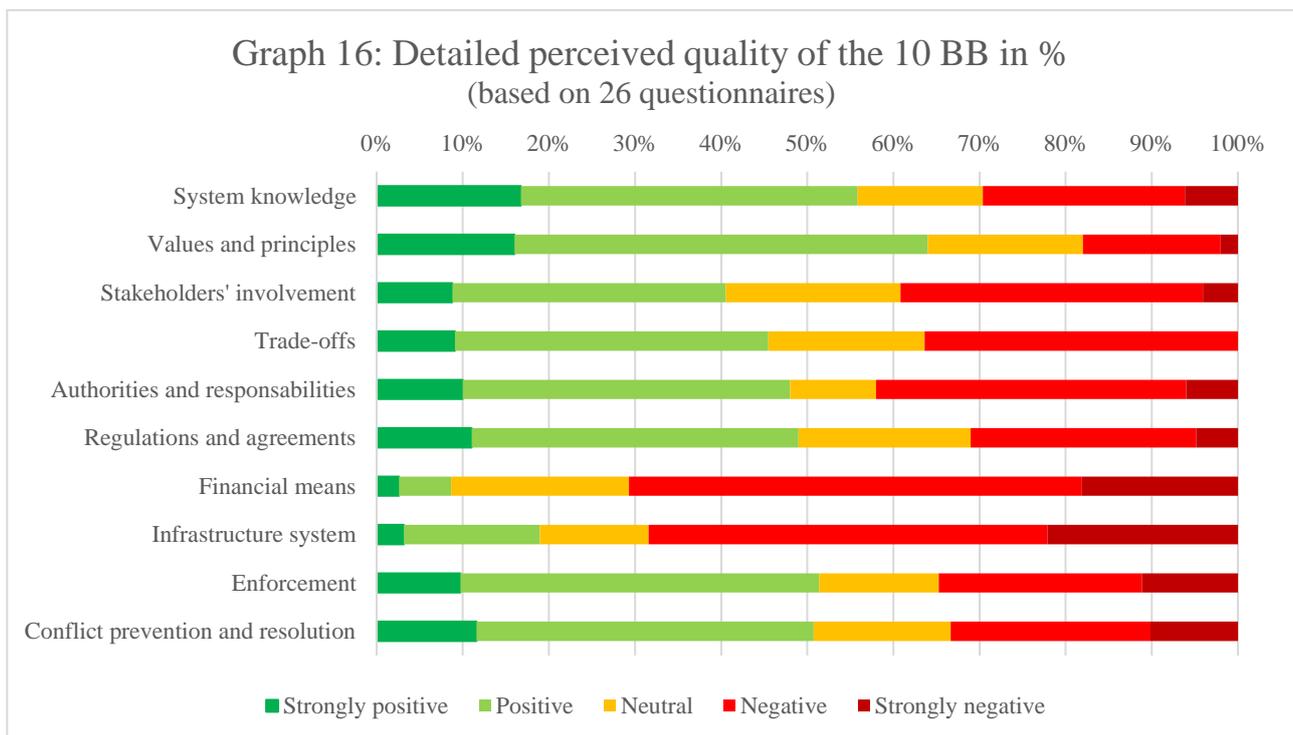
## APPENDIX 4: DETAILED ELABORATION OF DATA FOR EACH ASSESSMENT CRITERION OF THE 10 BB

In this Appendix, detailed elaboration of data for each assessment criteria are offered.

The appendix starts with showing the graphs of the results with every level of perceived quality, i.e., *strongly positive, positive, neutral, strongly negative*, and representation of *I don't know* and null answers.

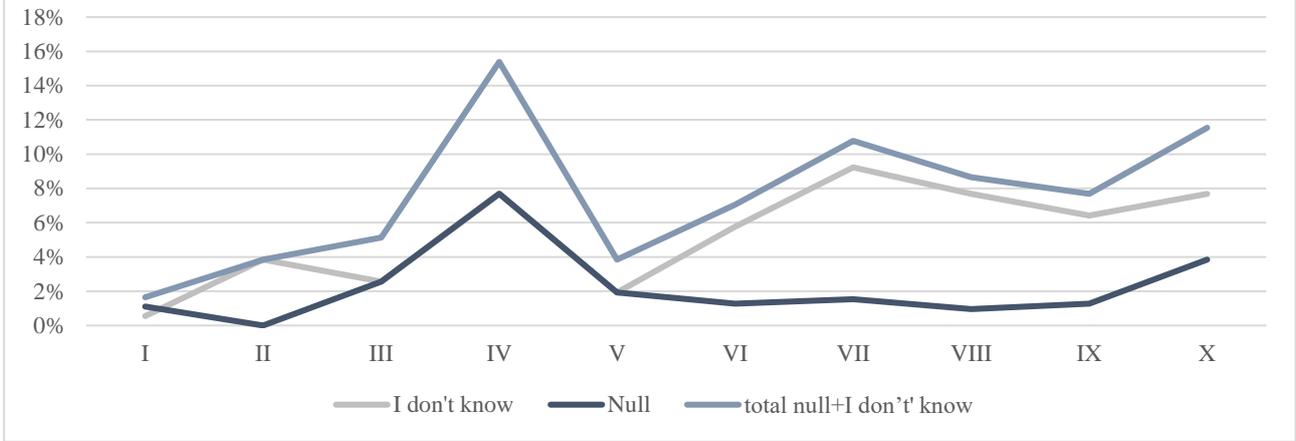
Following, further and detailed explanation of results found per each assessment criterion of the 10 BB is offered.

### Graphs:



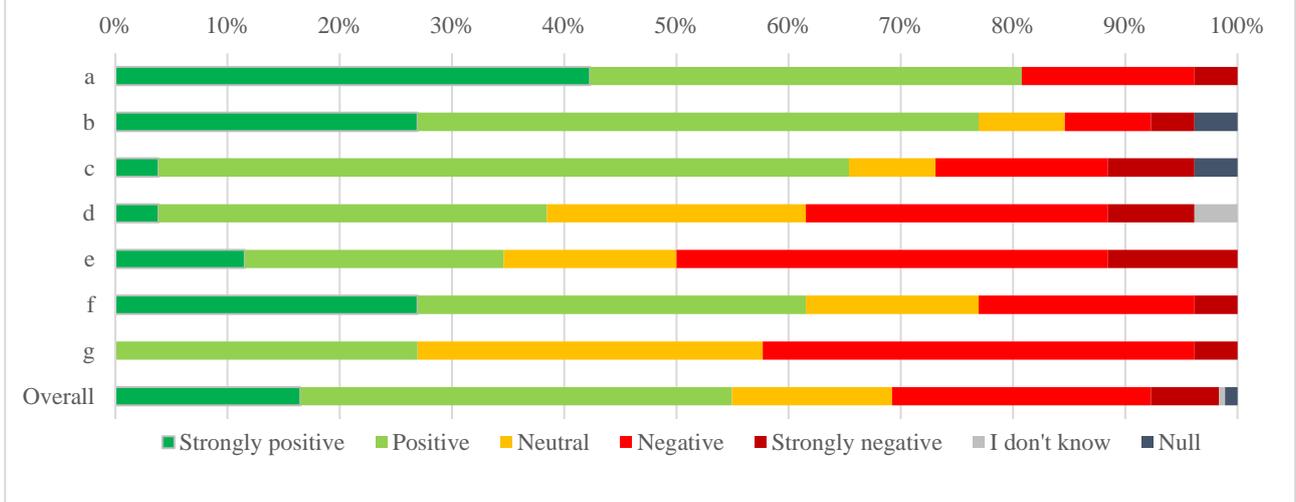
*Graph 16 Detailed results in % of the perceived quality of the 10 building blocks based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are not represented*

Graph 17: Trend of the "I don't know" and null answers for each BB  
(based on the 26 questionnaires)

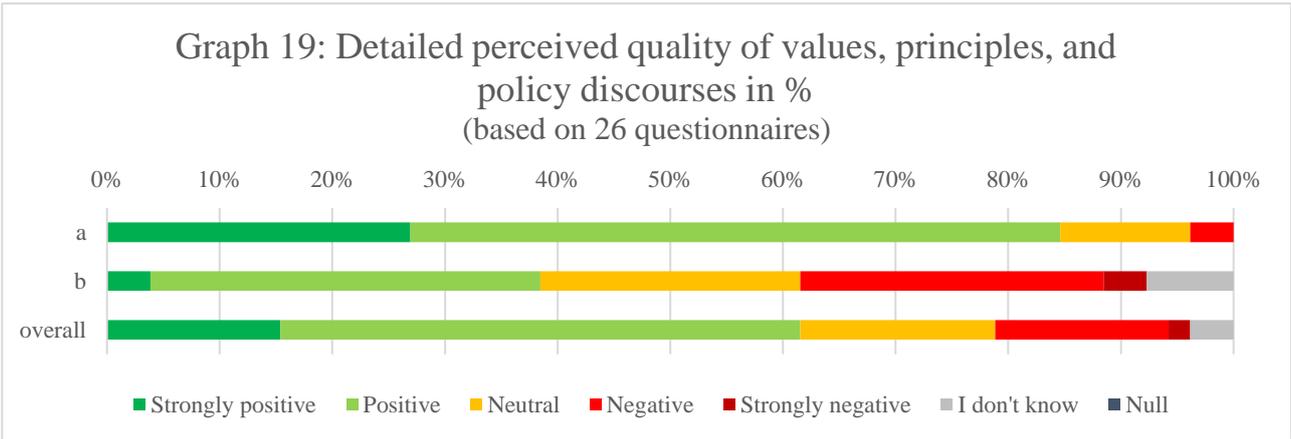


Graph 18 Results related to the overall trend of the "I don't know" and null answers for each BB and based on the multiple-choice questions of the 26 questionnaires compiled by experts.

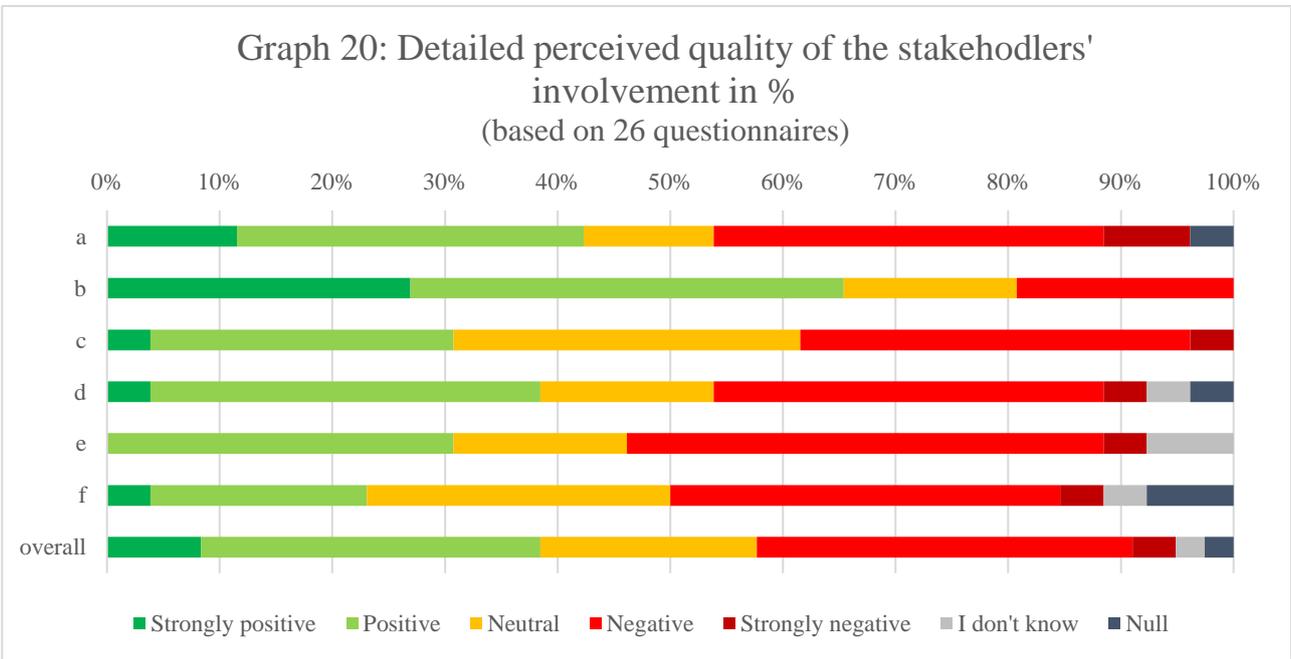
Graph 18: Detailed perceived quality of the system knowledge in %  
(based on 26 questionnaires)



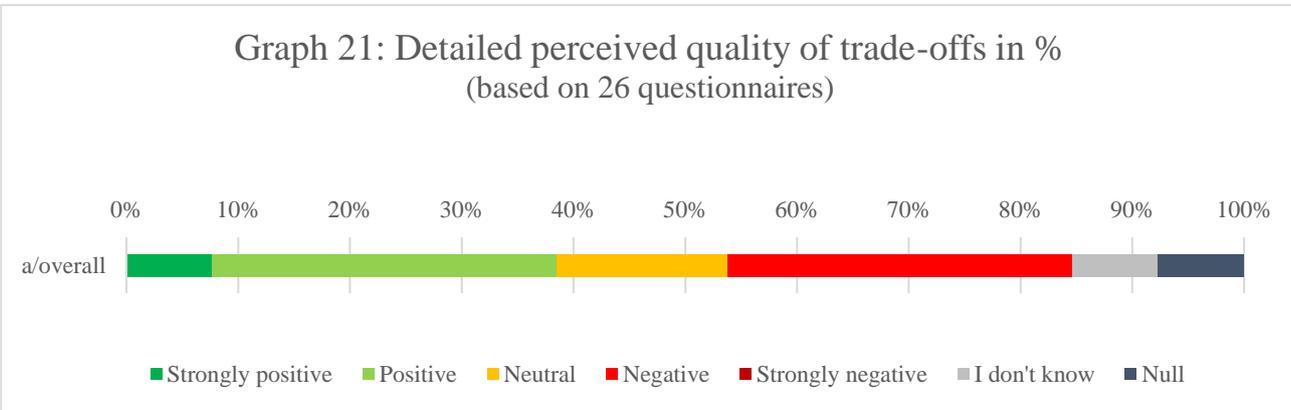
Graph 17 Detailed results in % of the perceived quality of the system knowledge based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented



Graph 20 Detailed results in % of the perceived quality of values, principles, and policy discourses based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.

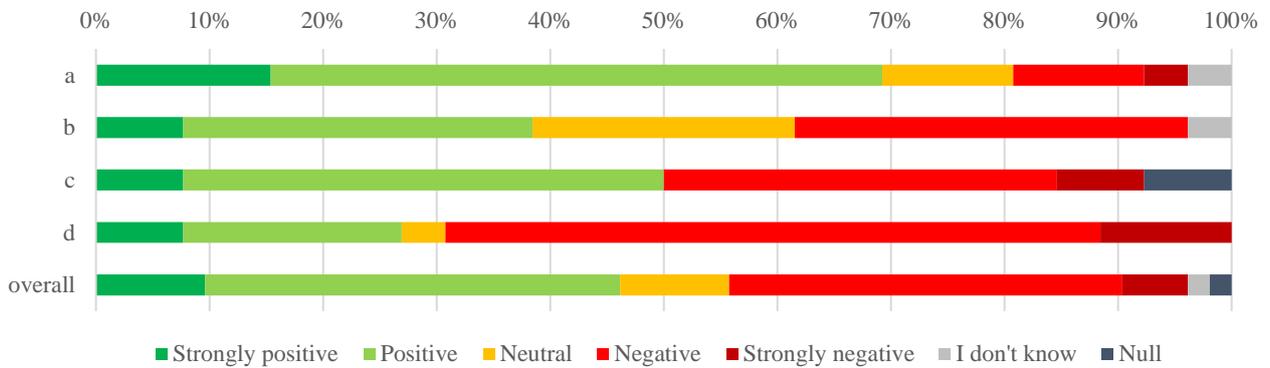


Graph 19 Detailed results in % of the perceived quality of the stakeholders' involvement based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.



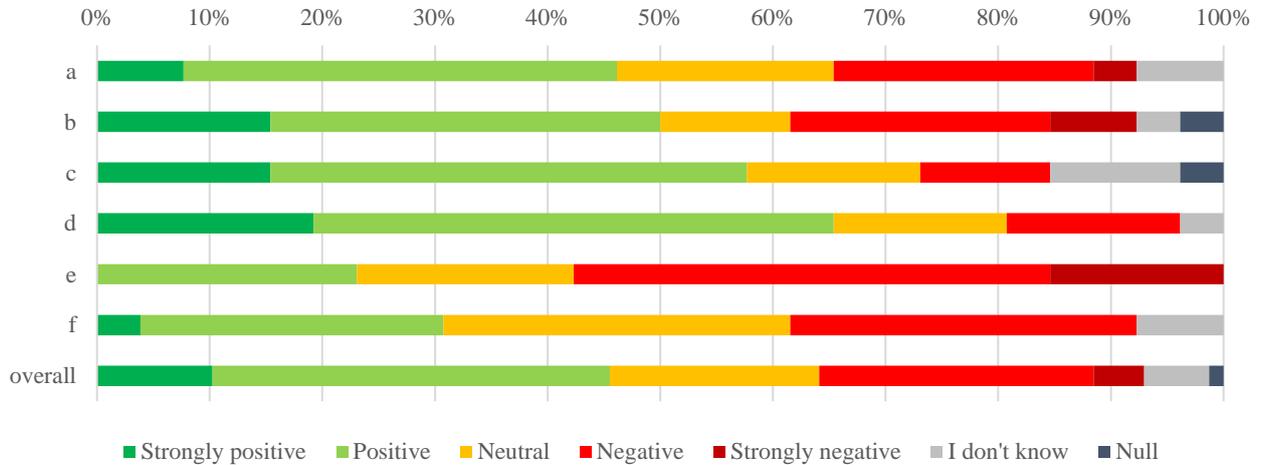
Graph 21 Detailed results in % of the perceived quality of trade-offs based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.

**Graph 22: Detailed perceived quality of authorities, responsibilities and means in %**  
(based on 26 questionnaires)

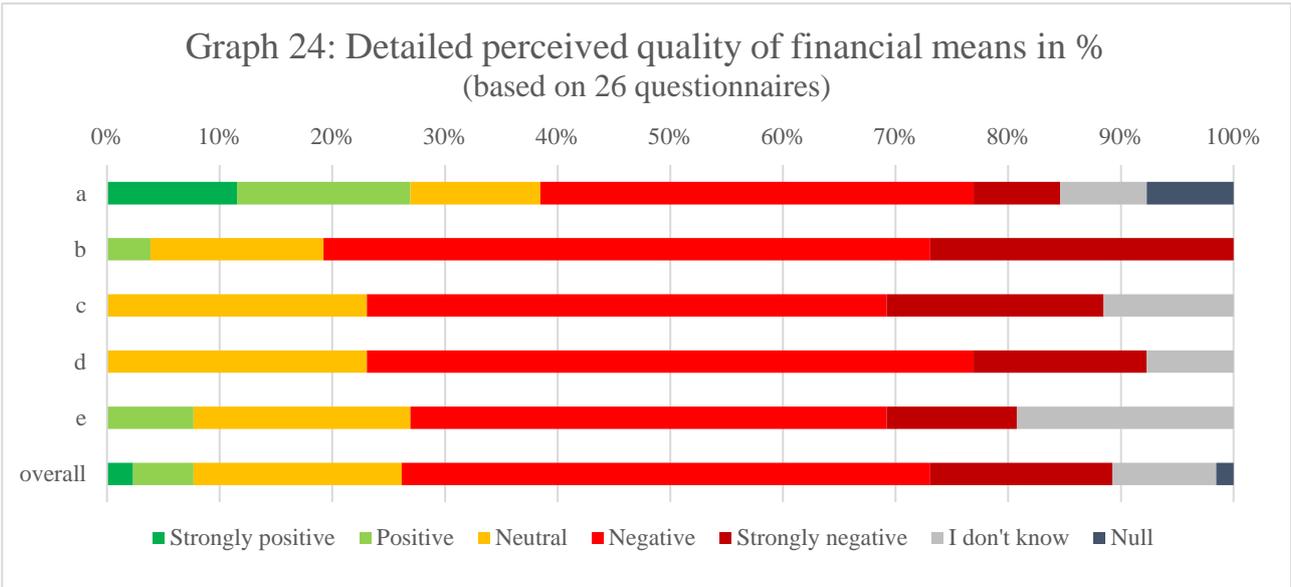


*Graph 23 Detailed results in % of the perceived quality of authorities, responsibilities and means based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.*

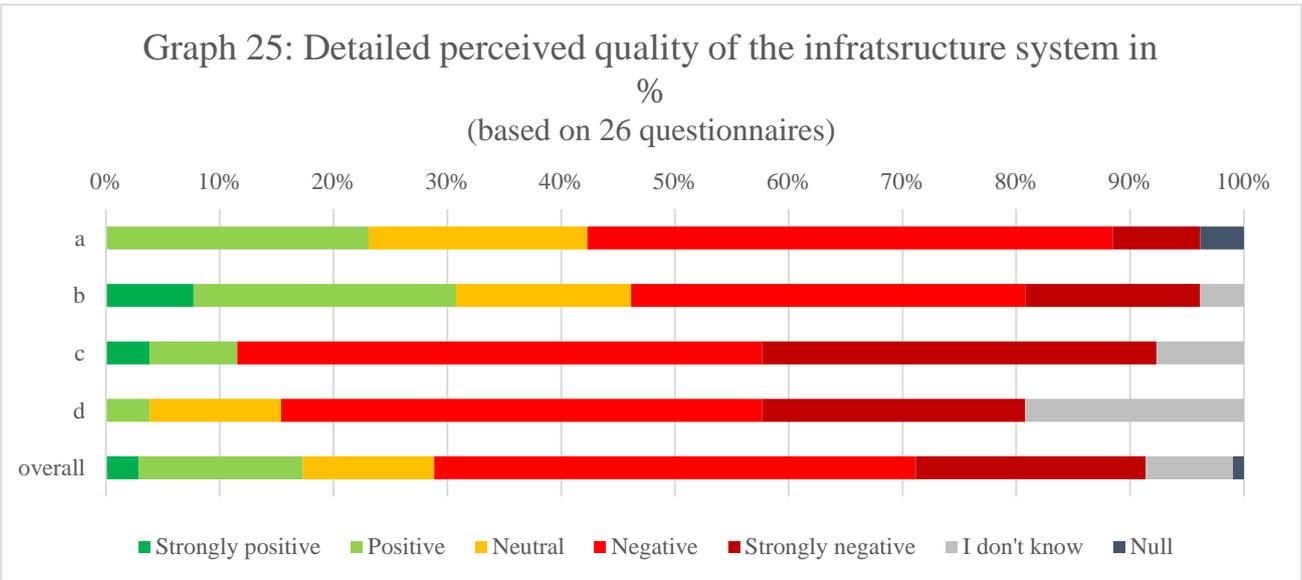
**Graph 23: Detailed perceived quality of regulations and agreements in %**  
(based on 26 questionnaires)



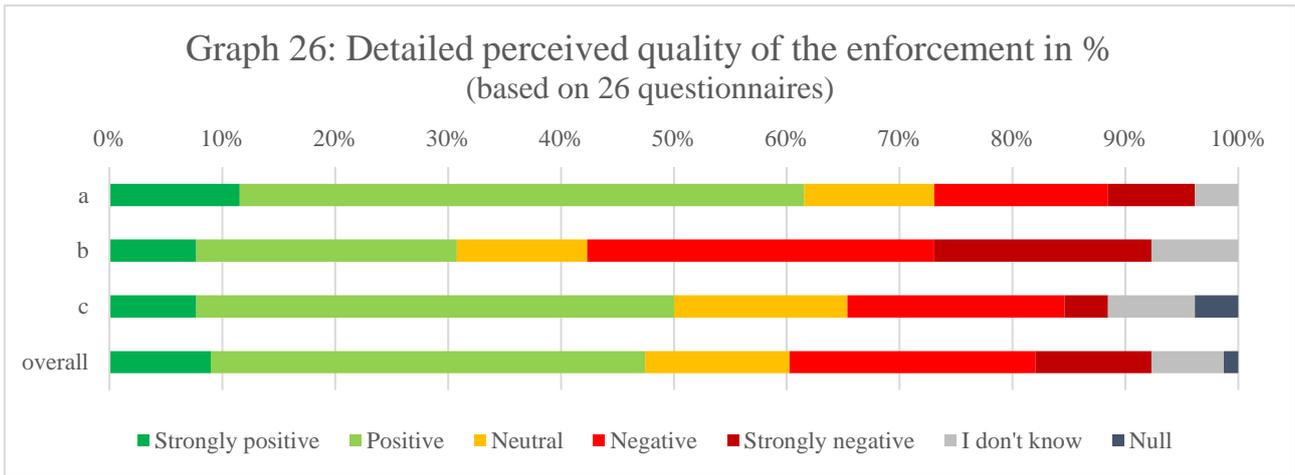
*Graph 22 Detailed results in % of the perceived quality of regulations and agreements based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.*



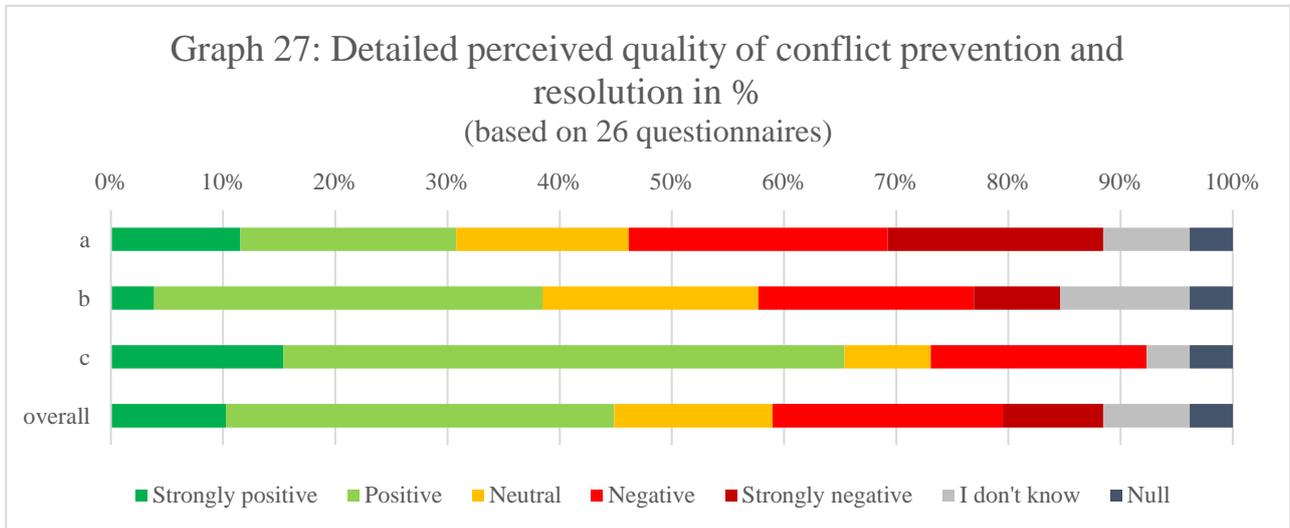
Graph 25 Detailed results in % of the perceived quality of financial means based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.



Graph 24 Detailed results in % of the perceived quality of the infrastructure system based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.



Graph 27 Detailed results in % of the perceived quality of the enforcement based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.



Graph 26 Detailed results in % of the perceived quality of conflict prevention and resolution based on the multiple-choice questions of the 26 questionnaires compiled by experts. In this table, the results related to the "I don't know" and null answers are represented.

## **Detailed explanation:**

### **System knowledge**

#### **a. Local institutions are sufficiently aware of local climate variability in rural areas in Zambia.**

From the questionnaires, it is clear how experts consider local institutions aware of local climate variability. Reasons related to the highly sensitization at a global level of climate change as a predominant issue to fight. Furthermore, local institutions have been able to see the phenomenon of local climate variability in the past two decades and the effects of local climate variability directly in the farming systems (unusual late rains and dry spells that cause various effects).

Despite the increasing sensitization and visible changes in local climate, not all local institutions are considered sufficiently aware due to a lack of data regarding microclimate, preventing access to clear information regarding the matter.

#### **b. Local farmers are sufficiently aware of local climate variability and its effects on crop production in rural areas over time.**

Consensus is reached in stating that local farmers have been experiencing the effects of local climate variability in their lands, becoming aware of the phenomenon. However, to a large extent, experts agree in a lack of sufficient (scientific) knowledge on the issue to permit farmers to understand its causes and its consequences at a field level, highlighting how farmers often rely uniquely on indigenous knowledge. Therefore, experts generally agree on the existing awareness of local farmers towards local climate variability, but they doubt its status.

Lastly, they clearly distinguish the level of awareness between literate and non-literate farmers as well as between farmers who get access to the internet (or different forms of communication media) and the farmers who cannot. The former in both scenarios seem to be more aware than the latter.

#### **c. Zambian local farmers are sufficiently aware of strategies and interventions in the ground that can deal with local climate variability.**

Generally, experts agree in affirming that local farmers are aware of the significance to take action starting at the individual farm level to respond with local climate variability, and it derives from their own indigenous knowledge and from experience (in fact, local farmers highly rely on what they see on the land). They are perceived to be also generally aware of the strategies to deal with the issue, due to the information and training conducted by local institutions (agricultural extension officers), external organisations, or local leadership. Cosmas Kasaro well explains the component of demo and field journal plots, where extension officers demonstrate agricultural practices to farmers.

### **However:**

- They miss having adequate input and technological support. Emmanuel Muma states that farmers are obviously aware of the changes in climate, but they do not have access to knowledge on technologies to deal with it and implement interventions like MCM (he gives the example of driving a tractor).
- There are areas where agricultural extension services do not have benefited from relevant information, therefore they cannot transmit knowledge (and awareness) to local farmers.

- Some of them implement certain agricultural practices being aware of the benefits deriving from the interventions. Others implement the practices just by watching the neighbours, without any knowledge or awareness on the cause and effects related to the intervention.
- Reynolds Shula states that farmers are aware of the existence of strategies, but they are incapable of understanding the link between environmental dimension (implementing sustainable interventions) to the socio-economic one (increasing crop production, increasing income and livelihood).

**d. Information that can be gathered on local climate characteristics and local geological characteristics is based on robust data.**

Experts concern about this statement, claiming that:

- Data in many localities is based on indigenous knowledge. Only the areas exposed to projects and supported by appropriate equipment can offer credible data. In general, lack of inadequate infrastructure, equipment, and tech-facilities impede robust data collection and management. Kabwe Mubanga explains well the poorness of local weather stations network, stating that during research at a local level, researchers sometimes need to compound areas or data from satellites and resolution of weather stations is too coarse to obtain robust data. Therefore, data finally are not accurate, and their robustness is very low. Consequently, information regarding local weather patterns offered to local farmers is not accurate, leading them to depend more on indigenous knowledge rather than proper scientific knowledge.
- Robust data on meteorological characteristics can exist, while robust data on geological characteristics are hard to find.
- Xavier Takam Tiamgne claims about data not being updated.

**e. Information regarding local climate variability is open and accessible by local farmers.**

In general, information is perceived as open, but not fully accessible. The lack of accessibility is due to:

- Language. Most of the information (booklets, manuals etc.) is mostly only available in English, rarely in local languages.
- Information is accessible through extension officers, but they do not reach farmers constantly.
- Information can be accessed via mobile phone network, radios, and television network, making its accessibility difficult for remote rural areas where farmers do not own these tools. Therefore, accessibility depends on the locality.
- Information at a national level is accessible, while at a local level is very hard to access.

**f. Information regarding local climate variability is open and accessible by researchers of research institutes/companies/university.**

As well as for local farmers, data are perceived to be open, but their accessibility is limited due to bureaucracy barriers. Public institutions and external organisations provide data, but they are usually accessible only through government channels. Experts complain about a lack of a repository, where all climate data can be available and easily accessible without incurring in long bureaucratic arrangements.

Furthermore, only a few research institutions consistently publish data/information, only when they own a proper website, the information is easily accessible.

**g. The communication between institutional bodies and local communities is efficient.**

In general, experts agree that institutions are willing to communicate, but there are issues difficult to overcome in efficiently delivering a message.

There are many challenges that impede communication to be efficient, mainly due to lack of resources to communicate and budget constraints. More in the specific, these issues are:

- Lack of resources to reach out farmers, amongst them are:
  - Human resources (unsustainable extension officer to farmers ratio. E.g., the ratio in Chongwe district is 1:1660, on average it is 1:1000. The recommended threshold is around 1:400).
  - Infrastructures (no electricity, poor internet connection and radio transmission) and technology (Information Communication Technologies ICT) amongst farmers (most of them do not own adequate digital communication network tools and they do not have knowledge to use this technology).
  - Mobility
  - Credit facilities/financial capacity
- Confusion, inconsistency in giving the information.
- Information package, which must be appropriate and accessible, considering literacy level and language barriers.
- Distribution space of farmers (they can be divided by 5 to 10 hitters of lands one from each other).
- Lack of interest and participation amongst local farmers.
- Lack of agricultural knowledge and expertise held by government officers.

### **Values and Principles**

**a. Values, principles, and cultural traditions of local communities in rural areas that influence their way of approaching the work in the field (and in shaping smallholders' attitude) and/or adopting new interventions in the field are known by local institutions.**

Generally, experts agree with this statement, and they suggest examples to reinforce their opinion. For instance, in Southern Province most of the farmers are not asked to work on Friday afternoons and Saturdays. This practice is well known such that local institutions cannot plan any activities on the said days.

**b. These values and traditions are considered and integrated in the local policy discourses.**

From one side, institutions are perceived to respect and integrate local traditions in the policy discourses. In fact, local leadership are engaged in the decision-making in order to foster and understand policy directions and to create a sense of ownership in future projects. In certain communities, farmers take actions and adopt new interventions only under approval of the village leadership. Knowing that, local authorities focus policy discourses on ensuring that the right channels of information flow are followed. Although traditional chiefs

are not recognized as official authorities by diverse institutions (e.g., banks), local institutional authorities respect the role of the village chief in this regard, for instance, by asking its permission before starting to work with farmers.

On the other side, this integration sometimes fails to occur, the tendency to draw policies based on donors' interests and conditions is predominant, bringing the targets and policy discourses not aligned with local culture and traditions (ex. despite the known fact the Northern Region of Zambia does not grow maize as the population is accustomed to Cassava, sorghum and millet, the government continues to give maize).

Another aspect that must be considered is the apparent lack of incorporation/integration of indigenous knowledge at a policy level. Policy decisions are mostly based on scientific knowledge, while there is very limited room for indigenous knowledge.

### **Stakeholders' involvement**

#### **a. Local farmers are involved in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.**

Farmers are perceived to be involved through the local chiefs, benefiting from community-based benefit sharing. For this reason, ward councillors work closely with traditional leaderships in fostering development. Furthermore, farmers are involved in the decision-making process through various institutions, such as Camp Agricultural Committee (CAC), and culture committee.

However:

- Farmers are **not well coordinated and not well organised** in order to actually have influence in policy. Furthermore, also the information they receive is not well organised, increasing their dependence on the government.
- There is a lack of **mechanisms that effectively allow for participation**.
- Existing districts development committees, i.e., **District Farmers Organisations** (constituted by some of the representatives of smallholder farmers cooperatives supposed to influence policies, their formulations and monitoring policy implementation), rarely meet, due to budget constraints, undermining space for participation.
- Various **levels of consultations exist**, but it is not always perceived as active involvement of farmers in the decision-making process.
- Exclusion from the decision-making process regards especially women.

#### **b. NGOs and other external organisations (i.e., Solidaridad Zambia) working at a field level in promoting new strategies to deal with local climate change in a sustainable way are included in the process of decision-making regarding the management of landscape, environmental resources, and the agricultural sector.**

The voice of external organisations is perceived as decidedly more heard than the voice of local farmers, because they are responsible for the projects, fundings, and technical support, giving them the opportunity to drive the agenda especially for implementation of sustainable management practices.

They are involved through institutions such as the District Development Coordinating Committee (DDCC) and the National Conservation Agriculture Task Force (NCATF), aimed at coordinating and harmonising the activities of stakeholders involved in the promotion of Conservation Agriculture and Climate Smart Agriculture.

However, there are opinions stating that they are not consulted and involved in the decision-making process, they are only informed and just inform vice versa about their action steps.

**c. The communication between external organisations operating in the field that claim for the promotion of adaptation strategies against local climate variability is efficient in Zambia.**

**Communication between organisations and farmers** is generally positively perceived. Experts state that cooperation has been formed between organisations and farmers to resolve climate change issues, especially through consortiums where coordinated efforts are joint. Their communication usually starts from baseline surveys before the implementation phase to gain a detailed understanding on target communities and location.

**Communication between diverse organisations** holds controversial perception. Experts claim that their communication is not efficient, especially because they have separate mandates and because they can consider each other as competitors. There is also a perceived feeling of fragmentation amongst organisations, where each organisation concentrates in their own area of operation and the actors work in silos instead of working together to build each other's expertise. In this regard, significant is the citation from Anonymous 1, who states that "they do not communicate. They duplicate efforts and even contradict each other. E.g., they may promote CSA differently in terms of agronomic practices, where some insist on not using herbicides in CSA systems while others promote them."

**Communication between government and external players** is not perceived as efficient. In fact, Reynolds Shula suggests that the government has no jurisdiction to regulate and interfere on the actions conducted by these organisations at a field level, and these organisations are not interested in finding any compromises in turn. Considering, however, that farmers respond first to the government, these organisations and government are effectively forced to find communication, resulting in being inefficient.

**d. The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is accessible by all stakeholders.**

On one hand, the process is perceived as accessible due to existing government platforms that permit local farmers access and engagement in the decision-making process. These platforms are:

- **National Technical Committee (NTC)** on climate change in operation, that coordinates most of the project on climate change and keeps updating on what is happening on the field. On this committee there are various actors sitting: academia, NGOs, government, and private sector. So, what generally happens is that some of the issues of local farmers are brought to the table by some of the same institutions sitting, and that also operate on the ground, providing direct interventions.
- **Zambia Climate Change Network (ZCCN)**, which is a network of NGOs, and it also sits at the table of the National Technical Committee. So, most of the issues discussed in the NTC are brought to

the table from this network.

- **MoA**, being the densest network in Zambia (more than the Ministry of Climate change for example) and having roots that reach very remote areas as well, offers direct access to farmers in claiming issues faced on the ground.
- **External organisations** compound to the information generated by the MoA.

**e. Stakeholders' involvement in the process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is equitable.**

In general, the main concern that comes up from both questionnaires and especially interviews is the power imbalance of diverse stakeholders in the process of decision-making. The government tries to involve all stakeholders for consultation in reviewing or developing policies in the agricultural sector, however, it tends to prioritise the voice of major corporations (principal investors in the agricultural sector). The inequity is also perceived by looking at the failure in conducting the decision-making process at local context. Lastly, **extension officers**, despite being the first government interlocutor with farmers, do not really have the ability to influence decision-making, due to operational structure that does not allow capacity to participate.

**f. The process of decision-making regarding the management of landscape, environmental resources and the agricultural sector is responsive to all stakeholders' interests.**

This criterion is not positively perceived for the following reasons:

- The traditional governance system is perceived as too predominant in the decision-making process
- Decisions are mostly conducted on the basis of the interests of corporations.
- "Some sectors are left out. Certain sectors are given more resources and attention than others" (Mwenda Singongi).

### **Trade-offs**

**a. Environmental targets decidedly fall within the principal political targets of local institutions.**

In general, environmental targets are perceived to be part of main political targets of the Zambian government, where the increasing negative effects of climate change are leading environmental targets to have major force on decision making at a national level. This is visible in strategic plans such as GRZ 6 and 7 national development plans. Also, from the interview it appears how there is the idea that sustainable strategies, such as CSA, have become a matter of policy, that give them the recognition to be an "approved way of doing agriculture" (Dennis Mooya). Furthermore, Zambia has pledged to reduce emissions by up to 47%, with external help and 25%, with internal resources (Kabwe Mubanga). So, a series of measures have been put in practice to reduce emissions, increase climate resilience, and convert agriculture from conventional to conservation. In fact, Wesley Wakun'uma states that the government has a serious recognition of climate change and Zambia is part of the UN CCF. He also highlights the high willingness to promote green based solutions. Therefore, from a policy perspective, the direction of the government seems to be clearly towards a sustainable use of natural resources and adoption of private smart cultural practice technologies.

**However**, trade-offs are perceived to be set at a higher level and only on paper. Furthermore, power relations are always at play. The implementation is perceived as limited as much as the political will, due to a lack of a holistic **approach** that permits addressing the climate variability issue as a whole.

Lastly, it is also perceived that the sectors with quick tangible benefits needed by people are prioritised in terms of defining targets.

### **Authorities and Responsibilities**

#### **a. Local authorities and their responsibilities regarding the management of landscape, environmental resources and the agricultural sector are known and well defined.**

Generally, authorities and their responsibilities are perceived to be well known and defined. However, uncertainty is perceived in distinguishing jurisdiction and responsibilities between traditional authorities and local government authorities. In this regard, there is often a **mismatch between traditional authorities and institutional local authorities**. An example is given by the management of customary lands: when the government starts a project for the development of the agricultural sector, it may have to bring innovative infrastructures inside the land (e.g., pipe and irrigation system). However, in customary lands, the person who has control to release and manage the land is the village chief. And here comes the issue. In fact, when he releases the lands, he also loses their control and consequently, his power. Therefore, the village chief is not always prone to release lands for development and installation of infrastructures and/or for the implementation of innovative interventions. The major consequence is that authorities and their responsibilities depend on local leadership, on their beliefs and geographical location. “Even large-scale farmers residing in a particular community have to adhere to local bylaws that the chiefs put in place” (Valerie Chanda Chibuye), limiting the role and power of local institutional authorities when it comes to implementing national policies.

Furthermore, since targets and projects are drawn at a higher level (national level), sometimes plans and responsibilities **are not well defined at local levels**. Wilfred Miga states that “there is a challenge of operationalising the responsibilities to effectively deal with their mandate”.

#### **b. The authorities act in a participative and integrative way while challenging environmental-related issues.**

Some experts highlight the perceived quality of this criterion affirming that authorities’ mandate champion local issues through quarterly meetings and demand driven workshops and they promote actively applying for grants and soft loans to boost businesses.

However:

- Experts claim a predominant top-down approach of landscape management in rural areas, which is highly influenced by fundings of external parties.
- A general sense of accountability on the part of institutions is also perceived. In fact, Kabwe Mubanga complained to UNDP, which promised the enlargement of the stations network with the addition of 120 stations, without any success. He also complains about the incapacity of the Zambian

Meteorological Department to collect robust and accurate weather data. Valerie Chanda Chibuye complains about the weak accountability of the government in considering and managing the cotton sector.

- “Not always. Sometimes authorities bulldoze and may not be integrative” (Mwenda Singongi).

**c. Ownerships of lands (land titles) are well defined and registered.**

The majority agree on the fact that **state** land titles are well defined, although not always properly registered

**d. Collective ownerships of lands (collective farmlands) are well defined and registered.**

The definition of customary lands is perceived as certainly unprecise, because:

- Land titles are not allowed, there are certificates owned by the traditional chief/authority (who has power to give consensus for the use of lands and he is in charge of it), which is usually not recognized by commercial entities like banks. Communal lands are often under the customary system. Even if they are well defined, they are not registered/well documented, considered community properties.
- In some cases, farmers do not have any title, they just occupy the land.
- Land borders are usually undefined.

### **Regulations and agreements**

**a. Regulations and agreements concerning the management of rural areas are in general appropriate, legitimate, and flexible when necessary.**

Main findings on **appropriateness**:

- For activities that have an impact on the environment, it is mandatory to carry out EIAs (Environmental Impact Assessment), making the projects and interventions more appropriate.
- Policies provide a great environment for chemical products companies to still operate in the country and have significant space in the market, despite the main direction promoted by the government in favouring sustainable agricultural practices.
- Policies are generally designed and developed without any community consultation (predominance of a top-down approach). Policies seem to be well designed on paper, but very difficult to implement at a field level.
- Policy discourses, policy decisions and, consequently, rules and regulations are based uniquely on scientific knowledge and on experts' opinion. While there is limited room for indigenous knowledge.
- Many concerns are related to the policies that manage subsidies, distributed without considering local needs. “We have known regions with different consumption patterns, the southern part, the consumer base, and the northern part, they consume cassava, the central part, they consume millet and sorghum. Now, we have this national program where they give only maize to everyone.” (Vladimir Chilinya).
- The projects are engineered towards the donor requirements.

Main findings on **legitimacy**:

- “The space and arrangements are riddled with corrupt practices” (Wesley Litaba Wakun'uma).

- Policies are designed to favour major corporations' interest (big seed and chemical companies) in the decision-making of the agricultural sector.
- Transparency is a challenge.
- Regulations and agreements of rural areas hold great political influence.

Main findings on **flexibility**:

- There are cases where regulations and agreements governing the management of rural areas are not very flexible, due to chiefdoms who are in control of lands and do not favour conditions for local institutions to provide certain services and implement interventions.

**b. Agreements between non-private actors (municipal, regional or state) and private landowners are appropriate and legitimate.**

It is overall positively perceived, because there are clear regulations at the initial stage of acquiring the land (Lands Act and the Regional and Planning Act 2015) and EIAs are carried out for the proposed land use. However, sometimes some privates own the lands illegally (WM)

**c. Experts' consultation usually occurs in the governance of the agricultural sector to achieve environmental targets.**

From questionnaires, there is a general consensus on the occurrence of expert consultation, especially in regard of scientific knowledge and indigenous knowledge, doubting if this occurrence is a "standard" phase in the design of regulations, and claiming that often there is lack of expertise in different various sectors.

**d. In general, bottom-up and top-down approaches in the governance of rural areas are balanced.**

Although, in terms of political will, the government is perceived as willing to strengthen bottom-up approaches, there are many concerns below briefly listed:

- Mechanisms to facilitate participation of farmers in the decision-making process are not drafted in the policies.
- Projects are designed without considering the farmers' needs at a local level, and especially do not integrate traditional knowledge in their formulation, designing projects and delivering messages that are far away from the farmers perspective. This is particularly visible at a practical level by the lack of farm assessments on the ground.
- The delivery of fertilisers does not reflect the local characteristics and needs. Some areas in Zambia are extremely sandy as well as waterlogged or rich in paddy rice. In these areas, the use of fertilisers is not recommended, however, they keep receiving this type of subsidies, because the decisions are made without consultations from the ground.
- Predominance of a centralised decision-making process, where policies are decided upon at national level.

**Insight into the Farmers Input Support Program: "a defeat for farmers' role as a catalyst for bottom-up approaches" (Reyonolds Shula)**

This program aims at collecting proposals from farmers; however, its implementation is highly discussed. Particularly, main considerations are:

- Inefficacy on empowering farmers' independence, enabling them to “stand on their two feet” creating a “dependence syndrome” in the farmers (Musamba Mubanga)
- Inefficacy on contributing to address food insecurity and enhance farmers’ productivity.
- Is being politicised, being diverted from its objective and it is used for the wrong purpose, defeating its role as a catalyst for **bottom-up approaches** (Reynolds Shula). It became a tool to gain political favour from voters and popularity amongst small scale farmers to parties during the campaigns. In fact, farmers believe that “the government is doing them a favour by giving them FISP, through which they can be engaged in policy change” (Emmanuel Muma).
- It’s become “selfish” (RS), because there are vertices in his structure as well, that concentrate all fertilisers input to a few beneficiaries, making the committee a biased system, “disinformation both farmers and government” (Reynolds Shula).
- Example of failure in getting information from the ground. The submissions of information along the chain, from farmers to decision-makers, undergoes changes failing in delivering the right messages.

**e. Generally, diverse policies are coherent and coordinated to find the most effective resolution for the implementation of sustainable strategies (such as MCM) to deal with local climate variability.**

From the questionnaires, experts relate this question to the consistent lack of coordination in implementing interventions on the part of different departments. Vincent Mofya states that the Ministry of Land and Natural Resources has control to authorise practices related to land management, but sometimes also to agriculture. Vladimir Chilinya claims the lack of harmonisation within environment and agriculture department interventions. Furthermore, key policy documents do not present any integrative policies of “different sectors taken as whole” to deal with problems such as climate change and “policy implementation strategies don’t really seem to be holistic”, missing them to fulfil the criterion under analysis (Musamba Mubanga).

Lastly, Francis Kubi highlights the unknown nature of the concept of microclimate management, justifying the lack of coordination between departments and claiming for strengthened and improved coordination of all players in environment management.

### **Financial Means**

**a. The communication channel with financial institutions is accessible and opened to all stakeholders.**

Although stakeholders are free to access bank information, experts raise some concerns, amongst them are:

- Stiff conditions of acquiring fundings, high leading rates and lack of collateral.
- Most financial institutions have not set up branches in rural areas.

**b. There are sufficient available fundings to pursue environmental targets (promoting sustainable strategies to deal with local climate change in rural areas).**

The perceived quality regarding this matter is very negative. In fact, many are the concerns that experts claim:

- The government converted its budget towards the increase of maize production for obvious food sovereignty purposes, spending a lot of money for input support programs that are tailored towards maize production in the country.
- The Government rarely packages products for farmers due to lack of assets and use of collateral.
- Fundings for the environment is largely donor driven and accounts for less than 1 percent of the national budget annually and they are available only for projects that operate for specific periods of time.
- Funding for logistic resources for extension officers (e.g., vehicles to reach remote areas) are unavailable.

**c. There are sufficient available fundings dedicated to promoting research regarding local climate variability.**

Kabwe Mubanga explains in the interview that conducting research for mitigating effects of local climate variability and regional climate change has many potentialities, but it is limited by low fundings. Most of the fundings is provided by external institutions (e.g., UK Climate Grow CCG), while the national budget line for research is very low. Furthermore, the available fundings is not generated locally, and conducting research on specific fields is difficult.

**d. There are sufficient available fundings to develop and implement awareness campaigns of environmental issues and adaptation strategies in rural areas.**

Although fundings has been invested in awareness campaigns, the yellow book (National Budget for 2022) does not reflect funds for this activity, unless from other sources like Donor Agencies (Francis Kubi).

**e. Financial institutions in Zambia are efficiently introducing the challenge of local climate variability in their primary financial criteria.**

Main findings regarding this matter are listed below:

- Much of the national agricultural budget is going towards fertiliser inputs and FISP, while it should be addressed mostly towards real sustainable interventions such as agroforestry. “It gets maybe 80 to 90% of the national budget (together with the Food Reserve Agency). So, these institutions are very costly to the Treasury and they are well seen from farmers because for example FRA help them selling maize etc. and the former helps them getting fertilisers at a cheaper price, and it is not attractive for foreign investors, because there is the fear that the funds that they give to the government will go to finance these programs, which are visibly not efficient for the agricultural development” (Emmanuel Muma). This occurrence suggests how the government is **not moving towards a greener economy**. In this regard, paradoxical is considering that most fundings in the agricultural sector (also in promoting green agriculture) derives from big corporations because “it's simply much more interesting for them to get massive market access for their produce” (Vladimir Chilinya).
- Available fundings derive mostly from external partners that come with a lot of conditions (first of all, lifetime). “The funding basket is very limited. Zambia is debt ridden and cannot have extra resources to fund any meaningful projects locally. We do not have any Conservation Project funded by any local

public funds' (Wesley Litaba Wakun'uma).

- Lack of transparency in the deployment of fundings. “The management (and deployment) of finances is a bit vague” (Anonymous 4).

In summary, main difficulties in providing finances to implement new interventions in the agricultural sector in Zambia are:

- Attract investor to finance new intervention due to:
  - Low-capacity building of staff.
  - Due to past funding misuses (from both government and NGOs).
  - Targets may not align with current targets of the government in agricultural sectors.
- High interest rates, collateral requirements, and markets/profitability.
- Irregular fundings.
- Dependence on government fundings and on international donor funding.
- Timeliness.
- Financial institutions' unwillingness to invest due to past heavy losses occurred and due to limited credit history at an individual farmer level).
- Lack of interest of the private sector for environmental matters.
- Inadequate capacity and lack of skills to develop fundable proposals.
- Limited availability.
- Lack of instruments to manage risks at a smallholder level.
- Developing a business case for the sector due to high risk connected to unpredictability of weather events.
- Inaccessible information and inefficient communication.

#### **Insight on delivery of subsidies to farmers:**

Although some experts sustain that efforts are being made to offer accessible subsidies by local farmers, many concerns raise on:

- Lack of conformity of the subsidies to specific local characteristics of the area.
- Uniform approach in terms of distribution of subsidies under the form of maize fertilisers, to enhance maize value chain only, disincentivizing diverse crop production. This suggests an incapability of technocrats to manage crop rotation and improve soils.

#### **Infrastructure System**

##### **a. Gathering data related to local climatic and geological features in rural areas is easy**

There are many methods in place that are becoming easy and cheap due to remote sensing and digital innovations. The ease depends on whether you have tools and partners with locals and whether there are Automatic weather stations for local climate in the area.

However, many concerns raise the inefficiency of infrastructures (road and telecommunication). The system is not very automated and independent, increasing the ineffectiveness of the system.

**b. Local weather monitoring systems work efficiently.**

The Ministry of Communication has piloted various early warning systems, there are both analogue and automatic weather stations and at every provincial centre has a weather station and in any location with airstrip or airport. However:

- Douglas Mwasi complains about the Meteorological Department, due to the incapability to generate accurate data caused by a lack of digital meditations where they can base their expert calculations.
- Modern system does not exist at a local level and resources for the national weather monitoring systems are inadequate.
- Newly installed Automatic weather stations (though past projects) have challenges in transmission of data since they are internet based. Repairs are not done frequently since lack of funds.
- The system is “hampered by lack of appropriate technologies” (Wesley Litaba Wakun'uma).

**c. The number of local weather stations working efficiently in rural areas is sufficient.**

There are insufficient stations available to collect granular data at a district level and local weather stations are mostly available in project funded areas. Modern systems stations do not exist. In general, the density of local weather stations is too low to collect robust data on local climate.

**d. Financial means for maintaining monitoring local weather stations are sufficiently available.**

- Fundings to repair Newly installed Automatic weather stations are not available.
- Fundings is still low for a robust maintenance plan.
- “While the reality is that farmers know, and data is available there is limited investments in data collection and dissemination” (Wesley Litaba Wakun'uma).

## **Enforcement**

**a. Agreements between non private actors (municipal, regional, statal) and private landowners can be easily enforced.**

The enforcement is perceived as difficult. In synthesis:

- Enforcement can be done though by-Laws.
- In the case of customary lands, it is very difficult. When the government brings innovations through infrastructures development (e.g., tap and irrigation system), this must be approved by the village chief, because he has the power and duty to release the lands for their development. If he does not approve, other farmers will not have the “audacity” to contradict his decision. This is a serious issue in terms of agricultural development.
- “Too much political interference” (Wilfred Miga)
- There are lack/limitations of policies to reinforce implementation of innovations. Policies are set up at a national level in terms of enhancing promotion and implementation of innovations, therefore, at a local level it seems to be very difficult to reinforce these innovations. This happens because at a local level, innovations are mostly “family or community lead”, and limited support is visible by the government in enhancing innovations.

**b. Local farmers are not confronted with any form of corruption that could intimidate their trust in the process of policy making.**

Reynolds Shula states that “it depends on how the facilitation is being done. If a carrot/inducement of any sort is used it could compromise the objectivity of farmer participation and decision making”. Generally, intimidation is not common but in places with high value resources (wildlife, minerals, forest resources), this may be different.

**c. Legislative and governmental spheres are supported by stakeholders’ acceptance.**

From both interviews and questionnaires, governmental spheres seem to be supported by stakeholders. However, the lack of full comprehension on the part of local farmers towards new government plans focused on interventions that appear to end, undermine their level of support. And the support is overcome by a stronger attachment/acceptance to local traditions. Furthermore, misappreciation is generated also by the fact that farmers think “data (delivered by the government) are not representative of the experience they had at microclimate level” (Anonymous 3), further undermining their level of support towards governmental spheres.

### **Conflict Prevention and Resolution**

**a. Mechanisms to prevent conflicts related to sharing natural resources (water resources, lands, etc.) are efficient.**

Mechanisms to prevent conflicts in the case of sharing natural resources are overall negatively perceived. Vladimir Chilinya offers the example of the Volume Two company in Bangweulu wetlands to show inefficiency in this matter. In fact, Vladimir says that “the company put its plantation there without any consultation or agreements with local communities who live in the wetland. It set up its factory, used chemical fertiliser, pesticides and herbicides, devastating flora and fauna of the land, and damaging life of local communities. They also fencing the wetlands, impeding people's access to the area. There were no benefits on sharing resources for communities, who were not consulted at all. People can use the wetlands as it is, without having to build any agreements”. This case suggests how mechanisms to prevent conflict and discomfort in sharing natural resources are absent. In this regard, Xavier Takam Tiamgne states that a general malcontent is perceived within local communities as a result of the installation of mining factories in certain areas, due to the belief that such activities can damage soil and water quality.

In case of customary lands, the traditional leader is in charge of giving control and managing possible conflicts generated by sharing natural resources. Contrarily, in the case of the state system, there are no specific rules that govern the management of shared resources, and the government would try to find a solution/a compromise to solve the pending conflicts on the fly. If farmers claim control over a natural resource such as a river, in general, there are boundaries at which a farmer can possess a certain portion of the river itself (the land must end to a certain distance from it in order to allow everybody access to it). However, if the natural resource is a tree, for instance, it is under family level arrangements, and there are no official regulations.

Lastly, local leadership in customary lands represent a local governance that acts through bylaws in terms of managing the natural resources. These bylaws, however, can run against the law of institutional authorities, becoming the origin of conflict.

**b. Mechanisms to prevent conflicts between farmers in collective farmlands are efficient.**

In general, mechanisms in this specific case are considered efficient. However, experts are concerned about possible disputes that can generate between the traditional authority and local government authorities in defining responsibility or jurisdiction.

**c. In case of conflict, there is a mediator (or a court) and it works efficiently to solve the conflict.**

Experts generally agree in the well organisation of rural areas in solving conflicts, especially where local leaderships are available. Contrarily, experts claim incapability of local institutional courts in solving conflicts stating that “court processes are slow and the local farmers who are mainly poor cannot afford legal representation” (Wesley Litaba Wakun'uma).