Using micro-finance services to support climate change adaptation among small-scale farmers: identifying opportunities and challenges in southern Mozambique

by

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Declaration

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Egídio Artur Alfredo Mutimba

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Dedications

I dedicate this work to my lovely girls, Nancy and Nwety.

Acknowledgements

Frist of all, I am grateful to God for the gift of life.

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Abstract

Microfinance organisations represent a potential opportunity to promote adaptation of smallholder farmers. Without access to credit, this group of farmers has few opportunities to invest in adequate technologies and practices required to respond to climate variability and change. In this context, this study explores how Microfinance Institutions (MFIs) can be capacitated in order to assist smallholder farmers to respond to climate change. The core objective of the study is to identify opportunities and needs to foster smallholders' adaptation through MFIs. The study is informed by a survey involving 13 MFIs operating in Southern Mozambique.

This paper finds that although MFIs are aware that climate risks affect their services in regards to a wider rural economy, these organisations do not have explicit policies to deal with climate risks. It also finds that majority of MFIs' managers recognise the potential for mainstreaming climate variability and change into services they provide to smallholders. However, for MFIs to achieve this they will require training of agents in climate related knowledge and adaptation, better access to climate related information, assistance in aspects of planning taking into consideration climate related risks and clear understanding of the benefits of investing in adaptation.

Key words: microfinance organisations, adaptation, smallholders, southern Mozambique.

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List of Acronyms

ARA SUL - Water Administration

DCAP - Department of Crops and Early Warning

FEWS NET - Famine Early Warning System Network

INAM - National Institute of Meteorology

INGC - National Institute for Disaster Management

MASA - Ministry of Agriculture and Food Security

MFI – Microfinance institution

NGO - Non-governmental organisation

PROSUL - Pro-poor value chain development project in Southern of Mozambique

SDAEs - Services of Economics Activities at district level

I. INTRODUCTION

Adaptation is increasingly important for countries such as Mozambique, ranked third most vulnerable to extreme weather and water related events in Africa (World Bank, 2009). In the absence of adaptation measures, the Gross Domestic Product (GDP) of Mozambique is predicted to decrease by 13% to 14% relative to the baseline growth scenario foreseen for period 2040 and 2050 (Arndt & Thurlow, 2015; Strzepek *et al.,* 2010). It is also anticipated that about 48% of the Mozambican population will be affected by cyclic droughts and floods due to future climate change (Croneborg, 2013). This will largely affect rural people whose livelihoods are dependent on small-scale farming (NCEA, 2015). Predictions indicate that the impacts of global warming will amplify the already observed disruptions in agricultural systems and ecosystems in Africa (Niang *et al.,* 2014). Given this unavoidable reality, adaptation is a way forward to address the socio-economic impacts of climate change (Adger *et al.,* 2009; Adger *et al.,* 2007; Eakin *et al.,* 2014; Eisenack *et al.,* 2014).

Unfortunately, smallholder farmers are currently unable to invest in adaptation because, among other barriers, they have limited access to credit (Schlenker & Lobell, 2010; Simpson & Burpee, 2014; Varangis *et al.,* 2014; Vermeulen, 2014). However, experiences from Bangladesh, Nepal, India and Latin America clearly show that the adaptive capacity of smallholders can be improved if they have an access to appropriate financial services. In these regions, MFIs combine the provision of credit to delivery of early warning information and technical assistance with the aim of reducing the impacts of natural hazards on borrowers (Basu, 2011; Hammill *et al.,* 2008; Ranger & Garbett-Shiels, 2012). An increasing number of studies claim that using MFIs as drivers of adaptation can be a win-win strategy for both these organisations and smallholders (Allet, 2013; Basu, 2011; Dowla, 2009; Hammill *et al.,* 2008; Rippey, 2009).

To date there have been no comprehensive assessments of MFIs in Mozambique, and how they might increase their support to smallholders' adaptation. This results in a lack of case studies to illustrate how MFIs should adjust their financial products in order to mainstream climate change adaptation into their services. This study addresses the knowledge gap on challenges and needs to foster the inclusion of climate variability and change into microfinance services. It also identifies existing opportunities to foster climate adaptation into MFIs' strategy. The concept of existing opportunities adopted in this study has been proposed by Biesbroek *et al.* (2013) as aspects that positively contribute to the process of adaptation by increasing chances of success and reducing chances of failure.

This research paper investigates the perception of climate risks within MFIs; the extent to which MFIs are mainstreaming climate risks and if not how flexible are they to incorporate climate policy in services they provide to smallholders. Its aim is to identify pathways to effectively integrate adaptation to climate risks and change into microfinance services provided by MFIs in Southern Mozambique. Smallholder farmers were chosen as focus for the study because it is widely accepted that this group will be the most affected by the impacts of climate change. In addition, the outcome of the study could be useful to the pro-poor value chain development project in southern of Mozambique (PROSUL), and district

plans for climate change adaptation as it explores pathways to make MFIs enablers of climate adaptation.

Findings of this research are based on primary data collected using semi-structured questionnaire submitted to 13 MFIs. The study responds to the following four objectives: 1) To evaluate the current understanding of climate risks and change within MFIs; 2) To identify to which extent climate risks and/or change are already integrated in the MFIs services; 3) To assess the flexibility of MFI's to mainstream climate change into their services; and 4) To identify in which way MFIs need to better integrate climate-related information into financial services offered to smallholders.

This research paper is outlined in six sections including this introduction which is followed by a literature review. In this section we contextualise the study and define key concepts applied throughout the study. The literature review is followed by a methodology section where we describe the rationale used for the definition of the study site; we provide description of the approach applied on the definition of the sample; and we describe the methods applied and limitations of the study. In the fourth section, we present the findings from the field according to the themes defined for this study. Then, follows the discussion that draws on the significance of the findings with regards to needs and challenges to integrate climate change adaptation into MFIs' strategy. Finally, the study discuss the way forward with emphasis on pathways to mainstream climate adaptation into services MFIs provide to smallholder farmers.

Overall, findings of this study reveal that while it is possible to harness MFIs as a vehicle to foster smallholders' adaptation to climate variability and change, this is not straightforward. Raising awareness of MFIs about the benefits of adaptation, capacity building of MFIs on climate-related knowledge and provision of adequate climate information are important prior steps to undertake if MFIs are to promote adaptation.

II. LITERATURE REVIEW

2.1 Adaptation of smallholder farmers in developing countries

Smallholder farmers are rural farmers who have farming as the main source of income and usually do not hire labour from outside the family (Morton, 2007). Their production system is basically for subsistence and focusing on staple crops produced under rain fed conditions (Rutherford, 2012).

Smallholder farmers are vulnerable to climate stressors (Agrawal & Perrin, 2008). In this context, vulnerability is defined as a function of exposure, sensitivity, and adaptive capacity (IPCC, 2001; Smit & Wandel, 2006). For instance, the occurrence of climate impacts in the form of droughts, floods and cyclones contribute largely to low productivity of small-scale farming in Mozambique (Santos *et al.,* 2015). Future projections indicate that any slight increase in temperature, intensity of floods, droughts and cyclones will worsen the livelihoods of smallholders mainly with regards to food security (Porter *et al.,* 2014), thus, increasing poverty and loss of human lives (Heltberg *et al.,* 2009). This will result from the decrease of yields if current agricultural practices are not improved or adapted to respond to climate variability and change (Porter *et al.,* 2014).

Smallholder farmers have historically adapted their production systems in response to threats imposed by seasonal variability, climate variability and change (Below *et al.,* 2010; Tambo & Abdoulaye, 2013). But, adaptation responses implemented by smallholders are often ineffective to successfully adjust the production systems to current and future unfavourable climate conditions (Vermeulen, 2014). In fact, smallholders' adaptation responses are mainly in a form of coping strategies (Antwi-Agyei *et al.,* 2014), meaning that they are not planned but reactive, and provide short-term responses to existing crisis. Due to risks of increased and more frequent climate-related disruptive events (IPCC, 2012), fostering adaptation strategies based on current climate variability is critical.

In the context of this study, adaptation is defined as processes of adjustment to actual or expected climate stressors – including seasonal and climate variability and change – and their effects, seeking to moderate harm or exploit beneficial opportunities (IPCC, 2014). Hence, adaptation is about minimising impacts of climate variability and change (Lobell, 2014). It comprises two dimensions – adaptive capacity referring to the ability of people or systems to respond to a change, and implementation of adaptation decisions based on actual adaptive capacity (Adger *et al.,* 2005; Tol, 2005; Tompkins *et al.,* 2010). A system is referred to be effectively adapted to climate change if it is prepared to respond to various climate stimuli (Adger *et al.,* 2005; Watkiss *et al.,* 2010).

On the other hand, there are coping strategies which are implemented in the context of climate shocks with the aim of achieving basic functioning of systems in the short to medium term (IPCC, 2014). The United Nations Office for Disaster Risk Reduction (UNISDR) defines coping strategies as 'the ability of people, organizations and systems, using available

skills and resources, to face and manage adverse conditions, emergencies or disasters' (UNISDR, 2015; 10). In other words, coping strategies include a range of actions available to reduce vulnerability usually in the short-term, without long-term planning. Coping strategies differ from adaptation from the perspective that they are reactive responses to actual stressors and not planned in expectation of future stressors, motivated by a lack of alternatives to deal with climate stressors (Taylor *et al.,* 2010). If coping strategies provide temporary relief to vulnerable communities, in some circumstances they can cause an increase in exposure to future climate stressors (Osbahr *et al.,* 2010) due to the degradation of livelihood resources (Taylor *et al.,* 2010).–Coping strategies also do not provide long-term livelihood security whereas adaptation to climate change can sustainably reduce vulnerability.

In Africa, very few smallholder farmers have the capacity to adapt to climatic change (Niang *et al.,* 2014), because of technological, biophysical, infrastructural and informational barriers (Tompkins & Adger, 2005; Niang *et al.,* 2014). This is because adaptive capacity is partially a function of good technologies, economic resources, adequate governance and social capital (Tol, 2005; Vincent, 2007). Reports and scientific research including the IPCC (2014), claim that inaccessibility to financial resources is one of the major constraints for adaptation of smallholder farmers (Antwi-Agyei *et al.,* 2014; Niang *et al.,* 2014; Nuhu *et al.,* 2014; Morvant-Roux, 2008). Therefore, although smallholder farmers perceive their vulnerability to climate risks, they fail to adapt because of the lack of finance to cover the expenses for the adoption of new technologies needed for their resilience (Schlenker & Lobell, 2010; Maddison, 2007; Nhemachena & Hassan, 2007). Moreover, the lack of credit also reduces the motivation to invest in agricultural production under an environment of climate risks (Porter *et al.,* 2014).

Smallholders' needs for effective adaptation to climate change

Future climate conditions will demand much more than the coping strategies that smallholder farmers have been implementing so far (Howden *et al.,* 2007). For instance, Cooper *et al.* (2006) had claimed that an increasing or decreasing of plant density is a coping strategy in semi-arid regions that does not build on the adaptive capacity of smallholders for even more exacerbated droughts. Arguably, the adaptive capacity of smallholders can be enhanced if existing local organisations act collectively in their assistance (Agrawal & Perrin, 2008). Among others, effective adaptation of smallholders requires access to advisory services with the objective of exposing them to production technologies that reduce the vulnerability of production system (Antwi-Agyei *et al.,* 2014; Agrawal & Perrin, 2008). In many cases decisions of smallholders with regards to adaptation is influenced by how they perceive risks (Antwi-Agyei *et al.,* 2014; Bryan & Behrman, 2013). Hence, the provision of adequate agro-climate information to smallholders is also needed for minimising uncertainties about future climate events during the crop season (Agrawal & Perrin, 2008; Nhemachena & Hassan, 2007).

The adaptation of smallholders is largely dependent on interventions from external institutions (Ludi *et al.,* 2012; Virtanen *et al.,* 2011). For instance, Osbahr *et al.* (2010) has

underlined the importance of formal and informal institutions in assisting the adaptation process of smallholder farmers in southern Africa. MFIs are part of the rural institutions with the ability to contribute to the adaptation of smallholders but not the only way to foster adaptation. MFIs can potentially play a key role building the adaptive capacity of smallholders through the provision of credit or through capacity building interventions (Osman-Elasha *et al.,* 2006). For instance, a research conducted in 12 countries of Asia and Africa has indicated that access to credit has positive influence on the ability of smallholders to shift to improved climate-resilient varieties (Wood *et al.,* 2014). The potential role MFIs could play, through facilitating access to credit for enabling adaptation is also confirmed by Niang *et al.* (2014). There are however risks such as difficulties to repay loan due to other climate and non-climate related risks (see section 2.3).

2.2 Microfinance in the context of climate risks

Microfinance services are defined as initiatives that are primarily motivated to enable poor people excluded from commercial banks to access basic financial services (Allet, 2013; Meyer, 2012). Microfinance products include small loans, savings, money transfer services and micro-insurance (Gutierrez & Mommens, 2011; Karlan & Zinman, 2011). In most cases these products provide impetus to small businesses including small-scale farming. Thus, it represents a window for the socio-economic change of rural livelihoods (de Aghion & Morduch, 2010; Nuhu *et al.,* 2014). One interesting fact is that from an economic viewpoint, impacts created by microfinance services are greater when investing in rural poor people than when investing in urban dwellers (de Aghion & Morduch, 2010).

Like other systems, microfinance services are expected to be increasingly impacted by the effects of climate variability and change (Gutierrez & Mommens, 2011; Rippey, 2009). The impacts affecting MFIs can be grouped into direct and indirect categories. The former category includes damages on the infrastructure, assets, disruptions of microfinances' operations and deaths among staff members (Gutierrez & Mommens, 2011; Heltberg *et al.,* 2009). For example, in 1988, a considerable number of employees of the Grameen Bank in Bangladesh lost their houses and about 170 were killed due to strong floods that hit two-thirds of the country over 13 weeks (Dowla, 2009). As the impacts of climate change become more common, MFIs will also face financial constraints due to economic recession and inflation caused by large disasters (Dowla, 2009).

On the other hand, the category of indirect impacts include reduced rate of repayments due to increasing vulnerability of the production systems of clients of MFIs (Gutierrez & Mommens, 2011; Hammill *et al.,* 2008). For example, it is expected that in Africa, by the middle of the century, without adaptation crop production will decline due to changes in climate and associated change in the incidence of plagues and diseases (Schlenker & Lobell, 2010). Ultimately, the impacts of climate change are predicted to contribute negatively to reduce loan repayment. This happens because borrowers are frequently excused from

repaying their loans after climate disasters (Dowla, 2009). This indicates that the efficient operation of MFIs will be increasingly impacted by climate variability and change.

In fact, MFIs are already facing the burdens of climate change (Dowla, 2009; Hammill *et al.,* 2008). Hallegate (2009) claim that at the present time one of the greatest challenges for decision makers and managers is planning given uncertainties with regards to future climate. This constraint also affects managers of MFIs. Therefore, the sustainability of microfinances depends on their flexibility to deal with climate uncertainties and on assisting its clients to stay ahead of current and future unpredicted risks imposed by climate change (Allet, 2013; Ranger & Garbett-Shiels, 2012; Rippey, 2009). In other words MFIs require fostering adaptation in the broader context of socio-economic development among the rural poor (Adger *et al.,* 2007).

To enhance the potential for adaptation, MFIs need to incorporate climate change risks into their strategies and planning systems, as they design products for the smallholder sector (Hammill *et al.,* 2008; Ranger & Garbett-Shiels, 2012; Rippey, 2009). According to Gutierrez & Mommens (2011), MFIs can adjust institutional policies to include educational, advisory and awareness-related activities for the benefit of clients, and institutional learning through monitoring and evaluation from climate smart projects. This indicates that MFIs can play an important role as enablers of climate change adaptation not only through the financial services they provide but also through the support and training offered to their clients.

With the integration of climate change adaptation into their services MFIs would be able to increase the number of clients as a result of economic development and reduction of poverty (Ranger & Garbett-Shiels, 2012). Other benefits include more access to funds from environmentally-sensitive donors, increased competitiveness of the financial services and increased rate of repayment (Allet, 2013). Another benefit that MFIs can accrue from successfully responding to current climate risks would be an increased adaptive capacity for dealing with uncertain future climate (Leary *et al.,* 2007).

The use of MFIs as enablers of climate change adaptation has been studied by Agrawala & Carraro (2010) in a context of Nepal and Bangladesh. However, their study does not focus on smallholder farmers as beneficiaries of MFIs' interventions. Furthermore, the study only discusses the necessary improvements on the financial products provided by MFIs rather than identifying the key organisational changes required for MFIs to promote climate adaptation. For this reason, this study addresses the current gaps in studies investigating pathways to foster climate change adaptation in the services MFIs provide among smallholders in southern Mozambique.

2.3 Possible drawbacks in using MFIs for adaptation

Despite the potential contribution of MFIs to adaptation, it is important to acknowledge that these organisations can also result in negative impacts among the beneficiaries of MFIs' services. The first important aspect is to be cautious and not fall in the trap of considering microfinance services as solution for all rural poverty issues. The reason is that some people, mainly the poorest, may not be in the condition to benefit from its services, thus they require other form of interventions (CGAP, 2004). For example, the most successfully Grameen Bank in Bangladesh, although reaching the poor, still fails to target the most vulnerable poor (Bryan & Behrman, 2013). It means that the main clients of MFIs are those economically active, and not the poorest part of the poor (Agrawala & Carraro, 2010).

Furthermore, it is important to acknowledge that MFIs can sometimes push their clients into an even worse debt condition and contribute to their low production (Ibrahim & Bauer, 2013). This is mainly because MFIs became highly profitable organisations for the benefit of their managers and proprietors. To meet their objectives MFIs charge high interest rates on the justification of covering operational costs (Bateman, 2011). One of the key impacts resulting from high interest rates is preventing smallholder farmers from accessing credit (Nuhu *et al.,* 2014; CGAP, 2004). Besides this, high interest rates can push poor people into a more impoverished conditions, and in some cases social inequalities when costs of interest rates surpass profits accrued from investments (Below *et al.,* 2010).

Clients of MFIs can also be pushed into more vulnerable conditions when microfinances are compelled to provide big loans without taking into account the capability of clients to repay, thus they become over-indebted (Meyer, 2012). MFIs are also found to provide unsustainable loans when they put focus on credit for consumption, as this does not contribute to income generation (Bateman, 2011). Moreover, some MFIs drive clients to more vulnerable conditions due to their inflexibility in altering repayment systems in the event of shocks (Parvin, 2012). This is to a large extent due to the lack of clear perception or understanding, among MFIs, of the burdens imposed by climate shocks, family crisis and job loss amongst small scale farmers (De Vletter, 2006). In the case of climate shocks, the inflexibility can also be greatly attributed to the lack of approaches to manage the impacts imposed by climate variability and change (Ibrahim & Bauer, 2013). To sum up, the provision of unsustainable loans and inflexibility of MFIs often worsen the socio-economic condition of their clients.

The socio-economic problems created by MFIs on people are translated into loss of useful livelihood assets such as land and livestock. This happens either because MFIs can decide to execute mortgages or smallholders may decide to sell assets for them to be able to repay loans (Ibrahim & Bauer, 2013; Hammill *et al.,* 2008). The negative impacts of MFIs can also induce a reduction of food consumption leading clients to a condition of food insecurity (Hammill *et al.,* 2008). For example, Parvin (2012) reports that 70% of the weekly income from microfinances' debtors is channelled to repay loans. The negative influences of MFIs also induce debtors to borrow money from illegal moneylenders at even higher interest rate for them to repay previous loans (Bateman, 2011; Hammill *et al.,* 2008). Thus, one can argue

that in these circumstances, microfinance services lead debtors to more vulnerable conditions rather than contributing to the adaptive capacity of their clients.

The previous subsection described the potential socio-economic problems that may affect beneficiaries of financial services as a result of the interventions and approaches adopted by MFIs. Whilst the abovementioned problems are worth considering when studying MFIs, they are not the focus of this study. The scope of this study is to investigate pathways to integrate climate change adaptation into services MFIs provide to smallholder farmers. Furthermore, the study includes a section about the spatial distribution of the sampled MFIs on the adaptive capacity of smallholder farmers.

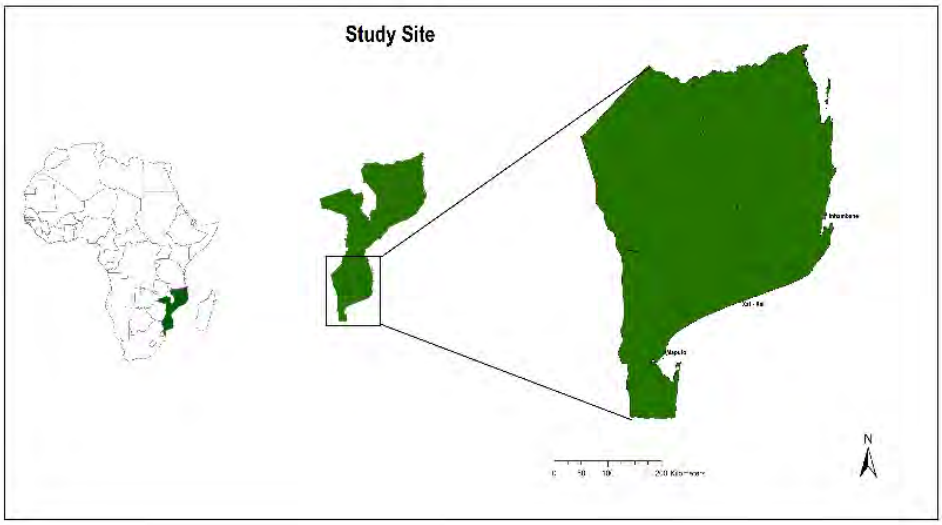
III. METHODOLOGY

This section describes the methodological approach followed in this study. It provides the rationale for the selection of the study site, then describes the methods applied for the definition of the sample and finally highlights some of the limitations that might have influenced the results. The section also identifies the thematic areas of the research in order to respond to the aim. As aforementioned the aim of the study is to identify pathways to effectively integrate adaptation to climate risks and change into MFIs for the benefit of smallholder farmers.

3.1 Study site

The target area of this study is southern Mozambique (Figure 1). This region was selected because climate variability and change are already affecting the livelihood of smallholder farmers living there (INGC, 2009; World Bank, 2009). Predictions suggest that more floods and droughts will cyclically hit the region (Tadross, 2009). The fact that the region is benefiting from the on-going PROSUL, also influenced the selection of this region as a case study.

PROSUL aims to establish improved and climate-resilient livelihoods of about 20000 smallholder farmers (IFAD, 2012). One of the approaches of the project is the provision of innovative financial products to smallholder farmers. Such financial products can be delivered by MFIs and are expected to trigger the involvement of smallholders producing horticulture, cassava, and red meat in the market while building on their resilience to climate variability and change. Thus, the project provides a good perspective for improvement of smallholders' livelihoods. Furthermore, as asserted by Varangis *et al.* (2014) the integration of smallholder farmers into a value chain creates a sound environment for MFIs to finance most of them more efficiently. Therefore, this research, which investigates pathways to mainstream climate adaptation into MFIs strategies, is in line with PROSUL's goal which is to increase the adaptive capacity of smallholder farmers.



Source: Author

Figure 1. Geographical visualisation of the study area

Southern Mozambique is a region with the highest rate of poverty in the country (Strzepek *et al.*, 2010). In 2009, the rate of poverty in the region was 56.9% against the National rate of 54.7% (Lawson *et al.,* 2014). Small-scale farming is the main activity of the region representing about 90% of the area under production (IFAD, 2012). The main commodities grown by smallholders in the region include maize, rice, vegetables, cassava and livestock. Farming in this region is mainly rain fed and only 5.3% of the farming units have access to irrigation. Due to these factors, smallholders have been unsuccessful in obtaining good yields, thus affecting the livelihoods of smallholders. Other factors explaining low yields include low soil fertility, use of low quality seeds, and poor farming practices (Silici *et al.,* 2015).

Nonetheless, the most important factor for the unsuccessfulness of small-scale agriculture is the drier climate characterising the region (Strzepek *et al.,* 2010). The region is home to the driest agro-climatic zone in the country, with an annual precipitation of about 300 mm (NCEA, 2015). Besides this, southern Mozambique is prone to recurrent droughts, floods and tropical cyclones (Arndt *et al.,* 2011), although droughts are the most important climate events to the livelihood of smallholders (INGC, 2009). The importance of droughts is further emphasised by the Ministry for the Coordination of Environmental Affairs - MICOA (2012) in the National Climate Change Strategy, and by the World Bank (*n.d*). These documents state that droughts are the single most extreme climatic event that has caused more deaths than other climate events put together over the last 50 year, in Mozambique. Furthermore, in southern Mozambique, droughts are observed quite often ranging from four to seven events every decade (Lotz-Sisitka & Urquhart, 2014).

Another significant element of the study site is low access to credit. In southern Mozambique, only 1.3% of the smallholder farmers have access to credit (INE, 2011). There are two arguments used to justify the low proportion of financing of agriculture. On the one hand, smallholders argue that they do not apply for loans because MFIs charge unsustainable interest rates and require assets as collateral (Hunguana *et al.,* 2012). However, the limited

demand for credit among smallholders can be as a result of lack of information and education on financing issues (Meyer, 2012). On the other hand, it has been found that MFIs have a tendency to not provide loans to smallholders because they find agriculture to be risky, costly and a less profitable activity to finance (Silici *et al.,* 2015; Hunguana *et al.,* 2012; Morvant-Roux, 2008).

3.2 Research methods

This is a qualitative study that uses primary data collected through semi-structured interviews involving 13 managers of MFIs operating in southern Mozambique. The field research was conducted in July 2015 for three weeks. We used an open-ended questionnaire which had 5 sections and the interviews were one-on-one, either in person or over the phone. According to Barker *et al.* (2005), open-ended questionnaires have the advantage that respondents are able to provide more details about the answers and perceptions. Exceptionally, one interview was conducted via telephone call as the respondent lived far away and could not be met within the short timeframe of the study. Emails were used to obtain additional information that some respondents could not provide during the course of the interviews. One example is the provision of information about allocations of funds made by MFIs to different portfolio activities.

The questionnaire was translated from English into Portuguese, the official language of respondents. This was not a barrier because the interviewer is fluent in Portuguese. Literature was consulted for the purpose of comparison and support of some of the findings from the survey.

Participation of respondents

In this study we followed the required ethics guidelines approved by the ethics committee at UCT. Thus, the participation of respondents was granted on a voluntary basis after they were informed about the scope and aim of the study. We also familiarised the potential respondents with the type of questionnaire that they would have to respond to. This was done with the purpose of increasing the likelihood of interviewing the right person across microfinance organizations. Moreover, we informed the respondents about the expected duration of the interview so that they could set enough time aside for it, thus minimizing the risk of dropping off in the course of the interview. However, we informed the interviewees that they could withdraw from the interview at any time without any prejudice or penalty against them. Lastly, we assured the respondents that information would be treated anonymously.

Thematic scope of the study

Our research framework includes six thematic sections, selected to identify opportunities, challenges, weaknesses and needs to foster climate adaptation into MFIs. The themes are represented in figure 2.

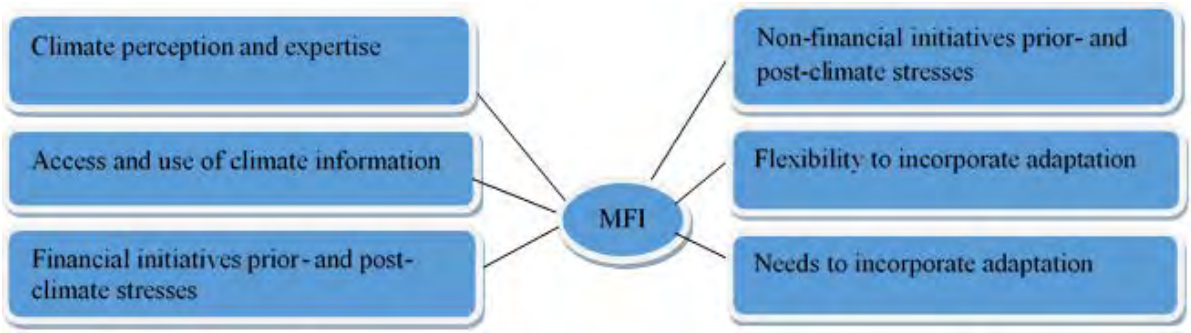


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Figure 2. Themes used as guiders of the study

The rationale and assumptions behind the above themes are as follow:

- The thematic section about climate risks perception and expertise aims to understand how climate variability and change are perceived by MFIs and their influence on MFIs services.

- The thematic section about access and use of climate information aims to assess the utility given by MFI agents to climate information. We defined this theme based on the assumption that the process of change of organisations requires reliable information for decision-making and definition of adaptation strategies (Ludi *et al.,* 2012).
- The thematic section about non-financial initiatives prior- and post-climate stresses aims to identify initiatives that are not related to the provision of financial services, but contribute on the responses adopted by MFIs in anticipation of climate risks or post climate impacts with benefits to smallholder.

- The thematic section about financial initiatives prior- and post-climate stress is based on the assumption that MFIs may or may not change rules of accessing to credit in a way that lock debtor smallholders into a more vulnerable situation.

- The thematic section about flexibility to integrate adaptation assess the willingness of MFIs to incorporate climate change adaptation into institutional policies. We propose this theme based on the assumption that interviews with managers would function as an opportunity of raising awareness for MFIs that would never have been exposed to similar dialogues.

- Finally, the thematic section about needs to incorporate adaptation identifies the kind of support MFIs need to be able to incorporate climate change adaptation into their strategies. This section draws from the analysis of the first five thematic sections.

We use GIS to display the spatial coverage of all sampled MFIs. This was done on a perspective of identifying the tendency of MFIs in reaching rural districts.

The sample

For this study we sampled 13 MFIs operating in southern Mozambique. The field work also included contacts with the focal person for the early warning system at the Ministry of Agriculture. We did this for the purpose of obtaining information on how the system works.

Our initial expectation was to study 15 organisations, targeting five in each of the three provinces of the study site. This was not accomplished due to reasons that are further described below. We accessed a database file of the Central Bank of Mozambique as a starting point for the identification of MFIs. The file contained 241 MFIs officially registered to operate in southern Mozambique, as of December 2014. Then, from the file, we selected only organisations with headquarters in the rural areas of the study area. The rationale behind the shortlisting was to increase the probability of contacting organisations that provide credit to farmers. The next step was to use the shortlist to randomly select five MFIs operating in each of the three provinces.

We then liaised with staff from Services of Economics Activities in the districts (SDAEs) where selected MFIs operate. This was done with the objective of certifying whether or not such organisations were operating in districts. Also, SDAEs connected us to MFIs, as these public organisations work closely with MFIs.

Some MFIs registered to operate across districts were not found in place as they had shut down. Others were not providing loans to farmers. Due to this, it was only possible to interview five organisations with headquarters localized at the district level.

For this reason, we followed an alternative approach which consisted of enquiring from the SDAEs about the MFIs operating at district level including those without branches locally. Through this approach we identified eight additional organisations that fulfilled the requirements considered in the study. The map below depicts the geographical coverage of the 13 organisations sampled in the study. Overall, these organisations provide financial services in 24 rural districts of southern Mozambique (Figure 3).

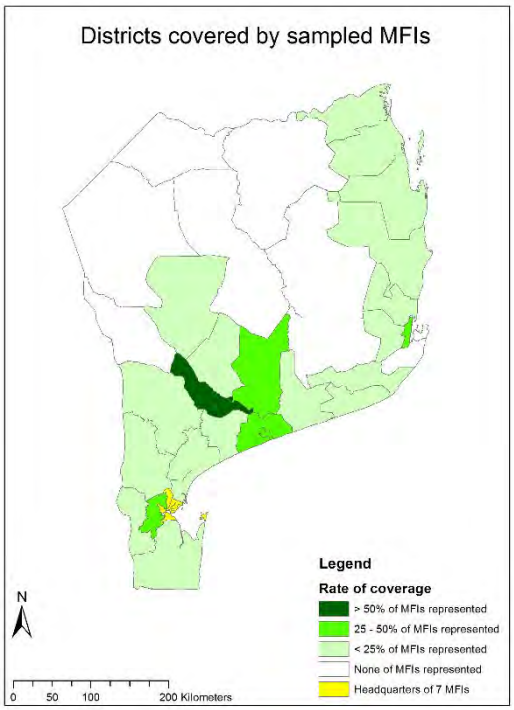


Figure 3. Spatial distribution of sampled MFIs across rural districts. Non-shadowed area represents districts which do not access financial services provided by the sampled MFIs. Yellow area (Maputo city) represents the location of headquarters of some of the sampled MFIs. Districts shadowed with light green colour are those with below of 25 per cent of MFIs operating there. Medium green shadowed districts have more than 25 per cent but less than 50 per cent of MFIs operating in those locations. Dark green represent districts in which more 50 per cent of MFIs provide financial services.

Figure 3 shows that our sampled MFIs present an uneven coverage throughout the region. There are nine districts where these MFIs do not operate; 19 districts with less than 25% MFIs operating there; four districts benefiting from 25 to 50% of the sampled MFIs; and just one district benefiting from about 50% of the sampled MFIs.

3.3 Limitations of the study

It is important to acknowledge that there might be aspects that we were not able to control which may have influenced the results of this study. Firstly, respondents were found to be extremely reserved about participating in the study due to reasons of confidentiality in providing operational information. To overcome this barrier we provided the respondents with an official credential disclosing the objectives of the study and how aspects of confidential information would be treated. However, this does not necessarily ensure that respondents provided true information for all the questions. Unfortunately, we did not have access to some documents such as reports, appraisals of loan applications and investment database that would function to minimise some of the biases.

It is our understanding that data analysis would have been more conclusive if we could have interviewed some of the clients of MFIs. Consequently, this would have allowed us to compare the information gathered from managers of MFIs to the needs, opportunities and

challenges from the perspective of smallholders. However, a study with smallholders would require analysis of various data including their vulnerability, livelihood strategies and type of investments that they would like to get from MFIs in order to adapt to climate variability and change. Therefore, the inclusion of such information in this study would have demanded much more time for data collection than the one available for this study. Therefore, we suggest that similar studies focusing on the smallholders are necessary to complement the findings of this one.

IV. RESULTS

This section summarises the main findings based on the six thematic sections aforementioned. It starts with a presentation of general information about the current status of financing provided by MFIs to smallholders. It then describes how they perceive climate-related risks, followed by a subsection of integration of climate risks into strategies of microfinance organisations. It ends with findings about access and use of climate-related information among MFIs.

4.1 Status of financing of agricultural activities

Overall, across the interviewed MFIs the proportion of credit provided to agricultural activities ranges from 8 to 100% of the total annual budget given out in loans. This wide variation was found to be associated with the nature and/or mission of the organisation as well as with the source of funds managed by a particular MFI. We identified three groups in which MFIs fall into based on the share of agricultural activities in the total budget of the loan portfolio.

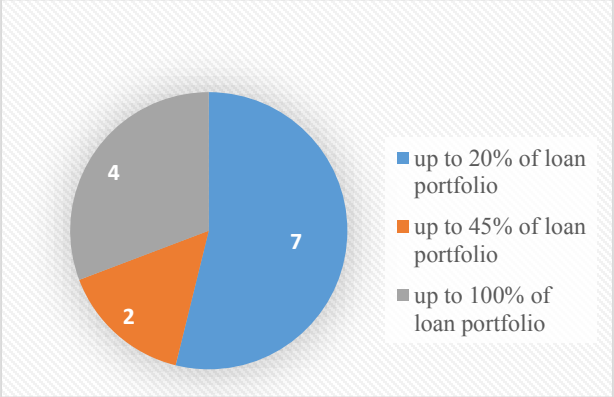


Figure 4. Number of MFIs out of 13 found in distinct groups based on the proportion of loan provided to agricultural activities. *N=13.*

The first group is made up of seven MFIs allocating up to 20% of their annual portfolio to financing of agricultural activities. The second group is comprised of two MFIs. These organisations dedicate up to 45% of the annual budget to loans aim at smallholders. These latter two groups both have the characteristic of managing their own capital. Moreover, respondents of these groups reported that their organisations allocate resources to its agricultural portfolio according to the importance they attribute to the sector and on the perceived risks affecting agricultural activities. The remaining proportion is shared by the other two portfolios – consumption and trading portfolios. Respondents mentioned investing more financial resources on the consumption and trading portfolios because these are not as risky as the agricultural portfolio.

On the other hand, there are four MFIs which allocate 100% of their total budget to agricultural loans. This proportion of investment is observed in organisations receiving consigned funds that have to be spent in agriculture. Such funds are received from the Government and/or external donors such as World Bank and European Union. Nonetheless, in the absence of external funds two of these organisations claimed to restrict loans to agricultural activities in favour of trading and consumption portfolios. The other two MFIs do not follow that approach because they were created by farmers to respond to their needs. So, they keep on financing agriculture even without specific requirements from donors.

Overall, loans are repayable over a period of six to nine months. Interest rates charged for agricultural activities vary from 2.5 to 4.5% per month. The exact interest rate is defined based on the distance between the living area of the applicant and the branches of MFIs. Longer distances result in higher interest rates. MFIs justified this approach as they need to bear operational costs of monitoring the application of loans by clients.

4.1.1 Agricultural activities financed by MFIs

The production of vegetables was reported to be the most preferable agricultural activity to finance. There are nine MFIs providing loans for smallholders who produce vegetables. Other commodities include poultry (5), rice (2), sugarcane (1) and pork (1). None of the thirteen MFIs are involved in the provision of credit to small-scale livestock breeders (Figure 5). Our respondents explained that livestock is not favourable for credit because of the long production cycle and the fact that breeders rarely sell their animals.

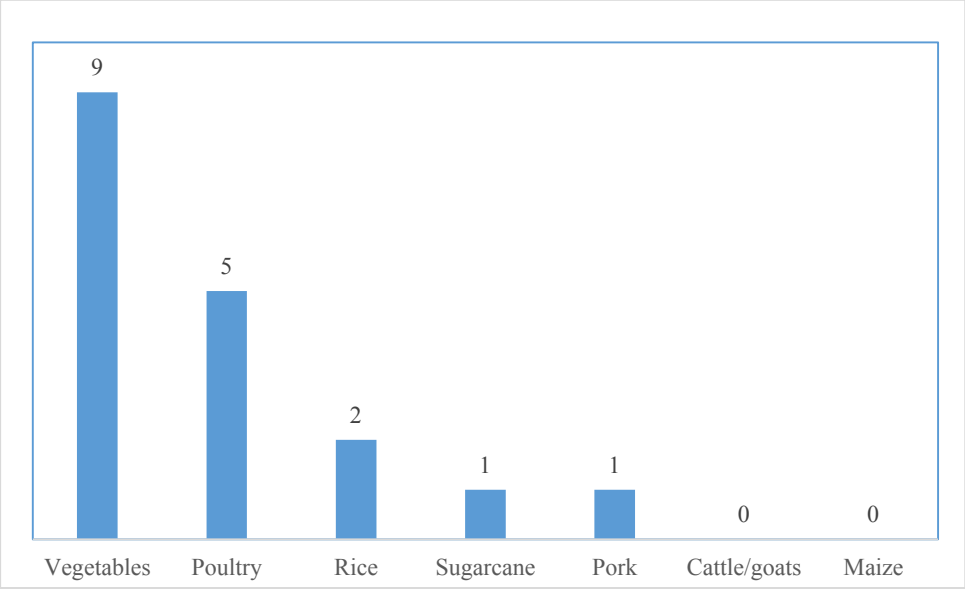


Figure 5. Agricultural commodities financed by MFIs, with number of organisations involved on the provision of credit. MFIs finance one or more commodities. *N=13.*

Respondents revealed that their organisations are reluctant to disburse loans for farmers who are planning to grow cereals. Respondents justify this credit policy by stating that returns from the production of cereals take long due to their long season of production. Besides this, rice is excluded from the loan portfolios due to risk of floods as the cultivation is done in lowlands and irrigation schemes. Maize is excluded because it is perceived as a non-profitable commodity as yields obtained by smallholders are too low. But in general, MFIs are comfortable with providing loans to traders involved in commercialisation of maize because of high demand for the commodity in the local market.

Loans provided by MFIs cover different phases of production. There are MFIs providing loans to smallholders for buying inputs (12), land preparation (5), hiring of short term labour (5), commercialisation (5), harvesting (3), input traders (2), and purchase of equipment such as moto-pumps (1) (Figure 6).

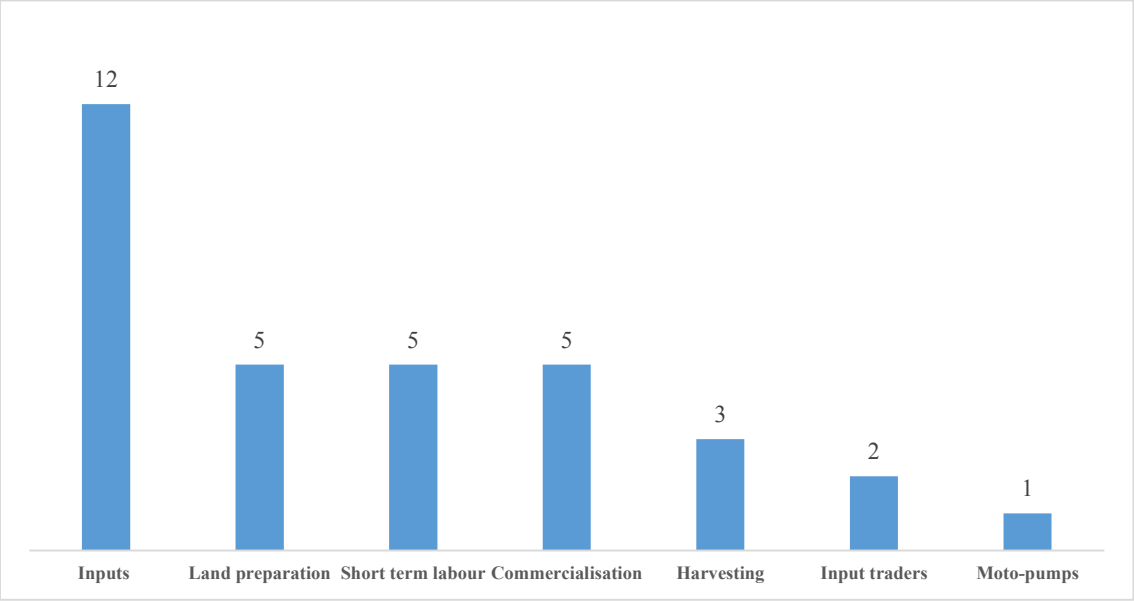


Figure 6. Agricultural value chain activities and tools financed by MFIs, with number of organisations involved on the provision of credit. One MFI finance one or more activities. *N=13*.

4.1.2 Factors and requirements impacting the provision of credit to smallholders

Overall, MFIs revealed that they dedicate a reduced portion of the loan portfolio to small-scale farming mainly due to climate related risks. Other factors impacting the provision of credit to small-scale farmers include market and infrastructure constraints, and low productivity. The latter was associated with a low technologic development of the production systems applied by smallholder farmers as well as with the incidence of pests and diseases. The argument related to market constraints was associated with weak price competitiveness of smallholders' products in comparison to those imported from South Africa. The second argument is that the long distance separates smallholders from favourable markets. The access of smallholders to the market is also

constrained by poor road infrastructures which are susceptible to disruptions during flood events. The degree of importance given by MFIs to these factors is presented on figure 7, together with the requirements for the approval of loans.

All organisations involved in the provision of loans for crop production require that applicants produce under irrigation conditions. Besides this, two MFIs do not approve loans if the sowing period is misadjusted from the crop calendar. This is the case for MFIs that provide loans to rice producers.

All managers revealed that their organisations are unable to evaluate the benefits of climate risk mitigation strategies when reviewing loan applications, which result in simply rejecting some applications based on the existence of a climate-related risk. This was reported to result from the lack of people with skills and experience to perform the task.

The common theme of MFIs is that the approvals of loans are subject to a historical compliance by farmers in repaying previous loans and existence of collaterals. Otherwise, farmers are required to have experience of growing the particular crop they are intending to invest in. One third of MFIs only provide credit to applicants who participated in any training provided by extension services or non-governmental organisations (NGO) regarding the production of the specific crop they intended to grow. Respondents expressed that applicants must own plots that are big enough to allow the return of the investment and that they must also be members of any farmer organization.

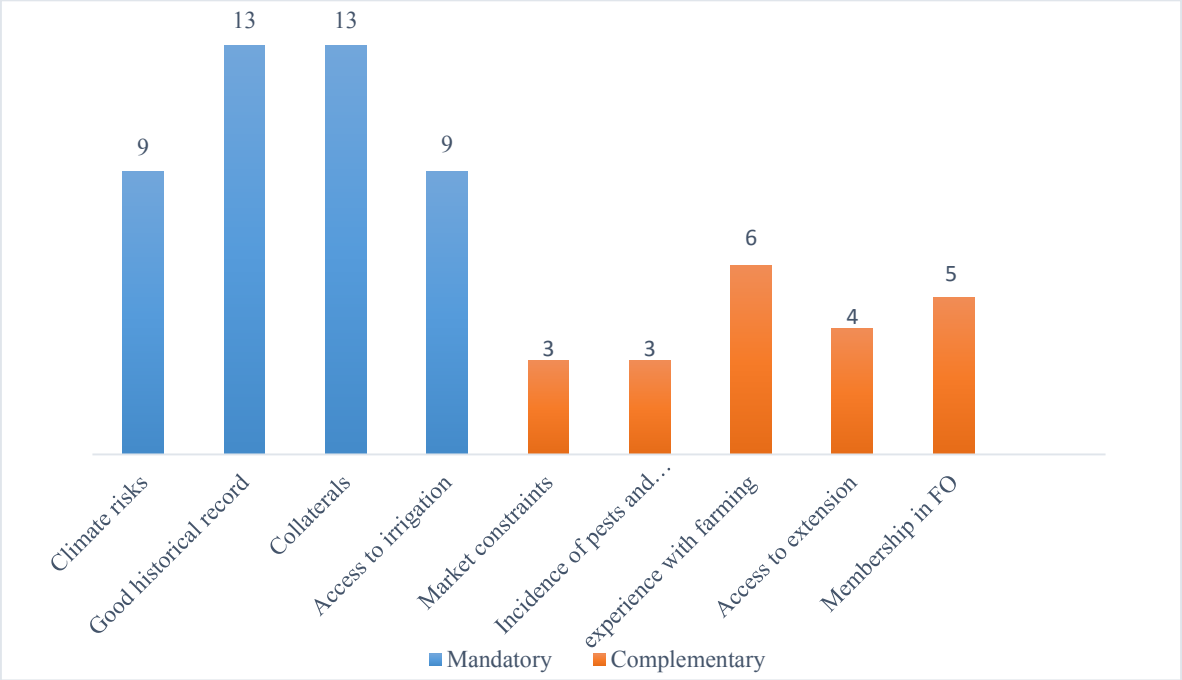


Figure 7. Mandatory and complementary criteria adopted by MFIs for the provision of loans to smallholders. MFIs adopt more than one criterion. *N=13*.

4.2 Perception of climate risks among MFIs

This chapter aims to present the findings of the extent to which climate related knowledge is integrated into microfinances' policies. It also discloses how impacts of climate variability and change are perceived across these MFIs. It starts with a description of the presence of climate experts within MFIs, and then it discloses information about perception of climate related risks and, finally it describes the actual impacts of climate variability and change on the activities of MFIs.

4.2.1 Presence of climate experts within MFIs

There are only two organisations with staff trained in climate related knowledge. Each of these organisations has two employees trained by the African Rural and Agricultural Credit Association (AFRACA) in Kenya. Within the organisations these people are involved in tasks such as developing agricultural calendars adjusted to each region, and planning interventions for water storage using low cost techniques in semi-arid districts.

There are seven organisations with credit officers who have an agricultural background. Their role is to monitor how clients use money and provide technical support needed by the clients. Credit officers with an agricultural background were reported by seven respondents to be important players in promoting best practices among the farmers. In all MFI organisations these personnel are regularly provided with internal refresher courses twice a year. Nonetheless, none of the organisations have ever included a topic about dealing with climate risks in agriculture.

4.2.2 Perceived climate risks by MFIs

The occurrence of impacts of climate variability is perceived by all respondents as an important factor affecting repayment of credit in rural areas. However, according to the respondents' perceptions of climate shocks affect the loan repayment differently. Floods are perceived as the event causing most damage to MFIs' services. This perception is shared by 12 respondents. All MFI managers consider floods as becoming much more frequent than in the past. Other climate events of importance for MFIs operating in southern Mozambique are droughts (nine respondents) followed by extreme events in a form of heat waves (six respondents) and finally cyclones (four respondents) (Figure 8).

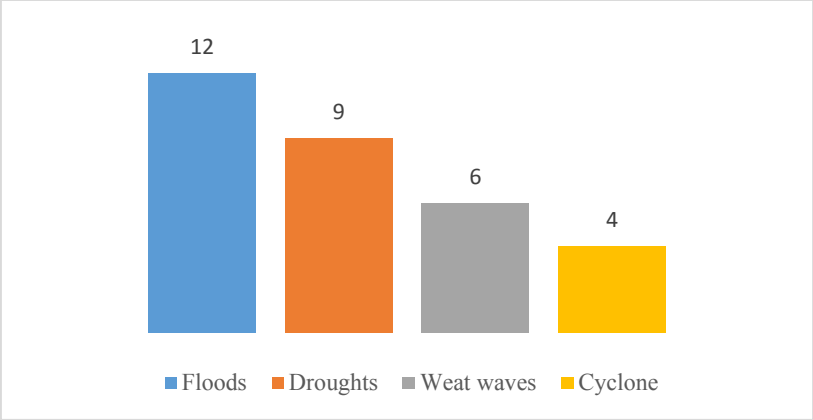


Figure 8. Important climate events for the MFIs. Values on the top of each bar indicate the number of respondents who mentioned that particular climate event. Each respondents reported one or more climate threat. *N=13*

Overall, the occurrence of cyclones is not perceived as being a determinant constraint for delays on the repayment of agricultural loans. Essentially, only two MFIs recalled negative memories of one cyclone, observed in the year 2012, to having affected the ability of smallholders to repay credit. But, cyclones are of importance for the two MFIs providing credit to fishermen in the coastal districts of Vilanculos and Inhassoro.

The majority of respondents, eleven of them, have the perception that the four above mentioned climate events happen during summer season which is the main agricultural season in Mozambique. Respondents are of the perception that the beginning of the rainy season starts later than it used to be, leading to drought conditions at the beginning of the crop season. On the other hand, sometimes heavy rains are observed in a reduced timespan resulting in floods. The other two respondents are of the view that floods may be observed even in winter. According to them, this is the case whereby from July to September each year, water authorities decide to release water from dams along the Incomati River as a preparation for the rainy season.

4.2.3 Impacts of climate variability and change in MFIs' services

Respondents were asked about how climate risks affect their activities. They pointed out the existence of direct and indirect impacts. Direct impacts were reported by all respondents as those resulting from the inability of farmers to fulfil the repayment agreement due to impacts of climate and/or incidence of pests and diseases affecting crops. Indirect impacts were proposed by two thirds of respondents. This group acknowledges that MFIs operating in rural areas are inevitably affected whenever a climate event is observed. The explanation put forth is that upon the occurrence of any climate shock the power of purchase of goods and/or assets by smallholder farmers is reduced. Thus, traders sell less than they would in absence of climate shock because smallholders who are the majority of the rural population do not buy. Consequently, the ability of traders to repay loans is also weakened.

4.3 Integration of climate risks into MFIs' strategy

This section depicts how climate related aspects are integrated within MFIs' strategies, building on aspects of written climate strategies, access and use of climate related information and finally the kind of climate based support MFIs provide to smallholders.

4.3.1 Status of climate policy across MFIs

The long term vision of 11 MFIs is portrayed in development strategies which are either already in place or under development. Respondents conveyed that such strategies do not include information about dealing with climate-related threats. They justify this by referring to the lack of awareness of the benefits that a climate policy would potentially bring. This is also because two thirds of MFIs have never been exposed to debates about risks of climate variability and change, and benefits of undertaking adaptation strategies. Only two MFIs participate in climate platforms – one is member of a district platform and the second one is a member of a National platform.

4.3.2 Microfinances' response to observed climate risks and impacts

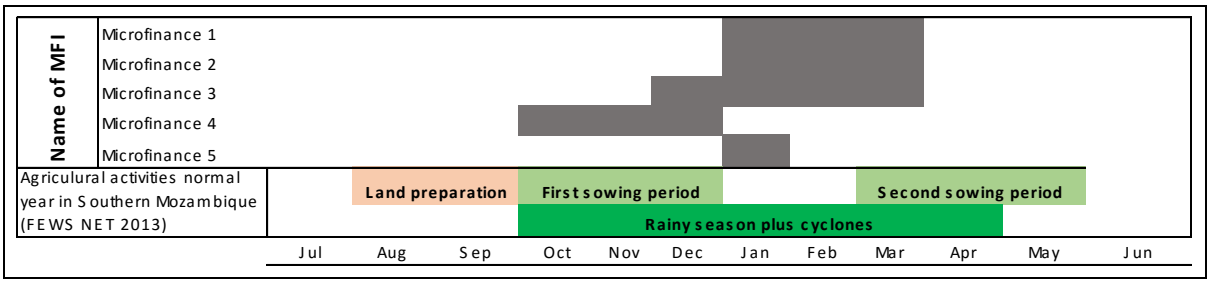
There are number of ways in which MFIs respond to climate risks and impacts despite the lack of a specific climate risk policy. Respondents mentioned that the adopted responses to climate risks are triggered by past experiences with climate impacts. Responses of MFIs to climate risks and impacts are grouped into financial and non-financial categories.

Financial mechanisms adopted in anticipation of climate risks

As a whole, there are only four MFIs implementing this type of mechanism. Two of these organisations provide additional credit for farmers when there is warning of floods. Such credit is approved based on the principle that for farmers to be able to harvest ahead of floods they need to hire temporary labour and/or transport. The other two MFIs provide loans to smallholders to grow heat tolerant vegetables.

There are nine managers who mentioned that their organisations respond to climate variability by providing less credit to smallholders. Their target clients are wage-earning people and traders. On the other hand, the common practice is to partially approve loans. In other words, farmers do not receive the entire amount requested in the application.

There are five MFIs which do not disburse loans for all kind of agricultural activities over certain period of the year. This is due to perceived threats of floods during the rainy season. As a whole the period of loan restriction encompasses December to March (Figure 9).



Adapted from FEWS NET (2013)

Figure 9. Months in which MFIs do not provide loans to farmers. Bar in pink correspond to the period in which farmers are engaged in land preparation. Bars in light green indicate the period in which farmers sow. Bar in dark green indicate simultaneously the normal rainy season and main agricultural season. Bars in grey represent the period of restriction of loans by each MFI. *N=5.*

There are two MFIs that stop providing loans before the end of the year, a period that overlaps with the first sowing period. These two MFIs only provide loans for harvesting and commercialisation. In this context, managers of the two MFIs reported to opt not to disburse loans as a strategy to avoid that farmers deviate on loans to invest in agricultural production. Another group comprise three MFIs that do not disburse loans at the beginning of the year, from January to March. This is so because the group perceive January to March as the most critical period for threats of floods.

Financial mechanisms adopted in response to climate impacts

Respondents were asked about the procedures that MFIs follow when climate impacts affect the ability of clients to repay loans. About 12 respondents mentioned that their organisations renegotiate the loan agreements. There were three forms of adjustments reported:

- Renegotiation of repayment schedules – There are 11 MFIs implementing this mechanism which is characterised by the extension of the active time of the credit.

- Renegotiation of interest rates. This initiative was observed in only four MFIs. In this particular case, MFIs can decrease or even exempt clients from paying the amount referent to interest rates.

- There are ten MFIs opting in refinancing the investment. This does not exempt farmers from repaying the first loan. Only farmers with a long term relationship and a good historical record on repaying credits are eligible for additional credit. MFIs also require that farmers have alternative sources of income.

Managers of MFIs revealed that these rearrangements are not part of the written policies of the MFIs. However, they opt to readjust the loan agreements in order to mitigate a possible loss of the capital invested in loans due to climate shocks.

Non-financial mechanisms adopted in anticipation of climate risks

There are seven MFIs providing non-financial support to smallholder to deal with risks. Managers mentioned that their MFIs rely on credit officers to provide the support to smallholders. Other managers claimed not to proceed in this direction because their organisations lack credit officers with an agricultural background. However, five managers revealed that their MFIs are strategically attempting to establish partnership with public and/or NGO extension services for technical support to their clients. The type of support found in place is in a form of technical support. Table 1 summarises the non-financial actions implemented by MFIs in anticipation of climate risks.

Table 1. Non-financial actions implemented by MFIs in anticipation to climate risks

Action	Rationale/aim	# MFIs involved
To advise farmers to invest more time, labour and inputs for production of vegetables in lowlands.	The likelihood of smallholders to succeed in growing vegetables is higher than growing maize, groundnut or pigeon-pea in highlands. Vegetables are good cash crops	Four
Promotion of savings.	This mechanism is reported to serve as preparation for smallholder to respond to any unexpected situation that can be either related to climate event, education fees, health or traditional ceremony.	Four
To advise smallholder farmers to adopt varieties of vegetables that are heat tolerant.	To create capacity for farmers to grow vegetables even during summer. Farmers benefit from this approach because prices are set to be higher during the hot season as a result of low supply of vegetables in the market.	Two
To advise farmers to harvest ahead of floods and/undertake precautionary actions such as the removal of equipment, especially moto pumps, from risky to safe places.	Reducing the exposure of farmers to floods.	Two
To advise farmers to establish nurseries along slopes	For smallholders to be able to produce seedlings on time and to harvest vegetables during a period of low supply in the market. The most important benefit is that farmers do not need to be concerned about floods.	One
To advise farmers to grow sweet potato.	This crop easily adapts to dry conditions, therefore is important for buffering the impacts of climate shocks in a perspective of food security and income generation.	One
To advise smallholders to implement integrated production system and crop rotation.	Contributing to the reduction of costs of production by using manure as fertilizer and stubble-farm to feed livestock.	One
To promote and train farmers to build roofing of poultry production units using alternatives to zinc.	To minimise the mortality of poultry due to weather extreme events in form of heat waves.	One

Non-financial mechanisms adopted in response to climate impacts

There are five MFIs engaged in the provision of non-financial support to farmers after climate shocks. In most cases this is done through the distribution of inputs, mainly seeds, fertilizers and agricultural tools such as hoes. The provision of the support is dependent on external funds received from donors such European Union and World Bank.

4.3.3 Access to climate-related information

There were eight respondents who admitted that their organisations access climate information in the form of early warning information. They access information that is produced by one or more of the following Government organisations: National Institute of Meteorology (INAM), National Institute for Disaster Management (INGC) and Water Administration (ARA-SUL). Figure 10 presents the number of MFIs according to the source of information accessed.

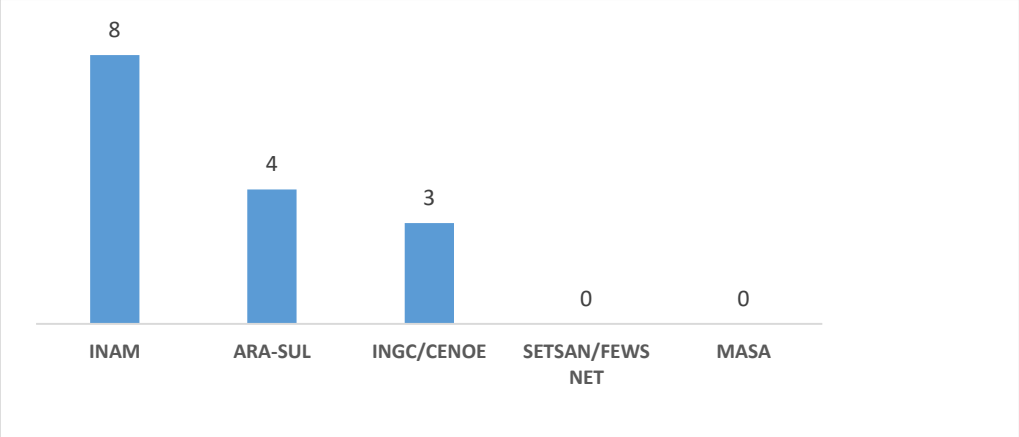


Figure 10. Identified sources of climate information, with number of MFIs accessing each source. *N=13.*

All respondents confirmed that they had never had access to early warning bulletins produced by the Department of Crops and Early Warning (DCAP) of the Ministry of Agriculture and Food Security (MASA). In fact, across MFIs, there is a general unfamiliarity of the existence of early warning bulletins produced by DCAP and the Famine Early Warning System Network (FEWS-NET). According to the focal person at DCAP, the early warning bulletins provide information about the likelihood of precipitation distribution across the country. This Information is compiled at the beginning of the main agricultural season in bulletins that include recommendations about suitable crops and varieties for the season. The information is updated monthly.

MFI managers reported that they access information through internet, radio, newspaper or during meetings of the committee of risk management at district levels and those of the management of Incomati River and Limpopo basin. Some organisations were found to use more than one channel to access information. Figure 11 depicts the number of MFIs per channel used to access information.

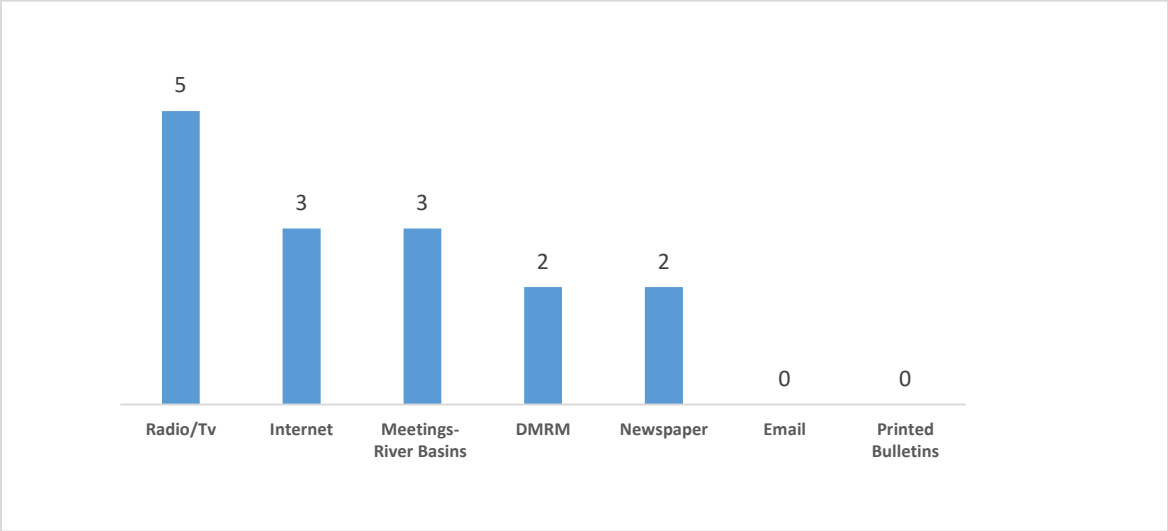


Figure 11. Identified channels used to access climate information, with number of MFIs per channel. *N=13.*

The frequency with which information is accessed varies across MFIs and is irregular. For example, all organisations revealed that they had access to daily weather forecast from INAM quite often. The access to information during District Meetings for Risk Management is irregular – sometimes meetings do not take place. MFIs that participate in meetings of management of river basins acquire information twice a year (April and October). Lastly, respondents reported that the access to climate information depends on their efforts to pursue it.

4.3.4 Use of climate-related information

Thus far, none of the eight MFIs with access to early warning information use it for planning and decision making during loan screening. Managers of these MFIs justified the non-use of climate information by pointing out the lack of people with climate related knowledge and experience in dealing with climate risks. Another argument presented is that climate information coming from INGC and ARA-SUL is not adequate for purposes of planning and decision making related to agricultural portfolio. Respondents reported that this is because information is irregular and not specific to agriculture. Nevertheless, managers of the eight MFIs highlighted the importance of early warning thus far accessed as being useful for disaster risk reduction. Despite that, there are only two MFIs which make use of early warning information about flood events to support/advise clients as referred to in table 1. Other respondents reported to take no action in regards to accessed climate information.

Respondents proposed that an ideal agro-climate information system would present the following characteristics:

- Messages that can be readily used for planning and decision making;
- Information that respond specifically to particular areas and that is relevant to the most important crops;
- Regular update of the information;
- Use of different channels to broadcast messages, with emphasis on radio, SMS and local regular meetings at local level;
- Messages developed using local languages.

4.4 Flexibility and needs in order to integrate climate adaptation into MFI strategies

Respondents were asked about the willingness to integrate climate adaptation into MFIs' strategies. About 11 managers expressed sympathy towards the integration of climate policy into the development strategies of their organisations. Managers of MFIs shared viewpoints about what would be necessary for an effective integration of climate policy into the strategies of their organisations. These are as follows:

- Capacity building with emphasis to training involving all staff members and the management.
- Reliable and timely climate information.
- Technical support from Government organisation – Research and Extension services;

The other two managers responded to be unwilling to adopt climate policy. Managers of these two MFIs justified their position referring that their organisation are nearly bankrupted. Thus, their current priority is to recover from the financial crisis.

V. DISCUSSION OF THE FINDINGS

As previously mentioned, this study investigates existing opportunities to foster climate change adaptation in the services MFIs provide to smallholder farmers in southern Mozambique. Accordingly, this section discusses key findings of the study with implication for the integration of climate adaptation into MFIs' strategies. The main finding presented in this section is that MFIs have not yet integrated climate change policies into their services. The lack of awareness about the importance of climate related risks to MFIs services and benefits of adaptation to climate change and variability are the main reasons found for that. The section starts with an analysis indicating that smallholder farmers living in inland districts bear higher costs for accessing to credit than those living along coastal districts. This is followed by a section about perception of climate risks and its impacts. Then, follows a section about aspects affecting the integration of climate policy into MFIs' strategies, and impacts on the non-adoption of climate policy by MFIs on the agricultural loan portfolio. Finally, a section follows that draws on the willingness and pathways to integrate climate change adaptation into MFIs strategies.

5.1 Interest rates charged by MFIs and influence of the spatial distribution of MFIs on the adaptation of smallholder farmers

The analysis of the spatial distribution of MFIs is not the core focus of this paper. Nonetheless, we draw some findings on this because of the potential effect on the ability of smallholders to adapt to climate change.

Overall, the interest rates charged by rural MFIs in southern Mozambique are within the range reported by Dehejia *et al.* (2012) and Parvin (2012) of 20% to 50% charged per year by MFIs to smallholder in other parts of the developing World. Hunguana *et al.* (2012) reported similar rates for MFIs in Mozambique and concluded that such interest rates were too high, compared to the repayment capacity of smallholders, because agriculture is a low profitable activity. Similar observations have been made in other parts of the Sub-Saharan region (Meyer, 2015).

Our results show that MFIs do not provide financial services in inland districts, which results in few opportunities for smallholders living there to access credit. The main reason found for this is the unfavourable agro-climatic conditions that results in a weak rural economy. For that reason, the cost for smallholders living in inland districts to access credit is comparatively higher than for those in coastal districts. For example, the smallholder borrower has to cover the cost of travel expenses to access to MFIs' branches and even higher interest rates. MFIs charge higher interest rates to inland smallholders due to even higher operational costs for monitoring loans. According to Ibrahim & Bauer (2013), farmers travelling long distances to reach any MFI branch accrue less profit from the granted loans. This analysis suggests that inland farmers accessing loans might be benefiting less from such loans for building their adaptive capacity.

To sum up, the positive effect of loans for adaptation to climate variability and change of smallholder farmers depends on the ability of MFIs to lower the costs of access. MFIs can achieve this by building on from successful experiences reported by Kumar *et al.* (2010); Meyer (2012) of mobile phone banking adopted by MFIs in Brazil and Kenya. In these countries, mobile phone banking is used for loan disbursements, repayments and deposits, thus minimising clients and credit officers need for travel and the associated costs.

5.2 Perceptions of climate risks across MFIs

Our results confirm that like in any other region rural MFIs from southern Mozambique are extremely vulnerable to climate variability and change. The climate impacts affecting MFIs are in a form of delays on loan repayments as well as payment defaults. The risks and impacts imposed by climate variability are well perceived among MFIs, and are taken seriously into account when it comes to providing financial services to agriculture. Floods are perceived as the most important event of all climate stressors. This perception, however, is not in agreement with INGC (2009) and Patt & Schroter (2008) whom define droughts as the most damaging socio-economic climate events for smallholders in southern Mozambique. The perception that agricultural portfolio is mostly affected by floods is influenced by the preference of MFIs of approving loans to farmers growing crops under irrigation schemes and lowlands. If MFIs were to extend their services to other farmers, then droughts would become a major climate risk to handle. Thus, MFIs require coaching for them to perceive not only floods but also droughts as important climate stressors for their services.

Overall, due to climate and other risks such as incidence of pests and diseases, rural MFIs prefer to reduce their portfolio towards the agriculture sector. The results also reveal that MFIs withdraw from providing loans to farmers producing under rain-fed conditions. The allocation of small proportions of funds to agricultural portfolios has also been observed in India and Kenya (Morvant-Roux, 2008). Conversely, Agrawala & Carraro (2010) found that in Bangladesh, MFIs allocate on average about 41 per cent of their funds to agricultural loans. Higher allocations towards agricultural portfolio occur without necessarily meaning that MFIs are managing climate and agricultural risks. This is observed when MFIs have to respond to the objectives of fund providers – Government and donors, which is to increase the outreach towards targeting huge number of smallholders. While these external funds result in an increased access to credit by smallholders, little is known about their impact on the sustainability of loan portfolios (Varangis *et al.,* 2014). To summarise, due to climate and other agricultural risks MFIs allocate much more credit to support smallholders if they receive external funds from Government or donors and/or if they are managed by farmers' organisation.

From the results, it is found that MFIs are aware that the approach of avoiding the provision of loans to smallholders does not reduce their indirect vulnerability to climate risks. It, however, results in an increased vulnerability of MFIs as well as that of the smallholders. As a result, both rural MFIs and smallholder farmers are iteratively locked into a vicious cycle of vulnerability as illustrated in figure 12.

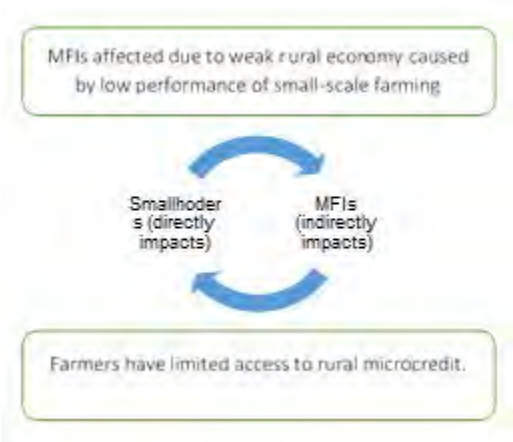


Figure 12. Vicious cycle of vulnerability involving smallholder farmers and MFIs. The cycle indicate that the non-access to credit by smallholders result in their inability to invest on the reduction of vulnerability. As a result, agricultural systems are disrupted thus resulting in weak economic performance in rural areas. This creates negative impacts on MFIs' services such as shut down. In turn the micro-credit for smallholders becomes increasingly unavailable.

Our finding that MFIs and smallholders are locked into a vicious cycle appears to confirm Dowla's (2009) claim that, to some extent, the sustainability of rural MFIs depends on the performance of agriculture sector. Thus, one can claim that long-term sustainability of rural MFIs in southern Mozambique depends on their ability to break the cycle, through investments towards adaptation. For effective adaptation to ensue, MFIs may have to invest in the adaptation of smallholder farmers, because this group is directly affected by climate variability and change. The approach suggested would integrate the category of private investment towards adaptation that result in public benefit (Tompkins & Eakin 2012), that result in a win-win benefit (Agrawala & Carraro 2010). This means that both MFIs and smallholders accrue benefits from MFIs' investments. Moreover, the approach agrees with the claim put forth by Adger *et al.* (2005); Nelson *et al.* (2007); Smit & Wandel (2006) that organisations are successful in pursuing adaptation if they can positively motivate the effective adaptation of other organisations with which they have an institutional relationship.

5.3 Integration of climate risks into strategies of MFIs

MFIs have not yet integrated climate change adaptation policy into their services despite the fact that they perceive climate risks as a serious threat to standard agricultural portfolio. Consequently, even the strategy to reduce loans towards the agricultural portfolio due to climate risks is not part of the written policy. The non-adoption of climate policy by MFIs reinforces Park *et al's.* (2012) observation that knowledge about climate risks cannot alone trigger a change towards adaptation.

In this context, MFIs have not integrated climate policy into their strategies because they lack awareness about the benefits of adaptation interventions. A better perception of climate stressors and importance of adaptation have been statistically proved by Billah *et al.* (2015) to provide momentum for adoption of adaptation investments by smallholders. Therefore, a minimum level of perception of benefits of adaptation is required to enable MFIs to integrate climate policy into their strategies. An equivalent claim has already been made by Burke & Lobell (2010) and Moser & Ekstrom (2010).

On the other hand, results indicate that the absence of climate policy across MFIs is negatively affected by the lack of climate experts. The role of climate experts would be to raise awareness about the institutional needs for adaptation. Leary *et al.* (2007) have conveyed that in most cases the implementation of adaptation is constrained by the lack of climate expertise. For instance, the lack of climate experts across the studied MFIs results in uncoordinated responses to climate risks and impacts.

Impacts of non-integration of climate policy into MFIs' strategies

a) On decisions about agricultural loans

As mentioned earlier, there is a lack of strategy to assess climate risks on agriculture, which results in withdrawing support to pre-determined types of agricultural production (e.g. no loans for non-irrigated crops). As MFIs are not assessing the agricultural strategies of potential client, it is likely that they reject climate-smart applications and/or approve other applications which are vulnerable to climate variability. Thus far, MFIs grant loans based on an applicant's previous repayments record. However, smallholders in this condition may still be vulnerable to climate variability and change. Their ability to repay loans can derive from alternative sources of income. For instance, Osbahr *et al.* (2008) had found that smallholders in southern Mozambique engage in strategies such as temporary work in urban areas or selling of dried fish and fruits as coping strategies upon failure of agriculture crop production.

Due to lack of climate policy MFIs provide loans that do not contribute to build the long-term adaptive capacity of smallholders to floods nor to droughts. For instance, in general, MFIs do not provide loans for smallholders to invest in improvement of irrigation systems nor for establishing shade net infrastructures as nurseries for growing vegetable seedlings. This also happens because

loans are of small amounts and short-term, yet analysing the nature of MFIs' loans and their suitability for adaptation is beyond the scope of this study. Existing research have analysed this issue, for instance Agrawala & Carraro (2010) and Meyer (2015) in a context of MFIs operating in Bangladesh, Nepal and other Sub-Saharan countries.

b) On responses to climate risks and impacts

A huge number of climate responses implemented by MFIs are coping strategies rather than adaptation measures. Moreover, the overall effectiveness of MFIs' responses towards adaptation investments is weak. This can be explained by the fact that MFIs' responses to climate risks and impacts are neither planned nor implemented in an integrated manner. For instance, although financial mechanisms to anticipate climate risks protect MFIs from making risky loans, they do not contribute to the adaptive capacity of smallholders. This is due to MFIs' tendency to avoid climate risks rather than manage them. MFIs follow this approach due to a lack of reliable climate information. Hence, this finding agrees with Howden *et al.* (2007) who claim that avoidance or inaction are common excuses in a context where uncertainties are not well understood. Nonetheless, avoidant reactions are a form of maladaptation (Noble *et al.,* 2014; Grothmann & Patt, 2005).

Conversely, the financial mechanisms adopted by MFIs to respond to climate impacts have the merit of not pushing smallholders into a more vulnerable condition. For instance, our results agree with a claim proposed by Nuhu *et al.* (2014) that MFIs do not prioritise mortgage execution and selling of smallholders' belongings as well upon climate shock. Nonetheless, responses from MFIs are not reliable as they depend on ad-hoc decisions on whether or not to adjust the financial agreements. Therefore, it is stated that smallholders would accrue more benefits if the provision of credit was combined with weather index-insurance. This is because smallholders can access credit even in periods post-floods, without having to be concerned about losing assets (Greatrex *et al.,* 2015). The implementation of weather index-insurance can also be considered as a mechanism of adaptation of MFIs by transferring the risk to insurers (WFP & IFAD 2011). There are successful stories of weather index-insurance initiatives across Africa that contributed to build smallholders' effective adaptation (Niang *et al.* 2014).

Overall, MFIs' responses to climate risks and impacts are implemented with the aim of protecting MFIs' financial resources. For this reason, smallholders accrue fewer benefits from such responses.

5.4 Access and use of climate information

Currently, MFIs access climate information on ad hoc basis, and can be attributed to two factors. First, MFIs are not aware of the potential value of climate information services thus, they do not seek the information to safeguard their financial services. This is similar to the finding that Archer (2003) reported over a decade ago. Second, MFIs do not pursue climate information because they consider available climate information as unsuitable to their exact informational needs. Archer (2003) had claimed this to be a challenge for information generators, and Lemos *et*

al. (2012) has highlighted it as an important factor that affects the use of climate information. Moreover, the perception that information is broader is acknowledged by MICOA (2012) in the National Climate Change Strategy. For that reason, MFIs do not use available climate information for planning or for decision-making in a context of climate change adaptation.

To sum up, due to limited access to appropriate climate information, MFIs are more likely to approve agricultural loans that do not contribute to the adaptation of smallholders. Strategies aiming to improve the use of agro-climate information need to be combined with raising the awareness about the importance of climate information. It also requires that staff of MFIs are trained on interpreting agro-climate information. Another approach which is discussed by Ludi *et al.* (2012), requires that providers of information understand the needs and capacities of the recipients of the information, for them to provide climate information that are tailored to users' needs.

5.5 Willingness and pathways to integrate climate adaptation policy into MFIs' strategies

The interviews with MFIs contributed to raise awareness of respondents about the benefits of adaptation to climate change. As a result, high numbers of the interviewed managers consider a shift towards an effective integration of climate policy into MFIs' development strategies as an opportunity. This is translated into a willingness to incorporate climate change policies into financial services. As Tschakert & Dietrich (2010) claim, a willingness to adopt climate change adaptation is a crucial step towards the institutionalisation of adaptation. Nonetheless, there are still some barriers to overcome in order to attain an effective adaptation across MFIs.

For instance, managers of MFIs perceive that institutionalising climate change adaptation demands huge financial investments. This is a crucial barrier that is likely to affect the momentum of the shift towards the adoption of a climate adaptation policy. This barrier becomes even more important due to the perception among managers that climate impacts do not affect MFIs directly and these organisations can underwrite the associated risks by taking a clients' assets. For this reason, MFIs fail to perceive the benefits of supporting the cost to integrate climate adaptation into their strategies. Like any other organisation, MFIs would need to perform a cost-benefit analysis, as it will bring exact responses for the removal of this barrier. A cost-benefit analysis is one of the most important tools for decision-making with regards to institutionalising adaptation (Agrawala & Fankhauser, 2008).

Other barriers with potential to affect the institutionalisation of climate change adaptation into services MFIs provide to smallholders are as follows: (a) lack of climate experts across MFIs; and (b) limited access to adequate climate information by MFIs; Thus, the following multiple actions are prior steps required in order to mainstream climate change adaptation policy into MFIs.

First, to assist MFIs in understanding that investing in adaptation for both floods and droughts result in greater economic benefit than inaction. This can be achieved by demonstrating the potential economic impacts of climate stressors on MFIs' services and organisational long-term sustainability. Then, showing the benefits of adaptive strategies to encourage the adoption of climate change adaptation into their strategies. The two actions agree with Osberghaus *et al's.* (2010) claim that a sound knowledge of climate impacts and of adaptation responses is important for reducing the vulnerability for both current and future climate stressors.

Second, to develop climate knowledge across MFIs. This requires training of MFIs staff in climate related knowledge. According to Billah *et al.* (2015) training in climate related themes triggers the adoption of adaptation. In the context of this study, it is advanced that refreshment courses are a good opportunity to accomplish this purpose. This is due to the fact that refreshment courses are tailored for credit officers who work closely with smallholders, and discuss lessons learnt from the field. Furthermore, it is proposed that MFIs liaise with research and extension organisations. As Smit & Wandel (2006) argue, a partnership with well-informed organisations is important for the identification of adaptation needs and strategies for implementation of adaptation initiatives.

Third, improve the access to adequate climate information by MFIs. This action requires efforts to improve the provision of agro-climate information to MFIs and smallholders by information providers, as previously discussed. Furthermore, based on Ludi *et al.* (2012) claim, it is suggested to involve MFIs' staff in training sessions on how to translate climate information into tools of planning and decision making.

Finally, to develop strategies aiming to increase the contribution of microcredit to the adaptation of smallholder farmers living in semi-arid districts. To attain this objective MFIs must be capable to lower the costs of accessing to microcredit by smallholders. Nonetheless, this should be combined to outcomes of a research on the adaptation and financial needs of smallholders. The findings will enable MFIs to develop financial products aiming to respond to the needs of smallholders.

VI. CONCLUSION

This study investigates existing opportunities to foster climate change adaptation in the services MFIs provide among smallholder farmers in southern Mozambique. As a result, we identify pathways to effectively mainstream climate change adaptation into MFIs' services. The study had 4 specific objectives: (1) assess the perception of climate risks across MFIs; (2) analyse the extent to which climate adaptation policy is integrated into MFIs' strategies; (3) evaluate how MFIs access and use climate information; and (4) identify needs to incorporate climate adaptation into MFIs' strategies.

With regards to climate perception, the study concludes that MFIs are aware of their vulnerability to climate variability and change. Despite this, MFIs have not yet integrated climate change adaptation policy into their services and/or products. Reasons behind the non-adoption of climate policy by MFIs include the lack of knowledge about the benefits of adaptation and lack of expertise across MFIs. The fact that climate impacts do not affect MFIs directly and their option of liquidating clients' collaterals are among the identified barriers to the integration of adaptation into services MFIs provider to smallholders. Other factors that could influence engagement with climate change risks among MFIs include a lack of financial and political incentive to do so, e.g. lack of support from the government or the fact that climate change is not perceived as a major concern by small-scale farmers as they face a range of other issues. While analysing these barriers was beyond the scope of this particular research, it is certainly another pathway to explore in order to understand ways to foster climate change adaptation within MFIs' strategies.

The study finds that due to non-adoption of climate policy, large numbers of loans provided by MFIs do not take into account smallholders' long-term adaptation initiatives to cope with both floods and droughts. Therefore, as it stands, MFIs play a limited role in strengthening smallholders' adaptive capacity. The two reasons identified for that in this study include the lack of climate expertise and chance access to adequate climate information. Another finding of interest is that although the presence of personnel trained in climate-related knowledge across MFIs plays an important factor in fostering adaptation initiatives, it is not enough to influence the adoption of an effective adaptation policy.

Likewise, although the exposure to climate debates and platforms triggers the motivation for MFIs to implement adaptation initiatives, it is not enough to stimulate the adoption of an effective climate adaptation policy. In this case, our findings suggest that the adoption of an effective climate change adaptation policy by MFIs is likely to fail because of the notion that it requires huge amounts of money.

From the abovementioned findings, it is concluded that although rural MFIs represent a good opportunity to foster smallholders' climate change adaptation, its exploitation demands that preliminary steps are implemented. This includes the raising of awareness about the benefits of climate adaptation, training of MFI staff on climate related knowledge and provision of adequate and timely climate information.

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Appendix

Questionnaire

Section A. General Information about the microfinance Organisation

Name of the Organisation_____
Year of establishment_____
Legal classification _____
Area of operation (districts) _____
Number of staff _____
Annual budget _____
Number of active borrowers_____
Number of smallholders among total borrowers _____

1. What type of agricultural activities does your organization finance?
2. What part of your annual budget is dedicated to support agricultural activities through loan? Why?

Section B. Perception of climate risks and expertise

3. Do you think climate shocks and variability affect your activities?
4. Have you observed an increase/decrease in climate related shocks that affect smallholders?
5. How does it affect your organisation?
6. Is there one or more climate expert(s) in your organization? How many?
7. What are the roles and responsibilities of these climate experts?
8. Does the MFI provide on-job training to the staff? Yes _____ No _____
   If no. Explain the reasons
   If yes, who provide those training?

9. Is climate information part of the priorities during those trainings? Yes ___ No____

If yes. How are climate risks/ change integrated into the training?
If no, why not?

Section C. Uses of climate information and climate risk assessment

10. Does your organisation have a development strategy? Yes_____ No _____
    If no, skip to question 13

11. When was it developed? _____
12. Does it consider climate risks? Yes_____ No _____

If no, why not?
If yes, describe how it is integrated.

13. Does your organization have access to early warning information or other climate information?
14. Does your organization use early warning information or other climate information to develop and implement its activity?
    Response Yes _____ No _____

    If no. Why not? Then skip to Q23
    If yes. When did the organization start to consider climate information?

15. Why at that time?
16. What sources does your organization use to access that information?
17. How often is that information acquired?
18. What are the mechanisms for accessing that information?
19. Provide examples of climate information uses:

    A. To minimize the risks of the loan portfolio.
    B. To minimizing the exposure and sensitive of the farmers (the vulnerability of the farmers).

20. What are the challenges to use that information in your activities?
21. How could information on climate risks be improved so that your organisation would be able to use it more effectively in its activities?
22. Does the MFI consider climate information when assessing risks attached to loan's application? Yes_____ No _____

If no, why not?
If yes. How does it influence your decision to grant a loan?

23. What are other indicators used for assessing risks in client's applications?
24. Is there a specific month in which your organization does not disburse loans for agricultural activities?

Section D. MFI products post-climate shock

25. Does the organization receive requests from smallholders for finance in relation to climate risks? Yes _____ No _____

    If no, skip to question 28.
    If yes, give example of received requests:

26. Is it for preparedness or for recovery?

27. Are such requests frequent – more or less frequent than a few years ago?
28. Does your organisation adjust its financing mechanism to facilitate smallholders' recovery from climate shocks? Yes _____ No _____

If no. Why not?

29. *If yes*, what are those adjustments?
30. Why did your organisation select such adjustment?
31. What are the long term shifts made on the financial products in order protect the loan portfolio from climate socks?

Section E. Non-financial climate adaptation initiatives

32. What non-financial support does your organization provide to smallholders after a climate shock?
33. Is your organisation involved in campaigns related to climate change?

    If yes, provide examples of such activities
    If no, why not?

34. What are the mechanisms in place used by the MFI to promote best 'climate adaptation' practices among smallholders?
35. What part of the budget is invested in response to climate risks?
36. What are the main 'climate risk-related' activities supported through that budget?

Section F. Flexibility and needs of the organisation to consider shifts in order to integrate climate adaptation into the strategy

37. Would your organization be willing to change its structure and budget distribution to better integrate climate risks into its services?
    If no, why not?
    If yes: What would be required to do so?

38. What would your organisation need to better integrate climate risks into micro-finance activities?
39. Why?
40. Do you have other suggestions of things your organization could do to better support farmers who are facing climate risks?