Tackling climate change under time-poverty: Cooperatives as temporal pacers

Running title: The temporal role of cooperatives

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ABSTRACT

We aim to unravel how smallholder farmers in agricultural cooperatives can address the consequences of climate change. Climate change oriented actions often pose an extra challenge to cooperative members in time-poverty, i.e., to those who have no choice but to work long hours yet remain consumption poor. Tackling climate change requires future-oriented action toward unpredictable events, whereas time-poverty requires people to deal with the bare necessities of the present. Through a qualitative inductive study of Rwandan smallholder farmers in agricultural cooperatives, we observe that climate change increases time-poverty, especially for women, and that smallholder farmers are hesitant to invest their time in making climate change adaptations. We find that smallholder farmers can overcome these challenges through membership of agricultural cooperatives, which can help in pacing climate change actions.

Keywords: time-poverty, climate change, agricultural cooperatives, smallholder farmers, Rwanda

1. INTRODUCTION

Climate change has become one of the grandest challenges of our time, bringing unpredictable and unwanted change with destructive consequences for those working in the agricultural sector (Diwakar & Lacroix, 2021; Ribeiro et al., 2021). Yet, research is also showing that the impact of climate change is unevenly distributed, hitting especially hard the lives of smallholder

farmers (henceforth, smallholders) in the Global South, who have little margin for adaptation (Clay & King, 2019; Feliciano, 2019). It is in this realm that scholars have called for organizations to develop more products and services designed to help smallholders cope with climate change (Diwakar & Lacroix, 2021; Welter & Baker, 2020; Terlau et al., 2019). The cooperative is reemerging as a feasible organizational form to tackle social ills, like poverty and economic inequality (Muñoz et al., 2020; Verhofstadt & Maertens, 2014), which are worsening through climate change. As cooperatives are increasingly developing programs to tackle climate change (Borsky & Spata, 2018), we aim to shed further light on how smallholders who are members of cooperatives can deal with this grand challenge. An underlying assumption of current research is that smallholders make trade-offs between investing their resources in the present or the future and that within cooperatives, smallholders can make temporally balanced choices, such as spending more resources on climate adaptation techniques (Borsky & Spata, 2018). We specifically focus on agricultural cooperatives, also referred to as farmer cooperatives or producer organizations, which are organized by smallholders with great vulnerability to climate change (Morton, 2007).

The International Cooperative Alliance (ICA) defines a cooperative as: "an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically-controlled enterprise". Agricultural cooperatives are considered important for rural development in the Global South (Bijman & Hanisch, 2020; Candemir & Latruffe, 2021). Although agricultural cooperatives may substantially differ, for instance in terms of objectives, activities and type of members (Bijman & Hanisch, 2020), it is widely acknowledged that cooperative membership has benefits for smallholders (Grashuis & Su, 2019). There is, for instance, growing evidence that cooperative membership positively affects smallholders income through improved production and market access (Verhofstadt & Maertens, 2014; 2015). Furthermore, cooperatives may

encourage smallholders to adopt their behavior by organizing agricultural training, sharing fixed costs, making investments more feasible and giving incentives through the services provided (Candemir & Latruffe, 2021; Verhofstadt & Maertens, 2015). Furthermore, agricultural cooperatives may fulfill the role of intermediary organization, connecting smallholders and more resourceful organizations, like NGOs and government bodies (Yang et al., 2014; Bijman & Hanisch, 2020). Yet, an important issue overlooked in understanding the role of agricultural cooperatives is how they can bring future-oriented climate change programs to members who experience severe time-poverty (Vickery, 1977). Therefore, the research question that we seek to answer in this study is how smallholders in time-poverty can deal with the consequences of climate change through membership of agricultural cooperatives.

Time-poor smallholders are those individuals "who have no choice but to work long hours," yet remain consumption poor (Bardasi & Wodon, 2010, p. 70). Climate change oriented actions within cooperatives often pose an extra challenge to time-poor members. By definition, tackling climate change requires future-oriented action toward unpredictable weather events, whereas time-poverty already poses challenges for smallholders who are dealing with the bare necessities each day. Therefore we investigate the temporal brokerage role of agricultural cooperatives in Rwanda where their member smallholders are suffering from the consequences of climate change. Beyond a clarification of the concept of time-poverty for smallholders in the Global South, the primary contribution of this study is uncovering the importance of temporal pacing. The pace of smallholder farming can be synchronized with preventive climate actions if agricultural cooperatives manage to reduce time-poverty and provide the temporal structure for sustainable adaptations.

The paper is structured as follows. First, we elaborate on the challenges smallholders face due to climate change. We further explain that cooperatives can support their member smallholders in dealing with these challenges as time poverty prevents them from coping with

the consequences of climate change adequately. Second, in the methods section, we discuss the sampling, data collection and data analysis. In the next section, we present and discuss the findings, taking into consideration the strengths and the limitations of our study and the opportunities for future research.

2. BACKGROUND

2.1 The challenge of climate change adaptation for smallholders in agricultural cooperatives

Climate change has a huge impact on agriculture in the Global South because of unpredictable rainfall patterns, floods, and droughts (Clay & King, 2019). In the fields, adaptations to the changing and unpredictable weather are needed in order to save crops (Ribeiro et al., 2020; USAID, 2019). Yet, smallholders often lack the adaptive capacity to deal with the consequences of climate change (Diwakar & Lacroix, 2021; Fayet & Vermeulen, 2014). Lack of adaptive capacity is about lack of the necessary resources, but also about the lack of willingness and capability to use resources for adaptive action (Cinner et al., 2018) and this is where agricultural cooperatives, have an important role to play. Indeed, Cinner et al. (2018) discuss five domains to build adaptive capacity, that are all relevant in the context of agricultural cooperatives. First, agricultural cooperatives can provide the assets (financial, technological and service resources) needed to adapt to climate change. For example, Bizoza (2016) argues that smallholders have an increased chance of adopting bench terraces as a member of an agricultural cooperative. Similarly, the adoption of modified seeds that are more resistant to climate change than traditional seeds is easier for smallholders who are members of cooperatives (Clay & King, 2019). Second, agricultural cooperatives can improve the adaptive capacity of their member smallholders by organizing collective action (Ortega et al., 2016). Indeed, it is difficult for smallholders to adapt to climate change on their own because not only

do they generally lack the individual resources required, but they are also dependent on the actions that other smallholders undertake to address climate change. For example, if one farmer fails to maintain irrigation channels across his or her fields, the neighboring fields are likely to be impacted in case of drought or heavy rainfall. Third, agricultural cooperatives can support the learning about climate change and its consequences through awareness creation (Aboniyo & Mourad, 2017) and training (Fayet & Vermeulen, 2014; Shapiro-Garza et al., 2020), which is important for the ability and willingness to adapt. Fourth, through agricultural cooperatives, the flexibility of member smallholders can be strengthened. Flexibility refers to being able to capture the options to adapt and having the opportunity to switch between coping strategies, for instance changing crops (Ribeiro et al., 2021). The fifth dimension to build adaptive capacity is agency, referring to the power to mobilize the aforementioned dimensions of adaptive capacity. Agricultural cooperatives may empower member smallholders through participatory processes.

Yet, despite the potential for smallholder farmers to strengthen their adaptive capacities as members of agricultural cooperatives, smallholders' experiences with time poverty can help us understand why adapting to climate change remains challenging. Climate change plans often reflect long-term oriented policies that are difficult to fit around the daily lives of smallholders (Mehta et al., 2019), who lack the time to invest in adaptations with unpredictable results. Instead, they prioritize "food on the table tomorrow," which can endanger long-term planning and structural adaptation (Jerneck & Olsson, 2014). In particular, scholars call for greater awareness of gender related issues in climate change adaptation strategies to ensure the improvement of gender equality and limiting maladapted solutions (Clay & King, 2019; Shapiro-Garza et al., 2020). Time-poverty experienced by women often makes adaptive behavior challenging since they have little time to inform themselves or to participate in training and decision-making processes (Abbott et al., 2015). Yet, to date, time-poverty (particularly as

experienced by women) is an issue that is largely neglected in theorizing about how smallholders can adapt to climate change.

2.2 Time-poverty among smallholders

Poverty in developing regions, like sub-Saharan Africa, is seen as a complex multidimensional problem that is difficult to measure (Masset & Garcia-Hombrados, 2021). When Vickery (1977) introduced the concept of time-poverty, her aim was to establish a new construct of poverty that would measure differences between households not only in terms of their income, but also in terms of time availability. Although everybody has the same 24 hours in a day, there are vast differences in how many hours a person must work to attain a minimal level of consumption. In keeping with the early work of Vickery, time-poverty is validated in various contexts and is still considered as the outcome of working long hours in the labor market and in the household while being monetary poor (Bardasi & Wodon, 2010). In other words, time-poverty characterizes those individuals who have no other choice except to work long hours, thus experiencing little time to rest or to think about something other than work.

Many studies point out that time-poverty is particularly problematic for women (Wodon & Blackden, 2006). The combination of unpaid household chores and farming work is problematic since it is known that off-farm employment is key for escaping poverty and that having less time to study leads to an increased likelihood of becoming poorer (Bizoza et al., 2018). This time-poverty situation is worsened by long droughts (Denton, 2002), environmental degradation, and deforestation (Kes & Swaminathan, 2006) caused by climate change, all negatively impacting the availability of water and firewood (Ajani et al., 2013). Thus, climate change poses substantial difficulties for smallholders, especially for women in time-poverty (Dube et al., 2017).

Time-poverty is also theoretically challenging our understanding of climate change adaptation, which is generally approached as a matter of institutional change (Ferraro et al., 2015; Ribeiro et al., 2021; Terlau et al., 2019). However, as time-poverty is experienced by individuals, it has profound effects on how people go about uncertainty and, thus, their willingness to invest in a climate-sustainable future. To understand the burden that time-poverty poses for climate change adaptation, scarcity theory (Shah et al., 2012) explains how poverty can change how people perceive problems and make decisions when solving them (Shah et al., 2012). Scarcity theory demonstrates that all forms of scarcity – in terms of money, social contacts, sleep, time, etc. - can cause people to focus their attention on dealing with the scarcity related problems in the present, neglecting other demands that might cause them troubles in the future. As we discuss earlier, agricultural cooperatives are expected to play an important role in helping smallholders with time-poverty to deal with climate change (Terlau et al., 2019), since they can help increase the ability to adapt through collective work (Ortega et al., 2016), awareness creation (Aboniyo & Mourad, 2017) and training (Fayet & Vermeulen, 2014; Shapiro-Garza et al., 2020). Hence, in this study we investigate how smallholders in time-poverty can deal with the consequences of climate change through membership of agricultural cooperatives.

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3. METHODOLOGY

3.1 Sampling and data collection

To build an inductive, theoretical understanding of how time-poor members of agricultural cooperatives can cope with climate change, our sampling approach followed a theoretical logic, whereby the iteration of literature, data, and emerging insights is used to explain our observations (Glaser & Strauss, 1967). Such an approach is appropriate to better

understand behaviors of people within their social environment and is particularly useful to study temporal concepts of time-poverty and climate change, which are predominantly studied through Western conceptualizations of time (Kim et al., 2018).

We chose to conduct our research in Rwanda since many smallholder farmers, particularly women, in the country face both severe time-poverty (Habimana & Pasqua, 2017) and climate change related challenges (Clay & King, 2019). Specifically, USAID (2019) reports that climate change impacts the Rwandan agriculture with rising temperatures along with more frequent and intense rains, droughts, landslides, floods, erosion, and crop damage or loss. Furthermore, given that more than half of the Rwandan population age 16 or above is a member of a cooperative in Rwanda (Musabwa, 2018), the high prevalence of agricultural cooperatives in Rwanda provided us with good opportunities for theoretical sampling. To identify individual members of agricultural cooperatives in Rwanda, we purposefully approached cooperatives in the southern and eastern provinces of Rwanda that are most prone to climate-related disasters (Republic of Rwanda, 2020a). Since the focus of our research is to understand the challenges of time-poor smallholders in dealing with climate change, we further narrowed down our sampling to agricultural cooperatives. The cooperatives that we selected for this study all received support from external stakeholders to mitigate the consequences of climate change, particularly through trainings (e.g. provided by NGOs), technical advice (e.g. from sectoral government offices) and lobbying for resources (e.g. through representation of village leaders in cooperative boards). Within the different cooperatives, we used a maximum variation sampling (Patton, 1990) to obtain a full range of experiences with time-poverty, thus selecting female and male informants from various ages, and with different responsibilities in the cooperative (e.g. leadership position) and/or the household (e.g. widow). We kept interviewing new informants until the point that qualitative comparative analysis of the data did not result in new insights, indicating that theoretical saturation was reached (Glaser & Strauss, 1967). After

11 months of interviewing, including breaks to focus on data analysis, we reached a sample size of 53 informants (35 women and 18 men) in six agricultural cooperatives with a dominantly female membership. The average age of our informants was 45, most of them married with children and having only finished primary education. All informants are smallholders farmers who were member of an agricultural cooperative (see Table 1). In addition to the research among smallholders, we had 22 informants affiliated to NGOs working directly or indirectly with agricultural cooperatives in Rwanda and 2 informants from within Rwanda's cooperatives government structures. Thus, our final sample comprised 77 informants.

Insert Table 1 about here

All our data was collected through semi-structured interviews with the help of a native Kinyarwanda speaker with field research experience and complemented with researcher observations as captured in field notes (Emerson et al., 2011). Beyond personal characteristics, the specifics of the interview guide changed hand in hand with the emerging theory but broadly questioned smallholders' experiences with farming (e.g. workload), the weather (e.g. heavy rainfall), and the cooperative structure (e.g. support). Interviews with informants from the agricultural cooperatives all took place in the villages where the cooperatives had a physical representation (e.g. office or storage space). To make the informants feel at ease, the lead researcher also followed extensive language courses to be able to engage in small talk with the informants in Kinyarwanda (Zhang & Guttormsen, 2016). The majority of the interviews were also conducted in small groups (mostly 2 persons) and were exclusively female or male (not mixed), whereas all other interviews were administered one-to-one. Interviews with informants

of NGOs and the government were directly conducted by authors of this study, mostly face-to-face and in English. Interviews lasted from 20 to 170 minutes and, with explicit oral consent from the informants, all interviews were audio recorded and translated verbatim. Finally, we administered a survey to collect organizational-level data among the agricultural cooperatives to compare for example the general characteristics (e.g. agricultural scope), membership requirements (e.g. yearly contributions) and government linkages (e.g. board composition).

3.2 Data analysis

Analysis was based on the grounded theory approach by Glaser & Strauss (1967) and, more specifically, the Gioia methodology (Gioia et al., 2013). This methodology encloses a systematic approach that is designed to guide the analysis and the presentation of the findings (Gioia et al., 2013). After importing the transcripts of the interviews into NVivo, a qualitative data analysis software, the first step was a line-by-line coding of all the data by two of the four authors. Although our data-analysis was inductive by nature and mostly coded *in vivo*, some of our data was coded through the lens of the concepts that we sought to observe among our informants, including time-poverty, gender issues, and farming techniques. The advantage of this approach is that we do not add new concepts that might unnecessary complicate existing theorizing (Tourish, 2019).

In a second step, we reviewed our full list of first order codes in search for differences and similarities between the various codes. While still keeping close to the data, this step in the analysis helped us to see the bigger picture of what we observed as represented in second order themes (Gioia et al., 2013). As data collection continued during this step of the analysis, the second order themes also changed substantially. For example, some themes (e.g. about "women empowerment" and "uncertainty") that had emerged after the analysis of a first set of interviews transcripts were dropped or recoded since they did not help to answer our research question.

In the third and last step, the final list of second-order themes was used to develop aggregated theoretical dimensions that could together formulate an answer to our research question. As we sought to understand relationships between the different theoretical dimensions, we also identified additional literature (e.g. on pacing) that helped shed light on our observations. In keeping with calls for rigor in qualitative research, we provide a visualization (see Figure 1) of our data structure representing the first-order concepts, second-order themes, and aggregate theoretical dimensions (Gioia et al., 2013).

Insert Figure 1 about here

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4. FINDINGS

In seeking an answer to the research question of how time-poor members of agricultural cooperatives can cope with climate change, we find that cooperatives play a vital role in bringing the temporally dissociated worlds of farming and climate change together. These findings rest on the observation that traditional farming practices are very time-intensive, especially for female smallholders, and that smallholders are primarily concerned about dealing with climate change consequences rather than preventing it. In presenting our findings, we first detail the challenges of dealing with climate change for smallholders, followed by our observations of how membership to cooperatives can help mitigate these challenges.

4.1 Climate change increases time-poverty of female smallholders

4.1.1 Responsibilities for women at the farm and in the family

While the consequences of climate change hit the lives of smallholders in general, they are worse for women (compared to men) because: “Women bear the brunt of everything, more than men.… They are the ones in agriculture, doing unpaid work, spending more time on collecting firewood or water…” (NGO informant). Women also declared that farming consumed most of their time, but they accepted this workload. The continuity of the work was reflected in the inability of female smallholders to rest, since every hour of the day was usurped with work and, if they could take some rest, they somehow felt ashamed to admit this. A woman in one of the group interviews said that the interview was an opportunity for her to rest and another female interviewee even fell asleep during the interviews (field notes). When we asked a female smallholder whether she ever has “free time” after work (note that Kinyarwanda does not have a word for “free time”), she answered:

> “It is hard to have free time at home, because we raise our cows in stables and after eating you have to go find grass for the cows to eat. When you are a farmer, it is not easy to find free time to relax.”
>
> > “You can’t even find like 2 hours a day where you are free from work?” (Interviewer)
>
> ”It is not possible, if you cultivate fruits, then you will go to find grass for mulching in the evening, or spray the pesticides before dawn…”

Although male smallholders also take up a fair share of the work on the farm and in selling the harvest, an important difference is that men are held less accountable for household work:

> “In a good marriage and because of our Rwandan culture, a man cannot cook when the wife is sitting there. We consider that a lack of respect and in case a man helps his wife, fellow men despise him saying the woman bewitched by giving traditional medicine that made him submissive to the wife.” (Male smallholder)

Importantly, this difference in accountability was very much internalized among women too: “we believe that men and women cannot be equals” (Female smallholder). Or like another female smallholder told us:

> “The activities meant for women are: preparing the land, sowing the seeds, and removing the weeds from the plantations. And when you are a good woman who respects her husband, you cook for him at home.”

Hence, compared to male smallholders, the women in our study were expected to take a lot of responsibility on the farm and in their household, and accepted the resulting workload. To a large extent, this observation echoes the observation of Wodon and Blackden (2006) that time-poverty is a gendered problem in Sub-Saharan Africa.

4.1.2 Climate change increases workload of smallholders

Due to the consequences of climate change, smallholders encounter more work to maintain their land and take care of the crops, and this on top of their already high workload. In the absence of other resources (e.g. money to pay workers) and facing the unpredictability of climate change consequences, putting in extra labor hours is the only feasible option for most smallholders. Drought is one of the challenges that leads to a short-term increase in time-pressure to water crops, mostly with water that needs to be collected far away from the fields and/or that is scarcely available. The other extreme is flooding, where water destroys crops (immediately, through the decay of roots, or through pests) with negative consequences for the harvest. Yet, the major impact on the workload comes from land erosion that washes away fertile soils, irrigation channels, and terraces. This requires smallholders to go to great lengths in restoring fields and prevent negative climate change consequences in the mid- and longer term. On top of the problems caused to farmland, smallholders can also face losses at home when their (mud-brick) houses are damaged or destroyed due to heavy rainfall, thus requiring

labor-intensive repair (e.g. making new mud bricks). One informant described the consequence of climate change as follows:

> "For instance, now, the corn that was planted in the valley, those that were close to the streams were destroyed by rain, so there will be no harvest for people who planted them. And since there were heavy rains, the people who conducted tests said the corn was completely destroyed. And even though we dig channels and construct ridges, they have overflowed with rain water and the soil was destroyed. The houses were destroyed too, people have vacated their homes. Well, the consequences are way too many." (Female smallholder)

Although climate change does not discriminate between men and women, the consequences were worse for female smallholders, because:

> "When the situation becomes unbearable, men can go search for work in another area, leaving the women and children behind. And sometimes the wife waits for the husband to send some money but he never does, sometimes he doesn't even come back.'' (Female smallholder)

Indeed, regardless of the situation, the female smallholders in our study have little choice other than to keep their household responsibilities and to hope that the situation will improve. This situation differs from male smallholders who have more job opportunities in, for example, the trading or transport sector (NGO informant). In sum, we find that cultural norms regarding women's responsibilities can lead to time-poverty, especially for female smallholders, and that this situation is worsened when they have to deal with the consequences of climate change.

4.2 Smallholders cannot risk investments in long-term climate change adaptations

4.2.1 Smallholders farm to survive

In the absence of any other valuable resources, smallholder farming is, for many people,

the only option to survive in rural Rwanda. More often than not, our informants expressed that they had no other choice than to farm and to be patient in case of fallbacks. With 297,996 smallholders in 2,433 registered cooperatives, accounting for 39% of the GDP (Musabwa, 2018), farming literally brings food to the table and only when surplus harvests can be sold, there is money to purchase additional goods or services:

> "If I have cultivated vegetables and I harvest more than I need, I bring the rest to the market, selling it so that I can get some money to buy myself body lotion." (Female smallholder)

Yet, this dependency on farming makes them highly vulnerable, especially since traditional agricultural practices go hand in hand with predictable, seasonal weather patterns:

> "Traditionally, we know to be a farmer you have to have land, seeds. and a hoe, then wait for the rain. But this is not the same anymore. You have to apply irrigation, fertilizers, and these come at a cost, so when you are not proud [*to be a farmer*] and don't understand the impact of doing that, you won't do it." (NGO informant)

Moreover, given the cyclical nature of seasonal farming, work on the farm is also embedded in strong, daily routines. Female smallholders expressed that they had highly organized daily routines with farming activities in the morning followed by household chores in the afternoon:

> "My daily routine… I told you that my youngest child is 5 years old, I start my day by bathing him so that he can go to school cleaned up. After my child goes to school, I go to the farm. When I come back from the farm at noon, I start cooking and while food is being cooked, I clean the house."

These routines followed an ordered series of sequential activities whereby women moved to the next task when the previous one was done:

> "Well, as women, we do not have a schedule to keep, you go search for cassava roots to

> plant, then you plant them and when you are done, it's around one or two in the afternoon, then you come home to cook and then you go search for grass for cattle feeding and when you are done you try to find the evening meal."

Put differently, guided by seasonal cycles and focused on sustaining the family, tasks within the daily routine were pretty straightforward and did not require longer term planning.

4.2.2 Short-terms concerns about climate change are most salient

In line with smallholders' understanding of "farming-as-survival," their primary concerns are related to the short-term consequences of climate change, or how extreme and unpredictable weather situations would negatively impact the availability of food, water, and housing. The long-term consequences of climate change rarely come up among smallholders. Such issues were probably less salient because,

> "Farmers have limited information about climate change and also they have limited capacity to adapt to climate change issues. For farmers, when they have a problem caused by climate change, [it] is that they need to feed themselves. If the food is on the table, you don't care what will happen tomorrow" (NGO informant).

Likewise, smallholders tend to be reluctant to invest their time and money in more structural measures to prevent and control climate change consequences on the longer term:

> "I think farmers, the majority of them, prefer to deal with the situation when it happens. Because when you tell farmers 'You have to apply irrigation, you have to buy the machine', [then] they tell you 'Next season there will be rain'. But they don't know the rain will come so farmers have the tendency of expecting it will be better." (NGO informant)

In addition, smallholders often have no idea about the causes of climate change, making it hard for them to invest their time or money in structural prevention measures. When asked where they thought climate change came from, smallholders often remained at odds: "we just

see it happening but we don't know why.'' There was a general agreement that climate change was real, but the problem was often reduced to a problem of unpredictable weather circumstances that only could be accepted when they came.

> "Usually when there are heavy rains, it is just a natural catastrophe. When you don't dig channels, the rains can destroy all the plants. So, when there are heavy rains, there is not much you can do about it. It is the same with too much sun, you water the soil but watering the soil is hard too. So, you accept the catastrophes as they come." (Female smallholder)

Smallholders are very much used to dealing with various weather circumstances, but climate change brings extreme and unpredictable events. Most smallholders grew up knowing exactly when to expect rain and sun; however, so far they are unable to detect cues in the environment that can help them prepare in time for the new weather extremes. On a regular day of combining farming and household chores, women know exactly when to do what without a stop. Yet, when it comes to dealing with the consequence of climate change, they do not know when to start preparing since they lack time-sensitive information:

> "For example this rain, you see it started raining in November. Usually in January, we wait to plant the beans in February and then the sun comes out on 15th January. And by the end of January, moderate rain starts falling and we start planting the beans.… Now we are afraid that things will continue like this and we will not be able to plant the beans of the short rain season, if the rain doesn't fall before the end of the month we won't be able to plant the beans.'' (Female smallholder)

As a consequence, smallholders' actions are focused on controlling potential damage from climate change in the short term, as illustrated by the following examples:

> "We mix the plants. For instance, if we produce cassava and bean, we also put vegetables so that if we lose the main crops, we keep the vegetables.'' (Female smallholder)
>
> &

> "I thought that since the erosion takes all the soil away, maybe I can plant crops that take a short time to grow in order to survive the hunger pandemic. For example, instead of planting cassava, I can plant sweet potatoes because the latter only take 3 months to grow, meaning it can feed the children. Or cabbages in the wetlands only take 2 months to grow. And beans take 3 months to grow." (Female smallholder)

Hence, smallholders did what they could, given their limited means at hand. At the same time they were also open to more structural, long-term mitigation of climate change consequences, but to this end they expected support from outsiders, including NGOs, governments, and agronomists. Unlike the daily struggle, as experienced with farming, the fight against climate change is seen as a challenge that is beyond the control of smallholders. Whereas farming was described from the "I" perspective, reflecting the focus on the individual smallholder and their household, climate change was considered to be an outsiders' problem that could not be controlled by the smallholders themselves. An NGO informant was concerned that these outward expectations led smallholders to take up a passive role in the stride against climate change:

> "These initiatives that are meant to control, to fight cannot be done by external people, they should be done by you. If it is you to do it then accept you are part of it, if you do right then you get right, if you do wrong and you want to dispense yourself, then it is up to you. And these are the messages we really want."

Initiatives that were typically mentioned by smallholders included water dam sheets, irrigation tools, loans, manure, seeds, terraces, training, trees, water tanks, and weather forecasting. Given the salience of short-term concerns among smallholders, support measures that were also immediately useful in the household, like water storage solutions, were especially welcomed. This was also reflected during our visits to cooperatives. Often we would find cooperatives sitting on infrastructure (e.g. warehouses) that was sponsored by NGOs or other development oriented organizations, but left unused given the lack of their immediate utility.

4.3 Long-term adaptations can be better paced with the routines of smallholders through cooperatives.

4.3.1 Reducing climate change related time-poverty through cooperative labor

Our first finding is that climate change increases the time-poverty of smallholders, especially women. In response to this time-poverty, we observe that working in cooperatives can play an important role in reducing climate change related time-poverty. First, they do so by calling upon the joint labor of groups of smallholders, both women and men:

> "To solve that problem [of heavy rains], we have put in place community service to construct channels. Even if the channels can overflow, it helps to prevent erosion for some time.'' (Male smallholder)

Although it might be a bit counterintuitive at first glance, labor within the cooperative does not increase time-poverty much because the individual time spent within the cooperative is quite limited (e.g. one day per week), efficiently organized, and allows for combining its work with household responsibilities. Similarly, meetings with the cooperative were held at times considerate of household chores:

> "When we have meeting in the cooperative, we cannot schedule it in the morning, we schedule it in the afternoon because time is costly… so that is why we scheduled the meeting at 2 p.m., after farming and getting some rest, then we end the meeting at 4 p.m., we go back home to do the household chores." (Female smallholder)

A second way that smallholders' membership of cooperatives help to reduce climate change related time-poverty is by selectively training cooperative members to deal with climate change (e.g. new farming techniques and interpreting weather forecasts). While this is consistent with smallholders' expectation for outside help, it is the smallholders themselves

who are trained to deal with the consequences of climate change. The temporal benefit for the gross of the cooperative members is that not everybody needs to spend time to go through a training program and that one can learn from others' experiences on how farming can be organized more efficiently:

> "What the government is doing, but also some others, is to start identifying those champions, like the climate change champions, within the communities. So if an influencing person in a community has adopted those [climate change] adaptation measures, the neighbors are likely to imitate.… It's a good thing because at least these influencers, these opinion leaders, as we call them here, are closely working with NGOs, with government, and these are the ones who have certain access to climate change information and adoption measures." (NGO Informant)

4.3.2 Facilitating anticipation to climate change adaptations

Our second finding is that individual smallholders do not want to risk investments in long-term climate change adaptations. In response to this problem, we observe that smallholders who form cooperatives, and with the support of NGOs, can play an important role in facilitating anticipation to climate change consequences. First, they do so by working together with NGOs that help translate long-term plans (often in accord with government plans) and by facilitating concrete actions that immediately benefit smallholders. This helps to overcome the gap between government plans and reality on the ground. The government often comes up with plans, but "the groups who are mostly affected by climate change are not really taking part in the decision processes, in the adaptation and mitigation planning. I think that is also limiting their resilience in taking part in the adaptation." (NGO informant). Hence, the facilitating role of NGO's was necessary:

> "We are trying to work as facilitators, we are trying to become a link between the service providers and environment agencies. So, the government has put in place those strategies and the farmers do not know those strategies. So, we are trying to facilitate those farmers to have access to those strategies. [Name NGO] sees itself as a facilitator and, later on, as an enabling environment because we are trying to put emphasis on

> advocacy so that we can advocate for farmers to have the services the government is providing. For example there is a very good policy that the government has put in place to subside irrigation materials." (NGO informant)

Secondly, through the collaboration with NGOs, the long-term consequences of climate change become more salient by focusing on prevention (instead of curing):

> "We all say that prevention is better than cure. The cost of adaptation to me would be more expensive than preventing, like the national land policy. If they are talking about 'these areas are suitable for farming, these are suitable for habitation.' It's a very good prevention measure, because if farmers know 'this is land for farming' and they apply all the necessary prevention measures in that land so the cost/impact of climate change would be minimal because farmers have put up barriers; so to me, I think we have to put in barriers earlier than putting the cost in dealing with the situation." (NGO Informant)

Third, and lastly, smallholders often express their discontent about climate change measures that were promised by the government, but that came too late or never at all. Through cooperatives, smallholders can work together with NGOs who are better placed to voice concerns about the timing of climate change measures::

> "Farmers need proper information and some push, some support. For example, how RAB/MINAGRI [Rwandan Agriculture Board/Ministry of Agriculture] is distributing seeds, farmers are saying that we are now having rains for a shorter period so we have to start farming as early as possible but we don't have seeds on time. If the season starts by September and you bring seeds in November, you are bringing farmers into loss. For the farmers now in Nyagatare, specifically, for beans if you have not yet started weeding, you will definitely have to bear losses. Because there is a short period of rains and if we had two months of rain, next season it will be shorter. Farmers are always complaining about lack of information and inputs and when they come, it's late. So farmers, they need that and they will claim it every day." (NGO Informant)

Similarly, the services provided by the NGOs also need to be well timed and fit with the seasonal farming cycles in order to lead to the desired effect. Overall, smallholder farmers reported to benefit in multiple ways from the work in cooperatives, Dealing with climate change

through cooperation and solidarity seemed the logical way forward in "trying to lift ourselves out of poverty" (Female smallholder). Yet, this process developed at a pace that was generally bounded by the support that their cooperatives received from outside.

5. DISCUSSION

While there is no doubt about the importance of tackling grand challenges like climate change, as resolution is not immediately obvious, finding solutions starts with the definition of the problem itself (Ferraro et al., 2015). Given the magnitude of grand challenges, it is not surprising that research has largely framed their resolutions as matters of institutional change. We theoretically contribute to this important debate by studying time-poverty that permeates the lives of smallholders and that impacts how institutional measures can be implemented in practice. Climate change adaptations led to more work for smallholder farmers that worsened their time-poverty, but this additional work could be better paced for members of agricultural cooperatives. Hence, we also advance our understanding on the role of cooperatives in helping tackle climate change by elaborating the concept of temporal pacing, which we discuss in more detail below.

5.1 The temporal challenge of smallholder farming for climate change adaptation

Smallholder farming is a gendered activity in Rwanda, and estimates for sub-Saharan Africa report that about 90 percent of land preparation (e.g. hoeing) and crop care (e.g. watering, weeding) is done by women (Kes & Swaminathan, 2006). Our understanding of why smallholders do not invest much in the prevention of climate change consequences is rooted in the observation of persistent time-poverty, particularly among women in rural Rwanda, that is exacerbated by climate change. This, in turn, further helps to explain why smallholders are hesitant toward investing in long-term climate change adaptations (Clay & King, 2020). Such adaptations are not always sufficient to save the seasonal harvest; hence, they are reluctant to

spend much of their precious time on climate change adaptations with mainly long-term benefits, i.e. when seasons have already changed. Our findings also echo recent work among smallholder farmers in Rwanda who found that smallholders struggle to keep up with long term livestock programs because of a lack of available labour force (Kim et al., 2022).

Thus, the first contribution of this research comes from further clarifying the concept of time-poverty within the discussion on climate change prevention in the Global South. It is a popularized misconception that people in the Global South have "more time" than those in the Global North. It is also in this spirit that outsiders are often left wondering why their well-intended interventions are not sustained when support measures come to an end. Yet, previous research notes that high demands on labor is an important boundary condition for food-insecure smallholders to invest in long-term projects like agroforestry (Jerneck & Olsson, 2014). Kim et al. (2018) further help us to see sustainable development through the lens of a "long present," i.e., as seasonal flows where trade-offs between using resources in the present or future do not matter. This insight brings an important nuance to the longstanding writings of Hall (1983), Levine (1997), and others (e.g., Gell, 1992) regarding time-related cultural differences. Our research further adds to current theorizing about time in the Global South by clarifying how smallholders' time-poverty leads smallholders to prioritize seasonal farming over investing in long-term climate change adaptations.

5.2 Cooperatives role in synchronizing smallholder farming with climate change adaptations

Unlike the farming activities of individual smallholders that mostly follow seasonal cycles, the temporal structuring of cooperatives can support longer-term growth aspirations. Temporal structures refer to the organizing elements that disclose expectations about time such

as work calendars, deadlines and routines (Shipp & Richardson, 2021). In the context of Rwanda, long-term plans are strongly incentivized through the temporal structures defined by governments and NGOs (Musabwa, 2018). Rwanda's Vision 2050 (Republic of Rwanda, 2020b) is one of those recent policy documents that serve as a temporal signpost of how a climate resilient agriculture must be attained: "In 2050 agriculture in Rwanda will be market-led and high-tech, driven by professional farmers with large farms on irrigable lands totalling about 600,000 hectares, with an irrigation rate of 100% of irrigable land […] Rwandan farmers will have tools at their fingertips to reduce losses from the effects of weather and climate change"

Our findings suggest that through working in cooperatives (who, as an organization, are eligible to receive support from governments and NGOs), smallholders' adaptive capacity to invest in long-term climate change adaptations can be improved. This is in line with previous research among smallholders in sub-Saharan Africa that the preparedness to adapt to climate change hinges, to a large extent, on the support of external actors (Borsky & Spata, 2018; Fayet & Vermeulen, 2014; Fosu-Mensah et al., 2012; Jerneck & Olsson, 2014; Ribeiro et al., 2020). For example, the One Acre Fund, serving over 631,000 smallholders in Rwanda, developed a system to insure crops for extreme weather damage, boosting smallholder farmers' appetite to invest in new agricultural techniques (One Acre Fund, 2022). Questioning how cooperatives can also help smallholders deal with climate change led us to discover the important role that they play in pacing climate change related adaptations.

Thus, the second contribution of this research comes from bringing the concept of temporal pacing to the discussion of how cooperatives can help smallholders deal with climate change in the Global South (Cinner et al., 2018). Pacing can be defined as "a person's preference for the allocation of time in task execution under deadline conditions" (Gevers et al., 2006, p. 55). Yet, such personal preferences are likely to be shared within the context of

cooperatives since leaders can define the pacers (e.g., time that irrigation channels must be restored) that are necessary to entrain, match, or synchronize (Ancona & Chong, 1996) smallholders' seasonal farming activities with long-term climate change adaptations plans. By reducing the climate change-related workload, cooperatives create the boundary conditions for synchronizing smallholder farming with preventive actions, including land maintenance and investments in crop care. Furthermore, through facilitating anticipation to climate change consequences, cooperatives provide the temporal structure against which smallholders can pace their adaptations.

5.3. Future research

Given that our study has been conducted among smallholders in Rwanda, where the role of cooperatives in tackling climate change is more institutionalized than in other parts of the Global South (e.g. Clay & King, 2019), our theorizing about temporal pacing might have been contextually bounded. The theoretical pathways that we uncovered remain to be tested through quantitative methods and should control for alternative explanations that have previously been identified (e.g. Burnham & Ma, 2016; Poulton et al., 2010). Scarcity theory (Mullainathan & Shafir, 2013) could be a useful backbone for such work, since it helps to look beyond explanations that treat climate change adaptation as a consequence of stable characteristics of the individual (e.g. land ownership) and the institutional environment (e.g. cooperative-led interventions), thus being unable to address differences in how individuals cognitively process climate change and their consequent response. In particular, the work of Mani et al. (2013) could help in looking at attentional mechanisms that affect the temporal demands of climate change adaptation, like future-oriented action, including the question of how time-poverty cognitively impacts smallholders' capacity to attend to the pacing efforts of cooperatives.

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TABLE 1. Sampling information

Agricultural scope of the cooperative	Cooperative land	Initiative for cooperation	Region	Number of informants by gender
Various vegetables	6 hectares	Smallholders	Southern Province	5 women
Pineapple	1,5 hectares	NGO	Southern Province	19 women, 10 men
Maize seeds	187 hectares	Smallholders	Southern Province	2 women, 3 men
Coffee	243 hectares	Smallholders	Southern Province	4 women, 1 man
Various vegetables and pigs	1 hectare	Smallholders	Eastern Province	4 women, 1 man
Pineapple	1 hectare	Government	Eastern Province	1 woman, 3 men