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The Role of Social Capital in Climate Change Adaptation: Small Farmers' Perspective

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Abstract

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Climate Change; Adaptation, Risk Perception; Vulnerability, Case study

Introduction

One of society's grandest challenges is adapting to the constant environmental changes. In the array of those challenges, climate change represents a major issue for society and business adaptation (IPCC 2022). The increasing occurrence of extreme weather events (EWE), such as floods, storms, and wildfires, and extreme weather threatens several business activities (CRED 2020) However, the vulnerability is not equal to all industries, and some activities, such as agriculture, are more exposed. Additionally, vulnerability is different from the perspective of smaller businesses, as small farmers are more exposed to the adversities of climate change. In this study, we address the double fragility of small farming and the factors that influence their decision-making toward climate adaptation.

Climate adaptation calls for strategies to protect business assets and investments from the increasing occurrence of EWE. To start, firms must be aware of the risks and vicissitudes of climate change affecting their businesses to decide. Some business sectors are more dependent on natural resources and more vulnerable to EWE than others, such as energy, transportation, tourism, and agriculture (Linnenluecke 2017). Climate change has affected global agricultural production (Masud et al. 2017; Sacchelli et al. 2017), particularly small farming in emerging and developing economies (Berchin et al. 2019; Mashizha 2019).

Yet, despite business vulnerability, responses to the risks of climate change vary broadly from proactive and innovative initiatives to reluctance and inaction (Gasbarro, Rizzi, and Frey 2016; Herrmann and Guenther 2017; Linnenluecke, Griffiths, and Winn 2012). Research has demonstrated that in addition to risk awareness, firms' decisions depend on resources and capabilities (Berkhout 2012; Busch 2011; Doh, Tashman, and Benischke 2019). Smaller firms are more vulnerable to the impacts of EWE, given the small scale of their resources and capital (such

as financial and knowledge) available (Halkos et al. 2018; Wedawatta, Ingirige, and Amaratunga 2010). Small farmers face unpredictable weather patterns, temperature changes, and EWEs with limited resources, such as available land, labor, technology, and capital to provide solutions.

Despite their importance in food production, small farmers tend to have a constrained adaptive capacity to climatic change (Berchin et al. 2019; Mashizha 2019). For a small business, public policies are crucial regarding guidance and support for changes and adaptations (Daddi et al. 2020; Mashizha 2019). Brazilian public policies have historically focused on economic inclusion via agricultural production systems through family farming (Berchin et al. 2019), however, in times of environmental changes, it is relevant to analyze small farmers' adaptation.

This article aims to answer the following questions: *How do farmers perceive the climate change risks questions*: *How do farmers perceive the risks of climate change and decide on climate adaptation? What is the influence of the context and social factors on farmers' perception and adaptation strategies?* We address that objective in a field study about small farmers' perceptions and responses to EWE. Agribusiness is a particular climate-sensitive industry, and EWE substantially influences agriculture and food production (Stone and Rahimifard 2018). Given their relevance in the food supply for the population, we investigate small farmers in the Brazilian Southeast region. Through the analysis of in-depth interviews, we build an inductive model of the influence of the event experience, risk perception, and decision-making toward climate adaptation strategies. The results contribute to discussing the influence of marketing and social relationships on the learning and adaptation process.

Therefore, our study contributes to investigating the factors that influence adaptation to climatic events considering the context of limited resources of small businesses. Moreover, in our approach, we account for both social influences in the adaptation decisions and the role of social

capital in risk perception and adaptation. Finally, our study demonstrates small businesses' challenges without adequate public policies and governmental support for climate adaptation.

Literature Review

Climate Adaptation in Food Market

Society faces significant challenges due to climate change, with greenhouse gas emissions contributing to various changes, such as rising temperatures and an increase in extreme weather events (EWEs) (IPCC 2012, 2023). Among the consequences of climate change, agricultural production is likely to suffer with decreased water resources, new pest populations, and may hasten soil nutrient mineralization (Jat et al. 2016). Thus, climate adaptation is a matter of food security and needs to be addressed in all nodes of the food supply system. For that purpose, developing and implementing new technologies and practices is necessary to make them readily available (Cradock-Henry et al. 2020).

Climate adaptation is "the process of adjusting to actual or expected climate change and its effects to moderate harm or exploit beneficial opportunities" (IPCC 2012, p. 36). Prioritizing equity, climate justice, social justice, inclusion, and just transition processes can enhance adaptation, mitigation, and climate-resilient development, supporting vulnerable regions and integrating climate adaptation into social protection programs (IPCC 2023, p. 35). Recent research on climate change and sustainability issues highlights gaps and requires updates for progress (DeQuero-Navarro, Stanton, and Klein 2021).

The process of adaptation starts with the recognition of environmental changes and the signs of environmental anomalies (Weick and Sutcliffe 2006). The development of adaptive responses is built upon learning processes driven by individual experiences (Minucci 2016; Tisch

and Galbreath 2018) and social learning (Arunrat et al. 2017; Nicolletti et al. 2019). Personal experience is one of the most important sources of learning stimuli regarding climate change adaptation (Arunrat et al. 2017; Hamilton-Webb et al. 2017; Masud et al. 2017; Ngo, Poortvliet, and Feindt 2019). The experience helps individuals realize the perils of EWE, enhances climate knowledge, and increases the perception of climate risks (Ngo, Poortvliet, and Feindt 2019).

Academic scholars have posited distinct remedies to address social dilemmas (Balliet 2010). These categories include consciousness and informational solutions, regulatory solutions, group-structure solutions, and structural solutions (Rashidi-Sabet and Madhavaram 2022). Understanding the dynamics and consequences of actions within social groups can be improved through the concepts of consciousness and informational solutions (Rashidi-Sabet and Madhavaram 2022). Studies demonstrate that the personal experience of disasters helps to convey the perception of climate exposure and the recognition of climate change risks (Arunrat et al. 2017; Masud et al. 2017).

To regulate behavior, authorities implement laws and regulations, known as regulation techniques (Rashidi-Sabet and Madhavaram 2022). Thus, the learning process may also come from outside references (such as the government) and social context (Arunrat et al. 2017; Nicolletti et al. 2019). Public policies and institutional communication are important guides to activating responses to climate risks (Daddi et al. 2020; Mashizha 2019). Public initiatives such as developing technology, infrastructure, and financing are crucial for small businesses' adaptation (Mashizha 2019). On the other hand, the lack of institutional guidance and political disputes over climate change fail to convey a message of urgency to society (Brito 2022).

Adaptative behavior can be influenced by various factors such as social context, peers, and market partners (Ma et al. 2022; Sá et al. 2019). Group-structure solutions involve modifying an

organization's design, hierarchy, norms, and interactions to promote cooperative decision-making. In contrast, structural solutions address specific circumstances by eliminating or reframing incentives (Rashidi-Sabet and Madhavaram 2022). These strategies include reducing the delay between actions and results, strengthening long-term negative effects, transforming social traps into trade-offs, and modifying payout structures (Rashidi-Sabet and Madhavaram 2022).

It is important to recognize that the proposed solutions may not be enough to address complex societal issues, such as climate change (Rashidi-Sabet and Madhavaram 2022). Farmers' limited awareness of EWE and unfamiliarity with available technologies are significant obstacles to making informed decisions (Arunrat et al. 2017). Urgent messages about climate change often fail to impact, and the lack of resources and technology prevents farmers from taking necessary steps (Ayanlade, Radeny, and Morton 2016). Small businesses that face greater vulnerability and resource constraints often lack the expertise, capacity, and financial means to cope with challenges (Wedawatta, Ingirige, and Amaratunga 2010). Climate adaptation in the food supply system requires the involvement of public and private spheres and stakeholders with different interests to engage (Cradock-Henry et al. 2020).

Vulnerability and Small Farmers' Context

Vulnerability refers to the extent to which an organization can be adversely affected, and exposure - which relates to the assets at risk - is a crucial aspect that needs to be identified and monitored to take proactive measures (Gasbarro and Pinkse 2016; Orr and Inoue 2019). The capacity to anticipate the vulnerability and protect the assets depends strongly on the availability of resources and technological possibilities (Ayanlade, Radeny, and Morton 2016; Tashman and Rivera 2016).

The journey of our food, from the fields to our forks, is the result of cooperation between farmers, growers, and other essential contributors, such as food processors. This partnership often

involves storage and marketing partners, such as cooperatives. Food processors supply distributors, retailers, and sometimes even end consumers. Additionally, suppliers of farm inputs, such as machinery, seeds, and agrochemicals, are significant stakeholders in this process.

Food production chains have become increasingly complex while our population grows, leaving us vulnerable to EWE (Ali et al. 2023). While major players in the food market hold significant influence, small-scale farmers in developing countries are key players in ensuring food security for all. Climate change threatens companies of all sizes and can leave them vulnerable in distinct ways.

In theory, small-scale farmers have a range of strategies for balancing power dynamics and responding effectively to the effects of climate change. These strategies include drawing upon insights from social networks participatory approaches, strengthening local institutions, diversifying crops, and adopting new technologies. In such situations, the relationships between market actors and social networks can prove extremely valuable in terms of mobilizing resources and offering support and guidance throughout the adaptation process (Baker et al. 2015; Halkos et al. 2018). Social networks enable farmers to share knowledge and information with their peers (Nicolletti et al. 2019), while market relations can be pivotal in facilitating resource allocation and disaster recovery efforts, particularly when all stakeholders are working towards common objectives (Baker et al. 2015).

The management of disasters and extreme weather events (EWEs) can prove to be particularly challenging for small-scale farmers, thereby putting them at a disadvantage in comparison to their larger counterparts (Halkos et al. 2018; Oteh et al. 2023; Prasad et al. 2015). Such farmers are required to navigate their local context and position in the value chain, which can prove to be an arduous task, especially when compounded by geographical and social isolation in

rural areas (Arunrat et al. 2017; Ayanlade, Radeny, and Morton 2016; Eakin, Lemos, and Nelson 2014; Glavee-Geo, Burki, and Buvik 2020; Mashizha 2019). Due to being upstream in the supply chain, small farmers are often vulnerable, lack bargaining power, and are not in direct contact with focal firms or consumer centers, leading to heavy reliance on other market players. This power asymmetry can result in conflicts during climate change adaptation (Nyaga et al. 2013; Steger et al. 2021; Yu et al. 2015).

Social Networks and Institutions

Social networks can benefit small farmers by providing access to resources, partners, and knowledge. Engaging in social learning allows these farmers to share information and resources related to climate change adaptation strategies. This type of learning is achieved through observing and interacting with others in their community (Kreft et al. 2023), also known as the neighborhood effect (Vroege et al. 2020) or endogenous network effects (Bandiera and Rasul 2006). Studies have explored the role of social networks in farmers' adaptation to climate change (Dapilah, Nielsen, and Friis 2020; Dowd et al. 2014; Rotberg 2013). Evidence has recently been discovered indicating a positive peer influence on farmers' adoption of climate change adaptation measures (Di Falco, Doku, and Mahajan 2020). However, the role of farmers' social learning networks in climate change mitigation adoption has yet to be investigated (Kreft et al. 2023).

Institutions are critical in influencing markets and developing mechanisms for climate adaptation. Local institutions can help farmers access resources, negotiate with buyers, and influence policy decisions. Thus, strengthening local institutions, such as cooperatives and farmers' associations, can increase their bargaining power. Shapiro-Garza et al. (2020) collaborated with smallholder coffee cooperatives in Latin America to assess the feasibility of five climate change resilience

strategies (i.e., crop diversification, rainwater collection systems, pest monitoring, and management, collective seed banks and nurseries, and solar dryers). Their findings provide a criterion that can be used for determining whether these five resilience strategies are suitable for environmental, socioeconomic, and political contexts, pointing out the need to tailor resilience strategies to local conditions.

Although public policies are crucial, the community's involvement is also vital in addressing the risks of climate change in participatory decision-making approaches. By involving farmers in the planning and implementation process, their opinions and needs can be considered, ensuring their voices are heard. Cradock-Henry et al. (2020) developed and applied a pathway for a participatory approach to support regional adaptation planning to deal with land use changes, competition for freshwater, and climate change. They identified values, impacts, and potential adaptation options, and the results highlighted the complex interaction between climatic and non-climatic drivers of change at the local and regional scale.

Another alternative is diversifying small farmers' livelihoods by adopting new crops or livestock breeds that are more resilient to climate change. This approach can help farmers reduce their reliance on a single crop or livestock species and spread their risk across multiple income streams. However, these activities can also create adverse effects by enforcing marginalization and conflict between diversification strategies (Dapilah, Nielsen, and Friis 2020).

Finally, small farmers can adopt climate-smart technologies, such as drought-tolerant crop varieties and water-efficient irrigation systems, to mitigate the impacts of climate change. However, technology adoption can be costly, and farmers may need support from government agencies or civil society organizations to access these technologies. For example, Maguire-Rajpaul, Khatun, and Hirons (2020)described adaptive techniques for cocoa smallholder farmers

related to low-change adaptation and short-term focus; however, they reached a relevant production scale with the proper support.

Adaptation Barriers

The reverse of learning and adaptation is inertia, in which individuals cannot re-conceptualize their mental models and promote change (Hodgkinson 1997). Some shared values and beliefs may clash with the acceptance of climate change and impose substantial barriers to behavior change (Gifford 2011). For that purpose, climatic events are surrounded by controversial discourses that bring uncertainty to the whole theme, its causes, and possible consequences (Ansari, Gray, and Wijen 2011; Weber 2016). Among the perceived uncertainties, ecological uncertainty is particularly relevant to businesses that depend on natural resources and must be prepared for the possible physical impact (Tashman and Rivera 2016). In those cases, scientific knowledge is received skeptically, and businesses are surprised by EWEs (Haigh and Griffiths 2012; Whitmarsh 2011).

Their socio-demographic and cultural backgrounds can influence how people perceive climate change risks (van der Linden 2015). Factors such as gender, age, education, and nationality are key predictors of risk perception regarding climate change (Wachinger and Renn 2010; Weber 2016). Research shows that women tend to be less skeptical about climate change risks than men (van der Linden 2015; Weber 2016). Political affiliation is also a significant factor in determining people's attitudes toward climate change, with some affiliations being more skeptical than others (Dai et al. 2015; Weber 2016).

The climate change phenomenon is too complex to be understood only from individual experience or knowledge; therefore, society relies on indirect sources of information (Arbuckle, Morton, and Hobbs 2015). Information is shared and interpreted in different social contexts (Hamilton-Webb et al. 2017). The sociocultural context provides shared values and beliefs that

influence decisions regarding climate change risk and engagement with adaptation initiatives (Brink and Wamsler 2019; Herrmann and Guenther 2017; Paschen and Ison 2014) Collective knowledge is built from shared information in groups and may hinder risk perception and adaptation (Herrmann & Guenther, 2017).

Method

Context

Our study covers all of Macromarketing's core dimensions ("Macromarketing as a Multidimensional Concept" 1981). Specifically, we examine the marketing processes involving perishable foods (such as fruits, vegetables, and legumes) from sensing climate change risks and production to distribution and sales. We are considering risk perception, scalability, production and commercialization methods, and strategies for resilience and sustainability that can benefit both the business and the community. While macromarketing studies primarily involve the effects on consumers (e.g., social impacts of promoting organic food), some studies have included relevant questions on producer communities (e.g., regarding Fairtrade) (Geiger-Oneto and Arnould 2011; Samuel and Peattie 2016).

The unique factors affecting small farmers' socio-environmental context and access to resources and capabilities to address climate change adaptation strongly represent a macromarketing perspective. Family-owned farms and family farmer's cooperatives face similar challenges, such as limited resources like land, labor, technology, and capital, as well as reliance on weather and climate conditions for agricultural production. Moreover, unpredictable weather patterns, temperature changes, drought, flooding, and other extreme events have been impacting them all, although in distinct ways, posing specific threats to their crops and livelihoods.

In this sense, our research approach was aligned with interpretivism to examine the empirical knowledge obtained from small farmers directly involved in the marketing system. This captures the epistemological key for understanding risk perception and decision-making in the context of climate change adaptation. To foster their continued existence and encourage their involvement in addressing the effects of climate change, it is essential to comprehend how they adapt their marketing strategies. By doing so, they can improve their quality of life at work, ensure the longevity of their business, and protect the environment in which they operate. Additionally, these efforts can help secure the well-being of their families and future generations of rural communities. All these benefits are beyond the economic supply chain aspect (Samuel and Peattie 2016).

Adaptation to climate change might be considered essential, but the type, intensity, and frequency of these triggering hazards and available resources can be a detriment to action. As a result of the occasional discrepancies and differing levels of vulnerability, there is no one-size-fits-all solution, nor eventually access to current solutions. As it is crucial to consider contextual and social complexities that may limit or grant access to resources, a qualitative approach based on multiple groups of organizations was designed for this research.

Our unit of analysis is the organization classified as small farmers that own small-size properties, and small family farmers manage their production mainly by their family members. As per Brazilian legislation, small family farmers have up to 24 to 395 acres. In this context, their role is essential for providing food security, contributing to agricultural diversification, and preserving rural cultural traditions. This level of analysis and method allows for gathering insights into subjective experiences, meanings, social networks, environmental conditions, and marketing dynamics that influence risk perceptions and decision-making.

Data Collection

We conducted fieldwork in three Brazilian Southeast region states: Minas Gerais, Rio de Janeiro, and São Paulo (Figure 01). Due to Brazil's diverse climate, geography, and vast territory, it has become a top producer of fruits, vegetables, and legumes. These features have resulted in a highly competitive agricultural technology and services market, making it an ideal place for exploration, innovation, and marketing. We chose this region because it has the highest GDP and population, is close to important consumer and technology centers and logistics hubs, and has a similar climate belonging to the same Atlantic Forest biome, which led us to a premise that our select cases will have potential commonalities regarding economic, social, and environmental aspects.

Insert Figure 1 about here

Deforestation and agrochemical pollution in Brazil's agribusiness sector contributes 25% of greenhouse gas emissions (Bennetzen, Smith, and Porter 2016). Unfortunately, this has led to some influential groups promoting climate denial as a response to the issue (Arbuckle, Morton, and Hobbs 2015). Therefore, there is a need for research to inform effective public policies and communication strategies to encourage adaptation to climate change.

We intentionally chose fruits, vegetables, and legumes for our study due to their perishability and the consequent impact of climate change on their growth, which can lead to food loss (production stage) and food waste (processing, distribution, and consumption stages). These types of perishable food are already a topic of climate change research in several countries,

including Brazil. The Brazilian Agricultural Research Corporation (EMBRAPA) is leading ongoing projects to develop technologies for the sector, including cultivating plants resistant to higher temperatures, water stress, and disease-causing microorganisms resulting from increased greenhouse gas emissions. Extreme weather events, such as heavy rains, hailstorms, landslides, and prolonged droughts, may pose challenges to maintaining the production of these crops.

EMBRAPA`s projects are part of the ABC Plan (an acronym for Low Carbon Emission Agriculture in the Portuguese language) conceived by the Brazilian Federal Government to organize action plans to be carried out for adopting sustainable production technologies, selected as responses to commitments to reduce GHG emissions in the agricultural sector assumed by the country (MAPA 2012).

Some actions planned for the Brazilian Southeast region considered that the fruits, legumes, and vegetables are planted mainly in sloping areas, with non-sustainable land management. In some cases, it is "downhill," which exposes cultivation to landslides, severe erosion, and loss of land, buildings, and lives. Another critical issue is that such management systems have caused a marked loss of soil fertility, harming crops and bodies of water due to agrochemical pollution (Macedo 2013).

One example of adaptation response is using no-tillage system (SPD) technology in the Brazilian Southeast region, combined with other soil management techniques, such as terracing and planting on contour lines. In this context, organic farming has increased with techniques and practices that avoid using chemical pesticides and promote the conservation of the natural environment (Cislaghi, Wegner, and Vieira 2022).

Still, the participants were recommended by sectorial associations and cooperatives, indicating those most affected by extreme weather events and providing the contacts of agricultural

managers and farmers. The sample comprises four groups of organizations characterized according to types of food production and market context, named as follows:

(A) Conventional farming cooperatives;

(B) Conventional farming;

(C) Organic farming cooperatives;

(D) Organic farming and

(E) Governmental agencies.

We used the governmental agencies' interviews to verify and confirm the findings (Table 1). The interviews with different groups provided diverse perspectives that allowed for data triangulation. Additionally, we interviewed local producers outside the main scope of the research (family farming) to analyze data from other perspectives.

Insert Table 1 about here.

Data Analysis

We started by investigating conventional farmers, and as the study progressed, we interviewed organic farmers. The same happens with the second parameter for organization selection regarding cooperative farmers or single farmers. With such a combination, we sought diversity in our sample and explored the possible differences in perception and context influence. Participants were interviewed within each group until theoretical saturation, when we achieved no new insights from the data. At that moment, we went to the governmental agencies responsible for researching and supporting farmers in search of clarification and confirmation of some findings.

We conducted 20 interviews during the second semester of 2022, recorded upon agreement. We defined the research protocol in the data collection process with semi-structured questions based on the relevant literature. In following the research protocol in all interviews, we sought to ensure the credibility of the process (Kaufmann and Denk 2011). We also collected additional information from the sectorial associations, government agencies, and website documents to triangulate the information and confirm our findings. During the interviews with sectorial associations, relevant secondary data sources, such as government reports, websites, and horticultural sectorial magazines provided by universities, were recommended and consulted.

We analyzed the data using qualitative analysis software to codify the transcribed interviews (QDAMiner). We followed the procedures of inductive research based on the tenets of grounded theory (Glaser and Strauss 1967). We analyzed our data in three coding stages (Gioia, Corley, and Hamilton 2013). We started by compiling the interviews at the organizational level and configuring the unit of analysis for this study. One researcher did initial coding, and the results were discussed with the team of researchers to reach an agreement and expand the analysis. The coding was initially based on identifying the most relevant concepts per literature (e.g., event exposure, risk perception, adaptation, vulnerability, and decision-making). Other codes were introduced as the patterns emerged from the data (e.g., social networks). As the analysis progressed, new themes were introduced, and the previous interviews were reviewed.

The first coding stage consisted of open coding in which we used the informants' expressions as much as possible, generating the first-order categories. Second, we applied an axial coding process to organize the first-order categories into second-order themes representing broader theoretical concepts (Gioia, Corley, and Hamilton 2013). Finally, the second-order categories were consolidated into the aggregate dimensions related to the theoretical framework.

Figure 2 presents the data structure with the four aggregate dimensions: vulnerability, risk perception, social network, and decision (regarding climate adaptation). The second-order themes and respective first-order categories support the aggregate concepts.

Insert Figure 2 about here.

Once the data structure was built, we moved to the cross-group analysis. In this phase, we reviewed and compared the groups and analyzed their predominant attitudes regarding climate risk perception, vulnerabilities, social networks, and the decision-making towards adaptation measures or inaction. Finally, based on the emergent patterns of our data, we derived a dynamic model regarding the relationships among the concepts describing the interaction of social networks in the process of perceiving and decision-making regarding climate change.

To ensure the confirmability of our analysis, we discussed the emerging patterns from our data with experts outside the team, government agencies, or research and support to improve the credibility of our interpretations. When possible, the information provided by key informants was also validated with secondary data, triangulating the information.

Findings

We present our findings in terms of the four aggregate dimensions: vulnerability, risk perception, social network, and decisions regarding climate change adaptation. The vulnerability encompasses small farmers' exposure and limited information and capabilities. In contrast, risk perception describes the interviewees' sensitivity, awareness, and uncertainties. When exploring the decision-

making process regarding climate adaptation, we encountered narratives reinforcing the role of the social network. Thus, this logic guides the presentation of the findings. We present our findings, first regarding commonalities among all cases and then the differences among the different groups of farmers (organic and conventional, cooperative, or not). We bring some illustrative quotes in the text, and Appendix 1 brings a more comprehensive Table with coding pieces of evidence.

Vulnerability

We identified farmers` exposure to climate change and their capacity to cope with adversity. Farmers' exposure occurred regarding physical (crop production) and financial losses. There were harvest losses of up to 100% in some cases, financial losses in investments made, and losses in product quality. Farmers have also reported changes in the production process regarding crop cycle, seedling, and harvest in recent years. The changes in temperature and humidity also cause increased diseases in the plantations and diminish productivity. Farmers` exposure was an important measure of their susceptibility to climate change.

Nowadays our risk is the pests that are coming; every year, they are coming, and there is no way to combat them (B2).

The man has a lettuce crop; it rains a lot and floods. It's a loss of 100%. He loses the labor and the inputs he uses (D3).

In terms of capacity to cope with the impacts of climate change, farmers reported having restricted sources of information about climate and the predicted impacts. In their words, "the information does not reach us," except for the general weather forecast websites. Therefore, they

had no access to climate tendency analysis, predicted agricultural impacts, or adaptation possibilities.

There are few people with access to long-term research and detailed information (A4).

Farmers in the region do not have a monitoring system. There are even some stations nearby, but the data is not disclosed to the farmer (D3).

Another source of vulnerability was the restricted availability of resources and capabilities that compromised their capacity to cope. One of the main issues was the restriction of water sources for irrigation, followed by possessing adequate equipment, technology, and knowledge. The financial restriction of farmers undermined the idea of investments in adaptive methods or technology.

Even if you foresee it, especially the small producer. Sometimes he doesn't have the structure and enough technology to protect a lettuce crop, for example (A1).

The cost today for you to do it is very expensive because greenhouses are expensive. So, what I see is a lot of these financial issue. Sometimes you see things that need to be done, but when you do a proper value analysis, they are very expensive things. So, we wait and let things happen (C1).

Climate change and EWEs can have devastating effects on family farming and can lead to climate-induced displacement. This displacement can be worsened by several factors, including crop failures and damage to agricultural infrastructure, which can reduce the financial resources of farming households and make them more economically vulnerable. As a result, they may be forced to seek alternative means of sustenance in other regions. Additionally, when rural

households are compelled to relocate to urban areas, it can create pressure to find adequate living conditions, employment, and well-being. This can also make it difficult for affected rural communities to find proper labor resources and manage costs. Finally, the lack of public policy for climate refugees and family farming can inhibit the ability of farming communities to withstand climate-related adversities. Policy initiatives promoting sustainable farming practices, robust infrastructure, and assistance to impacted households can help mitigate these effects.

Risk Perception

We asked the farmers about the main perceived risks, including climate risks, to their current and future business activities. Several aspects emerged, and we categorized them into two main topics: climate risk and uncertainty. Climate risk encompasses the awareness of the impacts of EWEs, mainly for having experienced severe events, such as hailstorms and droughts, that directly affected farmers' production. Adding to the severity, farmers recognized the intensification of rain seasons or a temperature rise. Both in terms of severity and frequency, climatic events were perceived as hazardous for farming.

Last year, my wife had a major challenge because it rained a lot here from November up to now. November, December, January, and February were still raining a lot (A3).

In years, you will see this change increasingly narrowing down this issue of periodicity of rain, cold and heat, and drought. Things that we used to see happen in the long term are getting shorter and shorter (C2).

Apart from climate, other aspects threatened farming activity. Farmers face several transformations in their business activities, such as changes in consumer market preferences, new

entrants in the business (called "neorural"), and the environmental changes provoked by land use. Additionally, there were concerns regarding the effects of agrochemicals on human health and family well-being. Another source of worry was the possibility of government support and public policies. Finally, family succession was an important issue for farmers, with the younger generation's disinterest in agribusiness activities and lack of continuity in their business. Given the nature of the non-predictability of such events, we categorized them as uncertainties.

Rural exodus is a major thing due to difficulties and issues that we find in the countryside. The young ones are not staying in the countryside (A5).

Here in Paraiba Valley [region], we have a lot of food plants, and the academy [studies] taught us that they are bushes and weeds that you need to throw poison on them. So, look at the intelligence of our society. We have a food in our region that is adapted, strong, and resistant to everything that plagues there. But they said that we needed to throw glyphosate on top to plant lettuce, an exotic species that comes from another place, that comes from the European region (C2).

Farmers' perception of climate change was different between conventional and organic cases. Organic farmers demonstrated more awareness of climate change, agrochemicals' hazardous impacts on crop production, and the increased dependence on conventional farming. Conversely, some conventional farmers reported doubts and questions regarding the existence of climate changes "in their region."

Decision-making

We explored the farmers` decision-making and behavior regarding climatic events. We found pieces of evidence in terms of initiatives already taken (or not) and plans. The pieces of evidence were categorized as a decision towards adapting, remedy-inaction, or a learning process.

Some adaptation initiatives took place using existing resources and knowledge repertoires, such as water reservoirs, the choice for more resistant plant varieties, and traditional knowledge, such as smoke, to fight frost. Some farmers mentioned environmental preservation, such as forest conservation, as a mechanism to retain water and preserve streams. Additionally, the diversification of crops and even business activity was another mechanism to adapt to the new climatic challenges. In family farming, diversifying crops is common, and it has benefits for preserving biodiversity and ensuring food security. Various plant species create different habitats, promoting greater biodiversity and supporting a broader range of creatures.

Crop rotation here we combine the useful with the pleasant. You have a crop rotation with Winter and Summer crops (B5).

There is no need to increase deforestation to produce more food. We need to produce more food and have less impact on our forests and the environment where we live (C2).

I see agriculture today with a very deteriorated bargaining power. Working well, those with active production are the producers with two or three different activities (D1).

In the decision-making process, some farmers were learning new technologies and testing the possibilities of adaptation, such as new equipment and stewardship. Others planned to extend and aggregate value to the value chain to escape the weather dependence and increase gains, such as the case of opening a local grocery store or restaurant (D2 - Family-organic). By fostering closer

connections to consumers, horticultural tourism highlights the importance of family farming in food production.

A lot of technology, resistant varieties, I think there will have to be a lot of research into this, investment in conservation structures, irrigation, rationing (A1).

I'm thinking maybe I'll get the consumer to create a restaurant for experiential tourism, so they'll come here (D2).

As opposed to the adaptation attitude, some farmers' reaction was limited to the remediation of the consequences without any preparedness for future climatic events; we named that attitude as remedy-inaction. The absence of possible solutions, unknown technology, and the need for assistance and support justified remedy-inaction. Farmers also explained inaction as "we do not have this tradition" (A3) regarding possible measures such as irrigation and preparedness.

What we have here is drought and maybe rain. We don't know how to prevent or diminish their impacts. Our reality today is that what happens really happens. There is no way of running away from it. (A5)

So, I talk to you, as an example, that there will be an event that will destroy everything, something that has never happened before. I'll tell you what I'm going to do to prevent it; in reality, I don't do anything, because we always think it won't come. (C2)

Organic farmers were more prone to diversification solutions, such as cultivating crop varieties that were well suited to the local ecosystem, which can help protect indigenous species and plant and seed varieties that may not be used in extensive commercial agriculture. Using different agricultural techniques, such as crop rotation, soil conservation, or even agroforestry, can

also have positive effects on biodiversity. More diverse ecosystems tend to have a better balance between predator and prey populations, which can help regulate pests and diseases and reduce the need for pesticides.

Social Network

The importance of social networks emerged as a relevant factor in the interaction between vulnerability, risk perception, and decision-making; however, acting on two opposite sides. We found evidence of farmers' isolation and power asymmetry as negative factors for adaptation. On the other hand, social exchanges were catalysts for solutions towards climate adaptation.

Isolation, geographical and social, was mainly related to the perceived lack of government and public support. There were recurrent farmers' complaints regarding the need for more technical support, communication, adequate public policies, credit lines, and technology transfers. The interviewed public agents also acknowledged several of those issues.

> *My office today has eight technicians. By my side, I have three agronomists, one forest engineer, three agrotechnicians, two veterinarians, and five vehicles. Most of our difficulty is needing more resources in time to do the assistance* (E3).

The relationship with buyers and suppliers was perceived as asymmetric, and farmers considered themselves the weak part of the value chain. That position prevented them from accessing markets, information, and knowledge. Upstream in the supply chain and far from the consumer centers, farmers felt the difficulties of bargaining losses from climatic events and developing investments. Moreover, small farmers perceived that more technology and investments were available for the large producers. Small farmers' isolation favored the influence of specific suppliers, such as agrochemicals, who became a source of information on issues such as climate

change. We coded those relationships as interest groups. Further investigation with the government agencies confirmed evidence of increased sales of agrochemicals as a response to the effects of climate change.

Here we have support from some agricultural technicians who we can say are store representatives. They pass the information to us (B4).

We look to the other side, the final consumer paying a high price, but only the intermediate is profiting from it (D1).

Small farmers' social exchanges with peers, cooperatives, associations, and universities were the main source of experience, knowledge, and information sharing without institutional support. The social exchanges with other farmers were important sources of experiences and information regarding climate change and EWE, creating awareness and increasing risk perception. Social ties with cooperatives, associations, NGOs, and universities were also sources of knowledge and new technologies. Finally, the relationship with cooperatives, associations, and governmental agencies (when available) was the main source of training, commercialization, and solutions for adaptation. Thus, the social network influenced how small farmers created awareness and responded to the threats of climate change.

When it works, we don't need to act much because the farmers already start disseminating the news, which spreads quickly (E2).

Most of the producers, especially the small ones, walk alone by themselves. So, they follow what is being said, what their peers say, what they hear through their studying son, and things like that. Information arrives to them in this sense, or they go to Emater and the Cooperative (A1).

Then we have the cooperatives because many are part of larger cooperatives, coffee, for example, goes on passing on this information and is where we have access (D1).

In Figure 3, we summarize the exchange flows of goods and information in the value chain and among the farmers. There, we illustrate the contrast between weak flows of information and the absence of institutional support that configures the farmers' *vulnerability*, with the stronger support and information exchange among peers provided by the *social network*.

Insert Figure 3 about here.

Another evidence of pressure suffered by small farmers came from mining activities. We noticed a potential conflict between mining and family farming regarding land use in some regions. Expanding mining activities may require the removal of agricultural land, leading to disputes between the parties involved. Open pit mining can cause significant environmental impacts such as soil degradation, air and water pollution, and destruction of vegetation. These consequences can indirectly affect family farming as soil and water quality is crucial for agricultural production. Large-scale mining projects may also require the relocation of local communities, including those who depend on family farming for their livelihood. These projects can result in the loss of farmland, and new sources of income must be sought. The coexistence of mining and family farming may trigger societal changes in the community, including increased living costs, pressures on public services, and shifts in social dynamics. These changes could affect both family farmers

and other residents. We found evidence of local mobilization to address the potential problem of mining.

> *There was a time when there was much propaganda about the importance of mining. But there's no way you can exchange family farming for this kind of thing [mining]. So, there were mobilizations, and things calmed down* (C1).

Among the cases, the organic farmers were more aware of the changes provoked by the agrochemicals. Such insights were confirmed in the interviews with conventional farmers, who acknowledged the increase of crop diseases as an effect of climatic events and highlighted the role of chemical suppliers in providing solutions. Therefore, we found conventional farmers more influenced by interest groups. Finally, the farmers engaged with cooperatives (conventional or organic producers) were less prone to the feeling of isolation. Cooperatives and associations were important sources of knowledge sharing and support for family farmers.

The four cases encompass organizations characterized by two main factors: the types of food production (organic and conventional) and market context (cooperatives and non-cooperative). The analysis brings commonalities and key differences among them, summarized in Table 2.

Insert Table 2 about here.

Discussion

The adaptive capacity depends on economic, political, and social-cultural context (Neder et al. 2021). Therefore, we investigated different natures of production (organic and conventional) and

different forms of network organization (cooperatives or not). The field research brought light to the role of different social interactions that take place in the small farmers' network. Such exchanges, including goods and information, influence their perception of the surrounding environment and their decision-making. Based on our findings, we derived a model (Figure 4) that provides a perspective of small farmers' behavior towards climate change adaptation.

Insert Figure 4 about here.

The model exposes the finding that all farmers share the characteristics of vulnerability and isolation in the supply chain. The exposure to the physical and economic impacts of EWEs demonstrates their vulnerabilities and triggers the perception of climate risks (Gallopín 2006). Nevertheless, our field study brings to light another vulnerability of small farmers, which is the restricted source of information regarding climate change. Although anticipatory strategies could be crucial, it is not likely to happen with restricted information. Moreover, the restricted access to resources limits their response capacity and configures the fragile condition of small farmers (Mashizha 2019). Together with the vulnerability, market isolation and insufficient support of public policies were a common factor for all small farmers.

Apart from those shared aspects, the data revealed two different behaviors toward climate adaptation, and the pathways start with risk perception. The model contraposes the paths of some farmers towards adaptation to others towards immediate remedy or inaction. Farmers usually consider climatic events as part of their "usual business risk"; however, for some, the recent

changes in the historical patterns and the emergence of a more intense climate risk were a reality. For others, the lack of information and the isolation left more uncertainties regarding the nature of the environmental changes and the possible actions.

The small farmers' perception of climate risk was built mainly upon shared experiences and information in their network. Far from consumer centers and with fragile network ties, some isolated small farmers were left with uncertainties regarding the possibilities of preparedness. As governmental agencies could not bring knowledge and support to small farmers, social exchanges were the main sources of learning. The anchorage in the historical events and the reliance on traditional solutions is inducted to simple remedial decisions and inaction, the "wait and see" behavior towards climate change (Berkhout, Hertin, and Gann 2006; Weber 2015).

In this context of institutional voids and the absence of proper public policies, we found that social networks offered a compensatory role as an information provider (Mair, Martí, and Ventresca 2012). Social capital was an essential catalyst in their capacity to recognize problems and use knowledge and technologies (Baron and Markman 2003). The adaptation decision was mainly addressed with solutions using the existing resources and capabilities. Environmental preservation was an important resource for organic producers, whereas, for conventional farmers, the usual response was in a water reservoir.

The small farmers' asymmetric network also demonstrates the influence of immediate suppliers and cooperatives. We found that some suppliers (mainly agrochemicals) provided short-term solutions for the increased crop diseases. On the other hand, the cooperatives were meaningful connections for supply procuring and selling their crops (Schmidt and Wagner 2019). However, not all small farmers are associated with local organizations or cooperatives. Some

farmers learned about extending the existing technologies and new adaptive possibilities, mainly by interacting with cooperatives, associations, and local agencies. Social capital appears as an enabling and restrictive factor.

On the one hand, the restricted social network prevented farmers from moving forward in the adaptive solutions. On the other hand, social exchanges provide learning and adaptation. We found that the nature of the social exchanges was relevant, not only for the access to information but also for their capacity to learn.

Conclusion

This study aimed to analyze the decision-making process toward climate adaptation in the context of small businesses in a vulnerable position. The objective was addressed by studying small farmers' perceptions and responses to climate change in an emerging economy. The data analysis revealed four major concepts in the adaptation decision-making process regarding climate change and the interaction among them. The concepts of risk perception, vulnerability, social network, and adaptive strategies have been discussed in the literature as significant aspects of climate adaptation(Brito 2022; Linnenluecke, Griffiths, and Winn 2012; Pinkse and Gasbarro 2019). Our data bring light to the role of different social interactions in the decision-making of small farmers.

The study contributes to the literature on small business adaptation in resource-constrained environments (Ayanlade, Radeny, and Morton 2016; Tashman and Rivera 2016). In the absence of institutional support, environmental changes involve uncertainties, and the exchange with partners may be the main source of adaptation influence (Daddi et al. 2020; Eakin, Lemos, and Nelson 2014; Mashizha 2019). Thus, social networks and peer exchanges can be a way to change a course of action and develop a new repertoire of solutions (Nicolletti et al. 2019). However, this

study demonstrates that the quality of social networks is an essential source of distinction between paths toward climate change adaptation. Thus, our study highlights that the network is not neutral, and social exchanges may drive different forms of climate adaptation.

Extant studies have acknowledged the influence of institutional support and social networks on the small farming adaptation process (Bandiera and Rasul 2006; Kreft et al. 2023; Vroege et al. 2020). However, the asymmetric exchanges in the network insertion are often not observed. The findings reveal small farmers' isolation in terms of information and knowledge regarding climate change. Although small farmers perceive exposure to climatic events, their adaptive capacity in terms of resources is restricted, thus increasing their vulnerability. In that context, small farmers` adaptation is given either by the existing repertoire of resources and capabilities or by simple remediation of consequences. Farmers seem to act where possible; however, it is not where it is necessary. This study highlights the importance of analyzing asymmetries in market and relational exchanges and their influence on learning and climate adaptation.

In terms of practical implications, our study draws attention to the importance of public policies and technology transfer to protect small farmers from climate change effects and provide food security. In our study, social capital fills the void of other capital, such as finances and knowledge, that should be provided by public support. The study also highlights the importance of relationships with peers, cooperatives, associations, and local government agencies as sources of guidance regarding climate adaptation.

We conducted this research with the Brazilian Southeast region's legumes and vegetables farmers, which provides a significant opportunity to analyze the small farmers` perceptions and decision-making processes. A specific set of criteria was undertaken to ensure the transferability

of our findings to other similar samples; nevertheless, generalization for our conclusions is limited due to the nature of the qualitative and inductive study. However, these limitations and our findings present opportunities for further impactful research. Future research should consider expanding to the supply chain analysis and incorporating the analysis of suppliers' influence as suggested by the results. The replication and/or test in different institutional conditions and regulatory environments might also provide more insights regarding the boundaries of the concepts' relationships. Finally, the study is relevant in identifying the importance of public policies and adequate communication and technology transference to the smaller agribusinesses.

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Tables and Figures

Figure 1: Location map of cases and support agencies

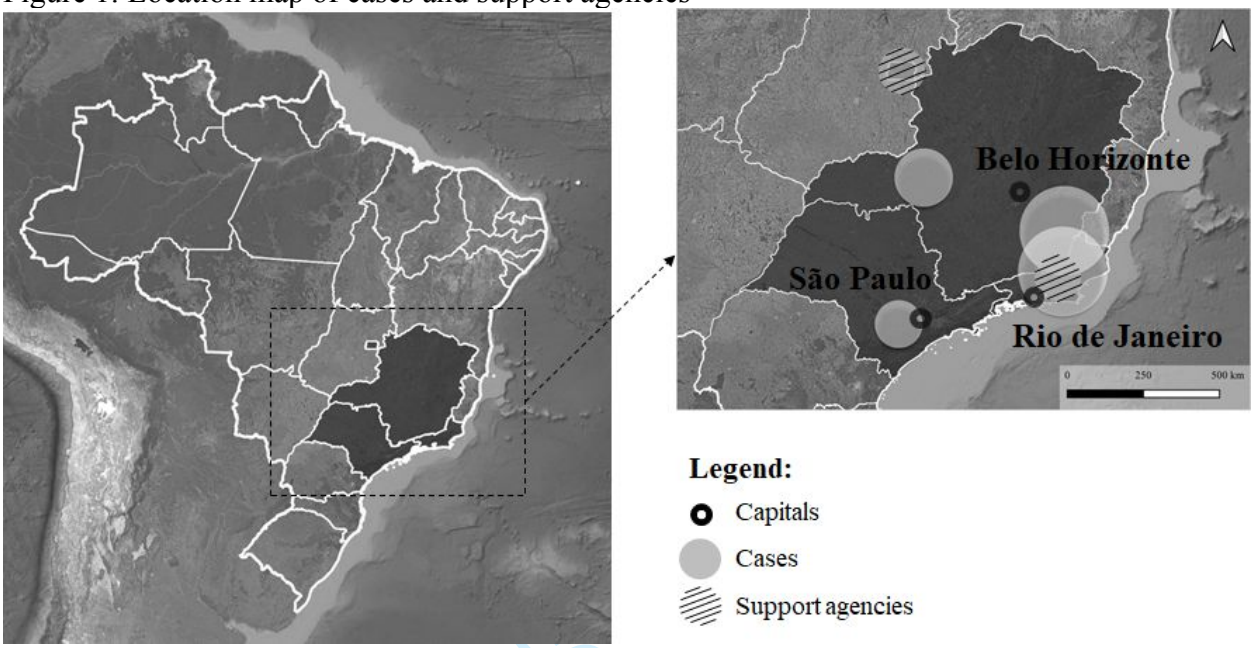


Table 1 – Case studies and supporting institutions

Case	Description	Farmers Given Name	Type of food	Type of social network
Case A	Conventional farming cooperatives	**A1**	Vegetables	Family Farming Cooperatives
		A2	Vegetables and poultry	Family Farming Cooperatives
		A3	Vegetables and poultry	Family Farming Cooperatives
		A4	Vegetables and poultry	Family Farming Cooperatives
		A5	Vegetables and coffee	Family Farming Cooperatives
Case B	Conventional farming	**B1**	Vegetables	Family Farming
		B2	Tomato only	Family Farming
		B3	Vegetables	Family Farming
		B4	Strawberry only	Family Farming
		B5	Vegetables and jam process.	Family Farming
Case C	Organic farming cooperatives	**C1**	Vegetables and coffee	Family Farming Cooperatives
		C2	Vegetables	Family Farming Cooperatives
Case D	Organic farming cooperatives	**D1**	Vegetables	Family Farming
		D2	Vegetables	Family Farming
		D3	Vegetables and citrus	Family Farming
Supporting institutions				
Case	**Description**	**Given Name**	**Institution**	**Support**
Case E	Governmental agencies	**E1**	Governmental agency	Research
		E2	Governmental agency	Research
		E3	Governmental agency	Technical
Additional Interviews				
Additional Interviews		**SP**	Small Producer and Former President of local association	
		MP	Median Producer in the region	

Figure 2: Data structure

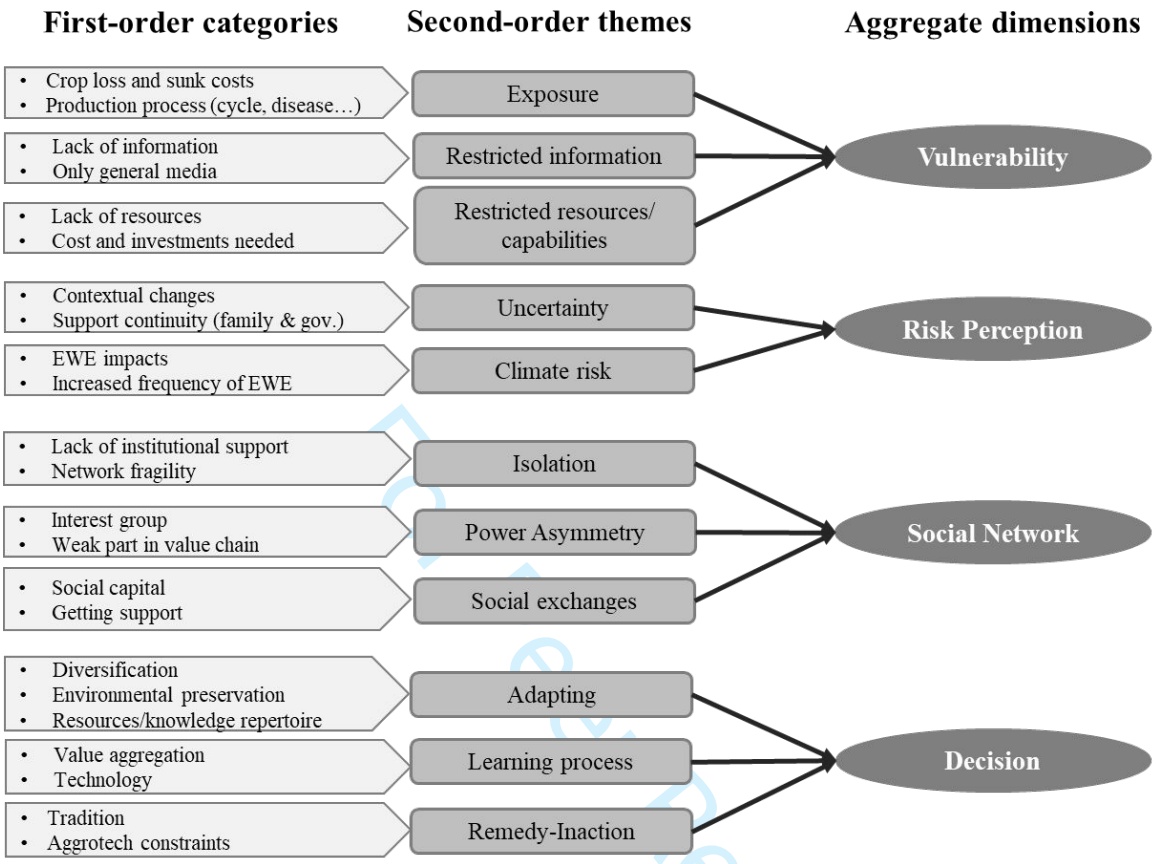


Figure 3: Small farmers' network

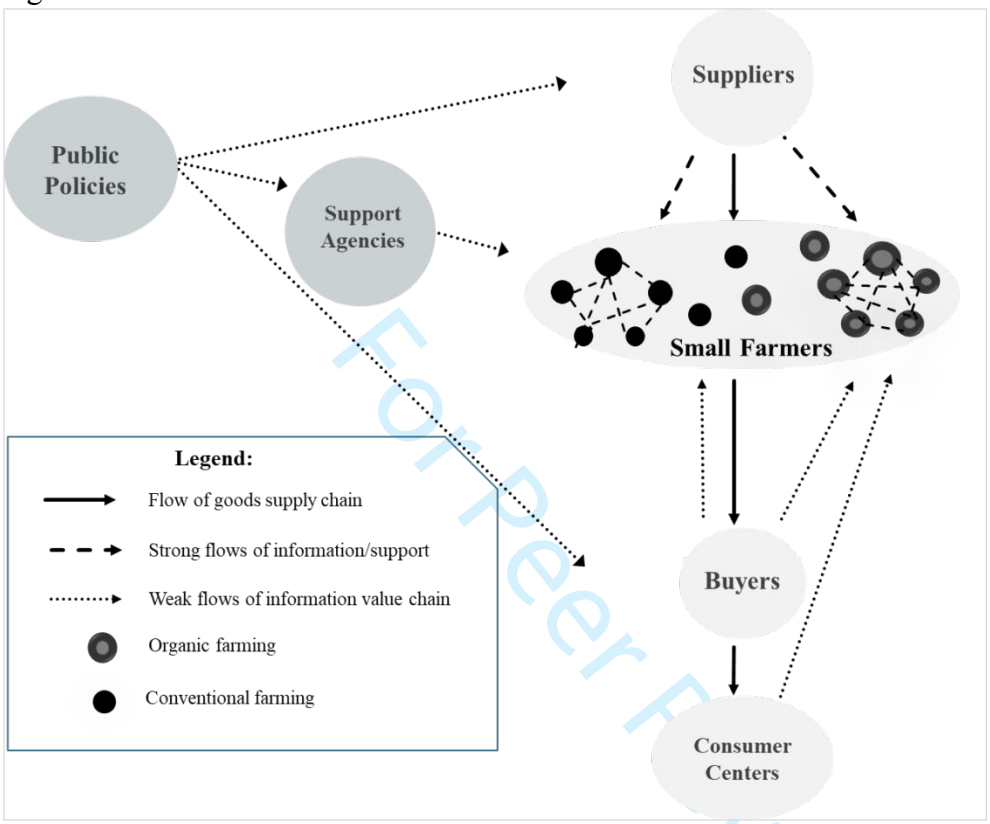
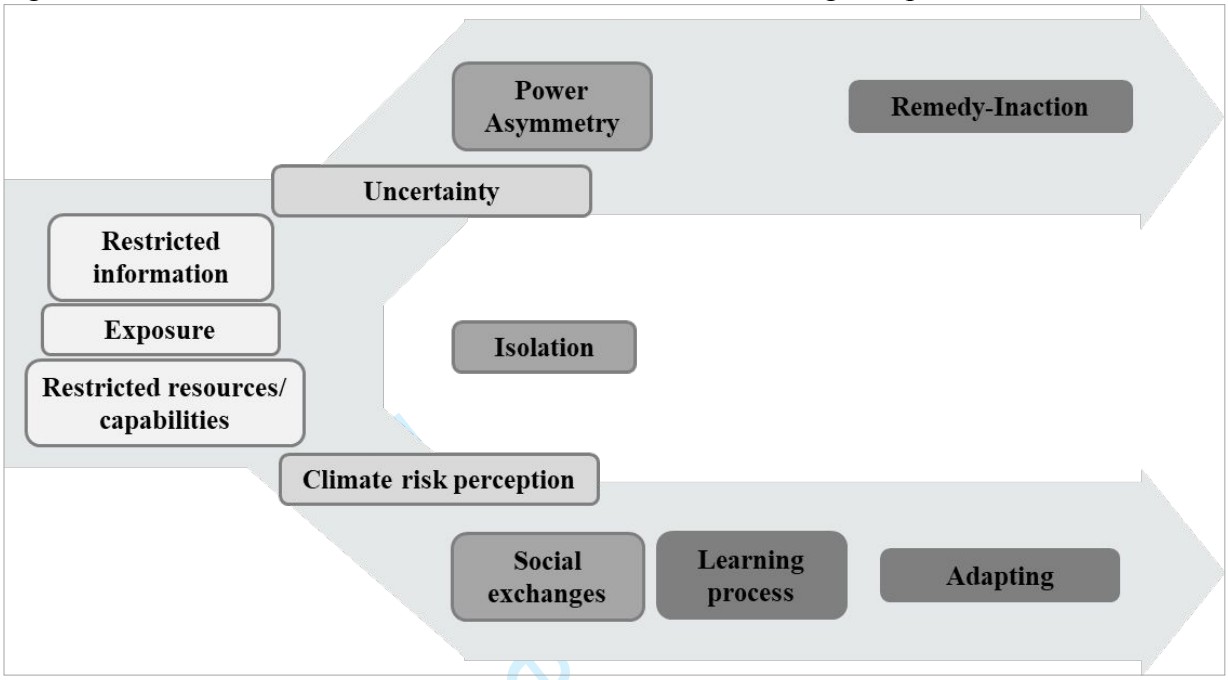


Table 2: Key differences across cases

	Organic Farmers	Conventional Farmers	Cooperative Farmers	Non-cooperative Farmers
Risk perception	Awareness of climate change	Doubts regarding climate change	-	-
Decision	Search for diversification solutions	-	-	-
Social networks	More agrochemical awareness	-	-	Isolation

Figure 4: Model of small farmers' behavior toward climate change adaptation



The Role of Social Capital in Climate Change Adaptation: Small Farmers' Perspective

Appendix 1

Table 3 – Data structure with quotes from participants

Aggregated categories	2nd order codes	1rst order codes	Participants	Quotes
Vulnerability	Exposure	Losses (financial, quality, and others)	A3	This year was terrible; there was direct rain, the staff lost, and almost no one had vegetables. Financial income has dropped a lot of these people.
			A2	We had a result in production, several plants that are from winter, and we only plant in winter; we had a loss, (…) they bloomed ahead of time.
		Production process (cycle, diseases)	B2	It has no control. Difficult because the product that we produce, if we lower the price, we have no way to hold it, we must put it out. If the holding is even worse, it matures more and passes the point.
			MP	In the market share, the issue is the seasonality of goods. So, the price of HF varies greatly. So, you must try to get an annual average.
	Restricted information	Lack of information	SP	Today the guy uses an herbicide that we have here in Brazil that is a huge poison. That just hurts. Why? Lack of information.
			A2	There was a recurring time, and I don't know, in other offices, but in the office here in my region, for a technician to come here at home, I had to pay for gasoline. So, if the person works at this level of precariousness, it is difficult for him to be able to provide quality technical assistance.
		Only general internet/ media	C1	The information I have is more on the Internet. There's going to be this, a frost forecast. It's more or less out there.
			A3	To have people willing to seek that information for this kind of thing. Today this information is very easy to pass on.
	Restricted resources/ capabilities	Financial (investments, costs, and others)	B1	After the pandemic, things went up a lot. It fled the market. Has gone up a lot for the farmer things [production costs]
			D1	It turned out to be decapitalized. We face the issue of inputs, techniques, and costing, so to speak, very high for the profitability offered by the activity today within the informality offers.

		Lack of resources	A2	Because my car has no refrigeration, my truck, I end up depending on the day; if it's too hot, which is what we didn't expect for now, we have a low-quality product;
			A4	If we have a lack of water, the product, in addition to getting worse, productivity drops a lot and falls in quality, and then with that, the consumer is also more selective, so he does not like it very much, and he runs away.
Risk Perception	Climate risk	Extreme weather events (EWE)	B3	Everything is extreme because there is a lot of rain at the beginning of the year. And what happens? When it rains a lot, the lettuce... Because we have the part on the ground too, a lot of fungi, and then you lose the crop, plantation.
			A2	Last year we had heavy rain that knocked down our two greenhouses. One we had just finished; she debuted and went down.
		Frequency	D3	Every year we have frosts. We lose a part of the production every winter because of frosts.
			A5	It has happened almost yearly in recent years but not in general areas. Sometimes it happens in one community in another community. It's been very frequent.
	Uncertainty	Changes (market, nature, health)	A4	I even remember my grandmother talking like this, garlic we plant from the 2nd half of March to the first half of April. Today, if we look only at this period, it usually goes wrong because the temperature has changed a lot.
			SP	Today the guy uses an herbicide that we have here in Brazil that is a huge poison. That just hurts. Why? Lack of information. Then the guy is suspected of cancer…
		Support maintenance (family & government)	DP4_MG2	We make the most of it. I produce diversity in the face of a certain informality; we also have a trade in the city, I am part of the rural community association, and we seek to work in groups in the association. Still, there is a certain resistance to give this motivation.
			D1	I only have that catastrophe as a reference. But catastrophe I don't think is worth it because we had support from everybody. The state was present, but for the catastrophe to focus... the Emater guy who did the TCC [research] on putting on a light.
Social Networks	Isolation	Lack of institutional support	A1	The current policy does not directly support anything financially and in research, in everything, especially to the lower layers, in this case, the horticulturist.
			D3	Here we even have associations, New Fribourg [city] has the Secretary of Agriculture, but the support is zero.
		Lack of participatory engagement	D1	Not all localities have access to this information in real time.
			A2	Maybe technical assistance, I think this is very important, access to quality information and technology. We have to know if any weather event is approaching or not, but this comes to us concisely. With support, I do not see this happening much..
	Commercial ties	Interest group (agrochemicals and other suppliers)	B2	Just yesterday, I was at Ceasa [wholesale market] and even had a trailer there from the Bank of Brazil [public bank], giving a lecture on loans, acquisition of machines, and various implements that we use in rural areas;
			B4	Here we have the support of some agricultural technicians whom we can say are representatives of stores. They pass on the information to us.

		Weak part of the supply chain	D1	Those who live in smaller and small areas have more difficulty implementing a project or action with favorable results.
			B2	We are considered a small producer, and we have very little incentive.
	Social exchanges	Getting support	B1	In my city, there is Emater always informing us, helping us, and making us seek more knowledge for each day we can harvest the good market and know what will happen.
			D1	Then we have the cooperatives because many are part of larger cooperatives, coffee, for example, goes on passing on this information and is where we have access
		Sharing (experience, information, knowledge)	A3	And we, as an organization of family agriculture, think it is very important, but we should have partners for this. The university that's very close to us, maybe some organization, the city hall itself with some department, some environmental [orientation], could be thinking about something.
			B2	There was a Rural Channel on cable TV (…) The meteorologists of Somar were employees of Rural Channel, consultants. I learned a lot about the weather and how to observe statistics by monitoring water.
Decision	Adapting	Diversification (crop)	C2	We work in a system called agroforestry. We try to copy nature in the sense of production, where we do not have a single culture; we work in the polyculture system. It is regenerative production (syntrophic).
			A4	My region here is a very strong issue with coffee, but we have coffee, and I work more with vegetables. Family farming has a diversity of products.
		Environmental preservation	MP c	The climate issue is an issue that everyone has to do their part of. In my case, I have practically 30% of the areas preserved. In my springs, I plant around 4,000 native trees in the year
			MP	But the climate issue, water, and preserving soil that is expensive to do but has to do with soil preservation, erosion prevention, soil health preservation, and soil microbiota. It's something we've been doing here for many years. So this soil preservation
		Resources/ knowledge repertoire	D3	Some producers have another vision: to produce the maximum amount in the minimum time and use the maximum of the land. But organic is the opposite; we try to produce with our resources.
			D1	Hence, it turns out that we are limited to insufficient resources for implementing an industry, a micro-industry, and an implement that would meet collectively.
	Learning process	Technology	D1	We have the technicians, the apprentices, and the teachers all giving this assistance and this monitoring, but it depends on the machine available, and you do not have it there in real time
			A2	Maybe technical assistance, I think this is very important, access to quality information and technology.
		Value aggregation	B4	I have to clean it, weigh it in the bag, and freeze it in a freezer. Hence, I sell at a cheaper price, but for those who will make jam or some kind of candy or juice
			D1	The most viable line is to raise awareness and organize this production in a way to add value, and I think agriculture, in the greatest of all links, needs to add value.

	Inaction	Tradition	A1	Those who have experience of horticulture, the oldest, still tell a lot about the change of the climate, the wind has turned, it is this kind of thing of the ancient tradition that the staff still
			A5	A very long drought. We've had more severe drought than we're having here. The volume of water drops a lot in the same spring. In my father's opinion, a spring that he has lived in for more than 30 years in the place never dried up; two years ago, it dried up.
		Unknown technology	A1	Today, even information channels via meteorological institutes, WhatsApp, and newspapers, in general, can anticipate this. It is very difficult to get around the problem
			A2	WhatsApp groups that I participate, (Cepog), (... theme of organic agriculture), articulation of (incomprehensible), but it is in this way, that is, whether it is a more informal way

Letter to Editor

Manuscript: The Role of Social Capital in Climate Change Adaptation: Small Farmers' Perspective

Ref: JMK-23-0204

Dear Professor Joe Sirgy,

Once again, thank you for the opportunity to improve our paper. To adjust all the references, we changed the citation manager and used the Journal of Macromarketing style. Afterward, we reviewed the paper to find possible adjustments.

Please, let us know of any additional adjustments needed.

Sincerely,

The Authors