

Assessing impacts of COVID-19 and their responses among smallholder farmers in Brazil, Madagascar and Tanzania

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Katharina Löhr^{1,2} , Paschal Mugabe^{1,3} ,
Ana Paula Dias Turetta^{1,4} , Jonathan Steinke^{1,2},
Camilo Lozano¹, Michelle Bonatti^{1,5}, Luca Eufemia^{1,5},
Larissa Hery Ito¹, Alexandra Konzack^{1,2}, Stefan Kroll⁶,
Charles Peter Mgeni⁷, Dina Ramanank' Andrasana⁸,
Sophia Tadesse^{1,2}, Masoud Yazdanpanah⁹ and Stefan Sieber^{1,5}

Abstract

This study investigates the impacts of the first wave of the COVID-19 pandemic on smallholder farmers and their coping strategies in three contrasting Low- and Middle-Income Countries. The case studies include Brazil (South region), Madagascar (Atsimo Atsinanana region), and Tanzania (Morogoro/Eastern Tanzania). These countries were chosen because i) the economies are strongly influenced by the agricultural sector; ii) their national food security is strongly affected by smallholder production, and, iii) they represent a set of contrasting government responses to COVID-19 including the denial of the pandemic. Data were collected through semi-structured household interviews in all three countries in rural areas. COVID-19 induced effects were found in all three countries, including in Brazil and Tanzania where both national governments initially neglected the existence of COVID-19 and introduced few containment measures only. Here, mobility and trade restrictions of other countries impact also on agricultural trade and production in countries in which governments took less action to COVID-19 and also people remained home and practiced social distancing even if no official government policy was issued. The findings in all three countries suggest that the COVID-19 crisis had negatively affected smallholders' agricultural production, leading to a vicious cycle of low production, low incomes, and higher food insecurity. Results of this study raise the thorny issue of how best to balance containment of pandemic and future shocks against the well-being of the vulnerable rural population in lower- and middle-income countries; especially considering also the degree of global interconnected and the potential of policies to effect people beyond the national scale.

Keywords

COVID-19, coping strategies, preventive measures, agriculture, smallholders, government policies

1. Introduction

The agricultural sector is vital for the economies of many developing countries. Not only does it provide raw materials, food, and employment for the growing urban population, but it also improves the welfare of producers who are poor smallholder farmers. Additionally, it is the most important strategy for achieving sustainable rural development. (FAO 2020a). Smallholder farmers are crucial as a strategy for food and nutrition security. About 500 million smallholders provide food and employment to approximately 2 billion people in countries of the Global South (HLPE, 2013), with family farms estimated to constitute 98% of all farms, cultivating 53% of all agricultural land (Graeub et al., 2016).

¹ Leibniz Centre for Agricultural Landscape Research (ZALF e.V.), Müncheberg, Germany

² Humboldt-Universität zu Berlin, Urban Plant Ecophysiology, Berlin, Germany

³ University of Dares Salaam, Dar es Salaam, United Republic of Tanzania

⁴ Brazilian Agriculture Research Corporation – Embrapa Soils, Rio de Janeiro, RJ, Brazil

⁵ Humboldt-Universität zu Berlin, Resource Economics, Berlin, Germany

⁶ Peace Research Institute Frankfurt (PRIF), Research Department II International Institutions, Hessen, Germany

⁷ College of Economics and Business Studies, Sokoine University of Agriculture, Morogoro, Tanzania

⁸ Independent Consultant, Antananarivo, Madagascar

⁹ Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran

Corresponding author:

Katharina Löhr, Leibniz Centre for Agricultural Landscape Research (ZALF e.V.), Germany.

Email: katharina.loehr@zalf.de

Smallholder farmers in developing countries are often very vulnerable to external shocks, facing various challenges, including unexpected negative events in the form of risks (Ngenoh et al., 2019, Ngenoh et al., 2018). These risks can be interpreted as a set of different shocks that are defined as adverse events, costing individuals and families in terms of limited or no income, reduced consumption, and/or the sale of assets (Bonfrer and Gustafsson-Wright, 2017). Some of these shocks are correlated in nature and are common to all families in a community, such as droughts and floods, while others are unique and specific to individual families, such as job loss and illness (Dhanaraj, 2014). Most shocks may affect production systems, food markets, and local economies, all of which have direct effects on food and nutrition security (Ngenoh et al., 2018).

Crises are situations of threat in which political actors have to make decisions quickly under conditions of great uncertainty (Boin et al. 2018). Hence, gaining a better understanding of the risks, vulnerabilities, and coping mechanisms available to deal with crises faced by rural households is essential in order to prioritize and properly design social safety nets (Yilmaz et al., 2014). Health shocks, defined as unpredictable diseases that undermine people's health status, are a common vantage point for this kind of crisis and an important reason for families to fall into poverty in developing countries (Dhanaraj, 2014; Leive, & Xu, 2008).

Since December 2019, the world is facing an unprecedented health shock, the COVID-19 pandemic. The COVID-19 pandemic exposed the world to unprecedented scenarios in relatively recent history, uncovering the vulnerabilities of our society. One of the first impacts was the rush to supermarkets to guarantee food and basic supplies for an unknown number of coming days, causing a wave of stocking up. Thus, the first clash with food systems was related to food access. However, as days passed, a crisis of planning and production in the agricultural process was revealed, affected by labor shortages and poor harvests, imposing a severe test for the existing food supply system (Turetta et al., 2021). The multi-dimensional impacts of the pandemic also interacted with climate stresses that are affecting natural capital, magnifying the economic, food, and nutritional security impacts (Nicola et al., 2020, Leal Filho, 2011). Another major impact does not come from the pandemic *per se*, but rather from policy responses to manage the pandemic, with containment measures affecting business, mobility restrictions, and border closures.

Global trade and travel disruptions had a severe impact on previously high-performing sectors in many countries. This was reflected in a sharp contraction in export revenues, particularly from textiles, mining, and tourism, which were key sources of growth and job creation prior to the crisis (World Bank, 2020). Agricultural value chains have felt the consequences of the health crisis caused by the COVID-19 pandemic more than others. The dairy chain in Madagascar is a good example. The country's milk producers and dairies are highly dependent on reliable transport services and demand, and they have found things difficult.

In the short term, markets and related services, like transport, were disrupted or shut down. Farmers producing perishable products with labor-intense value chains, like fruits and vegetables, are in an especially vulnerable position. Reduced labor mobility threatens to leave some high-value crops rotting in the fields; without adequate storage, the window of time to sell these products before they become unmarketable is short. Changes in market demand and consumer behavior are observable in some countries. Consequently, there is a higher risk of food loss of fruits and vegetables brought about by COVID-19. This may translate into lower incomes for smallholder farmers, which then negatively affects their household food security (FAO, 2020a).

The way that the governments will choose short-term and medium-term impacts will determine the long-term effects (The World Bank, 2020). A prolonged economic shock will affect the purchasing capacity of farmers for inputs and other foods that they do not produce. Likewise, the effective demands by consumers, which spur production, may also be lost, thereby removing a critical incentive for farming. The domino effect may lead to the failure of many businesses, especially small- and medium-sized enterprises that either service crop production or are dependent on its produce (FAO, 2020b). Concerns about the implications of COVID-19 on agriculture and food security in Sub-Saharan Africa abound. Containment measures in response to the pandemic have markedly different outcomes depending on the degree of enforcement of the measures and the existing vulnerabilities pre-COVID.

As example, existing research on bean production and food security using data collected from March to April 2020 in eleven countries in four sub-regions in Sub-Saharan Africa, including Tanzania, reveals that COVID-19 created significant bean production challenges across the sub-regions, including reduced or limited access to seed, farm inputs, hired labor, and agricultural finance (Nchanji and Lutomia, 2021). In Madagascar, the outbreak came during the rainy season, at the peak of production, milk collection systems were most vulnerable to restriction measures. Dairy industry actors faced major challenges as a result of quarantines, curfews, restrictions on use of public transport for dairy product distribution, checkpoints, reduced opening hours for shops, and border closures (Vall et al., 2021).

Therefore, the objective of this study is to deepen the understanding on COVID-19 impacts and to explore drivers impacting differing effects. This study explores the impacts of policy responses to the first wave of the COVID-19 pandemic on smallholder farmers as well as farmers' responses to this shock in three Low- and Middle-Income Countries (LMIC). Key research questions are 1) What impacts did COVID pandemic responses have on smallholder farmers in the selected areas of study? And 2) What strategies did smallholder farmers devise to cope with the COVID-19 crises?

Evidence from sub-Saharan Africa points to disparate effects of different governmental COVID-19 responses on

smallholder farmers' food and nutrition security (Daum et al., 2020). Whilst on a global scale, the governmental response across most countries align, with regards to acknowledging the severity of the COVID-19 and imposed measures, such as curfews, and trade restrictions, we selected three countries of study with differing government responses. The case studies include Brazil (South region), Madagascar (Atsimo Atsinanana region), and Tanzania (Morogoro/Eastern Tanzania). These countries were chosen because: i) the economies are strongly influenced by the agricultural sector; ii) their national food security is strongly affected by smallholder production, and, iii) they represent a set of contrasting government responses to COVID-19. Brazil government on the national level was reluctant to avail the severity of the pandemic but it later came to be one of the most affected countries. Madagascar decided to take absolute measures from the early beginnings of COVID-19 outbreak and even manufactured their own medicine. Tanzania under the former president Magufuli denied any existence of the pandemic but changed its stance after the change in government in February 2022.

A comparative approach is chosen in order to explore context-specific differences but also similarities between three countries of study. The approach shall help to derive contextual factors that governments need to take into consideration when governing crises. Analyzing these differences and their respective effects on farmers' wellbeing and livelihoods is expected to allow the better formulation of pandemic response policies and more effective, context-specific responses during similar crises in the future.

2. Methodology

This research is an exploratory study and uses a comparative case study approach. Comparative research methods have long been used in cross-cultural studies to identify, analyze and explain similarities and differences across societies. Independent of the methods used, research that crosses national boundaries increasingly takes account of socio-cultural settings. It undertakes the exploration through a variety of lenses in order to reveal multiple facets of the phenomenon (Baxter & Jack, 2008). Due to the relatively early point of time for data collection on COVID-19 induced effects after the outbreak of COVID-19, this study was exploratory and a qualitative data collection approach was chosen with semi-structured interviews conducted. Qualitative methods have several advantages over quantitative approaches, including that they do not limit researchers to predetermined hypotheses, thus facilitating the discovery of new insights.

2.1. Case study areas

COVID-19-related impacts and coping strategies of smallholder farmers are investigated in three Low- and Middle-Income Countries: namely Brazil (South region), Madagascar (Atsimo Atsinanana region), and Tanzania (Morogoro/Eastern Tanzania).

2.1.1. Brazil. Brazil is an interesting case of study as the government on the national level was reluctant to avail the severity of the pandemic but it came to be one of the most affected countries. The restrictions introduced to control the pandemic had different stages according to the administrative levels. The federal-level (national level) has weakly regulated public life. At the provincial level, in general, governments implemented stronger measures aiming at containing the pandemic (CoronaNet, 2021). Despite the national governments slow response to the pandemic, the gravity of the pandemic in Brazil is evidenced by the following epidemiological facts: Brazil had a huge number of cases early on (more than 5 million as of Oct. 15, 2020, per WHO), with high mortality, evidence of underreporting, and a high number of deaths among health professionals, pregnant women, and the local population (Ferigato et al., 2020). Still, by 2020, the Ministry of Health had not developed a national approach to combat the pandemic, nor had any other centralized agency. States and municipalities were still neglected, receiving insufficient assistance (Ferigato et al., 2020). In June 2020, the Federal Government announced the release of USD 236.3 billion in financing through the Plan Safra 2020/2021 for small, medium, and large national agriculture and farming enterprises. The total value of this season's plan was distributed as follows: USD 33 billion for smallholder farmers participating in the National Program for Strengthening Family Agriculture (Pronaf); USD 33.20 billion for medium farmers (Pronamp); USD 170.17 billion for other producers and cooperatives (KPMG, 2020).

Our research focuses on smallholders in South Region. This region was chosen as ongoing activities permitted data collection under the uncertain and challenging times of 2020. Also, in this region most of the rural properties are classified as family farming similar to the areas evaluated in Tanzania and Madagascar. The smallholder farmers here tend to belong to associations and cooperatives that allow them to reach economies of scale in both input acquisition and commercialization of outputs (Arias et al., 2017). Agricultural productivity in the South region generally benefits from favorable agro-climatic conditions. Agricultural production, characterized by the expansion of soybeans for export and agricultural modernization, with two states in this region - Paraná and Rio Grande do Sul - the second and third largest soybean producing states in Brazil, respectively (MAPA, 2020).

2.1.2. Madagascar. The island state is an example of studying the role of (international) mobility and trade during the pandemic. Early into the pandemic, in contrast to the Brazilian and Tanzanian government, the government of Madagascar established tight regulations on social gatherings (closure of schools, universities, and markets). In addition, despite strong economic dependence on export crops, such as vanilla and cloves, the government of Madagascar strongly restricted domestic and international travel, including tightly regulated inter-regional border control. For most

of 2020, traveling between regions required a special permit issued by public authorities. Commercial, international air travel was suspended between early 2020 and late 2021, affecting nationals and foreigners alike. In this period, entrance to Madagascar was only possible for members of diplomatic missions and international organizations. To mitigate the repercussions for vulnerable livelihoods, the government of Madagascar disbursed both financial assistance ('*tosika fameno*' program) and direct food distribution ('*vatsy tsinjo*' program) to the affected population. Both programs, however, were largely limited to urban agglomerations, and rural farmers hardly benefited. In contrast, there were continued efforts by then-President Andry Rajoelina and Madagascar authorities throughout 2020 to promote a phytomedicinal drink called "Covid-Organics" (CVO). This drink, developed by the Malagasy Institute of Applied Research (*Institut Malgache de Recherches Appliquées*), a private laboratory, was widely distributed to the population, as well as officially shipped to at least 13 countries in sub-Saharan Africa and the Caribbean.

Data were collected in the Atsimo Atsinanana region in the island's southeast. The region is characterized by a humid, tropical climate favorable to farming, but is also exposed to cyclones that can cause severe damage to farms and infrastructure. Within Madagascar, Atsimo Atsinanana ranks among the regions with the lowest per-capita income and highest rates of food insecurity.

2.1.3. Tanzania. Tanzania was chosen due to the initial negative response of its government to COVID-19. In response to the global pandemic outbreak, the government of Tanzania under President John Magufuli put only a few measures in place. The confirmed number of people who tested positive in Tanzania until May 8, 2020, was 509, including 21 who died from the disease. Up to March 2021, no public update on numbers related to COVID-19 infections and cases of death was provided. The country started releasing data on the disease in July 2021. As of June 1, 2022, Tanzania reported a total of 33,928 confirmed COVID-19 cases (Statistica, 2022). Nine regions were considered to be high-risk due to their proximity to border points of entry, connections to international flights, and the location of initial COVID-19 cases (UN, 2020). Following the country's first reported case, a 30-day ban was imposed on public gatherings (except for worship) and schools were closed. On April 17, 2020, the government extended the school closure indefinitely. Zanzibar banned all tourist flights from entering the region and authorities in Kigoma Region advised refugees to stay inside the camps. Tanzania then suspended all international commercial flights on April 12, 2020. However, on May 14, some flight restrictions were lifted for repatriations, humanitarian aid, medical, and relief flights and other safety-related operations. Then, on May 18, the passenger flight suspension to and from Tanzania was also lifted. Tanzania maintained open land borders throughout the COVID-19 outbreak. On June 8, 2020, the Tanzanian Government, under late President J.P. Magufuli, officially declared the country to be free of

COVID-19 and all restrictions were lifted. Only after the death of Magufuli, did the new President, Samia Suluhu Hassan, on April 6, 2021, announce the appointment of a technical committee to guide how the country could deal with the pandemic. On May 17, 2021, the Technical Committee released its recommendations to fight against the pandemic.

Data collection took place in Dakawa and Mlali wards at Mvomero District in Morogoro Region. In this district, the higher altitudes, range from 600 to 1200 meters above sea level. These areas are ideal land for agriculture and livestock, including miombo forests that grow there. The district can be considered representative for rural Tanzania, where the main economic activity is smallholder farming. Also, Mvomero district is a commercially important hub as it links Dar es Salaam and other regions such as Dodoma, Singida, Mwanza, Shinyanga, and Tabora for internationally traded products. The type of communities interviewed were subsistence and mixed farmers (food production and commercial).

2.2. Data collection

Overall, smallholder farmers in pre-selected regions per country were targeted to assess impacts of COVID-19 on agriculture and food security. The case study sites were chosen based on ongoing activities of the authors relating to agricultural research to permit data collection under the uncertain and challenging times of COVID-19. 20 interviews per case study with a balanced gender ration were envisaged. Sampling methods varied between countries: For Brazil, recruitment for the interviews was by snowballing, whereby a leader indicated a farmer and this one, the other colleague. In total 13 interviews were conducted (11 male and 2 female). A higher number of interviews as well as a more balanced gender ratio was envisaged. However access to interviewees was challenging due to the ongoing COVID-19 pandemic. The interviews were conducted in Portuguese by a Brazilian female interviewer. In Madagascar, 25 farmers were conveniently sampled (10 women and 15 men) from six communities (*fokontany*) in two districts, Vangaindrano and Farafangana. The unequal gender ratio among interviewees was influenced by local custom, where the man manages agricultural activities and agricultural income. In many cases, men were thus the natural respondent for our interviews, which focused on farming activities, without an explicit gender focus. The interviews were conducted by one of two local enumerators (one woman and one man), and both enumerators interviewed women and men alike. All interviews took place in Malagasy, the local standard language. In Tanzania, 20 interviewees were selected from the village farmers list which was provided by the village executive officer (VEO) and validated by the village agriculture extension officer. From the list, a purposive sampling method was employed to aim for a fairly equal number of representations for male (13) and female (7) farmers. The interviews were conducted by a team of one male and one female researcher. The interviews were conducted in Kiswahili,

Table 1. Data collection countries (September- December 2020).

Country	Area	Interviews	Men	Women
Brazil	South region	15	13	2
Tanzania	Morogoro (Dakawa and Mlali)	20	13	7
Madagascar	Atsimo Atsinanana	25	15	10

the country's lingua franca. All interviews were recorded and for documentation and further analysis.

2.2.1. Qualitative farmer interviews. Data was collected by means of semi-structured interviews in all three countries, between September and December 2020. To address the diversity of possible impacts and coping strategies, a qualitative questionnaire was designed that consisted of six thematic blocks related to farming activities, consumption, social networks, decision-making and policy, communication and IT technology, as well as outlooks. Interviewees were asked on changes experienced since the outbreak of COVID-19 and the time of the interview. Interviews were conducted in the respective native languages by local enumerators and face-to-face in most cases, though in Brazil some were also held via telephone due to COVID-19 induced mobility restrictions. Participation in the study was voluntary. All interviewees were informed about the purpose of the study and data protection issues by the enumerators and gave their consent orally at the beginning of each interview. Each interview was recorded with consent, then transcribed and translated into English. A total of 48 interviews (13 in Brazil, 25 in Madagascar, and 20 in Tanzania) were conducted (Table 1).

2.3. Data analysis

Data analysis was done in multilingual research tandems, i.e., by English-speaking team members working with the English transcripts as well as researchers from the respective countries of study, working with the primary data to avoid loss of information or misinterpretation due to translation issues. Generally, data was analyzed based on the subjective understanding and interpretation of the researchers. Data is analyzed and presented in anonymous and aggregated form.

3. Results

3.1 Effects of COVID-19 response policy on smallholder farmer livelihoods

Overall, people were aware of the pandemic and felt related effects in all three countries of study. Awareness on COVID-19 existed despite the differences in government responses to COVID-19. Information was obtained through media, mainly in form of international radio and television news or social media channels via people's

mobile phones. However, effects differ between countries as presented in the subsequent sections.

3.1.1. Productivity. In this study, we discover that agricultural productivity was negatively affected by reductions in labor quantity and quality associated with mobility restrictions as well as with fears and delays in habitual farming activities. This relates to both hired labor as well as farmers not being able to access their fields if located distant from their house. Additionally, changes in the marketing of farm products caused by COVID-19 affected the availability of seeds for growing new crops and progressing with the new season. For instance, a 3pm curfew in Madagascar reduced productivity by up to 75%, as farmers and agricultural laborers were not able to carry out as much labor as needed.

Although Tanzania did not impose strict measures, like lockdowns, smallholders indirectly felt both the effects of policy measures taken by other countries and of fear of the pandemic as they did not feel safe to freely go to their farming fields in a usual manner. Many smallholders stopped going to the farms due to fear even when there was no official government lockdown order. Due to this, there was a shortage of farm labor resulting in challenges to cultivate a large farm. One farmer in Madagascar summarized the effect as, "I couldn't get out of the house so much, so I couldn't plant [as much as I wanted to]." Due to restrictions on domestic travel and trade, seed availability at local markets in Madagascar was limited, leading to increased seed prices and reduced planted areas.

One respondent in Tanzania reported that the effects caused by COVID-19 to their family led to a decrease in farm production and income by 30%, and described a decrease of tomato yields from 100 baskets to 70 baskets since the outbreak of COVID-19. In Tanzania, many farmers interviewed shared a feeling that there were changes in the marketing of farm products caused by COVID-19: local buyers were not coming to the farm because international traders were not entering the country due to travel restrictions in their countries. Local petty and medium-class traders previously had acted as middlemen between farmers and international traders. For instance, interviews conducted in Southern Tanzania confirm that most of the respondents who were engaged in both food and cash crop production in study sites (80%) experienced changes in their agricultural harvest after the outbreak of the pandemic. According to them, agricultural practices change was the focus only on subsistence instead of both subsistence and cash crop as a result of change in income caused by expenses in agricultural inputs and market failure. This automatically affected their harvests

Majority respondents (70%) at Mufindi District (Tanzania) informed that COVID-19 had affected farm production because of loss of farm labor. One respondent at Kikombo village argued that farm hired labor became scarce as people were afraid of the pandemic after it was announced. Others had to retrench their farm laborers as they could no longer be able to pay them.

3.1.2. Incomes. Findings in all three countries indicate that smallholder farmers were affected by COVID-19 for both demand and supply chains. On the demand side, the demand for food has decreased due to uncertainty and the reduction of people's spending capacity. On the supply side, goods that are imported or exported as well decreased due to the closure of borders. Farmers' incomes from crop sales fell significantly as activity at food markets fell. The internal border closure in Madagascar hindered domestic travel and trade, meaning that fewer crop collectors were available, which strengthened their relative bargaining power, especially for perishable crops. This led to the disruption of markets at the national level. Although farmers tried to negotiate better prices, overall reduced consumer demand and challenges for exporting products to other regions meant that traders also faced reductions in business volume. At local markets, where farmers sell directly to consumers, the limited offer of products imported from other regions, the reduced cash income of consumers, and the curfew in Madagascar restricting opening time all contributed to weak demand and lower prices than before the pandemic. In addition, possibly due to the overall economic setback that increased rural poverty, multiple farmers reported increases in the theft of cash crops (such as vanilla in Madagascar). In Tanzania, smallholders reported lower income due to reduced prices for produces coupled with increased prices for agricultural inputs, increased price fluctuations, closures of markets, and travel restrictions resulting in limited demand due to a lack of buyers and no tourists. Overall a fear of consumer-producer interactions was reported due to COVID-19 induced behavioral uncertainties. Changes in the market structures also resulted in higher food waste at the farm level. Smallholder farmers in Brazil reported reduced income due to disruptions to the normal functioning of institutional markets (School Feeding Programme - PNAE and Food Acquisition Programme - PAA) and an increase in food waste at the farm level. There were no market options, with a drop in sales due to the closure of open fairs, restaurants, and catering. The reduced capacity to act, sell and purchase collectively due to gathering restrictions was felt by all farmers in all countries.

3.1.3. Health and wellbeing. The general public health and well-being of smallholder farmers were threatened by the pandemic and the response to it. More consumption at household levels due to "stay at home" orders and COVID-19 fears alongside difficult access to public health services in rural places can be observed. In Tanzania, smallholder farmers faced high risk due to government reluctance to acknowledge the presence of the pandemic. Farmers interviewed responded that COVID-19 was not in the country by God's grace. This hindered public health information, thus putting people at high risk. There was no substantial change in the means to access information. In this case, the health and well-being of people were threatened by the spread of COVID-19, even though there were no reported cases at the study sites in

Tanzania. The other health concern centered on the reduction of food varieties in the markets due to market disruptions caused by the pandemic. In Madagascar, reduced farm productivity and incomes jointly contributed to a general impoverishment of diet quality. Relative to previous years, many farmers reported reductions in both the number of meals per day and food diversity (many reported an increase in the share of staples vs. other food groups in household meals). As the price of rice, the preferred staple in the study region in Madagascar, has increased during the pandemic, farmers have increasingly replaced rice in their diets with cheaper local staples, including cassava and breadfruit. Some farmers reported a reduction in physical activity among their family members, linked with a decreased quality of diets.

3.2 Coping strategies

In the scenario of coping strategies, we find some commonalities and case-specific strategies adopted by smallholder farmers in all three countries. The most common adaptation strategy was consumption of own-produced food rather than taking it to the market, diversification of economy/agro-biodiversity by producing different crops (for own consumption) rather than depending on staple foods, the role of rural credit schemes, the application of e-commerce, and the use of the universal recommended standard for COVID-19 prevention measures of mask-wearing, social distancing, and sanitization. In Brazil, the rural credit schemes was sought to help farmers access small loans to recover from economic crisis. The e-commerce was adopted by few mixed farmers (small traders) who used mobile technology in search for markets. Regarding more specific adaptation techniques, open markets are important places for Brazilian small farmers to sell their products. Due to the pandemic, these markets were suspended, either because of the closing of the places where they took place (universities, schools, shopping malls) or due to municipal decrees that prohibited the carrying out of this type of trade; in some cases, fairs were still functioning, with security measures and reduced movement—which also reduces farmers' income leading to food waste on the farm level. However, the farmers that had the chance to engage in establishments that deliver to homes or to pick-up points, such as organized consumption groups, have experienced an increase in their demand. Another aspect from Brazilian farmers that can be considered a strategy to cope with crises is that 99,5% of the respondents said that they adopted agroecological practices in their properties and that these practices are the most appropriate for times of crisis. The agroecological farmers also reported a less impact of the pandemic to sell their product and for them was possible to maintain the same income. The role of the rural extension was highlighted as a source of guidance for adaptation to the COVID-19 situation. Smallholder farmer organizations also played an important role in creating solidarity networks, in accessing the information on prevention and care, as well as in alternatives for logistics and food distribution, among other strategies. In Madagascar,

negotiating better prices was an important strategy (albeit with limited success) to stabilize incomes. Many farmers reported increased reliance on collecting wild food. In addition, trying to generate non-agricultural income was an important strategy to deal with the loss of farm-based income. For example, not only did farmers start producing and selling handicrafts, they also entered the services sector, e.g., transporting goods by rickshaw. Farmers tried to diversify their economy from only depending on agriculture and engage in other small businesses. However, this was not very effective as border closure resulted in limited trade, and loss of income reduced market for the products. Borrowing money to buy food was also a commonly mentioned strategy. In addition, changes in social relationships and social networks in family and community life resulting from the outbreak of COVID-19 are observable. Specific examples include fewer inter-family gatherings and fewer public gatherings.

3.3. Smallholders recommendations regarding needed government support

When farmers were asked for measures they missed or would recommend to their government for future pandemic management, two types of external support to cope with the COVID-19-related challenges were suggested. (1) First, as a short-term measure and to buffer declines in harvests and incomes, farmers suggested immediate aid through food or cash distribution to affected communities. Also, the reduction of interest rates of existing loans by financial and micro-financial institutions was stated as most helpful to better cope with pandemic effects. Access to subsidized credit schemes, as well as subsidized digital technology for agricultural markets search were common issues raised as the support needed by smallholder farmers in all three countries. Digital technology, here referred to access to mobile phones, at a low cost to facilitate market communication during times of pandemic.

Second, farmers suggested interventions that build agricultural resilience and increase productivity in the long run. Membership in farmers' cooperatives or associations was recommended by farmers to facilitate the finding of new markets. Directly linked to this strategy, however, is the identified need for government policies that support the formation or operation of smallholder farmers' collectives. Also, better availability of reliable extension services in rural areas for technical support was suggested to better cope with future crises situations. These recommendations included training on agronomic management and breeding, improvements in access to agricultural tools and inputs, such as plows and fertilizer, as well as support in the construction of irrigation dams. In Tanzania, the provision of low costs protective gear (masks) and sanitizers, as well as education on COVID-19 management, were also suggested by farmers.

4. Discussion

Findings of this research show that smallholder farmers in all the three countries, Brazil, Tanzania and Madagascar,

experienced reduced access to inputs, labor, and farmlands, resulting in production loss, lower household income, and nutrition declines. However, the severity of impact differed depending on factors such as containment measures. For instance, Tanzania was mostly hit by later phases of the pandemic because its government ignored the spread of the pandemic at the initial stage. Madagascar on the contrary took strict measures right at the onset of the pandemic.

These findings indicate similarities with other studies such as FAO (2021) on the impact of disasters and crises on agriculture and food security. FAO found that, across the world, the severity of the damage caused depends on multiple factors such as the timing of COVID-19's spread and respective containment measures vis-à-vis the calendar for agricultural activities, the disturbance of input prices and demand. This underlines the need to quantify the COVID-19 impact on the agricultural sector to determine the effort required to restore damages and meet capacity needs.

Survey findings by Cariappa et al. (2021) in Asia indicate that the pandemic has affected production and marketing through labor and logistical constraints, while the negative income shock restricted access to markets and increased prices of food commodities affecting the consumption pattern. The pandemic wreaked a substantial physical, social, economic and emotional havoc on all the stakeholders of Indian agricultural system.

African Fertilizer and Agribusiness Partnership (AFAP, 2020) reports that even though Tanzania did not close its borders, it still relies heavily on the import of agricultural inputs from Asia and Europe. Lockdowns implemented overseas have had an impact on the availability and price of agricultural inputs in the local market. AgriSMEs (small and medium agricultural enterprises) were affected in that there was low purchasing power, agricultural inputs were unavailable, and skepticism regarding doing farming activities during the pandemic developed. Over 40% of the AgriSMEs reported a significant negative impact on their ability to source agricultural inputs for sale. Uganda – 90% impact, Tanzania – 60%, Ghana – 40%, Mozambique – 55%, and Malawi – 62%. Over 45% of the AgriSMEs reported a significant negative impact on their ability to reach farmers with all services. Uganda – 80%, Tanzania – 50%, Ghana – 60%, Mozambique – 64%, and Malawi – 46% (AFAP, 2020).

Descriptive analysis of data collected from bean farmers, aggregators, processors, bean regional coordinators, and mechanization dealers by Nchanji et al. (2021) reveal that COVID-19 and government restrictions had impacted the availability and cost of farm inputs and labor, distribution, and consumption of beans in Eastern and Southern Africa.

Maredia et al. (2022) used rural and urban survey data from 4000 households across five African countries to assess the pandemic's effect on incomes and food consumption. They found that a large share of the population saw incomes drop between March and July 2020. But these decreases were 43–63% smaller than predictions and early estimates, and highly correlated with the severity of restrictions. The income and food consumption impacts of the

COVID-19 shock were widespread over both rural and urban areas.

We found that, in all three countries, communities use different coping strategies to offset the impacts of the pandemic on their wellbeing. These include, among others, the change of consumption pattern from market to farm produce, diversification of economy/agro-biodiversity, abstinence from staple food dependency, the role of rural credit schemes, application of e-commerce, as well as the use of universal recommended standards for COVID-19 prevention measures of mask-wearing, social distancing, and sanitization. We find that the focus on non-export commodities was adopted in Tanzania as a result of the government's banning of the exportation of cash crops during the pandemic. We also find that changes in social/community patterns, including fewer gatherings and increased distancing, were adaptation mechanisms resulting from fear rather than a known mechanism for COVID-19 pandemic prevention in Tanzania. In this case, it was not an attempt of the farmers to align with universal COVID-19 preventive measures because the majority did not believe that COVID-19 was in the country. The Tanzanian study by Boniface & Magomba (2021) reveals that all respondents reported that not only had no members of their household shown any COVID-19 symptoms, but they were also unaware of any confirmed cases in their villages. About 97% of respondents said they were able to access health services since the relaxation of restrictions on movement. The fear with regards to COVID-19 had significantly decreased and many did not consider it a serious threat to their health or wellbeing (Boniface & Magomba, 2021). The study by Boniface & Magomba highlights different approaches taken by Tanzania, in contrast to many other countries. The initial denial of COVID-19 by the Tanzanian government, led to different levels of thinking in terms of how serious the pandemic was. However, our study confirms that the levels of negative impacts to smallholder farmers in all countries were similar, Tanzanian population could be at greater risk due to low levels of awareness. While in Brazil on the national level, COVID-19 denial did also prevail, on subnational level different measures were introduced and thus greater recognition of COVID-19 severity existed than in Tanzania. Our study also shows that even if a government denies a pandemic, citizens are still affected and are in need of good information, access to protective measures, such as masks and sanitizer, as well as other government support like loans or subsidies to keep up economic and agricultural activities.

The results of this study show that COVID-19 affected many development challenges facing all countries. Further, measures and policies taken by the countries had negative impacts on the economic well-being of their citizens. In this, we draw a lesson to prepare for future shocks so that measures taken to mitigate the problem do not bring other problems. The outbreak of the pandemic, its consequential effects, and measures taken attributed to other impacts, such as increased agricultural input pricing, high food prices, and a limited supply of agricultural labor in all countries. This is similar to Rukasha et al. (2021), who find that low availability and/or high

prices of inputs, such as pesticides, weighed on yields and crop production in 2020 and 2021, particularly in developing countries. Closed borders or slowing the transboundary movement of seeds potentially hamper seed supply chains and the on-time delivery of seeds with negative impacts on agriculture, feed, and food production over the next season and further into the future (Rukasha et al., 2021). Further research must therefore examine the extent to which these economic disadvantages are actually outweighed by the benefits of closed borders with respect to the spread of the pandemic. The question of the effectiveness of lockdown measures is central to learning from this crisis.

Given that the COVID-19 crisis affects the production and income (and other factors etc.) of smallholder producers, the prolongation of this crisis could aggravate the situation even further. To prevent this from happening, greater efforts must be made with public policies aimed at reducing income-related problems (e.g., the fast, efficient, and fair availability of liquid assets to smallholder farmers) and improving the food security of smallholder farmers in the study regions. Although the current analysis does not show whether the measures taken by governments lessened the detrimental effects of the restrictions, further steps are needed to prevent additional negative impacts on the subsistence and livelihoods of small producers. In the future, during possible recovery phases from the crisis, public policies that provide support to the most vulnerable groups and that ensure steady food production for local markets will play an important role. Policies aimed at increasing the income of smallholder farmers could help them to continue their productive activities, thus avoiding a possible collapse of agricultural production and helping them to overcome food insecurity. Further, it is necessary to implement policies that facilitate access to transport and to inputs required for production.

Based on the findings, continued health communication around the importance of COVID-19 prevention practices, health services strengthening, and programming aimed at economic strengthening is recommended. While most participants had some degree of knowledge about COVID-19 symptoms, there were gaps in understanding. This suggests that more work needs to be done to understand the information about COVID-19 and how this information delivery can be improved.

Lastly, as the impact of the COVID-19 pandemic on agriculture sector subsidies, policymakers will need to pivot and shift spending to investments that can enhance sector-wide resilience. Governments should adopt comprehensive economic recovery packages with measures that include new liquidity, flexibilities in taxes, or subsidies that will be applied to firms in the agriculture and food sector. At the same time, governments in need to create specific financial support measures for the agriculture and food sector.

6. Conclusion

The findings in all three countries suggest that the COVID-19 crisis has negatively affected smallholders' agricultural production, leading to a vicious cycle of low

production, low incomes, and higher food insecurity. In the three countries of Brazil, Madagascar and Tanzania, we find that smallholder farmers are in a more difficult position today than at the beginning of the pandemic, mainly due to the long exposure to high input prices and lower prices for their products. Although these are results observed only in the short term, the multiple challenges identified are likely to continue to affect sector performance and the food security of these farming populations in the medium- to long term. COVID-19, like any other crisis, is resource-intensive.

The immediate and/or short-term impacts of the COVID-19 pandemic on sustainable crop production systems originate from the near-universal response of governments to impose lockdowns in countries. This resulted in the inability of farmers, farm laborers, farm service providers, extension officers, input suppliers, processors, and other various actors in the food system to perform their tasks. These constraints may manifest themselves in the failure to plant crops in a timely manner or in the failure to use optimal quality and quantities of inputs needed (such as seeds, fertilizers, pesticides). Other issues arise with respect to carrying out varied cultural practices, harvesting, and post-harvest activities. The effect of this is that the expected crop production is not readily available to those who need it, where and when it is needed. While some may experience temporary setbacks from which production systems may recover relatively easily, the effects on more vulnerable smallholder farmers will persist (FAO, 2020a). This work reaffirms that continued exposure to the crisis seems to have increased the negative effects on respondents' agricultural production and income.

Three major impacts of COVID-19 on the welfare of smallholder farmers in case study countries can be observed in the agriculture and food sector. Firstly, the production of certain agricultural products was reduced due to the unavailability of labor, restrictions in the access to intermediate agriculture inputs, and the incapacity to sell output. Secondly, impacts on consumer demand driven by unemployment and income shocks associated with the containment measures and consumer shift in demand for food services. Thirdly, supply chain disruptions are due in part to the contamination of employees in processing firms, the adoption of distancing and sanitary requirements, and transport and logistic issues. Lastly, the principal preventative measures against COVID-19 of using running water, face masks, and/or sanitizers are all costly and, typically, a luxury; both are normally out of reach for most of the poor and vulnerable, especially in rural areas.

Based on these findings, the need for more proactive measures to support smallholder farmers in rural areas becomes apparent in order to protect them against the spread of the pandemic and future shocks as well as continue agricultural activities. Our findings also showed that farmers who adopt agroecological practices were less impacted by the increase in the input prices and the decrease in market demand for products. This fact demonstrates that the adoption of these practices, as they increase the

resilience of the agricultural production system, should be encouraged and considered strategic for facing crises.

Further research on the impacts of COVID-19 is needed, with a focus on different government approaches in order to identify implications for multi-level governance as well as points for policy-makers to consider as they build more resilient countries.

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The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.




Ethics declaration

This study was a non-interventional study. Participation in the study was voluntary. All interviewees were informed about the purpose of this study and data protection issues by the enumerators and gave their consent orally at the beginning of each interview. Data is analyzed and presented in anonymous and aggregated form.

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ORCID iDs

Katharina Löhr  <https://orcid.org/0000-0003-2691-9712>
 Paschal Mugabe  <https://orcid.org/0000-0002-6592-2087>
 Ana Paula Dias Turetta  <https://orcid.org/0000-0002-8987-1747>

References

- AFAP (2020) *COVID-19 Impact Assessment on the AgriSMEs and Farming Communities of Ghana*. Malawi, Mozambique, Tanzania and Uganda. Johannesburg, South Africa: African Fertilizer and Agribusiness Partnership.
- Arias D, Vieira PA, Contini E, et al. (2017) *Agriculture Productivity Growth in Brazil: Recent trends and future prospects*. *Brazil productivity growth flagship report*. Brazil: World Bank.
- Baxter P and Jack S (2008) Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report* 13: 544–559.
- Boin A, Hart P and Kuipers S (2018) The crisis approach. In: Rodríguez H, Donner W and Trainor JE (eds) *Handbook of Disaster Research. Second Edition*. Cham: Springer International Publishing, pp.23–38.

- Bonfrer I and Gustafsson-Wright E (2017) Health shocks, coping strategies and foregone healthcare among agricultural households in Kenya. *Global Public Health* 12(11): 1369–1390.
- Boniface G and Magomba C (2021) A Multi-Phase Assessment of the Effects of COVID-19 on Food Systems and Rural Livelihoods in Tanzania. APRA COVID-19 Country Report, Brighton: Future Agricultures Consortium.
- Cariappa AA, Acharya KK, Adhav CA, et al. (2021) Impact of COVID-19 on the Indian agricultural system: A 10-point strategy for post-pandemic recovery. *Outlook on Agriculture* 50(1): 26–33.
- CoronaNet (2021) *Corona Net Research Program*. Available at <https://www.coronanet-project.org/index.html>. Assessed on 15th September 2022.
- Daum, et al. (2020) Between pandemics and famines: Towards nutrition-sensitive lockdowns during Covid-19 and beyond, Working Paper 6-20, Universität Hohenheim.
- Dhanaraj S (2014) Health Shocks and Coping Strategies: State Health Insurance Scheme of Andhra Pradesh, India. WIDER Working Paper Series wp-2014-003, World Institute for Development Economic Research (UNU-WIDER).
- FAO. (2020a) Food Security in a Pandemic. Response Tool Kit: Tool 7. Available at https://www.paho.org/disasters/dmdocuments/RespToolKit_14_Tool%207_FoodSecurityinaPandemic.pdf. Accessed on 24th March 2022.
- FAO (2020b) *COVID-19 and smallholder producers' access to markets*. FAO.
- FAO (2021) *The impact of disasters and crises on agriculture and food security*. Rome: FAO.
- Ferigato S, Fernandez M, Amorim M, et al. (2020) The Brazilian government's mistakes in responding to the COVID-19 pandemic. *Lancet (London, England)* 396(10263): 1636.
- Graeub BE, Chappell MJ, Wittman H, et al. (2016) The state of family farms in the world. *World Development* 87: 1–15.
- HLPE (2013) *Investing in smallholder agriculture for food security*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome
- KPMG (2020) *Brazil - Government and institution measures in response to COVID-19*. Available at <https://home.kpmg/xx/en/home/insights/2020/04/brazil-government-and-institution-measures-in-response-to-covid.html>. Assessed on 15th September 2022.
- Leal Filho W (2011) *The Economic, Social and Political Elements of Climate Change*. Berlin, Heidelberg: Springer Berlin Heidelberg (Climate Change Management).
- Leive A and Xu K (2008) Coping with out-of-pocket health payments: Empirical evidence from 15 African countries. *Bulletin of the World Health Organization* 86(11): 849–856.
- MAPA - Ministério da Agricultura e Abastecimento (2020). Available at <https://www.gov.br/agricultura/pt-br>. Assessed on 15th September 2022.
- Maredia MK, Adenikinju A, Belton B, et al. (2022) COVID-19's impacts on incomes and food consumption in urban and rural areas are surprisingly similar: Evidence from five African countries. *Global Food Security* 33: 100633.
- Nchanji EB and Lutomia CK (2021) Regional impact of COVID-19 on the production and food security of common bean smallholder farmers in sub-saharan Africa: Implication for SDG's. *Global Food Security* 29: 100524.
- Ngenoh E, Kebede SW, Bett HK, et al. (2018) Coping with shocks and determinants among indigenous vegetable smallholder farmers in Kenya. *Agricultural Sciences* 9(07): 04.
- Ngenoh E, Kurgat BK, Bett HK, et al. (2019) Determinants of the competitiveness of smallholder African indigenous vegetable farmers in high-value agro-food chains in Kenya: A multivariate probit regression analysis. *Agricultural and Food Economy* 7: 2.
- Nicola M, Alsafi Z, Sohrabi C, et al. (2020) The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery* 78: 185–193.
- Preiss PV (2020) Challenges facing the COVID-19 pandemic in Brazil: Lessons from short food supply systems. *Agriculture and Human Values* 37(3): 571–572.
- Rukasha T, Nyagadza B, Pashapa R, et al. (2021) Covid-19 impact on Zimbabwean agricultural supply chains and markets: A sustainable livelihoods perspective. *Cogent Social Sciences* 7(1): 1928980.
- Staistica (2022) Cumulative number of confirmed coronavirus (COVID-19) cases in Tanzania as of June 1, 2022. Available at <https://www.statista.com/statistics/1258560/confirmed-covid-19-cases-in-tanzania/>. Accessed on 25 August 2022.
- The World Bank (Ed.) (2020) Covid-19 in Brazil: Impacts and policy responses. Available online at <http://documents1.worldbank.org/curated/en/152381594359001244/pdf/Main-Report.pdf>. Accessed on 23 March 2022.
- Turetta APD, Bonatti M and Sieber S (2021) Resilience of community food systems (CFS): Co-design as a long-term viable pathway to face crises in neglected territories? *Foods (Basel, Switzerland)* 10(3): 21.
- United Nations (2020) Tanzania Emergency Appeal: Flash appeal for covid-19 Tanzania. July -December 2020. UN.
- Vall E, Mburu J, Ndambi A, et al. (2021) Early effects of the COVID-19 outbreak on the African dairy industry: Cases of Burkina Faso, Kenya, Madagascar, and Senegal. *Cahiers Agricultures* 30: 14.
- World Bank (2020) Madagascar Economic Update: COVID-19 Increases Poverty, a New Reform Momentum is Needed to Build Back Stronger. Available at <https://www.worldbank.org/en/country/madagascar/publication/madagascar-economic-update-covid-19-increases-poverty-a-new-reform-momentum-is-needed-to-build-back-stronger>. Accessed on 25 March 2022.
- Yilmaz AG, Hossain I and Perera BJC (2014) Effect of climate change and variability on extreme rainfall intensity–frequency–duration relationships: A case study of Melbourne. *Hydrology on Earth System Science* 18: 4065–4076.