Sprin Journal of Arts, Humanities and Social Sciences

ISSN: 2583-2387 (Online)

Vol. 4(5), June 2025, pp, 13-23

Journal homepage: https://sprinpub.com/sjahss

Research Article

Analyzing the Impact of COVID-19 on Agricultural Cooperatives in Rwanda: Coping Strategies of the Dukunde Umurimo Cooperative

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ARTICLE INFO

Keywords:

Agricultural Cooperatives, COVID-19 pandemic, Dukunde Umurimo, Coping strategies, and Resilience

Article History:

Received: 01-04-2025

Accepted: 15-06-2025

Published: 22-06-2025

ABSTRACT

This study aims to unravel the profound impacts of the COVID-19 pandemic on Rwanda's agricultural cooperatives, concentrating on the nuanced dynamics within the Dukunde Umurimo cooperative. Its primary focus lies in assessing the extent of Covid-19's influence on the cooperative's members, exploring their adopted coping mechanisms, identifying post-pandemic challenges, and proposing strategies to alleviate these identified challenges. Employing a mixed-methods approach combining qualitative and quantitative research designs, the study encompassed 755 members of Dukunde Umurimo Cooperative, with a sample of 88 derived through the Yamane formula utilizing simple random and purposive sampling techniques. Data collection involved interviews, questionnaires, and documentation techniques. Utilizing descriptive statistics—frequency and percentage analysis—and comparative methods, the research evaluated cooperative productivity across pre-Covid, during, and post-Covid periods. Findings revealed a notable decrease in income and sales quantities during the Covid-19 period, followed by a significant post-pandemic increase. Concurrently, reductions in production, sales, and demand emerged as prominent challenges faced by Dukunde Umurimo cooperative members. Based on these findings, recommendations include strengthening resilience through diversification, and enhance the insurance risks management for the agricultural produce.

Cite this article:

CYUZUZO, A. C., Rufus, J., & Vasanthakaalam, H. (2025). Analyzing the Impact of COVID-19 on Agricultural Cooperatives in Rwanda: Coping Strategies of the Dukunde Umurimo Cooperative. Sprin Journal of Arts, Humanities and Social Sciences, 4(5), 13–23. https://doi.org/10.55559/sjahss.v4i5.494

1. Introduction

The COVID-19 pandemic has profoundly impacted the global economy and pushed an estimated 420 to 580 million people into poverty and reversing decades of progress (Sumner, Hoy, & Ortiz-Juarez, 2020). In Rwanda, the government implemented a nationwide lockdown on 14 March 2020 to curb the spread of virus. Non-essential businesses were closed, and movement was restricted, with exceptions for critical needs. Shops and markets selling food and essential items remained open, while restaurants operated on a takeaway-only basis. Motorcycle taxis were limited to delivery services, and most industries halted operations except for agro-processing and essential supply production. Although agriculture was exempt, transporting goods required administrative clearance.

The World Bank estimated that the COVID-19 crisis would push about 40 and 60 million people into extreme poverty, most of them in sub-Saharan Africa (Mahler, Lakner, Aguilar, & Wu, 2020) while it is expected between 420 and 580 million people would be pushed into poverty, reversing decades of decreasing poverty trends (Sumner, Hoy, & Ortiz-Juarez, 2020).

The pandemic's impact varied globally, with health system resilience playing a critical role (Sharma et al., 2020). Agriculture in Africa was significantly disrupted by containment measures that affected production, supply chains, and marketing channels. Lockdowns and border closures exacerbated transportation challenges and market disruptions, causing increased costs and reduced food availability. Informal and seasonal agricultural labourers were particularly vulnerable, and perishable goods suffered significant losses, further straining farmers' incomes (Mishra et al., 2021; Uğur & Buruklar, 2021).

Staple food prices surged across many African nations due to supply chain disruptions and panic buying, though surplus harvests caused price declines in some Southern African regions. Economic constraints and the closure of eateries reduced demand for nutritious foods, severely affecting agro-processing Small and Medium Enterprises (SMEs). These businesses faced reduced sales, limited market access, and increased input costs, leading to decreased capacity and employment. The severity of these impacts varied depending on company size, reliance on global markets, and government restrictions (FAO, 2021a–2021f).

In Rwanda, the agricultural sector encountered unprecedented challenges, particularly within cooperatives. Transportation disruptions, delays in customs clearance, restricted credit access, and rising input costs jeopardized farming operations' sustainability. Perishable produce further

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https://doi.org/10.55559/sjahss.v4i5.494

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compounded the issue, leading to significant financial losses for farmers and threatening food production and supply chains.

Despite growing research on the pandemic's economic effects on Rwanda's agriculture, a critical gap remains in understanding its impact on agricultural cooperatives. While studies such as those conducted by Arumugam *et al.* (2021), Bizoza and Sibomana (2020), Rwigema (2021), and Aragie (2021) have diligently addressed the broader impacts on the agricultural landscape, none have specifically scrutinized the effects on agricultural cooperatives. Therefore, this study addresses that gap by focusing on the Dukunde Umurimo Cooperative, which operates in both international and domestic markets. Specializing in produce such as peppers, green beans, onions, flowers, and carrots, the cooperative serves as an ideal case study. By examining Dukunde Umurimo's challenges, coping strategies, and potential mitigation measures, this research aims to provide valuable insights into the resilience of Rwanda's agricultural cooperatives during the COVID-19 crisis.

2. Materials and Methods:

This study employed a descriptive research approach, integrating both qualitative and quantitative methodologies, to examine the impact of the COVID-19 pandemic on agricultural cooperatives, with a specific focus on the Dukunde Umurimo Cooperative in Rwanda, located in Rulindo District. The target population consisted of 755 members, as recorded in September 2023. Through this mixed-method design, the study sought to capture the nuanced effects of the pandemic on the cooperative's operations, analyzing quantitative data for statistical insights and qualitative data to understand the experiences, challenges, and adaptations observed among cooperative members during this unprecedented period.

The sample size was determined using Yamane's formula (1967), as outlined below:

$$N = \frac{N}{1+N(e)2}$$

Where n is the sample size; N is the size of the population; e is a marginal error which is equal to 10% (0.1).

So, the sample size was: $n = \frac{755}{1+755(0.1)2} = \frac{755}{8.55}$; n= 88.30 ~ 88;

hence, the sample size was 88

The selection of this sample involved the utilization of both simple random and purposive sampling techniques to ensure a representative and insightful collection of data from cooperative members. Simple random sampling ensured an equal probability of selection for each member within the cooperative, while purposive sampling was employed to include specific criteria, such as involving the cooperative's leadership, within the sample selection process. Data collection encompassed Key Informant Interviews (KII), questionnaires, and documentation techniques. Interviews, primarily involving Dukunde Umurimo Cooperative leaders, were conducted through face-to-face, telephone, and virtual sessions. Questionnaires were utilized to gather information from general cooperative members, administered either in face-to-face interactions or physically via printed questionnaires. Documentation techniques were instrumental in acquiring pertinent literature from reports, prior research, and relevant books associated with the study.

Data processing involved editing, coding, and tabulation techniques. Editing ensured data accuracy, followed by coding for organization and tabulating for systematic presentation. For data analysis, descriptive statistical methods, employing frequency and percentage calculations, were utilized, alongside comparative analysis techniques to discern patterns and differences within the collected data.

A formal letter of consent was obtained from the Dukunde Umurimo Cooperative (DUC) administration, granting permission for data collection. Subsequently, individual consent was sought from participants, who were informed about the study's objectives and their right to voluntary participation. Consent forms were signed by participants, acknowledging their understanding of the study's scope and their confidentiality rights. The study ensured the protection of participants' anonymity as all data collected were used exclusively for research purposes. To maintain ethical standards, the data was securely stored on a password-protected laptop.

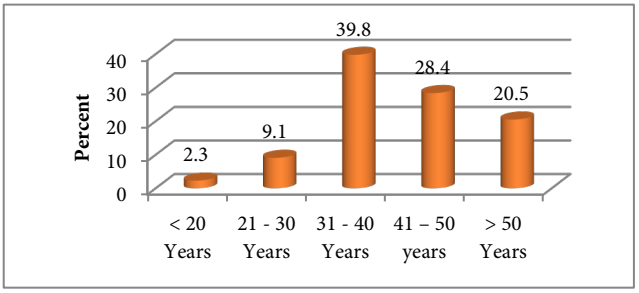
Lastly, this study is subject to certain limitations, particularly the potential for sampling bias due to the use of purposive sampling techniques, which may limit the generalizability of the findings to the broader population of cooperative members. Additionally, while relevant literature was reviewed to contextualize the findings, gaps remain due to the limited availability of localized, longitudinal studies on the economic resilience of cooperatives during the COVID-19 pandemic in Rwanda and comparable Sub-Saharan African contexts.

3. Results and discussion

3.1 Demographic profile:

Based on the study, it was evident that 88.7% of the respondents were above 31 years old, with the peak age range being 31–40 years, followed by 41–50 years (28.4%) and those above 50 years (20.5%). On the younger end, 9.1% were aged between 21 and 30 years, and only 2.3% were under 20 years. The majority of respondents were male (53.4%), compared to females (46.6%), and most were married (85.2%), while the remainder were single (5.7%), widowed (6.8%), or divorced (2.3%). Regarding education, 13.6% of respondents were illiterate, while 51.1% had completed primary education, 29.5% secondary, and 5.7% tertiary education. Family size was generally large, with 39.8% of households having 7–10 members, 37.5% having 4–6 members, and only 5.7% having fewer than four.

Furthermore, the analysis could be enhanced by explicitly connecting these variables—such as age, gender, and educational attainment—to respondents' coping strategies and vulnerability to the socio-economic shocks of the pandemic. For instance, older or less-educated members may have faced greater barriers in adapting to digital platforms or alternative markets, while younger or better-educated members may have been more adaptive and resilient. Gender disparities also deserve attention, as women often faced compounded vulnerabilities due to care responsibilities and reduced access to financial services. Addressing these dynamics would provide a more nuanced understanding of differential resilience among cooperative members. Minor grammatical refinements across the section would also enhance clarity and polish.



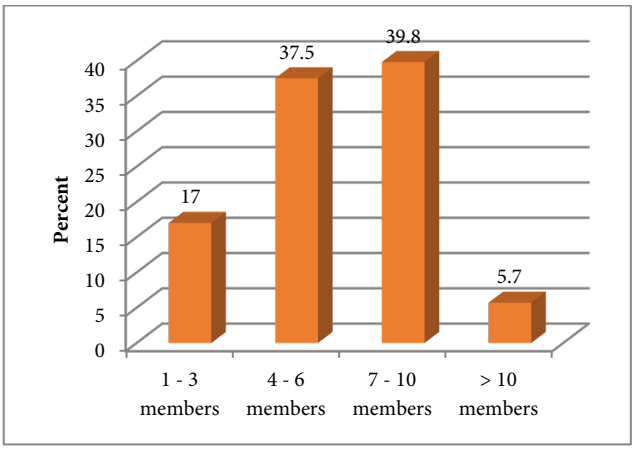
Source: Primary data, 2023

Fig 1: Age range of participants

Table 1: Demographic profile of study participants from DUC

Items		N	Percentage (%)
Age	Under 20 Years	2	2.3
	21 - 30 Years	8	9.1
	31 - 40 Years	35	39.8
	41 – 50 years	25	28.4
	Above 50 Years	18	20.5
	Total	**88**	**100.0**
Gender	Male	47	53.4
	Female	41	46.6
	Total	**88**	**100.0**
Marital status	Single	5	5.7
	Married	75	85.2
	Widower	6	6.8
	Divorced	2	2.3
	Total	**88**	**100.0**
Educational background	Illiterate	12	13.6
	Primary level	45	51.1
	Secondary level	26	29.5
	Tertiary education	5	5.7
	Total	**88**	**100.0**
Family size	1 - 3 members	15	17.0
	4 - 6 members	33	37.5
	7 - 10 members	35	39.8
	> 10 members	5	5.7
	Total	**88**	**100.0**

Source: Primary data, 2023



Source: Primary data, 2023

Fig 2: Number of family members in the families of the participants

3.2 Effects of the COVID-19 pandemic on the members of Dukunde Umurimo Cooperative

Globally, the pandemic in general was a stressful period. Worldwide, the pandemic and lockdown measures significantly affected many food systems, particularly marketing of agricultural inputs and products, food processing, and employment along food value chains (Kpadé, Bélanger, Laplante, Lambert, & Bocoum, 2023). It affected all kinds of activities. But agriculture sector that provides food to humanity was greatly hampered. The members of the cooperative encountered several challenges due to the pandemic is indicated in the table below (Table 2) and categorized as Very High (VH), High (H), Moderate (M) and Low (L).

Table 2: Challenges encountered by DUC

Items	VH		H		M		L	
	n	%	n	%	n	%	n	%
Unemployment problem	6	6.8	6	6.8	-	-	76	86.4
Disruption of Supply chain	25	28.4	60	68.2	-	-	3	3.4
Reduction in production, sales, & demands	88	100	-	-	-	-	-	-
Reduction of profit	19	21.6	51	58.0	9	10.2	9	10.2
Financial loss	61	69.3	27	30.7	-	-	-	-
Lack of agriculture inputs	42	47.7	40	45.5	4	4.5	2	2.3
Sales of products at a lower price	88	100	-	-	-	-	-	-
Absence of basic needs in the households	3	3.4	72	81.8	7	8.0	6	6.8

Source: Primary data, 2023

Globally, the COVID-19 pandemic constituted a major disruption to livelihoods and economic systems. The agriculture sector, a cornerstone of food security and rural income, was particularly impacted due to mobility restrictions, supply chain disruptions, and declining market demand (Kpadé et al., 2023). In Rwanda, like in many developing countries, smallholder farmers and agricultural cooperatives such as Dukunde Umurimo Cooperative (DUC) were among the hardest hit.

Findings from Table 2 illustrate the magnitude of the challenges encountered by DUC members, categorized by severity. Notably, 100% of respondents reported a reduction in production, sales, and demand, and the entire cooperative was forced to sell products at lower prices, signifying a total disruption in market access. These disruptions resonate with the resilience theory, which posits that systems (including socio-economic systems) have thresholds beyond which they lose functionality and require transformation or adaptation (Walker et al., 2004).

Supply chain disruptions were also significant, with 68.2% of respondents rating the impact as high. This reflects the vulnerability of localized agricultural value chains to global and national mobility restrictions, a key concern within the socio-ecological systems theory. This theory emphasizes the interdependence between human systems (cooperatives, markets, households) and ecological processes (farming systems, input cycles), and how disturbances such as pandemics test the adaptive capacity of these coupled systems (Folke, 2006).

The lack of agricultural inputs, which 47.7% of respondents rated as very high and 45.5% as high, aligns with findings from a

study by Oxfam (2020) in Rwanda, which reported that 20% of horticultural farmers struggled to access seeds and seedlings, while 18% faced fertilizer shortages due to border closures and intercity movement restrictions. The Institutional Theory, which examines how institutional arrangements, policies, and support systems affect actors' ability to respond to shocks, offers a lens to interpret these findings. DUC members, largely reliant on institutional support for input access and market linkages, were exposed when those support systems failed or were inadequate, thereby revealing institutional weaknesses.

Despite these major disruptions, unemployment within the cooperative was perceived as low by 86.4% of the members. This resilience in maintaining employment levels can be interpreted through the resilience theory's concept of absorptive capacity, which is the system's ability to absorb shocks while maintaining essential functions (Béné et al., 2012). It suggests that while income and profitability were affected, the cooperative members remained engaged in farming and community-level agricultural activities.

Comparatively, agricultural cooperatives across Sub-Saharan Africa faced similar patterns of disruption. In Kenya, a studies of Njehia (2023) and the study of Bitzer et al., (2024) highlights how farmer cooperatives encountered a sharp decline in access to agro-inputs and saw market closures that forced them to sell products at lower-than-usual prices. Similarly, in Nigeria, Ayanlade and Radeny (2020) reported that 74% of rural farmers experienced income shocks due to limited market access and delayed harvesting. These comparative experiences validate the findings in Rwanda and indicate that DUC's experience is part of a wider regional trend that highlights both the vulnerabilities and partial resilience of agricultural cooperatives during pandemics.

Additionally, the financial losses reported by 69.3% of DUC members, and the reduction of profit (58%), underscore the economic fragility of cooperative members during the pandemic. According to JICA (2022), similar losses in Rwanda's agriculture sector were attributed to disruptions in harvesting cycles, labor shortages, and unstable access to financial services. These findings highlight how crises expose and exacerbate structural vulnerabilities that cooperatives face—issues often cushioned by informal social networks and institutional arrangements pre-pandemic, but overwhelmed during large-scale shocks.

In light of the Institutional Theory, the inability of cooperatives to maintain access to essential services during the crisis indicates gaps in cooperative governance, dependency on centralized markets, and weak linkages with national emergency support systems. Cooperative members often depend on institutional partnerships for credit, technical support, and insurance; their disruption rendered the farmers more economically vulnerable (Organic Without Boundaries, 2020).

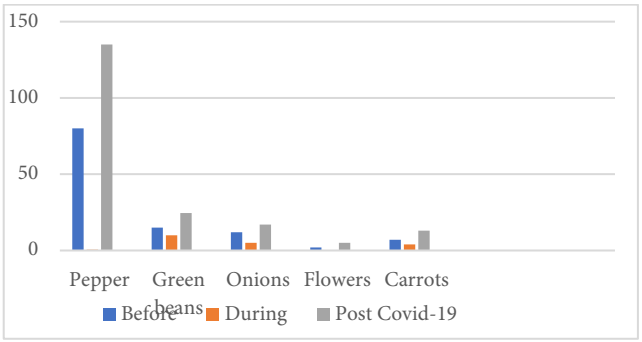
Moreover, the reported 81.8% rate of absence of basic needs in households reflects the cascading effects of production and market failures. In socio-ecological terms, this is indicative of a disturbance that moved beyond economic productivity to affect household-level well-being, nutritional access, and community resilience. Research from Uganda and Malawi also shows that food insecurity increased significantly among farming households during COVID-19, especially those involved in perishable crop production (World Bank, 2021).

The resilience theory encourages a shift toward building adaptive capacity through diversification, redundancy in supply chains, and decentralized market systems. Lessons from DUC suggest that while cooperatives displayed some absorptive resilience (e.g., continued employment), their adaptive and transformative capacities were limited by structural dependencies on external markets and institutional inefficiencies.

Furthermore, the experience of DUC supports the argument that resilience in agricultural cooperatives is not only ecological or technical but also institutional. Therefore, post-pandemic recovery policies should incorporate multi-scalar resilience frameworks that integrate institutional reform, community-based adaptation strategies, and enhanced autonomy in input sourcing and market access.

3.3 Agricultural Landscape at Dukunde Umurimo Cooperative: Pre- and Post-COVID-19

The cooperative under study produced the following horticulture crops: pepper, green beans, onions, carrots and flowers. An analysis on their production was made before, during and after COVID-19 period. As shown in Figure 3, the seasonal sales volume before the pandemic revealed distinct trends in product demand.



Source: Primary data, 2023

Fig 3: A comparison of the quantity of the volume of agricultural production

Prior to the COVID-19 pandemic, the Dukunde Umurimo Cooperative demonstrated a relatively stable and productive agricultural landscape, focusing primarily on horticultural crops such as pepper, green beans, onions, carrots, and flowers. Pepper was the most demanded commodity, with seasonal sales reaching 80 tons, followed by green beans (15 tons), onions (12 tons), carrots (7 tons), and flowers (2 tons), indicating strong local market demand and effective production capacity.

However, the outbreak of the COVID-19 pandemic drastically altered this trajectory. In alignment with global trends, the cooperative experienced significant disruptions in production and market linkages, primarily attributed to restrictive public health measures such as lockdowns, travel bans, and disruptions in international and local supply chains. The most severe impact was on pepper and flower production, which declined by 100% and 70% respectively, while onions, carrots, and green beans saw declines of 58.4%, 42.9%, and 44.4%, respectively.

This sharp decline in agricultural performance can be framed within Resilience Theory, which emphasizes the capacity of individuals or systems to absorb disturbance and reorganize while undergoing change (Folke et al., 2010). The pandemic served as a systemic shock that tested the resilience of the cooperative's socio-economic and agro-ecological systems. The cooperative's partial recovery in the post-COVID-19 period illustrates the adaptive capacity of its members, who gradually resumed agricultural activities through modified strategies and resource utilization, in line with the core tenets of resilience.

The experience of Dukunde Umurimo also resonates with the Socio-Ecological Systems (SES) Theory, which views human communities and natural ecosystems as interconnected and co-evolving systems (Berkes, Colding, & Folke, 2002). The disruption in supply chains and access to agricultural inputs—resulting from movement restrictions and market closures—highlighted the

fragility of external dependencies within the system. However, the observed recovery in the post-pandemic period indicates a degree of socio-ecological adaptability. Local resource mobilization, informal labor adjustments, and community-based support networks allowed the cooperative to slowly regenerate its productive base.

Moreover, Institutional Theory helps to explain the role of formal and informal institutions in shaping the cooperative's ability to navigate the crisis. The limitations imposed by pandemic-related policies exposed structural weaknesses in institutional support systems, particularly concerning agricultural extension services and market facilitation. As North (1990) argued, institutions—defined as the rules of the game—affect economic performance. The cooperative's recovery underscores the importance of institutional flexibility and support in enabling resilience, especially when formal structures are disrupted.

Comparative evidence from Sub-Saharan Africa further underscores these observations. For instance, in Kenya and Uganda, cooperatives experienced similar challenges in accessing inputs and markets due to pandemic restrictions, with reports of horticultural cooperatives in Kenya suffering losses of up to 60% in flower and vegetable sales due to export bans and supply chain failures (FAO, 2020). Similarly, a study conducted in Ghana by Anang, Mensah-Bonsu, and Boateng (2021) revealed that agricultural cooperatives faced decreased market access and limited input availability, though those with pre-existing adaptive mechanisms—such as diversified income sources and digital marketing channels—recovered more quickly.

In addition, this resurgence marked a notable recovery for the cooperative after the challenging period of the pandemic. Due to the mitigation and adaptation strategies that were put in place to combat the pandemic including local restrictions on travel bans, and lockdowns as well as the limitation of social gatherings led to limited access to farm inputs (seeds, fertilizers, etc.) due to disruption of supply chain and resulted in low agricultural production (Adebayo, Aromolaran and Muyanga, 2020). In Southeast Asian countries, there has been an overall decrease in agriculture production of 3.11% (17.03 million tons) in the first quarter of 2020 (Gregorio and Ancog, 2020). And this could be attributed to the rise in the price of seeds, and fertilizers, and the absence of labor (Gregorio and Ancog, 2020; Aromolaran and Muyanga, 2020).

In light of the theoretical frameworks and comparative analysis, it becomes clear that building long-term resilience in cooperatives like Dukunde Umurimo requires enhancing local capacities for adaptation, ensuring redundancy in critical systems such as input sourcing and labor, and strengthening institutional responsiveness. Supportive policy frameworks, improved risk communication, and the institutionalization of contingency planning can enhance both the ecological and economic resilience of such cooperatives in future crises.

3.4 Influence of pandemic on agriculture produce, price fluctuations and job creation

A comparison regarding the general income of Dukunde Umurimo Cooperative in the pre-pandemic, during, and in the post-pandemic period was done. Initially, the income per season for the cooperative stood at approximately Rwf 60,400,000 before the pandemic. However, at the height of the pandemic, this figure plummeted to Rwf 18,875,000. Remarkably, in the post-COVID-19 period, the cooperative experienced an exponential surge in income, surpassing its pre-pandemic levels to Rwf 90 600 000.

In the post-pandemic period, a noteworthy resurgence in prices was observed, surpassing pre-pandemic levels. Peppers were priced at 700 Rwf per kg, green beans at 500 Rwf per kg, onions at 360 Rwf per kg, while post-pandemic flower prices reached 40 Rwf each, and carrots were valued at 200 Rwf per kg. This marked increase in prices post-pandemic indicated a recovery surpassing the initial pre-pandemic rates for these agricultural products.

Job creation, during the pre-pandemic period indicated that each cooperative member, per season, facilitated the creation of an estimated 10 to 15 jobs. These roles encompassed various tasks such as cultivation, harvesting, ensuring security, and transportation of the harvest, among others. However, during the COVID-19 pandemic, a stark absence of recorded job creation was noted. This absence resulted from the cessation of numerous activities, especially non-essential tasks, aimed at curtailing virus transmission. Consequently, members dedicated their time predominantly to full-time work on their farms, a departure from their pre-pandemic engagement. Furthermore, reduced demands led cooperative households to predominantly rely on local markets, limiting the need for extensive transportation and additional labor.

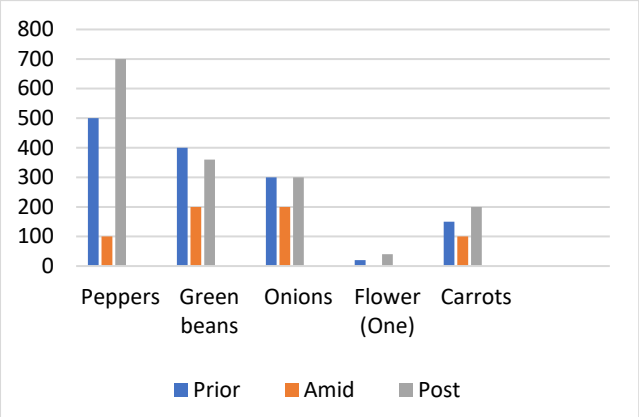
Conversely, in the post-pandemic period, a substantial increase in job creation emerged. Estimates indicated a surge to approximately 60 to 100 jobs created. This increase correlated with heightened demands and productivity levels. The advent of new domestic and international markets necessitated additional personnel across various facets, spanning cultivation, transportation, and financial operations. The amplified job creation signified resurgence in agricultural activities, reflective of the cooperative's adaptation to the evolving market dynamics post-pandemic.

Table 3: Income per season, Jobs created and amount of sales

Pandemic situation	Prior	Amid	Post
Income per season (Rwf)	60 400 000	18 875 000	90 600 000
Jobs created	10 - 50	0	60 – 100
Sales (per unit/kg) Rwf			
(a) Peppers	500	100	700
(b) Green beans	400	200	500
(c) Onions	300	100	360
(d) Flower (One)	20	0	40
(e) Carrots	150	100	200

Source: Primary data, 2023

The above table 3 that shows that the unit sale prices per kilogram (kg) of various produce that exhibited distinctive fluctuations before, during, and after the pandemic. During the pre-pandemic period, peppers were priced at Rwf 500/ kg, green beans at Rwf 400 / kg, onions at Rwf 300 / kg, while flowers and carrots were priced at Rwf 20/unit and 150 Rwf /kg respectively. Subsequently, these prices dropped significantly at the peak of the pandemic with peppers plummetingRwf 100 / Kg, green beans to Rwf 200 /kg, onions to Rwf 100 /kg, and carrots declining to Rwf 100 / kg.

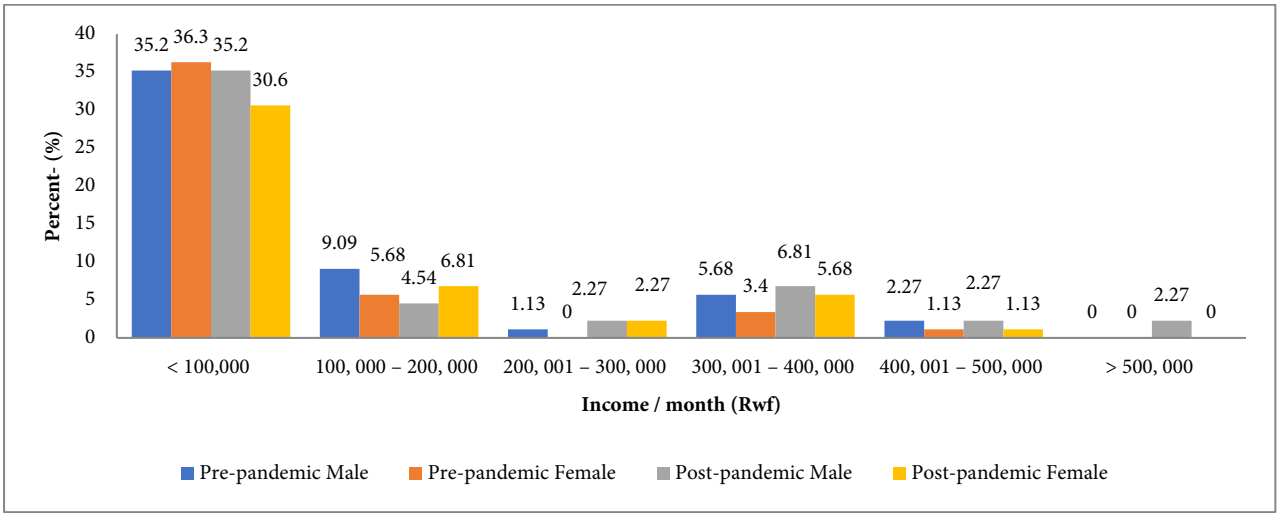


Source: Primary data, 2023

Fig 4: Number of Sales for Products Before and After COVID-19

3.5 Income of cooperative members before and during pandemic period

A comparison of the cooperative members' personal seasonal income before and during the post covid-19 pandemic period was done (Figure 6). The findings indicated that most members earned less than Rwf 100,000/month in both periods, with male members at 35.2% and female members at 36.3% before the pandemic, compared to 35.2% and 30.6% in the post-COVID-19 period, respectively. Income in the Rwf 100,000/month to Rwf 200,000/month range showed an increase among female members post-pandemic, rising from 5.68% to 6.81%, while male representation in this income range declined slightly from 9.09% to 4.54%. In the Rwf 200,001/month to Rwf 300,000/month categories, there was a slight increase in male members, rising from 1.13% to 2.27%, with females remaining constant at 2.27%.



Source: Primary data, 2023

Fig 5: Monthly income of Cooperative members' during pre and post COVID-19

In the Rwf 300,001/month to Rwf 400,000/month income bracket, there was an increase for males, from 5.68% before the pandemic to 6.81% post-pandemic, while female representation decreased slightly from 3.4% to 5.68%. Incomes in the Rwf 400,001/month to Rwf 500,000/month category remained relatively stable, with minor changes among both genders, while those earning above Rwf 500,000/month remained rare, with no females in this bracket and only a minor representation of males at 2.27% in the post-COVID-19 period. Overall, the data reveals that both male and female members experienced some shifts in income distribution, with a modest increase in higher-income brackets among men post-pandemic. However, a substantial proportion of members continued to earn below Rwf 100,000 monthly indicating limited economic advancement for the majority of members in the cooperative. This trend aligns with increased market productivity among cooperative members, contributing to augmented incomes in higher brackets while simultaneously decreasing incomes in lower brackets.

From a **resilience theory** perspective, these shifts reflect both adaptive and absorptive capacities among cooperative members in response to systemic shocks such as the pandemic. Resilience theory posits that the ability of communities or systems to absorb disturbances while maintaining core functions is crucial to their sustainability (Folke, 2006). The modest upward shift in some income brackets—particularly among men—indicates partial recovery and adaptability, possibly supported by institutional or market responses post-pandemic.

Socio-ecological systems theory also offers a pertinent lens to interpret these dynamics. This theory emphasizes the interdependence between human communities and the ecosystems they depend on. In the case of Dukunde Umurimo, disruptions in labor availability, input supply, and market access triggered systemic stress across the agricultural value chain. The gradual improvement in incomes for some members post-pandemic may reflect the re-stabilization of these interlinked systems and their capacity to reorganize without losing functionality (Walker et al., 2004).

Simultaneously, **institutional theory**—which underscores the role of formal and informal rules in shaping organizational behavior—helps explain the cooperative's income trends. Institutions such as cooperatives serve as mediating bodies between individuals and wider economic systems. In contexts where institutions rapidly adapt to crisis conditions, such as by reorganizing supply chains or accessing emergency funding, members tend to show improved economic outcomes (North, 1990; Ostrom, 2005). However, the persistent concentration of members in the lowest income bracket indicates institutional weaknesses in delivering inclusive resilience strategies, particularly for women.

The experiences of Dukunde Umurimo Cooperative mirror broader findings across Sub-Saharan Africa. Hammond et al. (2022) report that smallholder farmers across Rwanda, Kenya, Burundi, Tanzania, Uganda, and Zambia faced average income losses of up to 20% due to pandemic-related disruptions, with farm-based incomes declining by approximately 50% across all

study sites. Similarly, Mthembu, Mkhize, and Arthur (2022) found that COVID-19 severely impacted agricultural value chains in South Africa, reducing access to inputs and technical services and consequently limiting income generation among rural farmers.

Comparatively, some cooperatives in Sub-Saharan Africa demonstrated adaptive institutional responses that helped buffer income losses. For instance, the Mviwata Farmers' Network in Tanzania leveraged digital platforms to maintain market linkages, enabling a faster income recovery for its members (FAO, 2021). The contrast highlights the potential for institutional resilience-building strategies, such as digital innovation and local input sourcing, to enhance cooperative member welfare during crises.

In conclusion, while Dukunde Umurimo Cooperative exhibited elements of resilience—particularly among male members—the limited income mobility for the majority, and especially for female members, underscores the need for stronger institutional interventions. Embedding resilience-oriented strategies into cooperative frameworks, including gender-sensitive programming, diversified value chains, and contingency planning, could improve future outcomes in the face of socio-economic shocks.

3.5 Challenges and coping mechanism of Dukunde Umurimo Cooperative during COVID-19 pandemic

Following the onset of the pandemic, the Government of Rwanda, akin to some other global governments, implemented stringent measures such as total lockdowns, regional quarantines, and restrictions on public gatherings, closure of entertainment and hospitality activities, and enforced night curfews to curb the spread of the virus. While these measures played a role in mitigating the spread of the virus, their implementation significantly affected both micro and macroeconomic sectors.

Table 3 delineates challenges encountered by the agricultural cooperative attributable to the pandemic. The findings underscore a comprehensive array of challenges stemming from the pandemic, ranging from market closure to issues concerning investment, lockdown measures, inconsistencies in preventive strategies, and malfunctioning cold rooms. These challenges collectively impeded the operational efficiency and resilience of the agricultural cooperative during the pandemic period.

Table 43: Challenges faced by agricultural cooperative members during the pandemic

Challenges	Frequency	Percentage
Market closure	88	100.0
Lack of investment	70	79.5
Lockdown	80	90.9
Malfunctioning of cold room	88	100.0
Inconsistency in preventive measures of COVID-19	85	96.5

Source: Field data, September 2023

The findings imply that the multifaceted challenges faced by agricultural cooperatives during the pandemic. Restricted social gatherings, lockdowns, regional quarantines, and night curfews collectively limited access to both local and international markets, disrupting the supply chain. Market closures subsequently reduced demands for agricultural produce, coinciding with abundant harvests that posed conservation challenges due to malfunctioning cold rooms. Additionally, inadequate investment in the agricultural sector stemmed from investors' reluctance, driven by the sector's perceived lack of profitability amid the pandemic. Inconsistencies in COVID-19 preventive measures at both national and global levels further exacerbated challenges. Variations in stringent regulations among countries, sporadic lockdown implementations, migration policies, and disruptions in international transportation adversely affected agricultural cooperatives. These circumstances not only impacted the cooperative's operations but also diminished opportunities for increased investment.

In India, farmers primarily reported difficulty in selling their crops and livestock products during the COVID-19 lockdown, higher transport costs, and drastically lower daily wages compared to before the lockdown—with wages declining, on average, by nearly 80% as compared to the previous year (Jaacks et al., 2021). This left many without the necessary cash to purchase inputs for the upcoming sowing season and 41% could not harvest their crops in 2020 in parts of India (Gaon Connection 2021).

The urgency for rural cooperative organizations to help their smallholder members' access markets and facilitate their value chain integration was more pressing than ever. For example, in Rwanda, quite a few farmer-owned organizations ceased all activities because social distancing measures implied that meetings could not be held and decisions not made. In several organizations, members were allowed to withdraw their savings and shares to cope with the sudden decrease in household income. Some organizations did provide market information and undertook efforts to connect with output buyers and input suppliers. In that effect only in a few cases did these organizations manage to continue bulking and marketing the agricultural produce of members (Francesconi et al., 2021)

As the night curfew was imposed in some places. In the consistency of the findings that highlight the lack of investment or decrease in the COVID-19 pandemic periods, (Zharare and Mashingaidze, 2020) lenders are generally aware of risks and the COVID-19 crisis has reduced their risk appetite, given the uncertainty over the spread of the virus and the length of the economic downturn stemming from the restrictions. This resulted in reduced loans to farmers and agri-SMEs. In Ghana and Nigeria, SMEs experienced difficulties accessing loans during the lockdown, as most institutions stopped issuing new loans and group loan schemes and other microfinance institutions had limited funds (Zharare and Mashingaidze, 2020).

The agricultural produces were destroyed due to the lack of suitable storage facilities. It was revealed that 68%–80% had a problem with packaging equipment for harvested products, transportation of harvested products, storage and packaging as since processors were restrictive on the quality of their produce (Mthembu, Mkhize, and Arthur, 2022). Absence of cold rooms and the advent of pandemic halted farming and economic activities and caused significant losses to the sector (Kayiira, 2021).

The findings underscore the vulnerability of agricultural cooperatives to systemic shocks such as the COVID-19 pandemic, reflecting broader patterns observed across Sub-Saharan Africa. The constraints on market access, disrupted value chains, limited access to inputs and credit, and inadequate storage infrastructure align with the **Socio-Ecological Systems (SES) Theory,** which emphasizes the interdependence between ecological resources and human systems (Folke, 2006). The pandemic disrupted this interdependence, revealing the fragility of institutions and the limited adaptive capacity of cooperatives. **Resilience theory** further helps frame these findings, as resilience involves the ability of a system to absorb shocks and reorganize while undergoing change (Walker et al., 2004). In Rwanda, as in many parts of Sub-Saharan Africa, agricultural cooperatives showed low resilience—only a few could continue bulking and marketing produce due to limited digital integration and financial buffers (Francesconi et al., 2021). Similarly, in countries like Ghana and Nigeria, reduced

loan issuance during the lockdown mirrored a regional pattern of diminished financial flows to agriculture (Zharare & Mashingaidze, 2020), revealing institutional weaknesses that echo **Institutional Theory,** which posits that organizational outcomes are deeply shaped by formal and informal rules, norms, and constraints (North, 1990). The lack of institutional support and inconsistent pandemic policies weakened cooperative operations, limiting their capacity to facilitate resilience for their members.

Comparatively, across Sub-Saharan Africa, smallholder-focused cooperatives suffered similarly from halted operations, reduced investment, and post-harvest losses due to storage inadequacies. In South Africa, for example, cooperatives experienced a breakdown in supply logistics and price instability, while in Kenya, small-scale farmers faced increased input costs and reduced access to extension services, further weakening value chains (Mthembu, Mkhize, & Arthur, 2022; Hammond et al., 2022). These findings reinforce the need to strengthen institutional arrangements, improve rural infrastructure, and foster digital and financial inclusion as key components of building resilience. The pandemic has illuminated that without institutional robustness and socio-ecological balance, agricultural cooperatives across the region remain highly susceptible to external shocks, underlining the importance of adaptive governance, inclusive policies, and integrated market systems to mitigate future crises.

Such scenarios led to the coping mechanisms to survive. In the Dukunde Umurimo Cooperative the coping mechanism is indicated in the following table 4

Table5: Coping mechanism adopted by the Dukunde Umurimo Cooperative

Coping mechanism	Frequency	Percentage (%)
Changes in business lens	0	0
Request Bank Loans	5	5.6
Adding value to the produce	50	56.8
Improve the harvest conservation	67	76.1
Reduction of salaries	80	90.9

Source: Field data, September 2023

Notably, none of the respondents (0%) altered their business setup compared to the pre-pandemic period. However, 5.6% sought loans, while a significant proportion (56.8%) focused on adding the value to their produce, and a substantial majority (76.1%) prioritized harvest conservation. Additionally, 90.9% implemented employee salary reductions as a cost-cutting measure.

The findings underscore a predominant reliance on strategies emphasizing product value enhancement, enhanced harvest conservation efforts, and employee salary reductions. While endeavors to augment product value were hindered by technological and infrastructural limitations, the cooperative predominantly concentrated on improving harvest conservation using traditional methods, albeit facing challenges due to intermittent cold room malfunctions. Limited technological expertise hampered the implementation of advanced strategies like transitioning to electronic commerce (e-commerce). Nonetheless, the cooperative administration harbors intentions to digitalize operations in the foreseeable future.

The study also reveals a sparse uptake (5.6%) in loan applications, primarily constrained by the unavailability of low-interest loans and the Government of Rwanda's prioritization of economic stimulus loans for pandemic-affected sectors, predominantly favoring tourism and hospitality over agriculture. The finding collectively highlight the challenges faced by the cooperative in adopting sophisticated business changes and accessing financial resources, signaling both the need for technological and skill advancements within the cooperative and the broader economic policy landscape for enhanced support towards agricultural sectors amidst crises.

The findings reflect **resilience theory**, highlighting the cooperative's adaptive responses—such as value addition (56.8%), harvest conservation (76.1%), and salary reductions (90.9%)—despite no structural changes to their business setup. However, limited technological capacity and infrastructure restricted advanced strategies like e-commerce, and loan uptake remained low (5.6%) due to limited access to affordable credit, reflecting constraints outlined in **institutional theory** (North, 1990). This indicates a need for stronger institutional support and digital capacity building to enable rural cooperatives to better withstand crises.

In Japan, cooperatives together with the government and other institutions linked to the dairy industry, publicly promoted an increase in household milk consumption by introducing recipes incorporating the use of significant quantities of milk that increased 20% of milk consumption (FAO, 2020h). In India, the government Initiated the agricultural term and crop loans have been granted a moratorium of three months (Gummagolmath, Lakshmi, and Swamy 2021). Additionally, the widely practiced coping strategies during the pandemic were rationed spending, job diversification, reduction in hired labor, and household food rationing (Adeloye, Torimiro, and Olufemi, 2023).

In Rwanda maize farmers in the Kigali city region adopted alternative method of resilience to cope up with the pandemic. The maize farmers jointly decided to increase solidarity in the purchase of maize farm inputs through the adoption and domestication of the national digitization program instituted by the government of Rwanda, sharing technical skills and knowledge of extension services , online banking using phones to make withdrawals and payments, online marketing and advertisement and use of common transportation (vehicle pooling) for products by buyers and sellers (Dushimimana, Vasanthakaalam and Karangwa, 2023).

3.6 Resilient Strategies for Agricultural Cooperatives to Mitigate Unanticipated Shocks

The COVID-19 pandemic exerted profound impacts on community welfare and both micro and macroeconomic domains. Businesses actively engage in devising coping mechanisms to navigate the present circumstances, ensuring not only survival but also fostering conditions for future growth and resilience. Table 5 Fig outlines the lessons gleaned by Dukunde Umurimo cooperative from the COVID-19 pandemic, serving as a guide to pre-emptively address similar challenges in the future, thereby fortifying preparedness against global issues like pandemics, conflicts, and other disruptive events.

Table 6: Lessons learnt from covid-19 pandemic

Lessons learned	Frequency	Percentage (%)
Increased saving culture	78	88.6
Shift to the electronic/technological approach	79	89.7
Joining saving groups	88	100
Joining insurance scheme	88	100
Adding value to the produce	78	88.6

Source: Field data, September 2023

The insights gleaned from Table 5 delineate key lessons drawn from the Covid-19 pandemic's impact, showcasing respondents' perspectives. A substantial majority, comprising 88.6%, acknowledge the significance of cultivating a heightened saving culture as a crucial lesson learned. Similarly, an overwhelming 89.7% of respondents emphasize the pivotal lesson of transitioning towards electronic and technological approaches in response to the pandemic.

Moreover, the findings underscore unanimous consensus among respondents, with 100% acknowledging the importance of joining saving groups and insurance schemes. Additionally, 88.6% of participants recognize the imperative to initiate mechanisms that add value to their produce. These findings collectively underscore the multifaceted lessons derived from the pandemic's effects. They highlight the imperative of fostering a culture of saving, participation in collective saving groups and insurance schemes, and adopting strategies to enhance the value of harvested produce.

The findings from Table 5 unveil critical insights regarding the ramifications of the Covid-19 pandemic on respondents' perspectives and practices. The overwhelming acknowledgment of the need to bolster a culture of saving, alongside the emphasis on technological transitions, signifies a profound recognition of the vulnerabilities exposed during the pandemic. The unanimous consensus on joining saving groups and insurance schemes underscores a collective awareness of the necessity for communal financial support structures in times of crisis. Moreover, the significant proportion acknowledging the value addition to harvested produce signifies recognition of the need for enhanced resilience in agricultural practices. Additionally, they should be able to adopt online trading, vehicle pooling for transportation, skills development and use of online banking for financial transactions.

The findings revealing respondents' emphasis on cultivating a saving culture, embracing technological innovations, and participating in collective financial mechanisms such as saving groups and insurance schemes align closely with key principles from resilience theory and socio-ecological systems theory. Resilience theory highlights the capacity of social systems to absorb shocks and reorganize while maintaining core functions (Folke, 2006; Walker et al., 2004). In this context, fostering savings and insurance participation serves as adaptive strategies that enhance financial buffers and reduce vulnerability to future shocks. Furthermore, the shift towards technological adoption, including online trading and digital financial services, reflects institutional adaptation, a central tenet of institutional theory, which stresses how formal and informal institutions evolve in response to environmental changes to support system stability and performance (North, 1990). Such transformations signify proactive resilience-building measures that agricultural cooperatives employ to increase their robustness amid disruptions.

Comparatively, similar patterns have emerged across Sub-Saharan Africa, where cooperatives and smallholder farmers have increasingly recognized the need for collective risk management and technological integration to sustain livelihoods during the pandemic. For example, in Kenya and Uganda, cooperatives enhanced digital platforms for market access and encouraged group savings to mitigate income shocks caused by COVID-19 restrictions (Francesconi et al., 2021; Mthembu, Mkhize, & Arthur, 2022). Studies also show that participation in savings groups and microinsurance schemes strengthened the social capital and financial resilience of farming communities across Ghana and Nigeria, enabling more effective coping strategies under crisis conditions (Zharare & Mashingaidze, 2020). Thus, the current findings reflect broader regional trends where cooperative members increasingly prioritize financial preparedness, collective support mechanisms, and technological tools, demonstrating a shift towards more resilient and adaptive agricultural systems across Sub-Saharan Africa.

Overall, these findings imply a resounding call for proactive measures, financial preparedness, communal support mechanisms, and adaptive agricultural strategies to navigate future uncertainties and fortify resilience within communities amidst unforeseen challenges.

4. Conclusion and Recommendations

In this section, the conclusion and recommendations are discussed.

4.1 Conclusion

The study concludes that the Covid-19 pandemic significantly disrupted the supply chain, leading to reduced production, sales, and demand. This decline affected cooperative members' well-being, limiting access to essential cultivation materials and basic household needs. Findings indicate that agricultural output dropped during the pandemic but increased post-pandemic, with significant price fluctuations —a sharp decline during Covid-19, followed by a post-pandemic price surge.

Additionally, the challenges such as market closures, lack of investment, lockdowns, and malfunctioning storage facilities hindered operations and Dukunde Umurimo adopted strategies like value addition, harvest conservation, and salary reductions to cope with the crisis. Ultimately, lessons learned include increased savings culture, adoption of digital transactions, participation in saving groups, and expansion of insurance coverage.

4.2 Recommendations

Agricultural cooperatives, such as Dukunde Umurimo, should focus on diversifying their activities by cultivating alternative crops and livestock that can withstand market and supply chain disruptions. Additionally, they should invest in digital marketing and e-commerce platforms to expand their reach and improve accessibility to both local and international markets. To support this transition, government agencies and NGOs should facilitate training programs that enhance digital literacy among farmers. Policy makers and government agencies have a crucial role in strengthening the agricultural sector by establishing emergency resilience funds to provide financial support for cooperatives during crises. These funds should be easily accessible to cooperatives facing disruptions in production and sales. Furthermore, the development of modern and decentralized cold storage facilities through public-private partnerships can help minimize post-harvest losses and ensure the stability of perishable goods during market fluctuations. Financial institutions and development partners should also contribute by expanding agricultural insurance schemes, offering affordable and customized insurance products tailored for smallholder farmers and cooperatives. Awareness campaigns would be essential in encouraging cooperative members to enroll in these schemes. Lastly, NGOs and development agencies should focus on capacity building by providing training in financial literacy, risk management, and sustainable agricultural practices, thereby enhancing resilience and ensuring long-term sustainability.

Funding details:

This study was funded by the Authors.

Conflict of interest declaration:

Authors declare that no conflict of interests exist.

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