

Self-organization, networks and sustainable innovations in microfinance institutions: Does organizational resilience matter?

Sustainable
innovations in
microfinance

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Aziz Wakibi

*Marketing and Management Department, Makerere University Business School,
Kampala, Uganda*

Joseph Ntayi

*Procurement and Supply Chain Management Department,
Makerere University Business School, Kampala, Uganda*

Isaac Nkote

Finance Department, Makerere University Business School, Kampala, Uganda

Sulait Tumwine

Accounting Department, Makerere University Business School, Kampala, Uganda

Isa Nsereko

*Project and Small Business Department, Makerere University Business School,
Kampala, Uganda, and*

Muhammad Ngoma

*Business Administration Department, Makerere University Business School,
Kampala, Uganda*

Abstract

Purpose – The purpose of this study is to explore the interplay among self-organization, networks and sustainable innovations within microfinance institutions (MFIs) and to examine the extent to which organizational resilience plays a significant role in shaping these dynamics as a mediator.

Design/methodology/approach – This paper adopted a cross-sectional research design combined with analytical and descriptive approach to collect the data. Smart partial least squares structural equation modeling (PLS-SEM) was used to construct the measurement model and structural equation model to test the mediating effect under this study.

Findings – The results revealed that organizational resilience is a significant mediator in the relationship between self-organization, networks and sustainable innovations among microfinance institutions in Uganda.

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Research limitations/implications – The data for this study were collected only from microfinance institutions in Uganda. Future studies may collect data from other formal financial institutions like commercial banks and credit institutions to test the mediating effect of organizational resilience. More still, the study adopted only a single approach of using a questionnaire. However, future research through interviews may be desirable. Likewise this study was cross-sectional in nature. Therefore, a longitudinal study may be useful in future while investigating the mediating role of organizational resilience traversing over a long time frame.

Practical implications – A possible implication is that microfinance institutions which desire to have sustainable innovative solutions for their business operations in disruptive circumstances may need to scrutinize their capacity to be resilient and self-organize.

Social implications – Microfinance institutions play a great role to the underserved clients. Thus, for each to re-organize to be able to provide services that meet users' needs, without physical products so as to ensure long-term financial and social welfare combined with the ability to bounce back and adapt in times of economic downturn to avoid mission adrift.

Originality/value – While most studies have been carried out on organizational resilience, this paper takes center stage and is the first to test the mediating role of organizational resilience in the relationship between self-organization, networks and sustainable innovations, especially in microfinance institutions in Uganda. This paper generates strong evidence and contributes to the powerful influence of organizational resilience in enhancing the level of sustainable innovations based on self-organization and networks.

Keywords Self-organization, Networks, Sustainable innovations, Organizational resilience, Microfinance, Uganda

Paper type Research paper

1. Introduction

Microfinance institutions (MFIs) have become a critical tool for promoting financial inclusion and supporting economic development in developing countries, including Uganda (Abebe & Kegne, 2023). A study by the World Bank found that MFIs have been successful in providing financial services to low-income households and small businesses in developing countries. The study found that MFIs have helped to increase access to credit, savings and insurance, which has enabled households to invest in education, health and other productive activities.

The latest Global Findex Survey indicates that the share of adults owning an account is now 69%, an increase of seven percentage points since 2014. These numbers translate into 515 million adults who have gained access to financial tools. This upward increase in access and use of financial services is partly due to provision of microfinance services (Demirguc-Kunt, Klapper, Singer, Ansar, & Hess, 2018).

According to a report by the Consultative Group to Assist the Poor (CGAP), microfinance has played a critical role in financial sector development. The report notes that MFIs have been successful in reaching underserved communities and have helped to increase financial inclusion in the country. A study by the Uganda Microfinance Union found that MFIs have helped to increase financial inclusion in rural areas of the country. The study found that MFIs have been successful in providing financial services to smallholder farmers, who are often excluded from traditional banking services. According to the Uganda Bureau of Statistics, the percentage of adults in Uganda with access to formal financial services increased from 28% in 2009 to 54% in 2018. This increase is largely attributed to the growth of the microfinance sector in the country. The United Nations Development Programme (UNDP) has recognized microfinance as a key tool for poverty reduction and economic development. The UNDP notes that microfinance can help to create jobs, increase income and reduce inequality in developing countries.

However, MFIs often operate in complex and challenging environments, characterized by economic, social and political uncertainties. To be effective and sustainable, MFIs need to be able to adapt and evolve in response to changing circumstances while maintaining their operations and financial performance (Cull and Hartarska, 2023). Cull, Demirguc-Kunt, and Morduch's (2011) paper discusses the challenges and opportunities facing MFIs as they

attempt to operate in increasingly market-oriented environments. [Haq, Ahmad, and Shahzad \(2021\)](#) review of microfinance sustainability emphasizes the need for MFIs to balance social and financial objectives, manage risk and maintain client focus. [Morduch's \(1999\)](#) article highlights the potential of microfinance to promote economic development but also notes the challenges facing MFIs in achieving sustainability.

Self-organization, networks and organizational resilience are critical components of this process, enabling MFIs to respond effectively to external challenges and promote sustainable innovations that support financial inclusion and environmental sustainability. [Mendoza and Lutz's \(2018\)](#) case study of microfinance institutions in the Philippines shows how organizational resilience can help MFIs adapt to environmental change and support sustainable development. [Armendariz and Morduch's \(2010\)](#) book on the economics of microfinance highlights the importance of innovation and adaptation in the microfinance sector.

[Osterwalder and Pigneur's \(2010\)](#) book on business model innovation provides insights into how organizations can create and sustain innovation in their operations. [Schaltegger and Wagner's \(2011\)](#) paper highlights the relationship between sustainable entrepreneurship and sustainability innovation, and emphasizes the importance of innovation for long-term business success. [Tidd and Bessant's \(2018\)](#) book on managing innovation provides insights into how organizations can effectively manage innovation to drive growth and competitive advantage. [Nidumolu, Prahalad, and Rangaswami's \(2013\)](#) article in the Harvard Business Review argues that sustainability is now the key driver of innovation and highlights the need for companies to develop sustainable business models that address environmental and social challenges.

Finally, the United Nation Global Compact's ([UNGC, 2019](#)) framework for business innovation for sustainability provides a comprehensive overview of the principles and practices of sustainable innovation, and highlights the need for companies to adopt a holistic approach to innovation that integrates social, environmental and economic considerations.

The UNGC's framework for business innovation for sustainability emphasizes the importance of integrating social, environmental and economic considerations in sustainable innovation, which is aligned with the approach advocated by the complex adaptive systems (CAS) theory for promoting self-organization, networks, organizational resilience and sustainable innovations in MFIs in Uganda.

In this paper, we delve into the intricate dynamics of self-organization, networks, organizational resilience and sustainable innovations within MFIs in Uganda, utilizing the CAS theory as a foundational framework. The CAS theory, as articulated by [Cooper and Wheeler \(2015\)](#), posits that organizations are complex, adaptive systems influenced by a myriad of internal and external factors, characterized by nonlinear interactions among their components. In this context, self-organization, as defined by [Zhang \(2013\)](#), is the inherent capacity of an organization to adapt and evolve autonomously in response to changing circumstances. Simultaneously, organizational resilience, as described by [Theron \(2016\)](#), is the ability to maintain operational and financial stability amidst external shocks and stressors. Furthermore, sustainable innovations encompass the development and implementation of new products, services or processes that not only promote financial inclusion but also support environmental sustainability.

Despite their significance, gaps remain in the theoretical understanding, empirical evidence and practical application regarding the interplay between these elements in Ugandan MFIs. Theoretically, there is a need to unravel the mechanisms through which self-organization impacts organizational resilience and, crucially, how organizational resilience mediates the relationship between both self-organization and networks, and sustainable innovations in MFIs. Empirically, the nuances that constitute self-organization, organizational resilience and sustainable innovations within the context of Ugandan MFIs

are yet to be fully explored. From a practical standpoint, strategies to foster these elements in Ugandan MFIs are not clearly defined or understood.

This study aims to bridge these gaps by applying the CAS theory to explore the relationships between self-organization, networks, organizational resilience and sustainable innovations in Ugandan MFIs. It combines theoretical analysis with empirical research, supplemented by practical insights from microfinance practitioners. This approach will illuminate the mechanisms by which self-organization influences organizational resilience and, importantly, how organizational resilience mediates the relationship between self-organization, networks, and sustainable innovations. This investigation will also identify key factors contributing to these elements in Ugandan MFIs and provide actionable recommendations to promote their development and sustainability.

By addressing these research questions, the study aims to contribute significantly to the understanding of how self-organization, networks, organizational resilience and sustainable innovations function and interact in MFIs within Uganda. The findings are expected to offer valuable insights for the development and sustainability of MFIs, not only in Uganda but potentially in other similar contexts across developing countries. This research thus holds the promise of informing both theory and practice in the realm of microfinance, particularly in settings marked by dynamic and challenging operational environments.

2. Literature review and hypotheses development

2.1 *Self-organization and organization resilience*

Self-organization and organizational resilience are two critical concepts that have gained significant attention in the fields of management and organizational studies. These concepts describe the ability of an organization to adapt to changing environments and challenges, and to maintain its stability and functioning over time. Understanding the principles of self-organization and organizational resilience can provide valuable insights into how organizations can effectively respond to uncertainty, complexity and ambiguity in their internal and external environments.

In recent years, self-organization has gained increased importance as a crucial competency for fostering resilience in organizations, including adaptability, self-regulation, critical thinking and other related skills (Denyer, 2017). Indeed, self-organized organizations have the ability to accept changes in occupational situations and continue to work at a high level of performance. These organizations are able to make rational decisions, even when faced with complications or difficulties and are proficient at purposeful use of reasoning to identify strengths and weaknesses of alternative approaches in diverse situations (Denyer, 2017).

Previous studies have shown that there is a positive relationship between self-organization and organizational resilience in microfinance institutions (Achora, Anguyo, & Opio, 2021). Remer and Kattilakoski (2021) elucidate that self-organization is significant for the microfinance institutions who operate to meet the anticipated demand of about 250 million customers in future (Bayar, 2013). Self-organization shapes processes for these institutions to form a basis for structures, function and orders that correspond to respective circumstances and are adapted to the necessary needs to enable bouncing back in times of difficulties (Frädriich, 2023).

Furthermore, Lough (2021) contends that self-organized microfinance institutions appear indispensable in the situation of global crisis such as COVID-19 to provide prompt responses to complex issues and nurture collective resilience. Therefore, in times of emergencies, self-organization supports the creative efforts as institutions' spontaneous responses are multiple and striking to promote innovations to increase resilience during hard times Woodward and Shaffakat (2017). Consistent with scholars like Silva and Guerrini (2018), self-

organization is one of the properties of complex systems, and is directly related to the adaptability of these systems. Due to self-organizing, they are able to adapt and obtain flexibility from a framework of interdependent relationship (Uhl-Bien, Marion, & McKelvey, 2007). Therefore, here we hypothesize that:

H1. Self-organization significantly affects organization resilience among microfinance institutions in Uganda.

2.2 Self-organization and sustainable innovations

Microfinance institutions play a crucial role in promoting financial inclusion and poverty reduction in developing countries. According to Duvendack, Palmer-Jones, and Copestake (2011), sustainability is a major challenge for microfinance institutions, and many struggle to maintain their operations in the long run. Similarly, Khandker (2015) noted that the lack of sustainability is a common problem in the microfinance industry, which can lead to the failure of institutions over time. In addition, Mersland and Strøm (2009) found that financial sustainability is crucial for the success of microfinance institutions, and that many struggle to achieve this due to various factors such as high operational costs and low repayment rates.

There is a growing body of literature that highlights the importance of self-organization in promoting sustainable innovations in microfinance institutions. For example, a study by Arun, Bendig, and Arun (2012) examined the relationship between self-organization and innovation in microfinance institutions in India. The study found that self-organizing microfinance institutions were more likely to adopt innovative practices such as mobile banking, social performance management and client protection policies. The authors suggest that self-organization enables microfinance institutions to leverage their internal resources and capabilities to promote innovation and respond to the changing needs of their clients and stakeholders.

Similarly, a study by Zhang *et al.* (2020) explored the role of self-organization paradigms and optimization approach in promoting sustainable innovations in microfinance institutions in Kenya. The study found that self-organizing microfinance institutions were more likely to adopt sustainable practices such as environmental conservation, social responsibility and financial transparency. The authors argue that self-organization enables microfinance institutions to align their operations with sustainable development principles, respond to social and environmental challenges and maintain their competitiveness over time.

Overall, these studies suggest that self-organization is critical in promoting sustainable innovations in microfinance institutions, enabling them to adapt to changing environments and challenges, leverage their resources and capabilities and align their operations with sustainable development principles. However, the relationship between self-organization and sustainable innovations in microfinance institutions is not fully established, and further research is needed to test this hypothesis. We therefore hypothesize that:

H2. Self-organization positively affects sustainable innovations in microfinance institutions among microfinance institutions in Uganda.

2.3 Self-organization and sustainable innovations: The mediating role of organizational resilience

Despite the growing body of literature on the relationship between self-organization and sustainable innovations in microfinance institutions, little is known about the potential mediating role of organizational resilience in this relationship. Therefore, there exists a research gap in exploring the extent to which organizational resilience may mediate the association between self-organization and sustainable innovations in microfinance institutions. Additionally, there is an ongoing debate among scholars and practitioners on

the relationship between self-organization and organizational resilience in promoting sustainable innovations in microfinance institutions. Some argue that self-organization is a critical component of resilience, enabling microfinance institutions to adapt to changing environments, leverage their resources and capabilities and promote innovation. However, others contend that self-organization alone may not be sufficient to foster resilience and sustainability in microfinance institutions and that other factor such as leadership, culture and external support systems are also essential.

Nevertheless, recent studies provide evidence to support the notion that self-organization and organizational resilience are complementary components in promoting sustainable innovations in microfinance institutions. For example, a study by [Huang, Sun, Chen, and Golden \(2019\)](#) found that microfinance institutions that exhibit high levels of both self-organization and organizational resilience are more likely to adopt sustainable practices and achieve long-term success. The authors argue that self-organization enables microfinance institutions to leverage their internal resources and capabilities, while organizational resilience enables them to respond to external shocks and uncertainties. Organizational resilience aids actors and institutions to bounce back from adversities and transform to attain sustainable innovations.

According to [Nyland, Forbes-Mewett, Marginson, Ramia, Sawir, and Smith \(2009\)](#), organizational resilience through adaptability plays a vital role in enhancing sustainable innovations. For [Vogus and Sutcliffe \(2007\)](#), institutions are able to recover faster, respond quicker towards disruptive surprises and develop more unfamiliar ways of doing business under duress than others once resilience is adapted. The improvement of organizational resilience necessitates that sustainable innovation in a specific field have a collective meaning of how and why to innovate to attain a more strategic advantage ([Linnenluecke, 2017](#)). For [Felicioni, Lupíšek, and Gaspari \(2023\)](#) in their study of exploring the common ground of sustainability and resilience in Europe found out that institutions which are successful in achieving sustainability in the face of disruptions, intense competitive pressures, engage in detailed assessments of the marketplace and adopt specific and focused strategies to become resilient, adapting to marketplace and innovating.

Additionally, [Dentoni, Pinkse, and Lubberink \(2021\)](#) argue that integrating different CAS along strategic, institutional and learning system among partnering organizations can help them to derive value in order to attain socio-ecological resilience. In fact, partnership between organizations within the banking sector such as microfinance institutions and commercial banks through Association of Microfinance Institutions in Uganda and Uganda Bankers Association can integrate the diverse banking models used by the microfinance institutions and banks to strengthen their brand value, which drives resilience.

Therefore, from a theoretical perspective the resilient organization is quite remarkable ([Boin & van Eeten, 2013](#)) as a measure of systems persistence and the ability to absorb disturbances and still maintain the same relationships between system entities ([Bhamra et al., 2011](#)). Additionally, [Herbane \(2019\)](#) asserts that resilience is an adaptive process and capacity of an organization to address major acute disruptions and strategic challenges through responsiveness and reinvention to achieve sustainable organizational renewal. Resilience has been considered to be central for organizations' strategic agility and business sustainability.

Furthermore, research has shown that the effectiveness of self-organization in promoting sustainable innovations is contingent on the organization's ability to exhibit adaptability, flexibility and robustness, which are key components of organizational resilience. For example, a study by [Singh and Murty \(2009\)](#) found that microfinance institutions that exhibit high levels of organizational resilience are better equipped to adapt to changing market conditions, respond to the needs of their clients and promote sustainable innovations.

Overall, the evidence suggests that for self-organization to be effective in attaining sustainable innovations, it requires adaptability, flexibility and robustness, which are

essential components of organizational resilience. While there may be ongoing debates regarding the relative importance of self-organization and other factors in promoting resilience and sustainability in microfinance institutions, it is clear that both self-organization and organizational resilience are critical components in achieving sustainable innovations in microfinance institutions. From the foregoing we therefore hypothesize that:

- H3.* Organizational resilience mediates the relationship between self-organization and sustainable innovations among microfinance institutions in Uganda.

2.4 Networks and sustainable innovations: The mediating role of organizational resilience

In the realm of MFIs, the interplay between networks, organizational resilience and sustainable innovations forms a complex yet coherent narrative, one that is central to the operational and strategic effectiveness of these institutions. This relationship, as suggested by the current body of literature, can be viewed through a lens that captures the nuanced dynamics of these three critical elements. The concept of networks within MFIs transcends the traditional boundaries of professional connections and partnerships. [Uhl-Bien and Arena \(2018\)](#) highlight that these networks are not merely conduits for resource exchange but are fundamental in building an institution's resilience. In the volatile economic landscapes where MFIs operate, networks become lifelines that provide not only tangible resources but also intangible assets like knowledge, advice and support. These elements are crucial for MFIs as they navigate through challenges posed by market fluctuations, regulatory changes and socioeconomic shifts.

Networks, therefore, act as a buffer and a source of adaptive capacity, enabling MFIs to respond effectively to external pressures and uncertainties. Organizational resilience in MFIs goes beyond the mere ability to survive crises. As [Ortiz-De-Mandojana and Bansal \(2016\)](#) articulate, resilience is about the capacity to adapt, transform and ultimately thrive in the face of change. This adaptive resilience is a precursor to sustainable innovation. It allows MFIs to not just weather adverse conditions but to use these conditions as springboards for innovation ([Khandker, 2015](#)). Resilient MFIs are characterized by their agility, learning orientation and a culture that encourages experimentation and embraces risk – all of which are essential ingredients for sustainable innovation. According to SEEP network ([SEEP, 2011](#)), this innovative capacity is critical for MFIs, as it enables them to develop new financial products, improve operational processes and enhance service delivery, thereby ensuring long-term sustainability and impact.

The relationship between networks, organizational resilience and sustainable innovations is symbiotic and cyclic. Networks foster resilience by providing the resources and support necessary for MFIs to adapt and evolve ([Eremionkhale & Watkins, 2021](#)). In turn, this resilience enhances the MFIs' capacity to engage in sustainable innovations. These innovations, whether they are new financial products, service delivery methods, or operational improvements, can strengthen the networks by attracting more partners, resources and opportunities, thereby creating a virtuous cycle. Considering the insights provided by the literature, it is reasonable to propose that in the context of MFIs in Uganda, organizational resilience might play a critical mediating role between networks and sustainable innovations. This hypothesis is grounded in the understanding that while networks provide the necessary inputs for resilience, it is the resilience that ultimately enables MFIs to effectively translate these inputs into sustainable innovations. Therefore, the hypothesis.

- H4.* Organizational resilience mediates the relationship between networks and sustainable innovations among microfinance institutions in Uganda is formulated.

This hypothesis aims to capture the essence of the dynamic interplay between these elements, emphasizing the critical role of organizational resilience as a bridge that links the supportive infrastructure provided by networks to the innovative outputs that ensure sustainability and growth in MFIs.

3. Research methodology

3.1 Research design

This study used a cross sectional research design. This is because it allows large amount of data to be collected over a shorter period of time. Additionally, since it observes a representative subset at one specific point in time, problems arising from recurring errors in data collection instruments are also minimized as it does not suffer from unavailability of samples used in previous observations as in longitudinal study.

3.2 Population and sample

This study targeted MFIs in Uganda, a sector integral to financial inclusion and economic development, with a defined population of 130 MFIs as listed by the Association of Microfinance Institutions of Uganda. This listing served as the sampling frame. To establish an appropriate sample size, the study employed Yamane's formula (Yamane, 1973), $n = N / (1 + N(e)^2)$, at a precision level of 0.572%. This method is chosen for its balance of simplicity and accuracy and its widespread acceptance in social science research (Yamane, 1973). Applying this formula determined a sample size of 97 MFIs. In this research, a systematic sampling method was utilized, with a sampling interval of 1.34, calculated based on the total population and the desired sample size. This interval was instrumental in ensuring the equitable distribution and representation of MFIs within the sample.

3.3 Sampling design, sampling procedures and sampling adequacy

The study employed a systematic sampling method with a sampling interval of 1.34, calculated based on the total population of 130 MFIs and the desired sample size of 97. This interval was crucial for ensuring equitable representation of MFIs within the sample. Unique random numbers assigned to each MFI in the population, derived from a table of random numbers, facilitated the adherence to simple random sampling principles. This combination of systematic and random techniques was pivotal in selecting a diverse and unbiased sample, crucial for the study's statistical validity.

Additionally, to address the adequacy of the sample size, particularly in the context of structural equation modeling (SEM), the study utilized composite-based partial least squares SEM (CB-PLS SEM). CB-PLS SEM is particularly suited for small to medium sample sizes and complex models, offering robust outcomes even with lower sample thresholds (Hair, Hult, Ringle, & Sarstedt, 2017). The adequacy of the sample size for CB-PLS SEM was assessed using the guidelines provided by Hair *et al.* (2017), which suggest a minimum sample size based on the most complex model structure in the SEM analysis, typically determined by the construct with the largest number of formative indicators or the largest number of structural paths directed at a particular latent variable.

In this study, the most complex construct had four indicators, and following the recommendations of Hair *et al.* (2017), a minimum sample size of 10 times the number of indicators was considered adequate. Therefore, a sample size of 40 would be deemed sufficient. However, with a final sample size of 97 MFIs, the study far exceeded this minimum requirement, enhancing the statistical power and reliability of the SEM analysis results. This larger sample size also provided a more robust platform for testing the hypothesized

relationships within the model, ensuring the reliability and validity of the findings and allowing for generalizations to be made about the broader MFI population in Uganda.

3.4 Measurement and operationalization of variables

The measurement items for all study variables were derived from scholarly literature. The measures for *self-organization* were adopted from [Kauffman \(1993\)](#) and [Van Meerkerk, Boonstra, and Edelenbos \(2013\)](#). The measurement items for *organizational resilience* were generated from previous scholars like [McManus \(2008\)](#) and [Madni \(2007\)](#) who suggest that there is no universally accepted measure of organizational resilience. However, building on the metaphors of complexity theory highlighted by previous scholars, this study measures organizational resilience using dimensions of adaptation, robustness and flexibility ([Mafabi, Munene, & Ntayi, 2012](#); [Duchek, 2020](#)). *Sustainable innovations* was conceptualized and measured in terms of social innovation, economic innovation and environmental innovation. These dimensions have been adopted and validated by previous scholars like [Boons and Lüdeke-Freund \(2013\)](#) and [Calik and Bardudeen \(2016\)](#). All the measurement items developed were anchored on a six-point Likert scale ranging from 1 – strongly disagree to 6 – strongly agree.

3.5 Common method bias and non-response bias

3.5.1 Common method bias. In research, common method bias (CMB) is a significant concern, especially in studies employing a cross-sectional research design. CMB can lead to type I and II errors, thereby jeopardizing the validity of research findings ([Podsakoff, MacKenzie, & Podsakoff, 2012](#); [Ketokiv, 2019](#)). To mitigate CMB in this study, we adhered to the recommendations of [Podsakoff, MacKenzie, Lee, and Podsakoff \(2003\)](#). Procedurally, the survey instruments were designed to be simple, concise and clear, removing ambiguous and complex questions. This clarity in the questionnaire design was essential to minimize confusion and misinterpretation by respondents. Statistically, the “inner variance inflation factor (VIF) values” were tested in SMART PLS. The observed inner VIF values were all below the threshold of 3.300, indicating the absence of CMB in the data ([Koch, 2015](#)).

3.5.2 Addressing nonresponse bias. Nonresponse bias is a critical issue in survey-based research, as it can compromise the representativeness of the sample ([Hair, Black, Babin, & Anderson, 2010](#)). In our study on MFIs in Uganda, we undertook several steps to address and minimize nonresponse bias:

Firstly, we assessed the extent of nonresponse bias by comparing the characteristics of respondents and nonrespondents using available demographic and institutional data. This comparison helped identify any significant differences that might indicate bias.

Secondly, we implemented strategies to minimize nonresponse by ensuring confidentiality. Respondent confidentiality was strictly maintained during the questionnaire administration to encourage honest and complete responses. Follow-ups: Reminders and follow-ups were used to increase response rates. Simplification of survey process: The survey was designed to be less burdensome for participants, thus encouraging more responses.

Thirdly we used statistical techniques by weighting responses. We applied weighting techniques to adjust the responses to reflect the overall population distribution more accurately. Imputation methods were employed to estimate potential responses from nonparticipants.

Lastly, we reported and discussed nonresponse in the study: The response rate was transparently reported, along with a discussion on the potential for nonresponse bias. We acknowledged the limitations related to nonresponse and the implications it might have on the study findings.

3.6 Data collection instrument, validity and reliability

In this study, data were collected using a structured questionnaire, designed to assess four key constructs: self-organization, networks, organizational resilience and sustainable innovations. Initially, the questionnaire underwent a pilot test to ensure clarity and to refine its content. Ambiguous, negatively worded and complex questions were removed based on the pilot study feedback. The pilot results indicated valid and reliable Cronbach's alpha coefficients for the constructs, with self-organization at 0.762, network at 0.833, organizational resilience at 0.841 and sustainable innovations at 0.852. These results suggested that the instrument was capable of accurately measuring the intended constructs, enhancing the likelihood that the observed relationships and patterns in the data were not artifacts of measurement errors, thus increasing the potential for generalizability to a broader population or context.

The reliability and validity of the constructs in the main study were further evaluated using comprehensive statistical measures: Cronbach's alpha, composite reliability, average variance extracted (AVE), variance inflation factor (VIF) and content validity index (CVI). See Table 1 for details. Each construct demonstrated high levels of reliability and validity, as evidenced by the statistical outcomes:

Self-Organization: This construct was subdivided into function, process and structure, all of which exhibited Cronbach's alpha values above 0.830 and composite reliability scores above 0.880, indicating strong internal consistency and reliability. The AVE values were all above 0.5, and VIFs were below 3, demonstrating good convergent and discriminant validity without multicollinearity concerns.

Networks: Encompassing interaction quality, interdependence and ties, this construct showed high reliability (Cronbach's alpha values above 0.870) and robust validity (AVE values above 0.640 and VIFs below 3).

	Cronbach's alpha	Composite reliability	AVE	VIF	CVI
<i>Self-organization</i>					
Function	0.834	0.884	0.605	1.936	0.840
Process	0.839	0.881	0.553	2.429	
Structure	0.833	0.884	0.609	1.754	
<i>Networks</i>					
Interaction quality	0.920	0.936	0.708	2.334	0.862
Interdependence	0.909	0.927	0.647	2.537	
Ties	0.872	0.906	0.660	2.703	
<i>Organizational resilience</i>					
Adaptability	0.778	0.856	0.598	2.033	0.846
Flexibility	0.917	0.931	0.601	2.368	
Robustness	0.839	0.878	0.549	2.148	
<i>Sustainable innovations</i>					
Economic value	0.835	0.888	0.666	1.376	0.850
Environmental value	0.841	0.876	0.505	1.733	
Social value	0.810	0.887	0.723	1.428	

Note(s): AVE – Average Variance Extracted

VIF – Variance Inflation Factor

CVI – Content Validity Index

Source(s): Primary data

Table 1.
Reliability and validity

Organizational Resilience: This included adaptability, flexibility and robustness, with each component demonstrating satisfactory reliability (Cronbach's alpha values ranging from 0.778 to 0.917) and validity (AVE values above 0.540 and VIFs below 2.5).

Sustainable Innovations: Analyzed across economic value, environmental value and social value, this construct showed strong reliability and validity, with Cronbach's alpha values above 0.810 and AVE values above 0.500.

The study targeted 97 MFIs, with three respondents from each, leading to the distribution of 291 questionnaires. Of these, 230 were returned in a valid and usable form. The remaining 61 questionnaires were disregarded due to poor handling and careless scoring by respondents. This rigorous approach to data collection, coupled with the thorough assessment of the instrument's validity and reliability, ensures that the findings are robust, credible, and can be confidently applied to the broader context of the study.

3.7 Data analysis and management

The data was analyzed using Smart-PLS 3.0 professional version. PLS is deemed more apt for optimal performance with small sample sizes, in contrast to covariance-based structural equation modeling (CB-SEM). CB-SEM often encounters difficulties related to convergence and estimation issues when dealing with limited datasets. Initial analyses were performed on the data to check for errors ascending from improper data entry, missing values, and outliers existed in the data (Field, 2005). Occurrences for all the items in the questionnaire were generated using SPSS to establish whether missing values were present in the data. The results showed that missing values existed in the data and were missing completely at random (MCAR) at less than 5%. Thus, linear interpolation was used to replace the missing data that is recognized as the optimal method for data replacement according to Field (2005). Besides, we used box plots to test for presence of outliers in the data. The results showed that outliers were not problematic and the results were tenable and good enough to allow further statistical analyses.

4. Results and discussion

The results and discussion section of this research paper begins with demographic characteristics and descriptive statistics of the MFIs that participated in this study and provides a critical analysis of the empirical findings and their implications for theory and practice. In this section, we present and interpret the results of the study, including statistical analyses. We also explore the significance of the findings and their relevance for addressing broader research questions and practical challenges in the field of microfinance and sustainable development. Through a rigorous examination of the results, we provide insights into how self-organization and organizational resilience can contribute to sustainable innovations in microfinance institutions and help organizations adapt to changing environments and challenges.

4.1 Descriptive statistics

Results offer significant insights into the demographics and operational dynamics of MFIs. The selected sample illustrated a reasonable gender balance, with males representing 55% and females accounting for the remaining 45%. Age distribution of respondents also emerged as an important factor, with 54% being in the 30–40 years age group, 43.5% below 30 years and a minority of 2.4% above 40 years. A key observation from the data revolves around the operation longevity of the participating MFIs. Approximately half (49%) of the institutions reported an operational timeline of 11–15 years, indicating an element of resilience and expertise within this sector. 39% reported operations spanning 6–10 years, with the remaining 12% equally divided between newly established institutions (less than a year) and

those with over 15 years of service. The educational qualifications of the respondents also proved enlightening. The majority, at 67.7%, held bachelor's degrees, while 18% possessed master's degrees. This high educational attainment could play a significant role in the ability of these institutions to effectively incorporate and manage issues related to sustainable innovations.

Additionally, the results presented in Table 2 delves deeper into the constructs of self-organization, organizational resilience and sustainable innovations. Mean scores revealed a strong inclination toward these concepts: self-organization (mean = 4.397, SD = 0.840), networks (mean = 4.206, SD = 0.823), organizational resilience (mean = 4.329, SD = 0.791) and sustainable innovations (mean = 4.502, SD = 0.766). The relatively small standard deviation values, when compared with the mean scores, suggest a good fit of the observed data. This could indicate a strong presence and emphasis on these constructs within the MFIs, which aligns with the law of normal distribution. The amalgamation of these factors – operational maturity, gender diversity, high educational attainment and strong indications toward self-organization, resilience and sustainability – has significant implications for the microfinance industry. It suggests an environment conducive to the incorporation and promotion of sustainable practices, underpinned by a resilient organizational structure. These factors could enable MFIs to effectively navigate challenges, adapt to change and contribute to the larger sustainability agenda in the financial sector.

4.2 Self-organization and organizational resilience

The findings of the study indicate a noteworthy positive correlation between self-organization and organizational resilience ($\beta = .707$, $t = 13.058$, $p \leq 0.001$), thereby supporting H1. The interpretation of the finding suggests that MFIs that exhibit higher levels of self-organization in terms of function, process and structure tend to have higher levels of organizational resilience. This means that such institutions are better equipped to withstand internal and external challenges, adapt to changing environments and maintain their stability and functioning over time. For example, a MFI that has a clear organizational structure, defined roles and responsibilities and effective communication channels is more likely to respond quickly and efficiently to unexpected events such as pandemics (e.g. COVID-19), financial crises, changes in regulations, or natural disasters. By contrast, a MFI that lacks self-organization may struggle to coordinate its actions and decision-making processes, leading to inefficiencies, conflicts and a decreased ability to respond to external shocks. The positive correlation between self-organization and organizational resilience identified in the study implies that developing self-organizational capabilities can be an effective strategy for enhancing the resilience and sustainability of microfinance institutions. By investing in self-organizational capabilities, these microfinance institutions build resilience and ensure their long-term sustainability, while also continuing to fulfil their mission of serving the needs of underserved populations. Some real-life examples of microfinance institutions in Uganda that demonstrate the significant positive relationship between self-organization and organizational resilience include Pride Microfinance Limited (PML), FINCA Uganda and Opportunity Bank Uganda (OBU).

	N	Min	Max	Mean	SD
Self-organization	97	2.04	6.00	4.40	0.84
Networks	97	2.31	5.76	4.21	0.82
Organizational resilience	97	2.12	5.89	4.33	0.79
Sustainable innovations	97	2.82	6.00	4.50	0.77

Table 2.
Descriptive statistics

Source(s): Primary data

PML has demonstrated strong self-organizational capabilities by investing in digital platforms and technologies to improve efficiency and streamline operations. This has enabled PML to respond more quickly and effectively to challenges such as the COVID-19 pandemic, which disrupted operations and created new risks for clients. For example, PML was able to implement new digital loan applications and disbursement processes to ensure that clients could access financing remotely and safely. FINCA Uganda has demonstrated strong self-organizational capabilities by developing and implementing a range of innovative products and services to meet the needs of its clients. For example, FINCA Uganda introduced mobile banking services that allow clients to access their accounts and make transactions using their mobile phones. This has enabled FINCA Uganda to reach new clients and expand its reach in remote and underserved areas. OBU has demonstrated strong self-organizational capabilities by developing a range of products and services that cater to the needs of different client segments. For example, OBU has introduced savings and credit products specifically designed for women and youth, as well as agricultural loans that help farmers to improve productivity and income. This has enabled OBU to diversify its portfolio and reduce risk, while also better serving the needs of its clients.

Research in the microfinance literature supports the finding that there is a significant positive relationship between self-organization and organizational resilience. Several studies have examined this relationship, providing evidence of the important role that self-organizational capabilities play in promoting resilience in microfinance institutions. For example, in a study by [Ngwenya and Khumalo \(2018\)](#), they found that self-organizational capabilities, such as the ability to adapt to changing circumstances and innovate, were important factors in promoting resilience in microfinance institutions in Zimbabwe. The authors argue that self-organization enables institutions to respond to challenges such as economic downturns and changes in regulations, leading to greater resilience. Another study by [Ssekiboobo and Nakayiwa \(2021\)](#) explored the relationship between self-organization and organizational resilience in Ugandan microfinance institutions. The authors found that institutions with strong self-organizational capabilities were more likely to be resilient, with the ability to adapt to changing circumstances, manage risk effectively, and continue to provide services to clients during times of crisis.

Our study contributes to literature by emphasizing the importance of self-organization, adaptability and emergent behavior in complex systems, such as microfinance institutions. According to CAS theory, microfinance institutions are CAS that are characterized by nonlinear interactions among various agents, such as clients, staff and management. These interactions give rise to emergent behavior, which can be shaped and influenced by self-organizing processes within the system. Several studies have applied CAS theory to microfinance institutions, providing evidence of the important role that self-organizational capabilities play in promoting resilience. For example, in a study by [Achora et al. \(2021\)](#), they apply CAS theory to explore the relationship between self-organization and organizational resilience in Ugandan microfinance institutions. The authors argue that self-organization enables microfinance institutions to adapt and respond to changing circumstances, leading to greater resilience in the face of challenges such as economic shocks or natural disasters. Similarly, in a study by [Liu and Luo \(2021\)](#), they apply CAS theory to examine the impact of self-organizing processes on the performance of Chinese microfinance institutions. The authors find that self-organizing processes, such as knowledge sharing and collaboration, are important factors in promoting organizational resilience and improving performance.

These studies contribute to both CAS theory and organizational resilience theory by highlighting the importance of self-organizational capabilities in promoting resilience in microfinance institutions. They suggest that microfinance institutions should prioritize investing in developing self-organizational capabilities, such as fostering a culture of learning and innovation, and promoting collaboration and knowledge sharing among staff and clients.

Overall, these studies provide evidence of the significant positive relationship between self-organization and organizational resilience in microfinance institutions, and demonstrate the relevance of CAS theory for understanding the dynamics of complex systems in the context of microfinance.

4.3 Self-organization and sustainable innovations

Consistent with H2, the study further reveals a significant positive relationship between self-organization and sustainable innovations ($\beta = 0.375$, $t = 3.560$, $p \leq 0.001$). A significant positive relationship between self-organization and sustainable innovations can be seen in the ability of the microfinance institution to develop and implement innovative solutions that meet the needs of clients while also promoting economic, social, technological and environmental sustainability. By investing in self-organizational capabilities, these microfinance institutions have been able to identify economic, social, technological and opportunities for innovation and continue to fulfil their mission of serving the needs of underserved populations in a sustainable and responsible manner. Some real-life examples of microfinance institutions in Uganda that demonstrate the significant positive relationship between self-organization and sustainable innovations include but not limited to FINCA Uganda, UGAFODE Microfinance Limited and PML.

FINCA Uganda has demonstrated strong self-organizational capabilities by developing and implementing sustainable innovations that meet the needs of its clients. For example, FINCA Uganda has introduced mobile banking services that allow clients to access their accounts and make transactions using their mobile phones. This has enabled FINCA Uganda to reach new clients and expand its reach in remote and underserved areas, while also reducing the cost and environmental impact of traditional banking. UGAFODE has demonstrated strong self-organizational capabilities by developing and implementing sustainable innovations that promote financial inclusion and support environmental sustainability. For example, UGAFODE has introduced solar-powered automated teller machines that provide clients with access to banking services in areas without reliable electricity. UGAFODE has also developed a range of green loan products that support clients in adopting environmentally sustainable practices, such as renewable energy and sustainable agriculture. PML has demonstrated strong self-organizational capabilities by investing in sustainable innovations that promote financial inclusion and support environmental sustainability. For example, PML has introduced a range of digital platforms and technologies that enable clients to access financial services remotely, reducing the need for travel and transportation. PML has also developed a range of loan products that support clients in adopting environmentally sustainable practices, such as energy-efficient cook stoves and solar water heaters.

Our finding to H2 demonstrate the relevance of CAS theory for understanding the dynamics of complex systems in the context of sustainable innovations in microfinance. Several studies have applied CAS theory to microfinance institutions, providing evidence of the important role that self-organizational capabilities play in promoting sustainable innovations. For example, in a study by [Achora et al. \(2021\)](#), they apply CAS theory to explore the relationship between self-organization and sustainable innovations in Ugandan microfinance institutions. The authors argue that self-organization enables microfinance institutions to identify and respond to opportunities for sustainable innovations, leading to positive outcomes for both clients and the environment. Similarly, in a study by [Wali, Yadav, and Jena \(2019\)](#), they apply CAS theory to examine the factors that promote sustainable innovations in Indian microfinance institutions. The authors find that self-organizing processes, such as collaboration and knowledge sharing among staff and clients, are important drivers of sustainable innovations in microfinance institutions.

These studies contribute to both CAS theory and sustainable innovations by highlighting the importance of self-organizational capabilities in promoting sustainable innovations in microfinance institutions. They suggest that microfinance institutions should prioritize investing in developing self-organizational capabilities, such as fostering a culture of learning and innovation, and promoting collaboration and knowledge sharing among staff and clients, to promote sustainable innovations.

4.4 Self-organization and sustainable innovations: The mediating role of organizational resilience

Our findings reveal that Organizational resilience partially mediates the relationship between self-organization and sustainable innovations ($\beta = 0.345$, $t = 3.938$, $p \leq 0.001$) thereby supporting H3. Organizational resilience explains how self-organization might work and is on the pathway between self-organization and sustainable innovations. The results from this study showed that the direct and indirect effects of self-organization through organizational resilience explain 71% of the variation in sustainable innovations as indicated in Figure 1. The total effect of organizational resilience on sustainable innovations can be separated into the direct effect and indirect (mediated) effect. Mediated effect combines the paths from self-

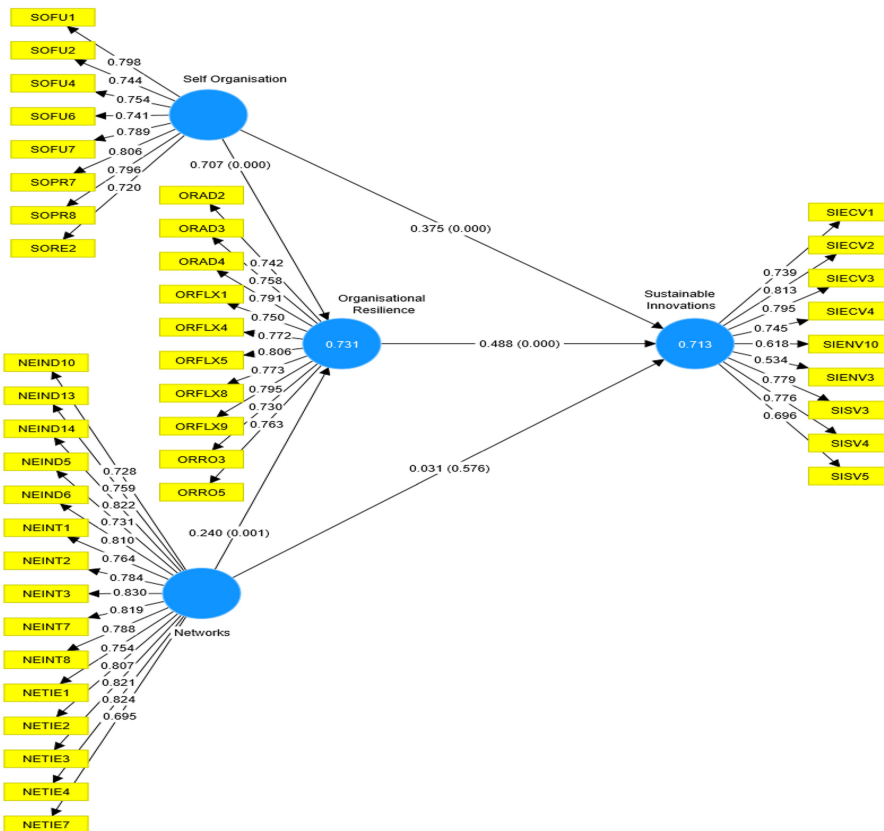


Figure 1. PLS-SEM Model for sustainable innovations predicted by organizational resilience, self-organization and networks

Source(s): Author(s) own creation

organization to organizational resilience and from organizational resilience to sustainable innovations. The results mean that organizational resilience is the conduit through which self-organization affects sustainable innovations. However, the direct relationship between self-organization and sustainable innovations remains significant ($\beta = 0.375$, $t = 3.560$, $p \leq 0.001$), implying a partial mediation as recommended by [Hair et al. \(2017\)](#). These results suggest that microfinance institutions in Uganda that are able to self-organize and adapt to changes in their environment are more likely to innovate sustainably. This is because they are able to identify opportunities for innovation and respond to them quickly and efficiently. Organizational resilience plays a partial mediating role in this relationship by enabling microfinance institutions to recover quickly from setbacks and disruptions that may occur during the innovation process. For example, if an innovation does not perform as expected, an organization that is resilient can quickly learn from the experience and make adjustments to improve the innovation or develop a new one. This is because organizational resilience and self-organization are interdependent and mutually reinforcing concepts that can lead to sustainable innovations. Self-organizing MFIs in terms of processes, function and structure help to build stronger resilience in terms of flexibility, adaptability and robustness, which promote sustainable innovations of MFIs and enhance the well-being of the MFI clients. By promoting resilience, self-organizing MFIs can identify the needs of the people and work toward developing flexible and sustainable solutions that improve their lives. Resilient microfinance institutions are characterized by a number of key factors, including strong risk management, diversified product and service offerings, efficient operations and strong partnerships and collaborations. Resilient microfinance institutions have strong risk management frameworks that enable them to identify and mitigate risks, such as credit risk, market risk and operational risk. These institutions are able to adapt to changing circumstances and manage risk effectively, even during times of crisis. Resilient microfinance institutions have diversified product and service offerings that enable them to respond to the changing needs of their clients. These institutions are able to adapt to changes in market conditions and client demand and to provide a range of financial products and services that meet the needs of underserved populations. Resilient microfinance institutions have efficient and effective operational systems that enable them to provide financial services in a cost-effective and sustainable manner. These institutions are able to manage their costs, maintain high levels of efficiency and sustain their financial performance over the long term. Resilient microfinance institutions have strong partnerships and collaborations with other organizations, such as government agencies, nongovernmental organizations and other financial institutions. These partnerships enable them to leverage the strengths of others and to build networks that can support their operations and growth. Overall, resilient microfinance institutions play a critical role in promoting financial inclusion and supporting the development of underserved populations.

The findings of this study provide support to [Lv, Tian, Wei, and Xi's \(2018\)](#) argument that the relationship between self-organization and sustainable innovations in microfinance institutions may not be a direct one. Instead, the study suggests that self-organization may indirectly affect sustainable innovations by enhancing an organization's adaptability and robustness through its level of resilience. To further explain the mediating role of organizational resilience, the CAS theory can be used. This theory posits that organizations, like microfinance institutions, are CAS that are able to self-organize, adapt to changes in their environment and demonstrate resilience in the face of disruptions. Thus, by promoting self-organization and organizational resilience, microfinance institutions can better position themselves to innovate sustainably and effectively serve the needs of their clients. Self-organization is a critical component of organizational resilience, as it enables microfinance institutions to respond effectively to external shocks and stressors and to maintain their operations and financial performance over the long term ([Achora et al., 2021](#)).

The CAS theory suggests that organizational resilience can mediate the relationship between self-organization and sustainable innovations in microfinance institutions. Specifically, organizational resilience can enable microfinance institutions to maintain their operations and financial performance even in the face of changing circumstances, such as the emergence of new technologies, shifts in client demand or changes in market conditions. This, in turn, can facilitate the development and implementation of sustainable innovations that support the long-term viability and sustainability of the institution (Fraccascia, Giannoccaro, & Albino, 2018). Overall, the CAS theory can help to explain the mediating role of organizational resilience in the relationship between self-organization and sustainable innovations in microfinance institutions.

4.5 Networks and sustainable innovations: The mediating role of organizational resilience

Our findings reveal that organizational resilience fully mediates the relationship between networks and sustainable innovations ($\beta = 0.488, p \leq 0.001$), thereby supporting H4. This finding is comprehensively discussed through the lens of CAS theory. In the context of MFIs in Uganda, CAS theory helps in understanding how various elements within these institutions interact dynamically and adaptively to promote sustainable innovation.

First and foremost, networks act as catalysts for resilience: Within CAS, networks are seen as vital in providing the necessary connections and interactions that enable systems to adapt and evolve (Uhl-Bien & Arena, 2018). In MFIs, networks often involve collaborations, knowledge exchanges and resource sharing, which are crucial for nurturing resilience. The finding ($\beta = 0.488, p \leq 0.001$) suggests that the strength and quality of these networks directly influence the development of organizational resilience.

Secondly, organizational resilience act as a mediator: Organizational resilience in MFIs, as per CAS theory, is the ability to anticipate, prepare for, respond to and recover from disturbances (Linnenluecke, 2017). This resilience is not inherent but developed through interactions within the network. By mediating the relationship between networks and sustainable innovations, resilience is highlighted as a critical adaptive mechanism. Resilient MFIs are better positioned to leverage their networks to foster innovation.

Lastly, sustainable innovations go through adaptation. Sustainable innovations in MFIs, as suggested by CAS, emerge from a series of adaptations and learnings. These innovations are responses to environmental challenges, market demands or internal inefficiencies. The study's finding underscores that resilience, nurtured by robust networks, is imperative for these adaptations, leading to sustainable innovations.

5. Conclusions

The main purpose of this paper is to examine the mediating role of organizational resilience in the relationship between self-organization and sustainable innovations among microfinance institutions in Uganda. Thus, the following are the conclusions from the findings of this study.

5.1 Self-organization and organizational resilience

The findings from this study showed that there is a significant and positive relationship between self-organization and organizational resilience among microfinance institutions in Uganda. Self-organized organizations have the ability to accept changes in occupational situations and continue to work at a high level of performance.

5.2 Self-organization and sustainable innovations

The findings from this study also indicated that there is a significant and positive relationship between self-organization and sustainable innovations among microfinance

institutions in Uganda. Self-organization is critical in promoting sustainable innovations in microfinance institutions, enabling them to adapt to changing environments and challenges, leverage their resources and capabilities, and align their operations with sustainable development principles.

5.3 Self-organization and sustainable innovations: The mediating role of organizational resilience

The findings from this study also revealed that organizational resilience partially mediates the relationship between self-organization and sustainable innovations among microfinance institutions in Uganda. Organizational resilience aids actors and institutions to bounce back from adversities and transform to attain sustainable innovations. Indeed, integrating different complex adaptive systems among different organizations can help them to derive value in order to attain resilience.

5.4 Networks and sustainable innovations: The mediating role of organizational resilience

In conclusion, by applying CAS theory, this finding from the Ugandan MFIs provides valuable insights into how networks and resilience interact to drive sustainable innovations. This not only enriches theoretical understanding but also offers practical guidance for MFIs and similar organizations operating in complex and dynamic environments.

6. Implications of the study

The finding that organizational resilience partially mediates the relationship between self-organization and sustainable innovations suggests that self-organizing systems can promote sustainable innovation by building resilient systems that can adapt to environmental challenges. This finding supports the idea that self-organization and organizational resilience are key mechanisms through which organizations can achieve sustainability and long-term success.

This finding enriches the CAS theory by empirically demonstrating how organizational networks contribute to resilience, which in turn fosters sustainable innovations. It extends the theory by linking these elements in a specific context, that of MFIs in Uganda. It also provides evidence that resilience acts as a crucial adaptive mechanism within complex systems, aligning with the theoretical perspectives of CAS.

The findings may help organizations leverage self-organization to enhance their resilience and adaptability to changing circumstances. Policymakers can also promote self-organization by creating an environment that fosters innovation and experimentation, and by promoting decentralization and flexibility in organizational structures. Where organizational resilience partially mediates the relationship between self-organization and sustainable innovations has significant policy implications for organizations and policymakers. Organizations can leverage both self-organization and organizational resilience to promote sustainable development and environmental sustainability through innovation.

Managers can leverage self-organization and organizational resilience to enhance the adaptability of their organizations by promoting a culture of learning, experimentation and innovation. Managers can also create a decentralized and flexible organizational structure that encourages self-organization and supports the development of resilient systems. This finding can inform managerial strategies aimed at promoting sustainable organizational growth and development.

For practitioners in the microfinance sector, particularly in Uganda, the finding that organizational resilience fully mediates networks and sustainable innovations underscores the importance of investing in and nurturing networks. Strong networks can be a source of

support, knowledge and resources, essential for building resilience. MFIs should focus on developing resilience as a strategic objective. This involves not just risk management but also fostering a culture of adaptability and learning. The finding also guides MFIs to recognize the indirect path through which networks impact sustainable innovations via resilience. This understanding can help in strategic planning and resource allocation.

7. Limitations and future research guidance

The data for this study were collected only from microfinance institutions in Uganda. Future studies may collect data from other formal financial institutions like commercial banks, credit institutions to the mediating effect of organizational resilience. More still, this study was cross sectional in nature. Besides, future studies may use longitudinal research design. Likewise, this study was conducted with data collected from only Uganda. Thus, a similar study can be carried out from other developing countries for purposes of generalization.

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About the authors

Aziz Wakibi is a PhD student at Makerere University. He is a lecturer in the Department of Marketing and Management, Makerere University Business School (MUBS). His research interests are in

sustainable innovations, market modelling, market intelligence, entrepreneurship especially women business start-ups and project management. Aziz Wakibi is the corresponding author and can be contacted at: awakibi@mubs.ac.ug

Joseph Ntayi, PhD, is a professor of procurement and logistics management at Makerere University Business School, Kampala, Uganda. His teaching and research interests are in Procurement, Supply Chain Management, Business Ethics, Leadership, Occupational Health and Safety, Marketing and financial inclusion. Professor Ntayi is on the editorial boards of scholarly journals, a reviewer of many international journals, a distinguished international scholar publishing over 150 journal articles in refereed journals.

Isaac Nkote, PhD, is the former dean faculty of Commerce Makerere University Business School. His research interests are in the areas of finance for microfinance institutions, real estate and strategy.

Sulait Tumwine, PhD, is an associate professor of accounting at Makerere University Business School, Kampala, Uganda. He is the former dean of Faculty of graduate studies and research. His research interests are in behavioural finance, managerial accounting, financial analysis, banking and financial institutions and stability. He has authored several papers in behavioural finance and accounting in peer reviewed journals.

Isa Nsereko holds a PhD from Makerere University. He is a senior lecturer at Faculty of Entrepreneurship and Business Administration, Makerere University Business School, Kampala – Uganda. His research interest are in Social Entrepreneurial Venture.

Muhammad Ngoma holds a PhD from Makerere University, Uganda. Professor Ngoma has research interest in the area of Marketing, Communication Strategy Corporate Governance.