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Exploring the necessity of corporate dynamic capability and sustainable performance

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Background: Many studies navigated corporate dynamic capability's direct and indirect effects on sustainable performance. However, there is an empirical literature conundrum regarding the sufficient and necessary condition of corporate dynamic capability that can enhance the sustainable performance of microfirms.

Aim: The main goal of this study is to explore the necessary and sufficient conditions for corporate dynamic capabilities that support sustainable performance and to determine if agility mediates the relationships between knowledge sharing, managerial cognitive capabilities, sensing capabilities, and sustainable performance.

Setting: This study surveyed 440 Tanzanian dairy microfirms between July 2021 and January 2022.

Method: Partial least squares-path modeling (PLS-PM) and necessary conditions analysis (NCA) were applied from the data collected from 602 managers and employees of microfirms in Tanzania.

Results: The study confirmed that a higher degree of agility, and sensing capability among employees is necessary and sufficient for achieving sustainable performance of microfirms. Agility possibly confounds the relationships between sensing capability, knowledge sharing and managerial cognitive capability on sustainable performance.

Conclusion: Knowledge sharing, agility and sensing capability are crucial for sustainable performance, while other dynamic capability factors are not critically sufficient and necessary for growth.

Contribution: The study offers valuable insights by identifying critical levels of agility, knowledge sharing, managerial cognitive capability, and sensing capability sufficient for sustainable performance in dairy microfirms. It also provides empirical evidence of agility's complementary role in mediating the effects of knowledge sharing, sensing capability, and managerial cognitive capability on sustainable performance.

Keywords: corporate dynamic capability; sustainable performance; microfirms; Tanzania; necessary conditions analysis.

Introduction

The sustainable performance of microfirms encompasses their ability to achieve long-term success while balancing economic, social and environmental responsibilities (Büyüközkan & Karabulut 2018; Bwabo, Zhiqiang & Mingxing 2022; Castellani et al. 2023; Cezarino et al. 2019). The debate about sustainable performance centres on the complex interplay between economic growth, social equity and environmental stewardship (Cezarino et al. 2019). Scholars, policymakers and business leaders discuss and often disagree on how to balance these three pillars of sustainability to achieve long-term viability and success for organisations and societies (Liu et al. 2020). Some argue that strong governance and ethical practices are crucial, ensuring transparency in the interplay of economic and environmental stewardship as an ethical treatment of resilience among microfirms (Abbasi et al. 2023). By integrating these sustainable performance dimensions microfirms can build a resilient and sustainable business that thrives economically and contributes positively to society and the environment (Yang et al. 2023). Consequently, the specific necessary and sufficient degrees required for constructing capability-resilience in order to account for sustainable performance and attain balance continue to be an unexplored area, with only a scant amount of research having been done from this perspective (Geyi et al. 2020; Ofori 2024).

From a socioeconomic perspective, Tanzania's dairy sector is a significant source of income and employment, especially in rural areas. The dairy industry supports livelihoods, contributes to food security and plays a role in poverty reduction (Bwabo et al. 2024). However, dairy microfirms are struggling to incorporate sustainability into their dynamic capabilities to balance economic, social and environmental responsibilities (Kurwijila 2011; Quaicoe et al. 2024). Investigating these socioeconomic conditions helps to identify key challenges and opportunities for strengthening the resilience and sustainability of dairy microfirms in this context. By focussing on this perspective, this study aims to uncover strategies that can promote their long-term sustainability and support the broader goals of economic development, environmental stewardship and social equity in Tanzania. Undoubtedly, previous scholars have exhorted exploration of sustainable performance through practices such as waste management, water conservation and sustainable sourcing (Bwabo, Zhiqiang & Mingxing 2023; Fainshmidt et al. 2018). Certainly, for dynamic capabilities to be effective in supporting sustainable performance, understanding the key necessary and sufficient conditions is pivotal in maintaining the dairy microfirms dynamism in challenging times and establishing a strategic performance balance. Sufficient conditions refer to those elements that ensure the necessary conditions are not only present but also utilised effectively to achieve the desired outcome – in this case, sustainable performance (Dul 2016). Sufficient conditions enhance the basic components, making them fully operational and impactful. Thus, by meeting these conditions and supporting them with strategic intent, organisational learning, resource allocation and effective governance, dairy microfirms can adapt and thrive. In recent years, scholars have attempted to narrow this knowledge gap concerning the interaction between corporate dynamic capability and sustainable performance. For example, Ndofor et al. (2014) showed how differences in the capabilities of management teams can improve resource action performance. Bwabo et al. (2023) also pointed out the positive relationship between unobserved dynamic capabilities and sustainable performance. However, there is a lack of empirical research on the necessary conditions that are sufficient for improving sustainable performance in dairy microfirms in emerging economies like Tanzania.

Corporate dynamic capability is a critical concept for understanding how firms achieve and sustain competitive advantage in a dynamic business environment (Pitelis, Teece & Yang 2023). Corporate dynamic capability is the firm's capacity to build, integrate and reconfigure its resources and capabilities to address and exploit changes in the external environment (Teece 2017). In that case, it emphasises the importance of flexibility, adaptability and continuous improvement in responding to external changes and opportunities (Pais & Santos 2014; Schilke 2014). For example, Herath and Harrington (2023) and Geyi et al. (2020) argued that corporate dynamic capabilities contribute to sustainable performance by enabling firms to align their operations with long-term environmental, social and economic goals. Together, the components of corporate dynamic capabilities (knowledge sharing, sensing capability, managerial cognitive capability and agility) create a synergistic effect, fostering informed sensing, continuous learning and innovation, ensuring long-term sustainable performance for microfirms (Zhou et al. 2019). Nonetheless, the necessary conditions of corporate dynamic capability – sensing, knowledge sharing, managerial cognitive capability and agility – are closely interwoven with sustainable performance (Ofori 2024; Quaicoe et al. 2024). Revealing conditions enable microfirms to adapt to environmental changes, innovate, improve efficiency and manage risks effectively. However, the interplay between necessary conditions of corporate dynamic capability for improving sustainable performance in the domain of dairy microfirms remains underexplored.

Following the ambiguous backdrop regarding critical necessary and sufficient factors of the corporate dynamic capabilities that enhance sustainable performance, this study offered two objectives. Firstly, to describe the necessary and sufficient condition of corporate dynamic capability that improves sustainable performance. Secondly, to examine how agility mediates the effects of sensing capability, managerial cognitive capability and knowledge sharing on sustainable performance. To significantly reduce this empirical oversight in the dynamic capability realm, this study provided a gripping insight into the two above problems with rare multi-level causal analysis approaches: partial least squares path modelling (PLS-PM) and necessary conditions analysis (NCA) (Richter & Hauff 2022; Vis & Dul 2018; Richter et al. 2020).

The study is structured as follows: Firstly, a review of the literature related to the Knowledge-Based View (KBV), dynamic capabilities, and sustainable performance is carried out. This review aims to describe each concept in detail and establish the connections among them. Based on this, a conceptual variable relationship is defined, which leads to the proposal of a unified conceptual framework. Subsequently, appropriate research methods are employed to present the findings. Finally, the article draws conclusions and emphasizes both the managerial and theoretical implications.

Literature review and hypotheses

Knowledge sharing and sustainable performance

The knowledge-based view (KBV) emphasises that knowledge sharing serves as both a sufficient and necessary condition for sustainable performance by fostering continuous learning, innovation and strategic agility (Albert 2024). According to KBV assumptions in the social sciences, knowledge is divided into two key categories: explicit information and tacit knowledge (Zheng et al. 2011). Explicit knowledge refers to codified knowledge that is easily transmitted between managers and employees within a firm

(Schwarz et al. 2020). For knowledge sharing to be effective, the flow of explicit knowledge or information between managers and employees must occur without loss. In this context, knowledge sharing involves the exchange of either explicit or tacit information to enhance sustainable performance (Pais & Santos 2014; Testa 2014). In the dairy industry, this could include daily sales reports, marketing strategies, intellectual property rights and knowledge protection (Bwabo et al. 2024).

Building on this background, the empirical literature lacks sufficient information regarding the necessary and sufficient thresholds of employee knowledge sharing required to impact sustainable performance in the dairy industry (Michaelis et al. 2021). Based on the two broad categories of knowledge, various knowledge-sharing characteristics could significantly enhance sustainable performance in this context. Among these, transferability, aggregation and appropriability are essential (Khan, Hussain & Sampene 2023). These three facets are vital for distilling explicit and codified knowledge between managers and employees, thereby strengthening the competitive advantage of dairy microfirms. Equipping managers and employees with these characteristics is crucial, as their ability to process and filter information can be greatly enhanced, positively impacting the sustainable performance of dairy microfirms.

Therefore, the study hypothesised that:

H1: Knowledge sharing among managers and employees is a sufficient and necessary condition for supporting sustainable performance.

Managerial cognitive capability and sustainable performance

The KBV suggests that managers and employees are viewed as information workers (Walsh 1995). Their primary role is to absorb, process, disseminate information and identify opportunities for the firm. The flow of information across various departments can often overwhelm both management and staff. Jenkins and Johnson (1997) noted that data processing is closely linked to market identification and reducing the risk of environmental disruptions. However, the current business environment presents a significant challenge in terms of the complexity of information processing, which is crucial for effective decision-making by managers and employees (Pitelis et al. 2023). A limited ability to process this information flow may compromise the firm's sustainable performance (Asiaei et al. 2021).

The core concept of managerial cognitive capabilities among managers and employees is that they can approach information processing in two fundamental ways. The first is the 'top-down' method, where the experience of managers and employees helps guide current decision-making processes (Jantunen et al. 2018). The second is the 'bottom-up' approach, where information gathered from the industry shapes the behaviour of managers and employees. In the top-down approach, cognitive structures are formed through experience and influence individual capabilities. Conversely, in the bottom-up approach, information shapes the capabilities of managers and employees. However, there is currently limited empirical literature on the sufficient and necessary conditions of employees' and managers' cognitive capabilities required to impact sustainable performance in dairy microfirms. Therefore, this study hypothesises that:

H2: Managerial cognitive capability among managers and employees is sufficient and necessary condition for supporting sustainable performance.

Sensing capability and sustainable performance

Given the aforementioned aspects of corporate dynamic capabilities, information sharing – an intangible yet critical factor, as highlighted by Teece (2010) – plays a key role in enhancing a firm's sensing capability. Codified and explicit knowledge are crucial tools that integrate with sensing capabilities between managers and employees, contributing to a firm's sustainable performance (Endres et al. 2020). Sensing capability refers to a firm's ability to identify, pursue and interpret opportunities by leveraging internal and external resources (Teece 2017). Within the framework of the KBV, sensing capability is both a sufficient and necessary condition for sustainable performance, allowing organisations to navigate dynamic environments through informed decision-making and strategic adaptation.

In the context of dairy microfirms, sensing capability means the ability of managers and employees to gather market intelligence, understand competitors and recognise emerging technology trends. These three factors are crucial for generating the marketing intelligence necessary for a firm's sustainable performance. Some scholars further equate marketing intelligence with identifying consumer needs and preferences (Fainshmidt et al. 2016; Quaicoe et al. 2024). Thus, interpreting marketing intelligence in line with industry resources and capabilities is crucial for managers and employees to steer the firm in the right direction (Abbas et al. 2023; Teece 2017).

Moreover, dairy microfirms need to integrate both tangible and intangible resources to strengthen their dynamic capabilities. This requires managers and staff to interpret marketing intelligence and compare it with available resources to enhance the firm's sustainable performance (Borah et al. 2022). Because knowledge is an immaterial asset, effective communication between managers and staff is essential for driving sustainable performance through the use of intangible resources (Cezarino et al. 2019). Despite its significance, the relationship between sensing capability and sustainable performance in dairy microfirms has been underexplored in the literature. Based on this background, the study hypothesises that:

H3: Sensing capability among managers and employees is sufficient and necessary condition for supporting sustainable performance.

Agility as the mediator and sustainable performance

As mentioned earlier, knowledge sharing is categorised into two main forms: explicit and codified. These two broad categories are imbued with numerous characteristics that can influence sustainable performance. It is fair to assert that a firm's agility or flexibility depends on how effectively managers and employees leverage this knowledge. In this context, a firm's agility is enhanced through the transfer of explicit or codified knowledge between managers and employees, which directly impacts the sustainable performance of dairy microfirms (Dey & Mukhopadhyay 2018; Schwarz et al. 2020). Knowledge sharing in dairy microfirms operates as a double-edged sword: on one hand, it improves the firm's flexibility and dynamic capabilities (Carneiro 2000), while on the other, it integrates explicit and codified knowledge into individual employees, fostering a knowledge-based function that is key to organisational flexibility.

By highlighting the strategic importance of knowledge assets in promoting organisational flexibility, the KBV connects sensing capability, knowledge sharing, managerial cognitive capability and agility. The logic of KBV underscores that knowledge is a critical strategic asset that offers a competitive edge (Grant 1996). For instance, sensing capability and knowledge sharing, as mentioned earlier, are core tenets of KBV, ensuring that insights gained from resource exploration and knowledge dissemination among employees and managers enable rapid and informed decision-making (Bwabo et al. 2024; Kurwijila 2011). Together, these elements promote continuous learning and adaptation, fostering a culture of agility among employees and managers. By exercising sensing capability, managers and employees can identify emerging trends and technologies, drive innovation and reconfigure resources effectively in response to changes, thereby maintaining organisational agility (2010; Herath & Harrington 2023).

In addition to this, previous scholars, including Jantunen et al. (2018), have pointed out that the relationship between agility and sustainable performance is synergistic. Agility enables firms to respond effectively to changing conditions, innovate continuously and optimise resource use, all of which contribute to enhanced sustainable performance. Conversely, a strong focus on sustainability can drive agility by fostering a culture of responsiveness and adaptation to environmental and social challenges. In this study, we measured the sustainable performance of dairy firms by employing subjective indicators as outlined by Schilke et al. (2018). It is important to note that these subjective measures allow for a nuanced evaluation of sustainable performance, capturing qualitative aspects that may not be reflected in quantitative data alone. The study leverages the logic of the KBV to assess various dimensions of sustainable performance, including environmental impact, social responsibility and economic viability. This approach provides a comprehensive understanding of how dairy firms align their operations with sustainability principles within the context of the dairy industry.

To this end, the integration of sensing capability, knowledge sharing, managerial cognitive capability and agility – guided by the principles of KBV – enables organisations to sustain a competitive advantage and achieve sustainable performance in dynamic environments (Fainshmidt et al. 2016). Although empirical literature validates the relationship between knowledge sharing, managerial cognitive capability and sensing capability in other domains (Michaelis et al. 2021; Ofori 2024). There is limited exploration of the mediation effects of agility, as well as the minimum necessary and sufficient conditions required to enhance sustainable performance in the dairy industry. Therefore, the study hypothesises that:

H4a$_1$: Agility mediates the effects of knowledge sharing on sustainable performance.

H4a$_2$: Agility mediates the effects of sensing capability on sustainable performance.

H4a$_3$: Agility mediates the effects of managerial cognitive capability on sustainable performance.

H4b: Agility among managers and employees is a sufficient and necessary condition for supporting sustainable performance.

Research methodology

To test the above hypotheses, the study developed the conceptual framework (Figure 1) and leveraged the managers and employees of the dairy microfirms to evaluate the short statements through Likert scales that have been consolidated following the two study objectives mentioned earlier. The study tested the conceptual framework with four tested hypotheses (H1, H2, H3, H4a$_1$, H4a$_2$, H4a$_3$ and H4b) among managers and employees of the dairy microfirms. The study has combined two software: smartPLS4 (Ringle et al. 2024) and R programming language (version 4.3.3) (R Core Team 2024). Certainly, combining the two software enhances the reliability, validity and multi-level analysis.

Assessment of survey response

The study data were collected in multiple waves to reduce the common method bias (CMB) in Tanzania between April and July 2021–January 2022 through drop and collection methods following the pandemic effects that affect the universe (Podsakoff et al. 2003; Ylitalo 2009). On one side, the first wave surveyed 320 dairy microfirms and on the other side, the second wave the study surveyed 120 dairy microfirms; together, the study surveyed 440 dairy microfirms. Following

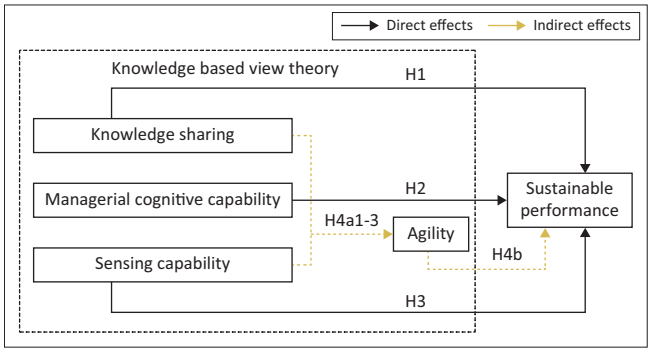


FIGURE 1: Conceptual framework.

the outcomes of the first and second waves, afterwards, the study conducted survey responses with a particular emphasis on the adequacy of responses and the demographic characteristics of the respondents. The designated sample size for the current study is 602 individual employees and managers. However, the employees and managers were randomly contacted. It is worth noting that this study deployed an EFA with a five-factor analysis to identify the key corporate dynamic capabilities underlying its relationship with sustainable performance (Figure 1). Five people from each dairy microfirm were chosen as responders in order to guarantee that the data gathered would be representative and appropriate to test the conceptual framework. In so doing, the study facilitates the distribution of enough surveys to ensure that an adequate number of well-completed surveys are received. Therefore, the study distributed 700 survey questionnaires and received 602 feedback, which is equal to 86% that are sufficient for developing the multi-level analysis (Ukko et al. 2017). In addition to that, the Likert scale of the surveyed questionnaire was designed with the seven-point Likert scale from strongly disagree to agree.

Methods and measurements

The study examined the data distribution through a normal quantile-quantile plot (Q-Q plot), which is a graphical tool used to assess whether our set of data approximately follows a normal distribution. Arguably, Q-Q plot is used to visually assess whether a dataset is normally distributed. Figure 2 confirmed that the study data points fall approximately along a straight line (the 45-degree line), therefore, the data are approximately normally distributed. On the other hand, there is a small percentage of data points that deviate from this line suggesting departures from normality (Bishop 2006). It is important to note that both PLS-PM and NCA are well-suited for non-normal data. Nonetheless, understanding the distribution pattern of the data and visualising its normality enhance the validity of the findings (Dul 2016; Sarstedt et al. 2020; Hauff et al. 2024). Therefore, in this study, the deviated data points between the Q-Q plot and the Robust Mahalanobis Distance (MD) were compared as an initial data purification step to improve the reliability and validity thresholds of the constructs.

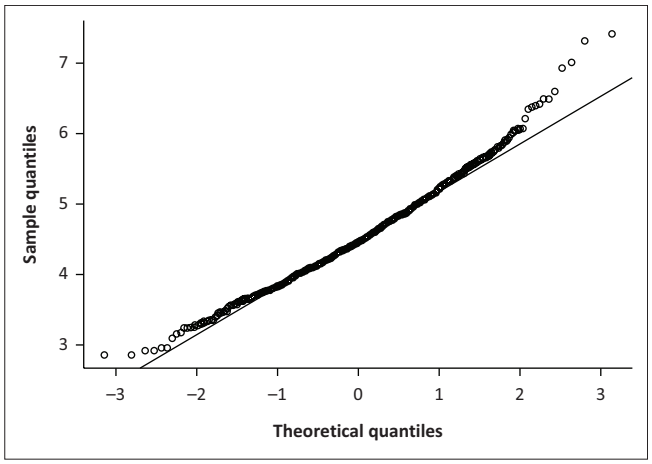


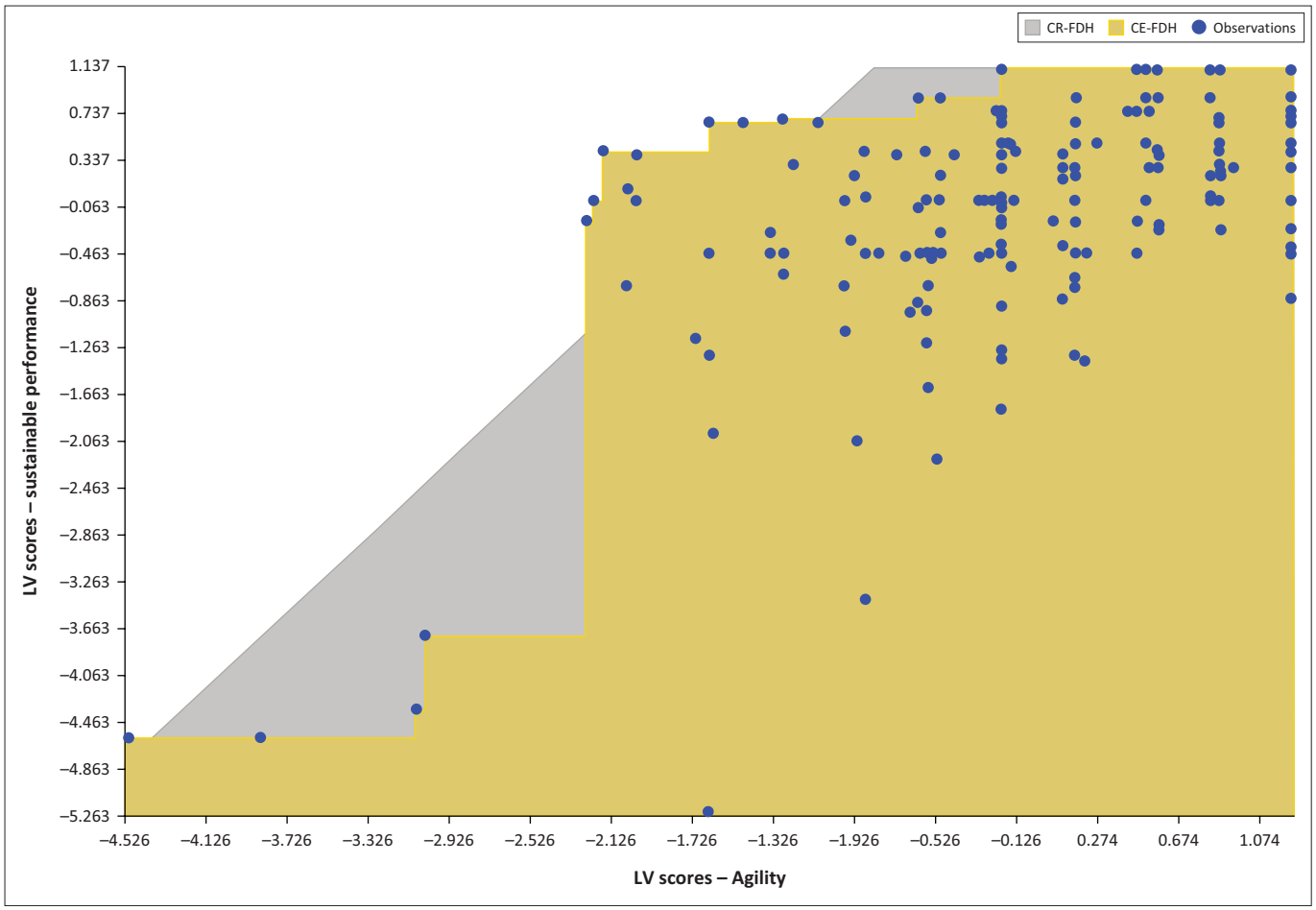
FIGURE 2: Normal Q-Q plot.

Moreover, the study unpacked the MD to evaluate any potential outliers that could influence either the PLS-PM or NCA analysis (Massiera et al. 2018). Mahalanobis distance measures the distance of a data point from the centroid of a dataset in multivariate space, considering the covariance structure of the variables (Hong et al. 2015; Tabachnick & Fidell 2019). Complementing with MD was important to identify and confirm potential outliers that can affect the downstream analysis (Leys et al. 2018; Streiner 2018). Therefore, outliers have been removed following the Q-Q plot and MD before carrying out the PLS-PM and NCA.

Following data cleaning and preprocessing steps, the study combined PLS-PM and NCA approaches. It began by calculating individual indicator weights while accounting for measurement errors within the variables (Henseler & Chin 2010). These weights, generated as part of the PLS-PM algorithm, were presented as regression weights and referred to as Mode A and Mode B. The study then used the indicator scores as input, enabling PLS-PM to generate composite scores for each construct as linear combinations of the relevant indicators, ensuring superior reliability. Following this, the PLS-PM results were used as a foundational base for NCA to evaluate the necessary conditions (Hauff et al. 2024; Richter et al. 2020; Sarstedt et al. 2020). By combining the two approaches, the study disentangles sufficient and necessary (must-have) factors in relation to corporate dynamic capabilities and their impact on sustainable performance (Clarke 2005; Ritchter et al. 2020). This technique provides valuable insights for comprehensively understanding both necessary and contributory factors, as well as the effects of agility on the sustainable performance of Tanzanian dairy microfirms.

To be more precise, NCA relies on calculating ceiling lines, with the strongest method being the 'ceiling envelope with free disposal hull' (CE-FDH) because this study used discrete data (Hernaus, Dragičević & Hauff 2024). The CE-FDH method produces a graphical representation where the size of the space in the upper left corner indicates the level of necessity that predictors must meet to achieve sustainable performance (see Figure 3 and Figure 4). This study also summarises the relationship in a bottleneck table, which details the results of CE-FDH for each level of knowledge sharing, sensing capability, managerial cognitive capability and agility in generating sustainable performance of dairy microfirms (Goertz 2006). Additionally, the study has run the permutation test of 10 000 to figure out the significance of the effect size towards sustainable performance (Henseler, Ringle & Sarstedt 2015).

Moreover, the validity and reliability analyses of the variables were assessed using Cronbach's alpha (CA) and average variance extracted (AVE). Knowledge sharing (CA = 0.917; AVE = 0.751, sensing capability (CA = 0.87; AVE = 0.661), managerial cognitive capability (CA = 0.815; AVE = 0.646) agility (CA = 0.775; AVE = 0.585) and sustainable performance



NCA, necessary conditions analysis; LV, latent variable; CE-FDH, ceiling envelope with free disposal hull.

FIGURE 3: Ceiling line chart (agility).

(CA = 0.798; AVE = 0.621). The results from CA and AVE analyses indicate that the variables used in this study possess strong reliability and validity (Tabachnick & Fidell 2019). Each variable demonstrates satisfactory internal consistency, with CA values exceeding 0.70 (Ringle et al. 2014). Furthermore, the AVE values confirm that the constructs have good convergent validity, with each variable explaining more than half of the variance of its indicators. These findings suggest that the measures used in this study are both reliable and valid for assessing the constructs of interest (Henseler, Hubona & Ray 2016).

Ethical considerations

An application for full ethical approval was made to the Commission of Science and Technology (COSTECH) and Moshi Co-operative University (MoCU) and ethics consent was received on 10/05/2021 and 7/05/2021. The ethics approval number is Ref.No.FA.195/132/01/122 and Ref. No.FA.228/276/03.

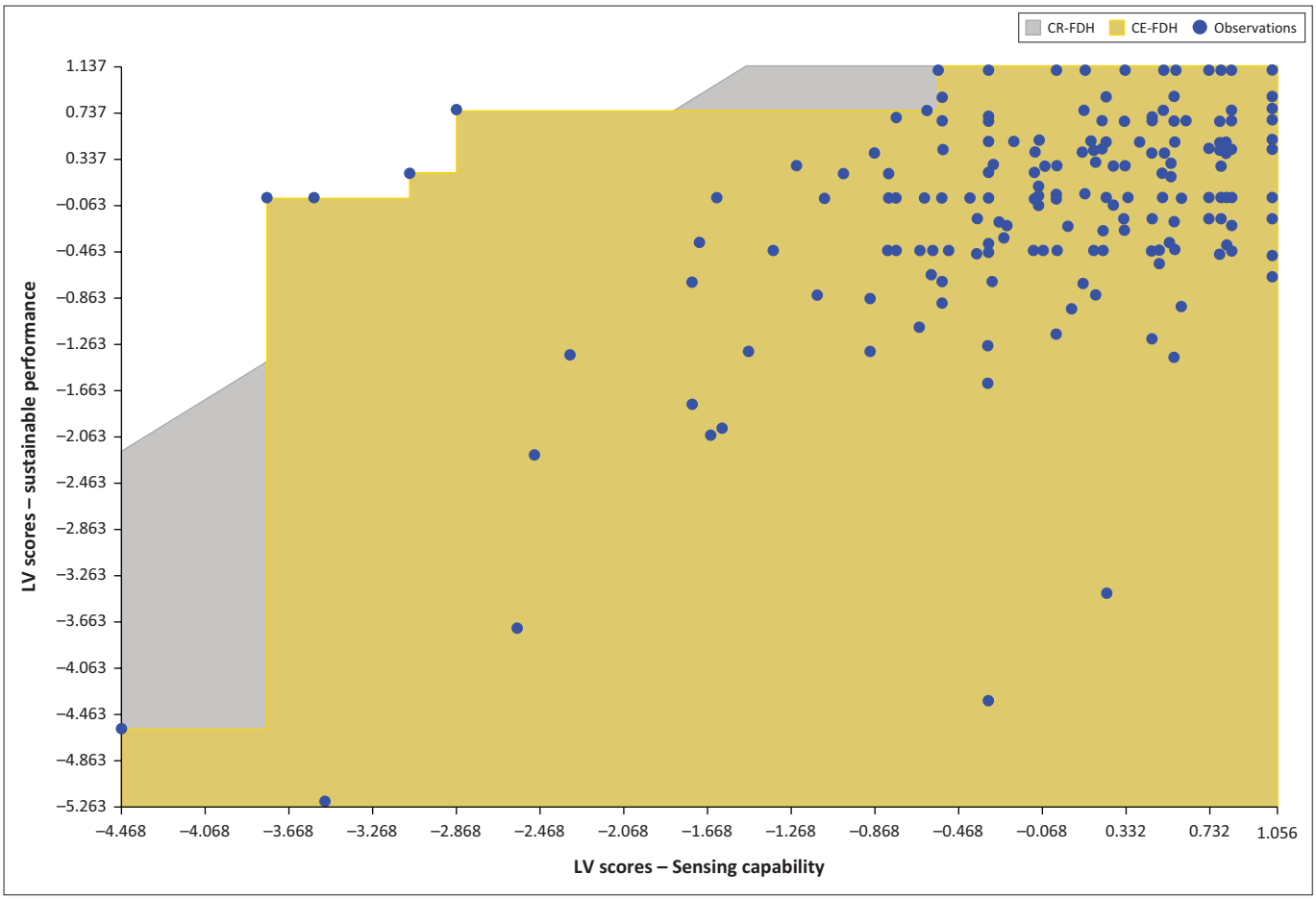
Results

Inner model summary (PLS-PM)

Table 1 presents the direct relationship between dynamic capability dimensions and sustainable performance using a PLS-PM. Subsequently, the study conducted regression analysis as an alternative model to validate the PLS-PM inner summary (see Appendix 1). The findings have confirmed the relationship between knowledge sharing and sustainable performance with the lower beta values (β = 0.09 [0.04], t = 3.12***). The study provides evidence of the relationship between sensing capability and sustainable performance having stronger beta values (β = 0.392 (0.041), t = 9.444***). On the other hand, the relationship between managerial cognitive capability and sustainable performance has a lower beta value and is insignificant (β = 0.000 [0.392], t = 0.009). The study findings highlighted strong direct effects between dynamic capability dimensions on sustainable performance. In that case, the findings reveal that these dimensions are necessary to improve the sustainable performance of dairy microfirms. To evaluate to what extent are sufficient and necessary to influence sustainable performance, the study complemented it with the NCA and cloned the latent score of the above dynamic capability to test the necessary conditions hypothesis H1–H4b.

Necessary condition analysis

Table 2 unravelled the ceiling line effects size overview following corporate dynamic capability latent score values. The findings revealed that agility and sensing capability



NCA, necessary conditions analysis; LV, latent variable; CE-FDH, ceiling envelope with free disposal hull.

FIGURE 4: Ceiling line chart (sensing capability).

TABLE 1: Structure analysis.

Path and Hypotheses	Original	Mean (M)	Standard deviation	*T* statistics	*p*	2.50%	97.50%
Agility -> Sustainable performance	0.406	0.404	0.037	11.045***	0.000	0.329	0.475
Knowledge sharing -> Agility	0.205	0.204	0.038	5.437***	0.000	0.13	0.278
Knowledge sharing -> Sustainable performance	0.092	0.090	0.029	3.126**	0.002	0.034	0.149
Managerial cognitive capability -> Agility	0.108	0.113	0.031	3.534***	0.000	0.054	0.173
Managerial cognitive capability -> Sustainable performance	0.000	0.002	0.024	0.009	0.993	-0.046	0.051
Sensing capability -> Agility	0.392	0.392	0.047	8.281***	0.000	0.296	0.484
Sensing capability -> Sustainable performance	0.392	0.392	0.041	9.444***	0.000	0.31	0.472

Note: Significance = **, 0.01; ***, 0.001.

TABLE 2: Necessary conditions analysis effects size and inner structure summary.

Variables	NCA – Sustainable performance						Direct effects		
	CE-FDH	Accuracy	Conditions inefficiency	Outcome inefficiency	95%	*p*	Original	*T*-value	*p*
LV scores-Agility	0.364	100	25%	10.39%	0.041	0.000***	0.406	11.045***	0.000
LV scores-KS	0.000	100	n/a	n/a	0.000	0.967	0.092	3.126**	0.002
LV scores-MC	0.003	100	96%	92.5%	0.002	0.036*	0.000	0.009	0.993
LV scores-SC	0.167	100	29.3%	10.39%	0.022	0.000***	0.392	9.444***	0.000

Note: Significance = *, 0.05; **, 0.01; ***, 0.001.

NCA, necessary conditions analysis; LV, latent variable; CE-FDH, ceiling envelope with free disposal hull.

have satisfactory effects on sustainable performance. For example, agility has a ceiling line effect size of 0.364 and sensing capability has a value of 0.167. Nonetheless, knowledge sharing and managerial cognitive capability have lower effects size ceilings to suffice the conditions that are important for necessary conditions. Given the fact that the study used the Likert scale of 1–7, which is discrete data, the study unpacks the CE-FDH to assess the significant effects through permutation tests (Hauff et al. 2024).

The findings have confirmed that agility among the employees is the necessary condition for sustainable performance between the dairy microfirms through the necessity effect size [d = 0.364***], in that case, agility

illustrated the strongest impact on sustainable performance. Thus, the study confirmed that a higher degree of agility among employees is necessary and sufficient for achieving the sustainable performance of dairy microfirms. In comparison with the PLS-PM inner structure summary, agility played a significant role as the mediator in the relationship between sensing capability and knowledge sharing on sustainable performance because the beta value was stronger. The findings have confirmed that knowledge sharing is not a necessary and sufficient condition for the sustainable performance of Tanzanian dairy microfirms.

Therefore, the study confirmed that a higher degree of knowledge sharing among employees is not a necessary and sufficient condition for achieving the sustainable performance of dairy microfirms. Similarly, managerial cognitive capability also has a lower necessity effect size [d = 0.003], still the p-value is significant after running permutation tests. Thus, the study confirmed that a higher degree of managerial cognitive capability among employees is somehow necessary for achieving sustainable performance in dairy microfirms. These findings contradict the inner structure relationship between managerial cognitive capability and sustainable performance (see Table 2). On the other hand, the sensing capability of employees and managers of the dairy microfirms has the necessary and sufficient condition to influence sustainable performance with the strong ceiling necessity effect size [d=0.167***]. Therefore, the study confirmed that a higher degree of sensing capability among employees is necessary and sufficient for achieving the sustainable performance of dairy microfirms.

Table 2 also highlights condition and outcome inefficiency. The NCA results suggested that agility at significant accuracy of 100% underscored the condition and outcome inefficiency 25% and 10.39% on sustainable performance. Furthermore, the NCA results confirmed that sensing capability at a significant accuracy of 100% uncovered the condition and outcome inefficiency of 29.3% and 10.39% towards sustainable performance. The NCA findings show that both agility and sensing capability underlined significant condition and outcome inefficiency (Hauff et al. 2024). On the other hand, knowledge sharing and managerial cognitive capability have insignificant conditions and outcome inefficiency. Having exercised the condition and outcome inefficiency enough, this study presented the bivariate technique to fundamentally examine the bottleneck table for corporate dynamic capabilities and sustainable performance (Dul 2016). Thus, the study presented the value of each dimension's capability that is decisive in achieving the sustainable performance of Tanzania dairy microfirms through CE-FDH in the percentile.

Moreover, the study presented the bottleneck analysis as a result of Figure 3 and Figure 4 showcased the percentage of the cases of individual employees who did not meet the necessary thresholds for agility and sensing capability to fully explain the necessary conditions to achieve sustainable performance. The findings show that 29.9% did not meet the necessary condition threshold to explain the sustainable performance of the dairy microfirms. At the same time, 17.9% of the employees' cases failed to explain the necessary conditions to describe the sustainable performance of the dairy microfirm. Managerial cognitive capability has 2.42% that has failed to explain the sustainable performance of the dairy microfirms. Moreover, the study presented Figure 3 and Figure 4 to predict the critical level that is necessary among knowledge sharing, managerial cognitive capability, agility and sensing capability that significantly suffice to achieve sustainable performance.

Furthermore, the study made an extra step and presented the comparison between the normal structure relationship and the necessary conditions underscored in Table 2. The relationship between knowledge sharing and sustainable performance is significant (H1); nonetheless, there is no minimum knowledge sharing needed for sustainable performance to manifest among the employees of dairy microfirms. The direct relationship between managerial cognitive capability and sustainable performance is not statistically significant (H2); similarly, the original effect size after running the NCA is minimal but is statistically significant. The relationship between sensing capability and sustainable performance is significant, which supports H3 to achieve sustainable performance and there should be a certain minimum level of understanding of sensing capability among employees of the dairy microfirms in Tanzania. For example, Figure 4 presents the total number of employees in dairy microfirms who are necessary for sensing capability to achieve the sustainable performance of dairy microfirms. The study has revealed that 1.056 of the employees of dairy microfirms can significantly influence sustainable performance.

Moreover, the study findings discovered that there is a positive significant relationship between employee agility and the sustainable performance of dairy microfirms (H4b). Certainly, there are certain levels of agility necessary and sufficient for the sustainable performance of dairy microfirms to manifest. Figure 3 presents the number of employees required to achieve the sustainable performance of the dairy microfirms. It turned out that the CE-FDH level of 1.074 is necessary to achieve sustainable performance at 1.137.

Mediation effects

Table 1 presents direct and indirect effects in the relationship between knowledge sharing, sensing capability, managerial cognitive capability, agility and sustainable performance. One of the key prerequisites of the mediation effects (indirect effects) is considering the third variable; in this study, the third variable is agility for that case. Given the fact that Table 1 confirmed mediation effects, it's worth navigating some of the important conditions necessary for the mediations to take place to identify the type and the magnitude effects of the third variable (agility) on the sustainable performance of dairy microfirms. Following the

recommendations framed by Zhao et al. (2010) to establish the mediation analysis is critical to examine not only the indirect effects effect but also the direct effects also come into play to figure out the type and magnitude of the mediation. In this study, we considered four steps before shedding light on how agility mediates the effects of sensing capability, managerial cognitive capability and knowledge sharing on sustainable performance.

Condition 1: The independent variable must have a significant relationship with the dependent variable, the relationship between knowledge sharing and sensing capability on sustainable performance should be statistically significant.

Condition 2: The relationship between sensing capability and knowledge sharing (independent variable) as path a should be significant.

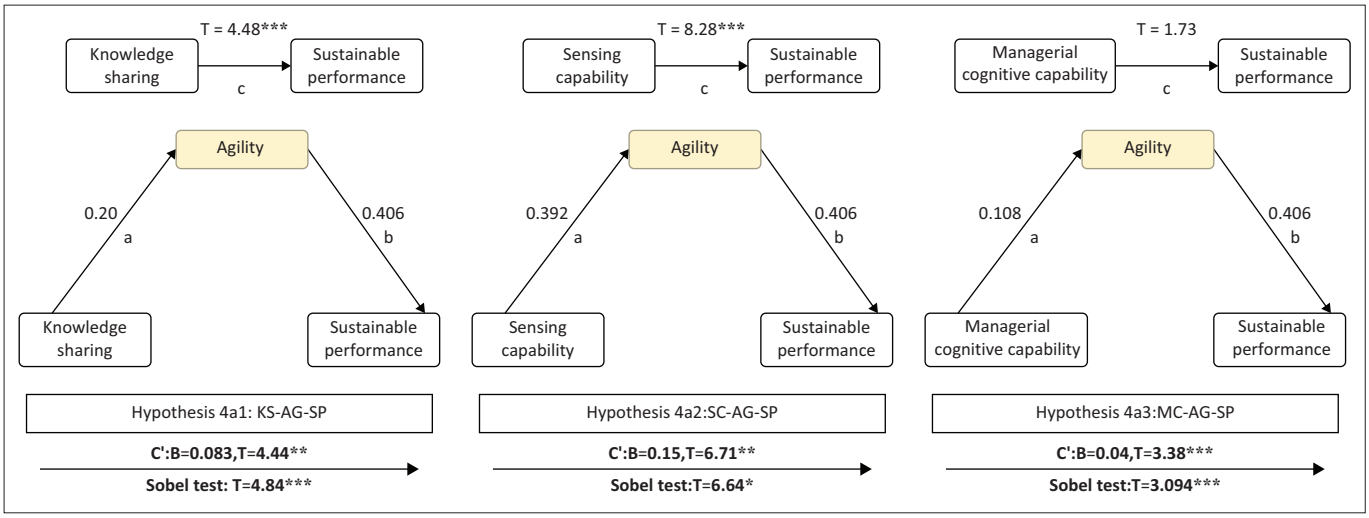
Condition 3: The variation between agility and sustainable performance should be different to zero (path b).

Condition 4: The relationship between knowledge sharing and sensing capability significantly increases or decreases with the presence of the mediation variable (agility).

The above conditions outline a key step in assessing the mediation effect of agility in the relationships between knowledge sharing, sensing capability and managerial cognitive capability on sustainable performance. In this study, we used Table 1 and plotted Figure 5 to help identify the partial mediation effect, allowing us to distinguish between complementary or competitive partial mediation effects (Coutts, Hayes & Jiang 2019). Both types of mediation were established based on the results of the direct effect (C) and the direct effect prime (C′), which are summarised in the mediation overview (see Figure 5).

For the first link ($H4a_1$: KS-AG-SP), the study presented the first condition regarding the direct effects (C) between knowledge sharing and sustainable performance was statistically significant ($\beta = 0.092$, $t = 4.482$***). In addition to this, knowledge sharing and agility (path a: $\beta = 0.20$, $t = 5.43$***), as well as the mediating variable have illustrated the significant effect on sustainable performance (path b: $\beta = 0.406$, $t = 11.04$***). The beta values of paths a and b have confirmed the significant relationships, and the first condition has been met as explained earlier. Thus, it supported $H4a_1$ that agility mediates the effects of knowledge sharing on sustainable performance. Taken together, the findings have suggested that agility has played a crucial role in mediating or intervening in the relationship between knowledge sharing and sustainable performance. The beta coefficient value between a and b shows some variation when compared with the total indirect effects for $H4a_1$. For instance, path a shows a beta coefficient variation of 0.12 and path b exercised a beta coefficient variation of 0.32. In the case of the first and second values, there is evidence that agility has fully intervened in the relationship between knowledge sharing and sustainable performance.

It is evidence that agility possibly confounds or falsifies the relationships between the former on the latter. On the other hand, the study carried out the Sobel test and deeply examined the standard error of paths a and b, Sobel test statistics was $t = 4.84$***. Therefore, the agility showcased the complementary mediation hypotheses type because the C′ is significant and there is positive variation in the inclusions of the agility in mediating the effects of sensing capability and knowledge sharing on sustainable performance. The study also presented the portion of the complementary mediation effects that agility, as demonstrated by unpacking the variance, accounted for through the ratio between direct to indirect effect (Rucker et al. 2011). The partition in percentage that agility influences sustainable performance as the mediator is 30%.



Note: Significance = *, 0.05; **, 0.01; ***, 0.001.

FIGURE 5: Mediation summary.

About the second link (H4a$_2$: SC-AG-SP), the study presented that the direct effects (C) between sensing capability and sustainable performance were statistically significant (β = 0.55, t = 12.53). Furthermore, in the path that links sensing capability and agility (path a: β = 0.392, t = 11.04), the mediating effects of agility on sustainable performance were the same beta value score mentioned earlier (path b: β = 0.406, t = 11.4). The findings show that all the guidelines to establish the mediation effects have been met. Comparing the variations in the beta coefficients between pathways a and b to the total indirect effect to which the mediator has contributed is now crucial. Path a has a coefficient difference of 0.24 and path b received a coefficient difference of 0.25 given that the beta weight for the two links does change. The results of this set of beta variations between paths a and b have verified that agility has acted as a mediator between the effects of sensing capacity and the dairy microfirm's sustainable performance. Thus, it supported H4a$_2$ that agility mediates the effects of sensing capability on sustainable performance. At the same time, the study carried out the Sobel test as has been shown in Figure 5. The standard error for paths a and b was used in the study's auxiliary analysis to get the Sobel statistics value of t = 6.64***. As the direct effect prime (C′) is statistically significant and the overall effect has also demonstrated a positive influence, it is reasonable to argue that agility also played the complementary type of mediation hypotheses in this path. In other words, agility has partially elevated positive directions. To shed light on the relationship between indirect with total effects, the study debunks Variance Accounted For (VAF); the study examined the ratio between a*b / (a*b + C′), which was presented in Figure 5. The VAF accounted for in this path is 55%, which is higher compared to the counterpart's knowledge sharing that obtained the VAF of 30%. The findings suggested that the hypothesis mediation effect is stronger than the former path.

Regarding the third link (H4a3: MC-AG-SP), the study demonstrated that the direct effects (C) between managerial cognitive capability and sustainable performance were insignificant with the lower beta value (β = 0.04, t = 1.73). Following this beta score, the path that links managerial cognitive capability and agility (path a: β = 0.108, t = 3.38), the mediating effects of agility on sustainable performance was the same beta value score mentioned earlier (path b: β = 0.406, t = 11.4). The findings show that all the guidelines to establish the mediation effects have been met although the direct effects were not statistically significant. Therefore, H4a$_3$ has supported that agility mediates the effects of managerial cognitive capability on sustainable performance. It is worth examining the variations among the beta coefficients between paths a and b, while comparing them to the total direct effect involving the mediator. Path a has a coefficient difference of 0.06, whereas path b has a coefficient variation of 0.36.

Following this set of beta variations between paths a and b, the findings have confirmed that agility has mediated the effects of sensing capability on the sustainable performance of the dairy microfirm. Thus, it supported H4a$_3$ that agility mediates the effects of managerial cognitive capability on sustainable performance. At the same time, the study carried out the Sobel test as has been shown in Figure 5. The study has made an auxiliary analysis leveraging the standard error for paths a and b to test the Sobel statistics value of t = 3.094***. Altogether, it is fair to argue that agility has a full mediation effect in this path because the direct effect prime (C′) is statistically significant while the total effect is insignificant. The VAF accounted for in this path is 14%, which is lower compared to knowledge sharing and sensing capability.

The above findings revealed that agility played a complementary partial mediation effect of knowledge sharing, sensing capability and managerial cognitive capability on the sustainable performance of dairy microfirms. The findings have proved that a*b and c′ are significant as well as positive directions. However, the direct effects between managerial cognitive capability on sustainable performance turned out not to be significant. In that sense, this has illustrated that the portion of knowledge sharing, sensing capability and managerial cognitive capability of the dairy microfirms is mediated through agility, while knowledge sharing and sensing capability still explain the sustainable performance of Tanzanian dairy microfirms. The total percentage value of the VAF is 99%, which implies that the magnitude of the mediation ratio is higher because the VAF exceeded the 99% threshold set by the general guidelines. Further explanations have been enriched in Figure 5. Taken altogether, the complementary mediation hypotheses suggested that agility turned out to be an important indicator that confounds relationships between sensing capability and knowledge sharing on the sustainable performance of the Tanzanian dairy microfirms (Nitzl, Roldan & Cepeda 2016).

Discussion

The main objective of this study was to investigate the necessary and sufficient conditions of corporate dynamic capability that help sustainable performance as well as explore how agility mediates the effects of sensing capability, managerial cognitive capability and knowledge sharing on the sustainable performance of dairy microfirms in Tanzania. The study findings have confirmed that the relationship between knowledge sharing and sustainable performance is significant (H1); nonetheless, there is no minimum knowledge sharing needed for sustainable performance to manifest among the employees of dairy microfirms (Bwabo et al. 2023; Zimuto & Maritz 2019). The direct relationship between managerial cognitive capability and sustainable performance is not statistically significant (H2), similarly, the original effect size after running the NCA is minimal but is statistically significant (Castaneda & Cuellar 2020; Quaicoe et al. 2024).

These results suggested that in order to increase sustainable performance, dairy microfirm employees must possess a

specific degree of managerial cognitive capacity. It is not advised, nonetheless, to raise managerial cognitive aptitude any more as this will not benefit Tanzanian dairy microfirm personnel (Kumbure et al. 2020). The relationship between sensing capability and sustainable performance is significant, which supports H3, to achieve sustainable performance there should be a certain minimum level of understanding of sensing capability among employees of the dairy microfirms in Tanzania (2017). At the same time, there are positive significant relationship between employee agility and the sustainable performance of dairy microfirms (H5). Certainly, there are certain levels of agility necessary for the sustainable performance of dairy microfirms to manifest (Ofori 2024).

About the mediation effects, the study findings have provided evidence that agility mediates the effects of knowledge sharing on sustainable performance, Thus, it supported $H4a_1$. In this context, the findings have suggested that agility has played a crucial role in mediating or intervening relationship between knowledge sharing and sustainable performance. In the same vein, the study confirmed that agility has mediated the effects of sensing capability on the sustainable performance of the dairy microfirm (Geyi et al. 2020). Thus, it supported $H4a_2$ that agility mediates the effects of sensing capability on sustainable performance. Lastly, the study findings have also confirmed the agility-mediated effects of sensing capability on the sustainable performance of the dairy microfirm in Tanzania (Bwabo et al. 2022). In that case, it supported $H4a_3$ that agility mediates the effects of managerial cognitive capability on sustainable performance.

Therefore, the study discovered that agility played complementary mediation effects in the interplay of knowledge sharing, sensing capability and managerial cognitive capability on sustainable performance. This implied that Knowledge sharing also improves organisational agility among managers and employees of dairy microfirms, which in turn enhances sustainable performance (Zimuto & Maritz 2019). Moreover, agility is characterised by the ability to quickly adapt to changes, respond to new opportunities and recover from disruptions. It benefits from shared knowledge, which provides the necessary insights and information to react promptly and effectively. Therefore, understanding complementary mediation effects can help design more effective performance enhancement programmes. For instance, initiatives that simultaneously promote knowledge sharing and build agility can lead to more sustainable performance improvements. In a similar context, agility exhibits stronger mediation effects in the relationship between sensing capability and the sustainable performance of Tanzanian dairy microfirms.

On the other hand, the study findings suggested that agility demonstrated the full mediation effects in the relationship between managerial cognitive capability on the sustainable performance of dairy microfirms. Given the fact that the employee's and managers' agility also includes the ability to manage risks effectively (Dey & Mukhopadhyay 2018; Michaelis et al. 2021). The findings revealed that dairy microfirms should develop risk management strategies that allow them to anticipate and quickly respond to potential disruptions, whether they are related to supply chain issues, regulatory changes or market dynamics. But in addition to that, managers' cognitive capabilities contribute to sustainable performance only if they translate into enhanced agility. Therefore, enhanced agility means that dairy microfirms should focus on building agile capabilities through training, organisational restructuring, technology adoption, market responsiveness, innovation and risk management.

Conclusions

Our study advances a new theoretical framework regarding the necessary and sufficient conditions of employees' and managers' sensing capabilities, managerial cognitive capabilities, and agility in relation to sustainable performance. This offers significant implications for empirical analysis. Dairy microfirms must continuously evaluate and refine their operations to eliminate bottlenecks and enhance both outcomes and conditional efficiency in performance, enabling them to pivot swiftly when required. Emphasising the necessary and sufficient conditions for sensing capabilities and agility among managers and employees not only equips these microfirms to address immediate challenges but also positions them to capitalise on future opportunities, thereby securing a competitive edge in the marketplace.

The findings of this study suggest that the KBV should adopt a broader dynamic - capabilities perspective. This perspective should incorporate the essential knowledge held by employees and managers as a necessary element for strengthening the fundamental infrastructure. Such infrastructure is vital for enabling the effective utilisation of sensing capabilities and agility within dairy microfirms. Furthermore, our study redefines and broadens the concept of agility by examining its mediating effects as an internal mechanism and bridging the gap between knowledge sharing, sensing capabilities, managerial cognitive capabilities towards sustainable performance in Tanzanian dairy microfirms. By elucidating how agility influences multiple dimensions of dynamic capabilities, the study provides a comprehensive understanding of how dairy microfirms can enhance their adaptability and responsiveness to market dynamics, ultimately improving long-term sustainability and performance.

Moreover, the study underscored the pivotal role of agility as a full mediator between managerial cognitive capability and sustainable performance in dairy microfirms. This implies that the cognitive capabilities of managers, such as problem-solving, strategic thinking and adaptability, significantly contribute to sustainable performance primarily through enhancing organisational agility. The complementary partial mediation effects of agility on the relationship between sensing capability and sustainable performance highlight the importance of both direct and indirect pathways to sustainability. Similarly, knowledge sharing is essential, as it fosters an environment where agility can thrive, ensuring that valuable insights and information are effectively utilised to

improve performance. To achieve long-term sustainable performance, dairy microfirms must focus on developing agility through comprehensive training and development programmes, organisational restructuring, technology adoption, market responsiveness, innovation, flexibility and robust risk management strategies. By integrating these elements, dairy microfirms can effectively leverage their managerial cognitive capabilities, sensing capabilities and knowledge-sharing practices to navigate the complexities of their operating environments and achieve sustainable success.

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Competing interests

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Authors' contributions

L.M. was involved in the conceptualisation of the study, developing the main conceptual framework and experimental setup. L.M. also took the lead in writing the original draft and provided the necessary resources and funding for the project. M.Z. oversaw the data collection and initial processing and conducted the formal data analysis. M.Z. was also responsible for obtaining project funding and reviewed and edited the manuscript. B.G. verified the analytical methods and results, and was involved in the initial data processing, cleaning, and experimental studies. B.G. also participated in writing, reviewing, and editing the manuscript. S.X. secured funding for the project and oversaw its progress, providing guidance and contributing to the writing. M.H. was in charge of data visualisation, preparing figures and tables, and managed the administrative tasks of the project. M.H. also reviewed and edited the manuscript. M.H.B. conducted a cross-sectional survey for data collection, curated the data, and set up the experiments. M.H.B. used two software programs (R programming language and smartPLS) for data analysis, performed statistical modelling, presented an initial empirical analysis, and drafted the original manuscript.

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Data availability

The data that support the findings of this study are openly available from the corresponding author, M.H.B., upon reasonable request.

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Appendix 1. Robustness check (regression analysis)

TABLE 1-A1: Summary coefficient: validation via regression analysis.

Constructs	Standardised coefficients	STD	*T*-values	*p*	2.50%	97.50%	VIF
LV scores-Knowledge sharing-SP	0.086	0.030	2.844**	0.005	0.026	0.145	1.285
LV scores-Sensing capability-SP	0.349	0.033	10.680***	0.000	0.284	0.413	1.512
LV scores-Sensing managerial cognitive capability-SP	0.007	0.027	0.266	0.790	-0.046	0.060	1.044
LV scores-Agility-SP	0.362	0.034	10.700***	0.000	0.295	0.428	1.620

STD, standard error; SP, sustainable performance; VIF, variance inflation factor.
Note: Significance = **, 0.01; ***, 0.001.