



(RESEARCH ARTICLE)



## The influence of business networks on frugal innovation capability: The role of organizational ambidexterity

Josephat Deusidedith Sengura <sup>1,2,\*</sup>, Renyan Mu <sup>1,3</sup> and Jacobo Busumabu <sup>2,4</sup>

<sup>1</sup> School of Management, Wuhan University of Technology, Wuhan 430070, China.

<sup>2</sup> Department of Applied Science and Social Studies, Arusha Technical College, Arusha P.O. Box 296, Tanzania.

<sup>3</sup> Center of Production Innovation Management, Hubei Province, Wuhan 430070, China.

<sup>4</sup> Xi'an Jiaotong University, Shaanxi Province, Xi'an 710049, China.

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### Abstract

This study explores the role of business networks—specifically, inter-firm collaboration (IFC), university relationships (UR), and government relationships (GR)—in shaping frugal innovation capability (FIC) among small and medium-sized enterprises (SMEs) in emerging and developing economies (EMDEs). Based in the resource-based view (RBV) theory and dynamic capability theory (DCT), the study expands on existing literature by investigating how these networks influence FIC and the moderating role of organizational ambidexterity (OA) in these relationships. The empirical findings confirm that IFC and GR significantly enhance FIC, whereas UR does not have a substantial impact, likely due to a misalignment between academic research and the practical needs of SMEs. Notably, OA negatively moderates the IFC-FIC relationship, indicating that high OA might introduce complexities that hinder the benefits of IFC on FIC. In contrast, OA positively moderates the GR-FIC relationship, suggesting that the effectiveness of government support in promoting frugal innovation is amplified when SMEs possess high levels of OA. The findings highlight the importance of targeted business networks and the nuanced role of OA in maximizing FIC in resource-constrained environments. This research contributes to the RBV literature by demonstrating the differential impacts of various business networks on FIC and highlighting the critical moderating role of OA.

**Keywords:** Business networks; Frugal innovation; Frugal innovation capability; Organizational ambidexterity; Manufacturing SMEs; Emerging market and developing economies

### 1. Introduction

In today's business environment, where technological progress is swift and global competition is intense, the ability to innovate frugally has emerged as a vital strategic capability for firms, especially in resource-constrained environments (Cai et al., 2019; Santos et al., 2020). Recently, there has been a major increase in scholarly interest in frugal innovation (FI), which is the process of developing affordable and resource-efficient goods and services that are customized to meet the requirements of low-income populations (3–6). It also involves the process of minimizing the intricacy and expense of a service or a good, making it particularly relevant for Small and Medium-sized Enterprises (SMEs) in emerging market and developing economies (EMDEs), such as Tanzania (7,8). These firms often face significant resource limitations, necessitating innovative approaches to remain competitive and sustainable (9). Additionally, they must meet customer demands, which are typically focused on affordability and are highly sensitive to prices (1). In the contemporary, rapidly evolving environment, the ability of SMEs to thrive is predominantly dependent on their capacity for innovation, which allows them to respond effectively to the rapid changes in the marketplace (10,11). As a result, both practitioners and researchers are continually investigating and identifying ways to enhance the innovation capacity of business organizations.

\* Corresponding author: Josephat Deusidedith Sengura

Therefore, to successfully implement frugal innovation, SMEs in EMDEs must develop particular capabilities due to its unique approach, which diverges from conventional innovation methods (12). Given the unique attributes of frugal innovation, it is recommended that SMEs must develop specialized capabilities to foster its advancement (13). The current literature predominantly views this process as driven by grassroots initiatives (14), rather than as a more widespread application across the firm. Additionally, Brem et al. (14) did not attempt to ascertain the specific capabilities required for the development of FI. Although there is research addressing FI, including studies on capabilities (15) and resources (16), there remains a gap in understanding how to develop these capabilities within firms. Furthermore, the SME sector in EMDEs, such as Tanzania, has insufficient research to demonstrate how these enterprises develop frugal innovation capability (FIC) within the resource constrained environment. Studies at the micro-level processes of business innovation highlights that firms rely on and utilize external resources, such as business networks, for their innovation and development efforts (17–19). Business networks are pivotal for SMEs, as they provide access to essential resources, knowledge, and opportunities that might otherwise be beyond the reach of individual firms. Through collaboration with other businesses, suppliers, customers, and various stakeholders, SMEs can leverage external expertise and capabilities, fostering an environment conducive to innovation (20). In the context of FI, business networks can offer critical support by facilitating the exchange of cost-effective solutions, sharing best practices, and enabling joint problem-solving efforts (21). This collaborative dynamic can significantly enhance an SME's ability to innovate under resource constraints, thereby improving its competitiveness and sustainability.

Similarly, organizational ambidexterity (OA)—the ability of a firm to balance exploration and exploitation activities—is considered a critical internal capability (22). This capability fosters firms' innovation capabilities in emerging markets (8). Exploration entails the pursuit of new knowledge and opportunities, whereas exploitation is concerned with improving existing capabilities and optimizing the use of resource (23). For SMEs in EMDEs, achieving ambidexterity is essential to navigate the complexities of frugal innovation (8). By balancing these dual activities, firms can effectively harness their business networks to innovate efficiently and sustainably. Ambidextrous organizations are better positioned to integrate external knowledge with internal capabilities, thereby enhancing their frugal innovation outcomes (22). Despite the recognized importance of business networks and organizational ambidexterity in fostering innovation, there is limited empirical research examining their combined impact on FIC in the context of EMDEs. This study seeks to fill this gap by exploring how business networks influence the frugal innovation capability and how organizational ambidexterity moderates this relationship with evidence from Tanzanian manufacturing SMEs. The findings of this study are expected to enrich the current body of knowledge on RBV, DCT, frugal innovation, business networks, and organizational ambidexterity by offering insights specific to the context of EMDEs manufacturing SMEs. Moreover, the practical implications of this research can guide policymakers, business leaders, and other stakeholders in designing strategies and interventions that support the innovative capabilities of SMEs in resource-constrained environments. By highlighting the critical role of business networks and the importance of fostering organizational ambidexterity, this study aims to inform efforts to enhance the competitiveness and sustainability of SMEs through frugal innovation.

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## 2. Literature review and hypotheses development

### 2.1. Underlying theories

This research draws on two fundamental theories: the “resource-based view (RBV)” and “dynamic capability theory (DCT)” to explore the connections between the variables. According to the RBV, in order for businesses to accomplish their objectives, they must be in possession of and able to effectively manage their distinctive assets (24). Barney (25) stated that these assets might consist of knowledge, capabilities, and resources. The RBV suggests that companies possessing resources that are “valuable, rare, difficult to imitate, and non-replaceable (VRIN)” can achieve a competitive edge and earn economic surplus (25). The theory further suggests that firms' ability to control these assets varies, as rivals will struggle to replicate these critical resources (26). The RBV highlights the importance of both internal and external resources, including those acquired through business networks, in driving a firm's innovation success (27). According to Wernerfelt, (28,29) and Barney, (25), the fundamental tenet of the RBV philosophy is that a firm's strength is derived from its core competences, which give it a long-term competitive advantage via efficient resource management. However, resource availability is often a weakness for SMEs. SMEs often face challenges related to finances, size-specific disadvantages, and their ability to fully leverage their strengths. The key aspect of a network lies in the resources and exchanges among its partners (30). According to Zaheer and Zaheer (31), SMEs may derive significant benefits from networks only if they select the appropriate network to obtain the essential resources. These resources will only be beneficial to SMEs and their network partners if they can be effectively utilized to implement strategies that positively impact performance. The DCT emerged as an extension of the RBV theory (32). According to Schilke (32) and Helfat and Peteraf (33), while the RBV theory focuses on how a firm's current resources affect its competitive position, the dynamic capabilities perspective emphasizes the need for reconfiguring existing resources

and developing new ones. Moreover, Helfat and Peteraf (33) state that the RBV explains differences among enterprises based on the resources they possess, which, in turn, affects their competitive advantage.

Therefore, dynamic capabilities are crucial because they enable a firm to modify its resource base, thereby enhancing its competitive advantage (32,33). DCT delves into how firms can adapt and sustain competitive advantage by continually modifying their capabilities and resources to meet evolving market demands. This adaptation process involves crucial elements such as learning, innovation, and strategic decision-making (34), enabling firms to coordinate resources and cultivate new capabilities to enhance their ability to innovate (35). Moreover, organizational ambidexterity (OA), which refers to the ability to balance both exploration and exploitation, is recognized as a vital dynamic capability that impacts innovation (36,37). Exploration involves searching and sensing capabilities, while exploitation involves selecting and seizing resources and opportunities (36). Balancing these aspects ensures both immediate performance and long-term innovation. Therefore, organizational ambidexterity strengthens a firm's adaptability, innovation capacity, and competitive advantage (38). This study, however, focuses on SMEs and examines how external resources, such as business networks, and internal capabilities, like organizational ambidexterity, influence frugal innovation. These capabilities help achieve a sustainable competitive advantage by serving as strategic resources characterized by their value, rarity, difficulty to replicate, and lack of substitutes, which distinguishes firms in competitive environments (39).

## 2.2. Frugal innovation capability

From a theoretical perspective, frugal innovation (FI) remains in its early stages of development (4). However, there has been a growing interest in this innovation type because of the advantages it provides to organizations, such as minimizing resource consumption, lowering production expenses, and reducing unnecessary material (40). Consequently, it has been argued that the marketplaces with limited resources are particularly conducive to fostering the growth of FI (41). EMDEs are frequently the source of frugal innovation (FI) in situations when resources are limited (42). Originally, this kind of innovation was developed to give customers who could not otherwise have access to particular goods or services an inexpensive option to satisfy the specific requirements of these markets (43). This notion, motivated by the desire to meet the demands of customers from EMDEs, has been present for a considerable duration (5,44). FI takes place within value chains that are designed to be inclusive, making efficient use of resources to enhance value and lower costs. This approach transforms limitations into chances for creating creative strategies (4,42). FI may be identified by four primary attributes: cost-effectiveness, user-friendliness, high efficiency, and sustainability (45). According to Weyrauch and Herstatt (46), an innovation to be considered as "frugal," if it fulfills three specific requirements: "substantial cost reduction, a focus on core functionalities, and optimized performance levels". In a previous study, Bhatti (47) suggested that FI has the ability to not only improve the design of offerings more effectively, but also to reorganize value chains and redefine business models. This can ultimately lead to the creation of sustainable marketplaces that cater to all sorts of consumers. As a result, Pisoni et al. (5) contend that FI is an all-encompassing technique that spans the entire method of developing creative and cost-effective options in a variety of geographical locations. These conceptualizations align with the newly suggested theoretical paradigm presented by Rossetto et al. (13). According to Rossetto et al. (13), FI consists of three dimensions: "focus on core functionalities, shared sustainable engagement, and substantial cost reduction". Moreover, FI is not just described in terms of mindset, but also the process capabilities that allow them to innovate under constraints and turn adversity into growth opportunities (48).

Furthermore, Adler and Shenbar (49) define innovative capability as the capacity to respond to unexpected opportunities created by a dynamic competitive environment. In order to demonstrate how innovation capability functions, Sher and Yang (50) underline the significance of volatile circumstances. They claim that companies with this competence have effectively combined systematically important resources to foster innovation and preserve competitive advantages (51). Greeven (52) provides a comprehensive definition of innovation capability that includes all of the previously mentioned aspects. It is defined as "a firm ability of a firm to integrate, build, and reconfigure internal and external critical resources to develop and successfully commercialize new products and services". This definition is strongly established within the context of DCT. Consistent with this perspective, evidence from enterprises that operate in emerging markets and developing economies (EMDEs) demonstrates that enterprises actively use frugal innovation as a strategy to access a burgeoning middle class and tackle the uncertainties of a turbulent economic environment (4,53). It is also observed that in order to survive in high velocity and uncertain EMDEs, firms have continuously to change/rejuvenate themselves, a core tenet of dynamic capabilities theory (54). Firms that want to exploit opportunities in EMs recognize that the dynamic capabilities required in the present context differ from those cultivated in previous times (Eisenhardt and Martin, 2000). Thus, this paper leverages the advances in RBV and DCT to empirically validate the influence of business networks in developing frugal innovation capability in EMDEs moderated by organizational ambidexterity with evidence from Tanzania manufacturing SMEs.

### 2.3. Business networks and frugal innovation capability

The notion of a network has been examined from multiple perspectives. It can be viewed as a combination of various participants and the interconnected network of interactions that link them (55). Or, as Knoke and Kuklinski (56) described it, a network can be seen as a distinct structure that depicts the connections among a set of individuals, groups, or events. As a particular kind of network, a business network is characterized as a collection of two or more related interactions, with each exchange connection connecting commercial enterprises, which are seen as collective participants in commercial relationships. To put it another way, business networks can be seen as collections of interconnected enterprises (57) or as collections of interconnected and constantly changing linkages between enterprises (58). More precisely, a business network is an extended collaboration between two or more firms that emerge through mechanisms that are different from both market transactions and organizational hierarchies (59). Powell (60) viewed networks as a transactional intermediary that blends elements of both market and hierarchical structures, characterized by collaborative conduct. Previous studies have consistently acknowledged the significance of business networks in facilitating company innovation (61–63) and enhancing company competitive advantage (64). Through business networks companies may share valuable technical information and engineering expertise inside networks of social, professional, or transactional ties, giving them a competitive edge (65).

Furthermore, collaborative partnerships can boost R&D innovation (66). In general, the significance of business networks and collaborations with various entities—including inter-firm collaboration (customers, suppliers and competitors), universities, public research institutions, as well as government bodies—enables firms to access external resources (67). Building on this premise, the present study examines the role of business networks as providers of intangible resources for firms. Numerous research on innovation in SMEs have come to the conclusion that these firms often struggle with limited financial and specialized human resources, which impedes their innovation capabilities (68,69). As a result, innovative SMEs are motivated to work with others due to the challenges they face in independently managing the whole innovation process (70). Different collaboration models, such as networks in cooperation, strategic alliances and partnerships are influenced by the interaction between different players, their specific responsibilities, and the intensity of their connections (71). The substantial body of literature on inter-firm collaboration among SMEs, including supplier–customer–competitor relationships, has been extensively explored (72). SMEs have the opportunity to enhance their skills by learning from their suppliers, enabling them to capitalize on the combined strengths of their offerings and technology (73,74). Additionally, SMEs may improve or preserve their competitive advantage and better position their goods in the market by gathering market-oriented information from customers (75,76). Furthermore, SMEs can enhance their innovation capabilities by learning from competitors through benchmarking best practices and forming collaborative networks for shared innovation projects, relationships (73–75).

Building upon this, inter-firm collaboration among SMEs in EMDEs can significantly bolster frugal innovation capability, especially within resource-constrained environments. Such collaborations enable SMEs to pool their limited resources and share risks, which is crucial in contexts where financial and material constraints are prevalent (72). By working together, SMEs can engage in cost-sharing initiatives for research and development, leading to more affordable and resource-efficient innovations (73,74). Collaborative efforts also facilitate the sharing of tacit knowledge and practical expertise, which are often pivotal creating cost-effective, valuable solutions that meet specific local market demands (75). Through strategic partnerships, SMEs can access new markets and distribution channels, thereby enhancing their ability to scale frugal innovations (74). Based on a comprehensive review of the available literature, the following hypothesis was developed;

**H1a:** *Inter-firm collaboration positively influences frugal innovation capability*

Furthermore, a rising body of academic research and policy publications on innovation has emphasized the importance of corporate-university partnerships as a means to assure the efficacy of an ecosystem of innovation (73,77). Collaboration between SMEs and universities, as well as research organizations, significantly enhances innovation capabilities. Studies show that partnerships with academic institutions and government research institutes positively impact innovation performance by bridging the gap between innovation creation and commercialization (78). Additionally, informal interactions between SMEs and universities are found to be more impactful in fostering successful collaborations and knowledge co-creation, aligning with SMEs' preferences for informal modes of interaction (79). Public funding programs promoting Industry-University-Research Institute interactions have been effective in establishing networks that facilitate knowledge flow and dissemination among actors, with universities playing a central role in these collaborations (80). Additionally, it has been demonstrated that collaboration with a variety of partners, including universities, rival businesses both domestically and internationally, customers and suppliers, predicts innovation performance in SMEs, highlighting the significance of varied collaborative relationships for SME innovation (81,82).

Collaboration with universities and research institutions may greatly improve the ability of SMEs in EMDEs to innovate in a cost-effective manner, particularly in contexts with limited resources. Such partnerships facilitate access to cutting-edge research, advanced technology, and specialized knowledge that SMEs might otherwise lack (78). By leveraging the expertise and infrastructure of academic institutions, SMEs can develop cost-effective, sustainable, and innovative solutions tailored to the specific needs of emerging markets (77). This synergy not only helps in overcoming the resource limitations but also accelerates the innovation process by combining practical business insights with academic rigor (73). The mutual exchange of knowledge and resources between SMEs and academic institutions thus creates a robust framework for frugal innovation, enabling SMEs to thrive in competitive and resource-limited environments while addressing the unique challenges of emerging markets (81,82). From this information, the following hypothesis was developed;

**H1b:** *SMEs collaboration with universities and research organizations positively influences frugal innovation capability*

Additionally, by establishing suitable legislative frameworks, offering monetary supports, and cultivating an innovation-friendly climate, governments can enhance the ability of SMEs to develop cost-effective solutions. For instance, policies that reduce bureaucratic hurdles and improve access to financing can help SMEs allocate their limited resources more efficiently towards innovative activities. Moreover, government initiatives aimed at enhancing infrastructure, such as improving internet connectivity and transportation networks, can further support SMEs in overcoming resource constraints (83). Additionally, public-private partnerships and government-supported training programs may equip SMEs with the essential expertise and knowledge to leverage frugal innovation strategies effectively (21). Consequently, an active and supportive governmental role is pivotal in enabling SMEs to thrive and innovate in resource-limited settings in emerging markets. Therefore, based on this information, the following hypothesis was developed;

**H1c:** *Government role positively influences SMEs frugal innovation capability*

#### **2.4. Moderating role of Organizational ambidexterity**

Organizational ambidexterity (OA) is the ability of a firm to concurrently engage in both exploitative and exploratory operations (38,84). There is a general consensus in the body of works a firm with ambidextrous capabilities can effectively utilize its current strengths while also seeking out new opportunities, leading to improved performance and competitiveness (85). Researchers in the field of OA suggest that companies can enhance their performance by simultaneously engaging in both exploitation and exploration (86,87). According to Volberda and Lewin (88), companies that prioritize exploration activities enhance their ability for updating their knowledge pool. However, a disproportionate focus on exploration might result in a never-ending cycle of searching and implementing futile improvements. In order to prevent this issue, companies must also engage in exploitation activities. While effective exploitation is crucial for maintaining a company's present viability, engaging adequately in exploration is vital for securing its future sustainability. Previous studies (89,90) suggested that in order for businesses to achieve innovative synergy capabilities, they must maintain optimal equilibrium between exploitation and exploration in their inventive operations. The beneficial influence of OA on a company's effectiveness is widely acknowledged from a balanced viewpoint (91,92). Studies conducted earlier highlight the positive outcomes of incorporating both exploitation and exploration capabilities into the overall dimension. Companies may improve their business learning ability and effectiveness by utilizing the combined dimension, which enables them to successfully harness both exploitation and exploration capabilities (93). Furthermore, ambidexterity—which effectively blends the two different strategic philosophies of exploration and exploitation—allows businesses to realize their dynamic capabilities (94). The ambidexterity which provides for this integration improves businesses' innovation strategy.

The underlying assumption of the aforementioned main argument is that exploitation and exploration work well together to provide a matching strategy that increases the effectiveness of innovation methods (95). OA places a strong emphasis on striking a balance between the exploitation and exploration orientations in order to accomplish innovation deployment; this balance should improve the innovation results of organizations. OA benefits businesses, and as a result, these businesses are more likely to search for and obtain the necessary resources to handle the demand for internal innovation implementation and carry out ongoing innovation initiatives. Recent research has explored OA within moderated models. For instance, OA serves as a moderator in the association between green supplier integration and business performance (96). According to Roldán Bravo et al. (97), the link between a purchasing organization's supply chain competency and its desorptive capacity was found to be moderated by organizational ambidexterity. In order to solve their internal resource limitations and enhance their innovation ability, organizations need external innovation resources like business networks. Additionally, they need be driven to pursue new possibilities (98).

To extend the discussion on organizational ambidexterity, it is crucial to consider its moderating role. In the context of SMEs operating in EMDEs, organizational ambidexterity can serve as a critical moderating factor between business networks and the development of FIC. These SMEs often face significant resource constraints and operate in volatile environments, making the balance between exploitation and exploration crucial for their sustainability and growth. By leveraging organizational ambidexterity, these firms can effectively utilize their business networks to acquire external knowledge and resources while simultaneously refining and exploiting their existing capabilities (38,84). This dual approach allows SMEs to innovate in a cost-effective manner, aligning with the principles of frugal innovation. The integration of external insights from business networks with internal capabilities through an ambidextrous approach enables these firms to develop innovative solutions that are not only resource-efficient but also tailored to the unique challenges of emerging markets. Therefore, organizational ambidexterity leads to stronger competitive advantages in resource-constrained situations by optimizing the value generated from business networks and enhancing SMEs' ability to innovate (99). Hence, we propose the following hypothesis:

**H2a:** Organizational ambidexterity positively moderates the relationship between inter-firm collaboration and frugal innovation capability

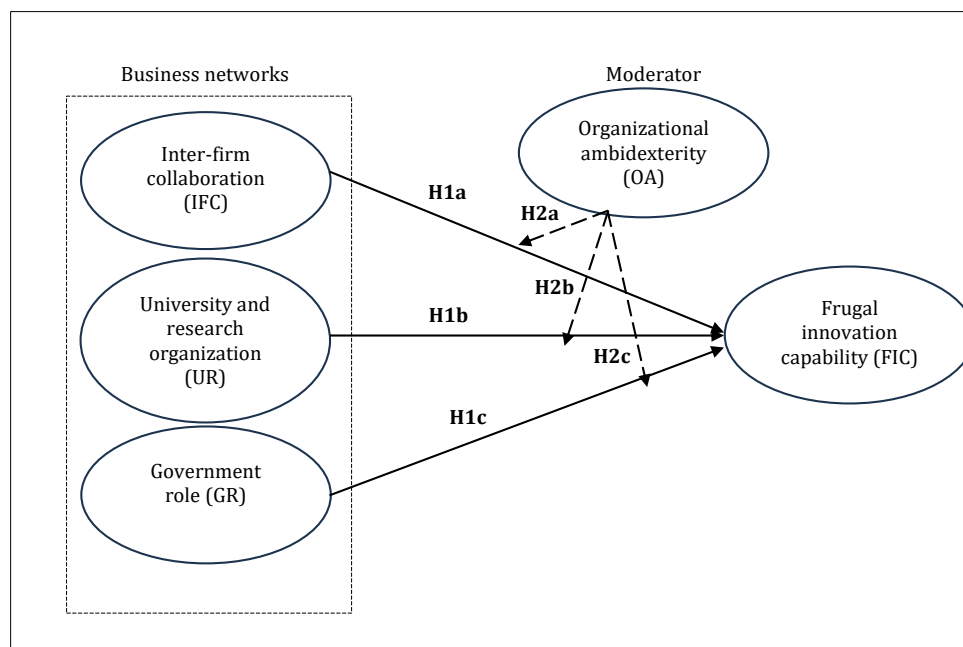
**H2b:** Organizational ambidexterity positively moderates the relationship between SMEs collaboration with university and research and frugal innovation capability

**H2b:** Organizational ambidexterity positively moderates the relationship between Government role and frugal innovation capability

**Figure 1** Illustrates the theoretical model for this study, including each of the proposed hypotheses.

### 3. Methods

#### 3.1. Sample and data collection



**Figure 1:** The theoretical model

This study gathered survey data from manufacturing SMEs located in Dar es Salaam and Arusha, two key Tanzanian cities known for their significant roles in the nation's manufacturing industry (100). The study focused on manufacturing SMEs within three specific sub-sectors: furniture (including products made from metals and plastics), fashion (which covers apparel, shoes and clothing) and food (which includes food processing and beverages). These SMEs were required to have been operational for at least three years. Quaye et al. (101) suggest that a period of three years is considered sufficient to assess the growth and success of a business. The decision to focus on these sub-sectors was influenced by their strong presence among Tanzanian manufacturing SMEs (102). The unit of analysis in this

research corresponds with the Tanzanian definition of SMEs, which categorizes them as enterprises employing up to 100 people (103). Our sampling frame was developed using a comprehensive list of all SMEs, sourced from the “Business Registration and Licensing Agency (BRELA)”, and further validated by an official list acquired from “small industry development organizations (SIDO)” in the respective regions. We began by reaching out to the administrative departments of the relevant SMEs using multiple methods, including personal visits, phone calls, or email to seek permission for their participation in the study. A pre-test survey was carried out and refined prior to distributing the final questionnaire. In total, 845 questionnaires were sent via email, with a request for completion by key decision-makers such as “CEOs, owners, general managers, marketing managers, production and operations managers, finance managers, and human resources managers”. We received a total of 663 completed questionnaires, of which 84 were invalid due to incomplete responses, resulting in a valid response rate of 69%. The survey was carried out over approximately four months, was completed in August 2023. To enhance the response rate, phone calls and follow-up emails were made throughout the data collection period. In order to assess the possibility of non-response bias, we conducted a comparison between the replies of early respondents (those who completed the survey within three months) and late respondents (those who answered after three months or after reminders). Non-response bias is unlikely to be a problem in this research, given no significant differences were seen between these two groups on important variables (104).

### **3.2. Measurement scales**

This study utilizes scales generated from existing empirical research. The study used five-point Likert scales, with a rating of 1 indicating strongly agree and a rating of 5 indicating strongly disagree.

#### *3.2.1. Business networks*

The construct of business networks was evaluated using a scale that included three main dimensions: inter-firm collaboration (IFC), adapted from Huang et al. (105) and Gemünden et al. (106); university and research organization (UR), based on the work of Orozco and Ruiz (107); and the government’s role (GR), as defined by Shou et al. (108) and Mondejar and Zhao (109). The scale consisted of 12 items for IFC, 14 for UR, and 10 for GR.

#### *3.2.2. Organizational ambidexterity*

The construct of organizational ambidexterity (OA) was assessed using a scale that comprised two dimensions: exploratory and exploitative. SMEs in EMDE can develop dynamic and resilient innovation capabilities by simultaneously engaging in both exploratory and exploitative activities. The OA construct was evaluated using a 12-item scale, with 6 items dedicated to exploratory activities and 6 items focused on exploitative activities, based on the work of Lubatkin et al. (110).

#### *3.2.3 Frugal innovation capability*

Frugal innovation capability (FIC), a second-order construct, was evaluated using a scale for frugal innovation that encompasses three dimensions: focus on core functionalities (FCF) with 3 items, substantial cost reduction (SCR) with 4 items, and sustainable co-creation (SCC) with 3 items. The measurement scale for FIC was adapted from Santos et al. (42) because it is well-suited to the requirements for measuring FIC and covers the essential aspects needed for this study.

#### *3.2.3. Data analysis methods and Common method bias*

The analysis utilized structural equation modeling (SEM) to evaluate how well the constructs within the data aligned with the proposed model. This was conducted using AMOS 29 software. Additionally, SmartPLS4 was employed to assess the reliability and validity of the measurements, as well as to test the hypothesized relationships between the research constructs through structural model assessment. We utilized Podsakoff et al. (111)’s single-factor Harman test to evaluate the possibility of common method bias. We performed exploratory factor analysis (EFA) on all self-reported measures, employing principal factoring with varimax rotation. Seven variables with eigenvalues greater than one were found in this study, and they collectively explained 64.98% of the variation. The first factor accounted for 31.49% of the variation, which falls below the 50% criterion. This indicates that common method bias is not a major problem in the present study.

## 4. Results

### 4.1. Demographic characteristics

The demographic variables examined in this study include gender, respondents' years of service within their current SMEs, job designation, SMEs sub-sector within the manufacturing industry, the age of the SMEs since establishment, and their geographical location. Among the respondents, 64.1% were male, while 35.9% were female. Regarding tenure, 28.67% of respondents have been with their current SMEs for 1 to 3 years, 54.58% for 4 to 6 years, and 16.75% for more than 6 years. In terms of job roles, 40.41% of respondents held positions as Owner, CEO, or General Manager, 10.19% as Finance Manager, 19.52% as Marketing Manager, 8.64% as HR Manager, and 21.24% as Production or Operations Manager. The SMEs in the manufacturing sector were distributed across various sub-sectors, with 33.85% in the fashion sub-sector (e.g., textiles, clothing, footwear, leather goods, cosmetics, and soap, jewelry), 40.76% in the food sub-sector (e.g., food processing, beverages, dairy products), and 25.39% in the furniture, fittings, plastics, and metals sub-sector (including lighting articles and appliances, chemicals, and rubber products). The majority of the SMEs surveyed (47.67%) have been established for 5 to 10 years, with 28.50% having been established for less than 5 years and 23.83% for more than 10 years. Geographically, most of the SMEs participating in this study were located in Dar es Salaam (64.08%), followed by Arusha (35.92%). The demographic profile of the study's respondents is detailed in **Table 1**.

**Table 1** Demographic characteristics of Manufacturing SMEs

Demographic variables	Frequency	Percentage
<i>Gender</i>		
Male	371	64.08
Female	208	35.92
Total	579	100.00
<i>Years of services in the current organization</i>		
1 to 3 years	166	28.67
4 to 6 years	316	54.58
More than 6 years	97	16.75
Total	579	100.00
<i>Designation</i>		
Owner/CEO/General Manager	234	40.41
Finance Manager	59	10.19
Marketing Manager	113	19.52
HR Manager	50	8.64
Production/ Operations Manager	123	21.24
Total	579	100.00
<i>Firm sub-sector in manufacturing industry</i>		
Fashion (e.g., Textile/ clothing, footwear, leather goods, cosmetics & soap, jewelry)	196	33.85
Food (e.g., Food processing, alcoholic & non-alcoholic beverage, dairy products)	236	40.76
Furniture, fittings, plastic & metals (including lighting articles & appliances, chemicals, rubber products).	147	25.39
Total	579	100.00
<i>SMEs age since establishment</i>		



Below 5	165	28.50
Between 5 to 10	276	47.67
Above 10	138	23.83
Total	579	100.00
<i>Firm location</i>		
Dar es Salaam city	371	64.08
Arusha city	208	35.92
Total	579	100.00

#### 4.2. Measurement model

In order to ascertain if the model adequately fits the gathered data, we first used AMOS 29 software to perform confirmatory factor analysis (CFA). The fit statistics demonstrate excellent match between the model and the data, as evidenced by a chi-square ( $X^2$ ) to degrees of freedom (df) ratio (CMIN/DF) of 1.900, where the  $X^2$  value is 2990.404 and the df is 1574. The measurement model also includes the following fit indices: GFI = 0.842, RMSEA = 0.039, IFI = 0.940, NFI = 0.907, AGFI = 0.828, and CFI = 0.939. All fit indices, as shown in **Table 2**, are within an acceptable range, indicating a good fit between the model and the data (112,113). Moreover, SmartPLS4 software (114) was employed to assess the measurement model's validity and reliability. Composite reliability (CR) and Cronbach's alpha were used to assess the theoretical constructs' internal consistency. According to Cronbach's (115) criterion, all of the constructs as presented in **Table 3** have Cronbach's alpha values more than 0.7, which indicates good internal consistency and reliability of the constructs. Similarly, all constructs' composite reliability (CR) scores were higher than the suggested cutoff of 0.7, which further validates the measuring scales employed in the research (116). In addition, the factor loadings for each item were above the acceptable value of 0.5, demonstrating an adequate level of reliability (116). Furthermore, **Table 3** shows that all constructs' average variance extracted (AVE) values were higher than the suggested cutoff point of 0.5, thereby confirming convergent validity (116). We computed the heterotrait-monotrait ratio of correlations (HTMT) in accordance with Henseler et al. (117)'s guidelines to evaluate discriminant validity. All HTMT values were below the suggested cutoff of 0.90 (118), demonstrating discriminant validity, as indicated by the results displayed in **Table 4**. Moreover, we examined the variance inflation factor (VIF) (refer **Table 3**), all indicators and constructs reporting values below 0.5, indicating no significant multicollinearity. Thus, the constructs in this study satisfy the criteria necessary for conducting structural analysis.

**Table 2** The fit indices of the CFA model

Fit index	Scores	Proposal threshold criteria
Absolute fit measures		
CMIN/df (Chi-square/df)	1.900	$\leq 2^a$ ; $\leq 5^b$
GFI (goodness of fit index)	0.842	$\geq 0.90^a$ ; $\geq 0.80^b$
RMSEA (root mean square error of approximation)	0.039	$\leq 0.08^a$ ; $\leq 0.10^b$
Incremental fit measures		
IFI (Incremental fit index)	0.940	$\geq 0.90^a$
NFI (incremental fit measures including normed fit index)	0.907	$\geq 0.90^a$
AGFI (adjusted goodness of fit index)	0.828	$\geq 0.90^a$ ; $\geq 0.80^b$
CFI (comparative fit index)	0.939	$\geq 0.90^a$

Note(s): <sup>a</sup>: Good fit; <sup>b</sup>: Acceptable fit (112,113)

**Table 3** Results of the measurement model, including factor loadings, reliability indices, validity assessments, and variance inflation factors (VIF)

Construct	Item	Outer loading	Cronbach's alpha	Composite reliability	AVE	Collinearity statistics (VIF)
Inter-firm collaboration	IFC1	0.830	0.948	0.954	0.634	2.914
	IFC2	0.836				3.010
	IFC3	0.790				2.623
	IFC4	0.763				2.298
	IFC5	0.801				2.886
	IFC6	0.763				2.161
	IFC7	0.820				2.839
	IFC8	0.787				2.369
	IFC9	0.794				2.447
	IFC10	0.804				2.598
	IFC11	0.776				2.638
	IFC12	0.788				2.787
University and research organization	UR1	0.782	0.946	0.952	0.586	2.394
	UR2	0.813				2.625
	UR3	0.755				2.088
	UR4	0.761				2.146
	UR5	0.757				2.162
	UR6	0.738				2.008
	UR7	0.754				2.089
	UR8	0.758				2.143
	UR9	0.765				2.181
	UR10	0.765				2.207
	UR11	0.756				2.048
	UR12	0.766				2.004
	UR13	0.761				2.261
	UR14	0.785				2.238
Government role	GR1	0.813	0.936	0.946	0.636	2.550
	GR2	0.715				2.368
	GR3	0.799				2.603
	GR4	0.817				2.899
	GR5	0.825				2.129
	GR6	0.764				2.708
	GR7	0.804				2.555
	GR8	0.798				2.623
	GR9	0.824				2.597
	GR10	0.812				1.758

Organizational ambidexterity	EXPL1	0.765	0.936	0.945	0.588	2.222
	EXPL2	0.778				2.435
	EXPL3	0.780				2.352
	EXPL4	0.762				2.184
	EXPL5	0.787				2.867
	EXPL6	0.804				2.920
	EXPR1	0.747				2.091
	EXPR2	0.764				2.183
	EXPR3	0.765				2.200
	EXPR4	0.757				2.122
	EXPR5	0.736				1.996
	EXPR6	0.755				2.144
Focus on core functionality	FCF1	0.871	0.841	0.904	0.759	2.011
	FCF2	0.869				1.957
	FCF3	0.874				2.011
Sustainable co-creation	SCC1	0.919	0.907	0.942	0.843	3.007
	SCC2	0.907				2.740
	SCC3	0.929				3.288
Substantial cost reduction	SCR1	0.900	0.902	0.932	0.774	3.335
	SCR2	0.838				2.004
	SCR3	0.904				3.380
	SCR4	0.875				2.553
Frugal innovation capability	FCF	0.862	0.722	0.844	0.644	1.623
	SCC	0.784				1.407
	SCR	0.757				1.362

**Table 4** Results of the Discriminant validity – Heterotrait-Monotrait (HTMT)

Dimension	FCF	GR	IFC	OA	SCC	SCR	UR
FCF							
GR	0.569						
IFC	0.680	0.508					
OA	0.626	0.539	0.525				
SCC	0.599	0.604	0.483	0.521			
SCR	0.574	0.342	0.482	0.625	0.407		
UR	0.219	0.214	0.200	0.262	0.113	0.212	

Note: FCF: focus on core functionality; GR: Government role; IFC: Inter-firm collaboration; OA: organizational ambidexterity; SCC: sustainable co-creation; .SCR: substantial cost reduction; UR: University and research organization

**4.3. Structural model**

The structural model, as suggested by Sang et al. (119), indicates a relationship of cause and effect between the constructs. It is evaluated to ascertain the predictive power based on the computation of path coefficients and the value of the R-squared ( $R^2$ ) (120,121). To ascertain the direct correlation between constructs and their degree of significance, a 10,000 subsample BCa bootstrapping approach was employed (122).  $R^2$  was utilized to assess how well the model accounted for differences in the data. The findings shown in **Table 5** indicate that, with an  $R^2$  value of 87.6%, the exogenous variables (IFC, UR, GR, and OA) in the model explains a significant amount of the variance in FIC. Therefore, there is a significant degree of association between the exogenous and endogenous variables, as shown by the FIC  $R^2$  value, which is more than the 26% threshold (123). Likewise, we evaluated the model's predictive power using PLSpredict. **Table 5** displays the findings for  $Q^2$  values that are greater than zero, which validates the predictive ability of the model (122). **Table 6** displays the results of the analysis of the associations between the constructs, which include the beta coefficient ( $\beta$ ), p-values, t-values, and  $f^2$ . The significance of the model was initially assessed by analyzing t-values and p-values, with Hair et al. (118) specifying that t-values should be greater than or equal to 1.96. In the aforementioned results (refer **Table 6**), all t-values were greater than 1.96, with the exception of one specific case - the direct relationship between UR and FIC. Regarding the p-values, the same constraint holds true: every p-value is less than 0.05, with one notable exception of the direct relationship between UR and FIC (which does not support hypothesis H1b). Consequently, hypotheses H1a and H1c are supported. **Table 6** also includes the  $f^2$  effects, which were assessed in accordance with Cohen's (123) recommendations. Cohen's definition categorizes a large  $f^2$  impact as being equal to or greater than 0.35, a medium effect as being at least 0.15, and a minor effect as being at least 0.02. Therefore, with the exception of the UR–FIC relation, which had a minor impact, it is therefore reasonable to confirm that the findings of the direct relations test ranged from larger to medium effects. Additionally, it can be concluded that the higher-order construct of FIC (as shown in Table 6) demonstrates validity across its first-order variables: Focus on Core Functionalities ( $\beta = 0.827$ ), Sustainable Co-Creation ( $\beta = 0.765$ ), and Substantial Cost Reduction ( $\beta = 0.810$ ).

**Table 5** Results of Coefficient of determination ( $R^2$ ) and Stone—Geisser criterion ( $Q^2$ )

Construct	R-Square	Q-Square	R-Square Adjusted
Frugal innovation capability	0.876	0.607	0.875

**Table 6** Direct relationship and test of hypotheses results

Hypothesis	Relationship	Beta Coefficients ( $\beta$ )	T statistics (t - value)	p-values	$f^2$	Results
H1a	IFC → FIC	0.298	6.996	0.000	0.640	Significant
H1b	UR → FIC	-0.007	0.306	0.760	0.001	Not significant
H1c	GR → FIC	0.214	5.069	0.000	0.309	Significant
<i>Second Order Construct (Frugal innovation)</i>						
	FIC → FCF	0.827	45.845	0.000	2.156	
	FIC → SCC	0.765	36.006	0.000	1.410	
	FIC → SCR	0.810	30.773	0.000	1.914	

Note: Significant level ( $p \leq 0.05$ ); → stands for direction of the path; second-order construct reflects the standardized factor loadings of the indicators on their corresponding latent variables.

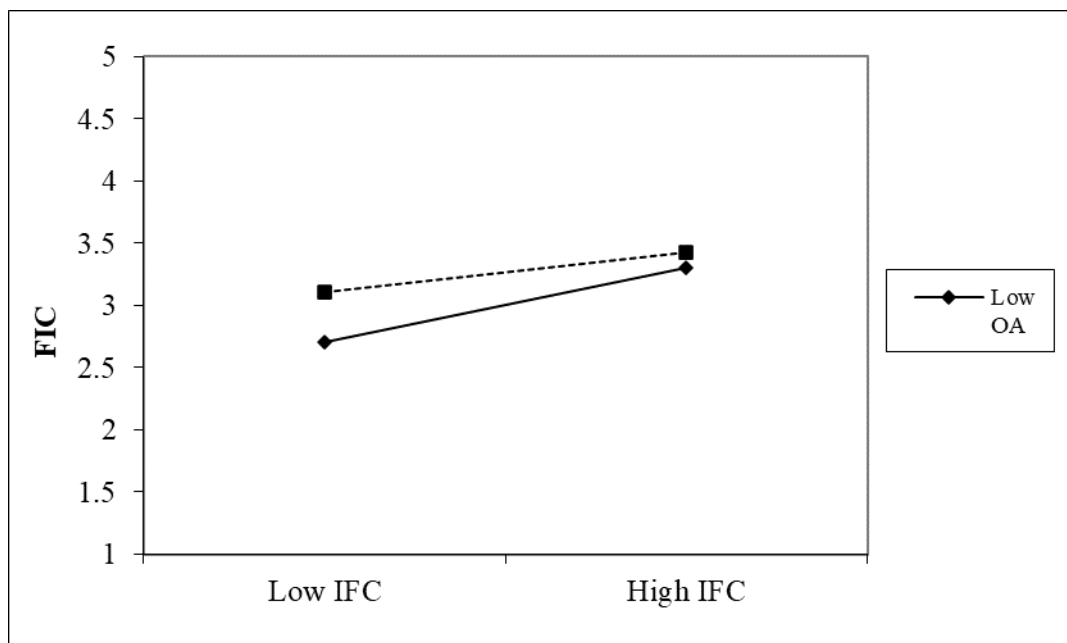
**4.4. Moderation testing**

In this study, we calculated the simple effects at both low and high levels of organizational ambidexterity (OA) using the outcome of PLS-SEM analysis as shown in **Table 7**. The findings suggest that OA significantly affects FIC ( $\beta = 0.267$ ,  $t = 3.158$ ,  $p < 0.05$ ), and that the OA\*IFC interaction also has a substantial impact on FIC ( $\beta = -0.142$ ,  $t = 3.536$ ,  $p < 0.05$ ).

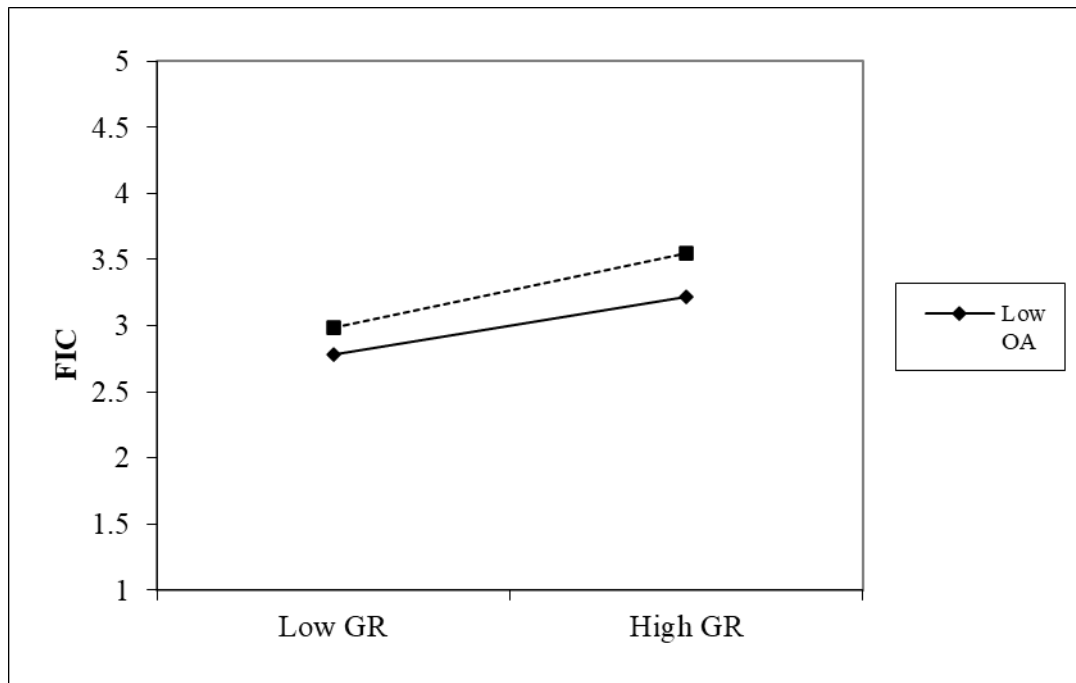
Thus, hypothesis H2a is supported. These results suggest that OA negatively moderates the relationship between IFC and FIC, with a higher level of OA weakening this relationship. Additionally, **Figure 2** illustrates that the influence of IFC on FIC is notably stronger at low levels of OA compared to high levels. In addition, the  $f^2$  effect size of the moderating effect is 0.236, which falls within the broad guidelines suggested by Cohen (123). Specifically, effect sizes represent a minor, medium, and large effect, respectively, at 0.02, 0.15, and 0.35. Hence, the  $f^2$  effect size of 0.236 suggests a moderate moderating impact of OA on the link between IFC and FIC. Moreover, the moderating influence of OA between UR and FIC was also examined. The findings provide evidence for the substantial impact of OA on FIC ( $\beta = 0.267, t = 3.158, P = <0.05$ ). However, FIC is not significantly influenced by the interaction between OA and UR ( $\beta = -0.014, t = 0.692, p = 0.489$ ). Therefore, hypothesis H2b is not supported. This is further corroborated by the lack of a significant direct link between UR and FIC ( $\beta = -0.007, t = 0.306, p = 0.760$ ). Consequently, OA does not moderate the relationship between UR and FIC, since the direct relationship between these variables is not significant. Finally, we investigated the moderating influence of OA on the association between GR and FIC. The findings provide evidence for significant impact of OA on FIC ( $\beta = 0.267, t = 3.158, P = <0.05$ ), and that the OA\*GR interaction also has a substantial impact on FIC ( $\beta = 0.067, t = 2.711, P = 0.047$ ). Thus, hypothesis H2c is supported. These results suggest that OA positively moderates the relationship between GR and FIC, with a higher level of OA strengthening this relationship. Additionally, **Figure 3** illustrates that the influence of GR on FIC is notably stronger at high levels of OA compared to low levels. In addition, the  $f^2$  effect size of the moderating effect is 0.072, which falls within the broad guidelines suggested by Cohen (123). Specifically, effect sizes represent a minor, medium, and large effect, respectively, at 0.02, 0.15, and 0.35. Hence, the  $f^2$  effect size of 0.072 suggests a small moderating impact of OA on the link between GR and FIC.

**Table 7** Results of moderating effect

Hypothesis	Relationship	Beta Coefficients ( $\beta$ )	T statistics (t - value)	p-values	$f^2$	Results
H2a	OA x IFC → FIC	-0.142	3.536	0.000	0.236	Significant
H2b	OA x UR → FIC	-0.014	0.692	0.760	0.489	Not significant
H2c	OA x GR → FIC	0.067	2.711	0.047	0.072	Significant
	OA → FIC	0.267	3.158	0.002		



**Figure 2** Moderating effect of OA on IFC and FIC



**Figure 3** Moderating effect of OA on GR and FIC

## 5. Discussion

This study, in line with the RBV standpoint, investigated and extended the RBV theory by providing a justification for the significant role of Business network (namely IFC, UR, and GR) in influencing FIC for SMEs operating in EMDEs. According to this study's empirical results, two of the three hypotheses on the direct relationship were confirmed. In H1a, the study examines the influence of Inter-firm collaboration (IFC) on FIC, with the results confirming that IFC has a significant influence on FIC. These results are consistent with those of earlier research that show IFC to be the main factor influencing businesses' innovation (62,63), and they support Haffar et al. (124) notion that Inter-firm collaboration allows organizations to share resources and knowledge, which is crucial for frugal innovation. By collaborating with other firms, organizations can gain insights into market needs and customer preferences, which can inform their frugal innovation efforts (124). Moreover, the results of this study provide further evidence for the claims made by Barzotto et al. (125) that collaborating with external partners enables companies, especially SMEs with limited resources, to tap into a broader spectrum of technological opportunities by sharing knowledge and pooling resources. This ultimately leads to an improvement in their ability to innovate.

H1b posits that UR has a significant influence on FIC; however, the study's findings do not confirm this, resulting in H1b not being supported. Surprisingly these findings do not align with previous studies that found that building networks and collaborations with universities and research institutions (UR) can significantly influence the innovativeness of SMEs through providing SMEs with access to new knowledge, technologies, and innovative practices that they may not have developed independently (126). Moreover, the findings did not support the notion that partnerships with UR significantly bolster both individual and joint innovation capabilities of SMEs (127). However, insignificant influence of UR on FIC may be due to the fact that UR often focus on basic research, which may not align with the immediate, practical needs of SMEs. This is especially relevant in the case of EMDEs, where there is a considerable gap between academic research and industry needs (48,128). There is evidence that weak linkages between academia and industry in many developing countries, including Tanzania, reduce the potential impact of academic research on SMEs (129). H1c proposed that GR has a positive influence on FIC, and the results of this study confirm this hypothesis by showing that GR has a significant and positive impact on FIC, thereby supporting H1c. Government support and institutional policies are shown to positively affect the innovativeness of SMEs (126). This suggests that when governments offer resources, funding, or favorable policies, SMEs are more inclined to engage in innovative activities. These align with the results of Feranita et al. (130) and Choi et al (131), which demonstrated that government funding directly enhances SMEs' innovation capabilities.

Furthermore, the study investigated the influence of OA as a moderator in the link between the three dimensions of business networks (IFC, UR, and GR) and FIC. Hypothesis H2a proposed that OA moderates the relationship between

IFC and FIC. The results indicate that OA negatively moderates this relationship, weakening the positive impact of IFC on FIC at high levels of OA. This suggests that, although OA is generally beneficial, it may introduce complexities in inter-firm collaborations that could reduce their effectiveness in promoting frugal innovation. Hypothesis H2b proposed that OA moderates the relationship between UR and FIC. The study found no significant moderating effect of OA on this relationship. This implies that collaborations with universities and research organizations may not directly enhance frugal innovation capability, possibly due to a misalignment between academic research goals and the practical needs of firms engaged in frugal innovation. The lack of a moderating effect of OA suggests that balancing exploration and exploitation does not influence this particular type of collaboration in the context of FIC. Lastly, Hypothesis H2c proposed that OA moderates the relationship between GR and FIC. The study supports this hypothesis, finding that OA positively moderates this relationship, with the impact of GR on FIC being stronger at higher levels of OA. This finding implies that government support, when combined with high organizational ambidexterity, can significantly enhance a small or medium-sized enterprise's frugal innovation capability.

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## 6. Conclusion

With RBV and DCT as its pillars, this study's main goal was to investigate how business network (IFC, UR and GR) Influence SMEs' frugal innovation capability. More precise, the goal was to provide a comprehensive analysis of the multifaceted influence of business network dimensions—IFC, UR, and GR—on SMEs' frugal innovation capability, with organizational ambidexterity acting as a moderator. The study developed a conceptual model which was then validated through empirical testing within the Tanzanian manufacturing (SMEs) sector. The absence of empirically supported research on frugal innovation in developing countries, particularly in African contexts, and the inadequate understanding of the impact of business networks on SMEs' innovation capabilities served as impetuses for this study. The study's findings validate that both IFC and GR have a substantial influence on the FIC of SMEs, while UR showed a negative impact on FIC. Moreover, OA has a moderating role in the link between the dimensions of IFC and GR with FIC, but UR showed no significant relationship. This highlights that utilizing aggregate business network dimensions as a unified concept may yield imprecise outcomes in some situations.

### 6.1. Theoretical implications

The theoretical implications of this study primarily extend and reinforce the RBV and DCT within the context of SMEs operating in EMDEs. First, the findings build on the RBV by highlighting the critical role of business networks—specifically IFC and GR—as a strategic resource that significantly influences FIC in SMEs. By confirming that IFC and GR positively impacts FIC, the study provides empirical support for the RBV's emphasis on the importance of valuable, rare, inimitable, and non-substitutable (VRIN) resources. It demonstrates that business networks can serve as crucial external resources that SMEs can leverage to overcome resource constraints and enhance their competitive advantage through innovation. Second, this study further contributes to the DCT by highlighting the role of dynamic capabilities, such as organizational ambidexterity, in moderating the association between business networks and frugal innovation. It suggests that the ability of SMEs to continuously adapt, learn, and reconfigure their resources in response to changing environments is vital for maximizing the benefits derived from business networks. The finding that OA positively moderates the link between IFC and FIC reinforces the importance of balancing exploration and exploitation in fostering innovation, particularly in resource-constrained environments.

Third, interestingly, the study found that collaboration with universities and research organizations (UR) did not significantly influence FIC, contrary to existing literature. This challenges the assumption that all forms of external collaboration equally contribute to innovation capabilities in SMEs particularly in developing countries such as Tanzania. It suggests that the effectiveness of such collaborations may depend on specific contextual factors within EMDEs, such as the alignment of academic research with market needs, the absorptive capacity of SMEs, or the nature of the knowledge transferred. This finding calls for a refined comprehension of the ways in which diverse kinds of business networks foster innovation in various contexts. Fourth, by offering empirical insights into SMEs in the context of developing and emerging African nations, this study adds to the body of literature by examining the effect of business networks (IFC and GR) on FIC of manufacturing SMEs in EMDEs, such as Tanzania. Fifth, the study highlights that for SMEs in EMDEs, inter-firm collaboration is particularly crucial in driving frugal innovation. This suggests that, in resource-constrained environments, SMEs may benefit more from collaborations that directly align with market dynamics and immediate business needs rather than from academic partnerships. The study emphasizes the need for SMEs to strategically select and manage their business networks to enhance their innovation capabilities effectively.

## 6.2. Managerial implications

The study presents several significant managerial implications, especially for managers and owners of SMEs operating in EMDEs, as well as for policymakers. The findings affirm that IFC and GR are all significant in influencing FIC. Therefore, owners/managers should prioritize developing strong collaborative relationships with other firms. This could be accomplished through forming alliances, joint ventures, or simply informal partnerships where knowledge and resources are shared. Regular engagement with partners to understand market needs and technological advancements can also enhance the firm's ability to innovate frugally. This is particularly crucial in resource-constrained environments where pooling resources can lead to significant competitive advantages. Moreover, owners/managers should stay informed about government initiatives and policies that could benefit their innovation activities. This includes applying for grants, participating in public-private partnerships, and taking advantage of any training or infrastructure development programs offered by the government. Additionally, managers should consider advocating for more supportive policies by engaging with industry groups or directly with government representatives. Additionally, the study found that collaboration with universities and research institutions (UR) did not significantly impact frugal innovation capability. This suggests that, while such collaborations are generally valued, they might not always translate directly into practical, frugal innovations for SMEs in EMDEs. Owners/managers should therefore reevaluate the specific benefits they expect from academic partnerships and ensure that these collaborations are aligned with their innovation goals. They should focus on partnerships that offer tangible, practical benefits, such as applied research that directly addresses the firm's innovation challenges, rather than purely theoretical knowledge. Alternatively, they might consider redirecting resources to more impactful areas of collaboration, such as direct partnerships with other firms.

Furthermore, the notion of organizational ambidexterity, which entails balancing exploitation (focused on efficiency) and exploration (focused on innovation), is crucial for sustaining competitive advantage. Owners/managers should ensure that their firms are not overly focused on either exploring new opportunities or exploiting existing resources but instead maintain a balance that allows for continuous innovation and efficiency. To achieve this, they should develop strategies that support both the exploration of new ideas and the efficient use of current resources. This could involve setting up dedicated teams for innovation that work alongside teams focused on improving existing processes. Regularly reviewing the balance between these two activities will help ensure that the firm remains adaptable and competitive. Similarly, owners/managers should adopt a context-specific approach to innovation, taking into account the local market conditions, resource constraints, and the specific needs of their customers. This might involve tailoring innovation strategies to focus on affordability, usability, and sustainability, all key elements of frugal innovation. In addition, the study highlights the importance of government support in boosting the frugal innovation capabilities of SMEs. Policymakers should continue to develop and implement policies that provide financial support, innovation incentives, and favorable business conditions for SMEs. The weak link between academic research and industry needs, particularly in developing countries, is a barrier to innovation. Policymakers should foster stronger connections between universities and SMEs, perhaps by aligning research funding and academic incentives with the practical needs of the business sector. Moreover, given the positive impact of IFC on innovation, policies that encourage and facilitate inter-firm collaborations should be prioritized. This could include support for industry clusters, networking events, and collaborative innovation platforms.

## 6.3. Limitations and future research directions

The limitations of this study should be taken into consideration when evaluating the results, as they may present opportunities for future researches. First of all, this study was undertaken with a selected sub-sector of manufacturing SMEs in Tanzania, which may impact the broader applicability of the findings. Different outcomes may arise when considering SMEs and large firms across several countries of EMDEs. Hence, it is imperative for future research to reproduce this study in other EMDEs, especially in Asian and Latin American nations, in order to assess the generalizability of the study's results. In addition, because of the surprisingly detrimental impact of UR, it is recommended that future research incorporate a qualitative paradigm into the analysis of the study's data to further investigate the causes behind this unfavorable outcome. Furthermore, since there is a debate about how the business network construct is measured and how it affects the findings on business network-innovation, we suggest that future studies explore other important structural characteristics of business networks to determine if they lead to different conclusions. This will help to scientifically validate the claim and expand our current understanding. Additionally, cross-sectional methodology was utilized in this study; nevertheless, it is proposed that future studies evaluate how the variables used in this study change over time using longitudinal designs, which may provide alternative results and advance the body of knowledge. In conclusion, control factors like business size and firm category should be investigated in further research.



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## Compliance with ethical standards

### *Disclosure of Conflict of interest*

No conflict of interest to be disclosed.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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## References

- [1] Cai Q, Ying Y, Liu Y, Wu W. Innovating with Limited Resources: The Antecedents and Consequences of Frugal Innovation. *Sustainability*. 2019 Jan;11(20):5789.
- [2] Santos LL, Borini FM, Oliveira Júnior M de M. In search of the frugal innovation strategy. *Rev Int Bus Strategy*. 2020a;30(2):245–63.
- [3] Bhatti YA, Ventresca M. How Can 'Frugal Innovation' Be Conceptualized? *SSRN Electron J [Internet]*. 2013 [cited 2023 Oct 25]; Available from: <http://www.ssrn.com/abstract=2203552>
- [4] Hossain M. Frugal innovation: A review and research agenda. *J Clean Prod*. 2018 May 1;182:926–36.
- [5] Pisoni A, Michelini L, Martignoni G. Frugal approach to innovation: State of the art and future perspectives. *J Clean Prod*. 2018 Jan;171:107–26.
- [6] Von Janda S, Kuester S, Schuhmacher MC, Shainesh G. What frugal products are and why they matter: A cross-national multi-method study. *J Clean Prod*. 2020;246:118977.
- [7] Rosca E, Arnold M, Bendul JC. Business models for sustainable innovation – an empirical analysis of frugal products and services. *J Clean Prod*. 2017 Sep;162:S133–45.
- [8] Sengura JD, Mu R, Zhang J. Towards Frugal Innovation Capability in Emerging Markets within the Digitalization Epoch: Exploring the Role of Strategic Orientation and Organizational Ambidexterity. *J Theor Appl Electron Commer Res*. 2024 Sep;19(3):2000–29.
- [9] Shivdas A, Barpanda S, Sivakumar S, Bishu R. Frugal innovation capabilities: conceptualization and measurement. *Prometheus [Internet]*. 2021 Sep 1 [cited 2023 Oct 30];37(3). Available from: <https://scienceopen.com/hosted-document?doi=10.13169/prometheus.37.3.0259>
- [10] Curado C, Muñoz-Pascual L, Galende J. Antecedents to innovation performance in SMEs: A mixed methods approach. *J Bus Res*. 2018 Aug;89:206–15.
- [11] Fichman RG, Dos Santos BL, Zheng Z (Eric). Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *MIS Q*. 2014 Feb 2;38(2):329–43.
- [12] Bernardes R, Borini F, Figueiredo PN. Innovation in emerging economy organizations. *Cad EBAPE BR*. 2019;17:886–94.
- [13] Rossetto DE, Borini FM, Bernardes RC, Frankwick GL. Measuring frugal innovation capabilities: An initial scale proposition. *Technovation*. 2023 Mar 1;121:102674.
- [14] Brem A, Wimschneider C, de Aguiar Dutra AR, Vieira Cubas AL, Ribeiro RD. How to design and construct an innovative frugal product? An empirical examination of a frugal new product development process. *J Clean Prod*. 2020 Dec 1;275:122232.
- [15] Lim C, Han S, Ito H. Capability building through innovation for unserved lower end mega markets. *Technovation*. 2013 Dec 1;33(12):391–404.
- [16] Asakawa K, Cuervo-Cazurra A, Un C. Frugality-based advantage. *Long Range Plann*. 2019 Apr 1;52.
- [17] Gupta AK, Tesluk PE, Taylor MS. Innovation At and Across Multiple Levels of Analysis. *Organ Sci*. 2007 Dec;18(6):885–97.
- [18] Hoholm T, Olsen PI. The contrary forces of innovation: A conceptual model for studying networked innovation processes. *Ind Mark Manag*. 2012;41(2):344–56.

- [19] Raesfeld A von, Geurts P, Jansen M. When is a network a nexus for innovation? A study of public nanotechnology R&D projects in the Netherlands. *Ind Mark Manag.* 2012 Jul 1;41(5):752–8.
- [20] Zeng SX, Xie XM, Tam CM. Relationship between cooperation networks and innovation performance of SMEs. *Technovation.* 2010 Mar 1;30(3):181–94.
- [21] Radjou N, Prabhu J. Frugal Innovation: How to do more with less. *The Economist*; 2015.
- [22] Raisch S, Birkinshaw J. Organizational Ambidexterity: Antecedents, Outcomes, and Moderators. *J Manag.* 2008 Jun 1;34(3):375–409.
- [23] March JG. Exploration and Exploitation in Organizational Learning. *Organ Sci.* 1991 Feb;2(1):71–87.
- [24] Penrose ET. *The Theory of the Growth of the Firm.* Oxford University Press; 1959. 301 p.
- [25] Barney J. Firm Resources and Sustained Competitive Advantage. *J Manag.* 1991 Mar;17(1):99–120.
- [26] Day GS. The Capabilities of Market-Driven Organizations. *J Mark.* 1994 Oct 1;58(4):37–52.
- [27] Tehseen S, Sajilan S. Network competence based on resource-based view and resource dependence theory. *Int J Trade Glob Mark.* 2016;9(1):60.
- [28] Wernerfelt B. A resource-based view of the firm. *Strateg Manag J.* 1984;5(2):171–80.
- [29] Wernerfelt B. The resource-based view of the firm: Ten years after. *Strateg Manag J.* 1995;16(3):171–4.
- [30] Wincent J, Westerberg M. Resource Contributions from Entrepreneurial Firms in Strategic SME Networks. *Int J Entrep Innov.* 2006 Feb;7(1):23–31.
- [31] Zaheer S, Zaheer A. Market microstructure in a global B2B network. *Strateg Manag J.* 2001;22(9):859–73.
- [32] Schilke O. On the contingent value of dynamic capabilities for competitive advantage: The nonlinear moderating effect of environmental dynamism: On the Contingent Value of Dynamic Capabilities. *Strateg Manag J.* 2014 Feb;35(2):179–203.
- [33] Helfat CE, Peteraf MA. The dynamic resource-based view: capability lifecycles. *Strateg Manag J.* 2003 Oct;24(10):997–1010.
- [34] Cristofaro M, Lovallo D. From framework to theory: an evolutionary view of dynamic capabilities and their microfoundations. *J Manag Organ.* 2022 May;28(3):429–50.
- [35] Ambrosini V, Dekker N, Venkitachalam K. Towards a Better Understanding of Strategic Knowledge Dynamics: A Dynamic Capability Exploratory Study. In: *The Routledge Companion to Knowledge Management.* Routledge; 2022.
- [36] Birkinshaw J, Zimmermann A, Raisch S. How Do Firms Adapt to Discontinuous Change? Bridging the Dynamic Capabilities and Ambidexterity Perspectives. *Calif Manage Rev.* 2016 Aug 1;58(4):36–58.
- [37] Vahlne JE, Jonsson A. Ambidexterity as a dynamic capability in the globalization of the multinational business enterprise (MBE): Case studies of AB Volvo and IKEA. *Int Bus Rev.* 2017 Feb 1;26(1):57–70.
- [38] O'Reilly CA, Tushman ML. Organizational Ambidexterity: Past, Present, and Future. *Acad Manag Perspect.* 2013 Nov;27(4):324–38.
- [39] Porter M. *Competitive strategy: Techniques for analyzing industries and competitors.* 1998;
- [40] Agarwal N, Grottke M, Mishra S, Brem A. A Systematic Literature Review of Constraint-Based Innovations: State of the Art and Future Perspectives. *IEEE Trans Eng Manag.* 2017 Feb;64(1):3–15.
- [41] Zeschky M, Widenmayer B, Gassmann O. Frugal Innovation in Emerging Markets. *Res Technol Manag.* 2011;54(4):38–45.
- [42] Santos LL, Borini FM, Oliveira M de M, Rossetto DE, Bernardes RC. Bricolage as capability for frugal innovation in emerging markets in times of crisis. *Eur J Innov Manag.* 2020 Jan 1;25(2):413–32.
- [43] Soni P, Krishnan R. Frugal innovation: aligning theory, practice, and public policy. *J Indian Bus Res.* 2014 Jan 1;6(1):29–47.
- [44] Agarwal N, Brem A. Frugal innovation-past, present, and future. *IEEE Eng Manag Rev.* 2017;45(3):37–41.
- [45] Angot J, Plé L. Serving poor people in rich countries: the bottom-of-the-pyramid business model solution. *J Bus Strategy.* 2015 Jan 1;36(2):3–15.

- [46] Weyrauch T, Herstatt C. Frugal innovation—What is it? Criteria for frugal innovation. In: R&D Management Conference, Cambridge, July. 2016. p. 3–6.
- [47] Bhatti YA. What is Frugal, What is Innovation? Towards a Theory of Frugal Innovation [Internet]. Rochester, NY; 2012 [cited 2023 Oct 29]. Available from: <https://papers.ssrn.com/abstract=2005910>
- [48] Radjou N, Prabhu J, Ahuja S. Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth. John Wiley & Sons; 2012. 289 p.
- [49] Adler PS, Shenbar. Adapting Your Techno—logical Base: The Organizational Challenge. 1990;
- [50] Sher PJ, Yang PY. The effects of innovative capabilities and R&D clustering on firm performance: the evidence of Taiwan's semiconductor industry. *Technovation*. 2005 Jan 1;25(1):33–43.
- [51] Lawson B, Samson D. DEVELOPING INNOVATION CAPABILITY IN ORGANISATIONS: A DYNAMIC CAPABILITIES APPROACH. *Int J Innov Manag*. 2001 Sep;05(03):377–400.
- [52] Greeven M. Innovation in an Uncertain Institutional Environment: Private Software Entrepreneurs in Hangzhou, China [Internet]. 2009 [cited 2023 Oct 30]. Available from: <https://repub.eur.nl/pub/15426/>
- [53] Tiwari R, Herstatt C. Assessing India's lead market potential for cost-effective innovations. *J Indian Bus Res*. 2012;4(2):97–115.
- [54] O'Connor GC. Major Innovation as a Dynamic Capability: A Systems Approach. *J Prod Innov Manag*. 2008;25(4):313–30.
- [55] Iacobucci D, Hopkins N. Modeling Dyadic Interactions and Networks in Marketing. *J Mark Res*. 1992 Feb;29(1):5–17.
- [56] Knoke D, Kuklinski JH. *Network Analysis*. Beverly Hills: SAGE Publishing; 1982. (Quantitative Applications in the Social Sciences).
- [57] Miles RE, Snow CC. Organizations: New Concepts for New Forms. *Calif Manage Rev*. 1986 Apr 1;28(3):62–73.
- [58] Håkansson H, Johanson J. A model of industrial networks. 1993 Jan 1;28–34.
- [59] Thorelli HB. Networks: Between markets and hierarchies. *Strateg Manag J*. 1986;7(1):37–51.
- [60] Powell WW. Hybrid Organizational Arrangements: New Form or Transitional Development? *Calif Manage Rev*. 1987 Oct 1;30(1):67–87.
- [61] La Rocca A, Snehota I. Relating in business networks: Innovation in practice. *Ind Mark Manag*. 2014 Apr 1;43(3):441–7.
- [62] Öberg C. The role of business networks for innovation. *J Innov Knowl*. 2019 Apr;4(2):124–8.
- [63] Xu Z, Lin J, Lin D. Networking and innovation in SMEs: evidence from Guangdong Province, China. Li J, editor. *J Small Bus Enterp Dev*. 2008 Oct 24;15(4):788–801.
- [64] Uzzi B. The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. *Am Sociol Rev*. 1996;61(4):674–98.
- [65] Nohria N, Eccles RG. t ORGANIZATIONS. 1992 [cited 2024 Aug 26]; Available from: [https://edisciplinas.usp.br/pluginfile.php/3597474/mod\\_resource/content/1/GRANOVETTER.pdf](https://edisciplinas.usp.br/pluginfile.php/3597474/mod_resource/content/1/GRANOVETTER.pdf)
- [66] Baum JAC, Calabrese T, Silverman BS. Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strateg Manag J*. 2000 Mar;21(3):267–94.
- [67] Hervas-Oliver JL, Ripoll-Sempere F, Moll CB. Does management innovation pay-off in SMEs? Empirical evidence for Spanish SMEs. *Small Bus Econ*. 2016 Aug;47(2):507–33.
- [68] Ács ZJ, Audretsch DB. *Innovation and Small Firms*. MIT Press; 1990. 234 p.
- [69] Vossen RW. Relative Strengths and Weaknesses of Small Firms in Innovation. *Int Small Bus J*. 1998 Apr 1;16(3):88–94.
- [70] Edwards T, Delbridge R, Munday M. Understanding innovation in small and medium-sized enterprises: a process manifest. *Technovation*. 2005 Oct 1;25(10):1119–27.
- [71] Lee S, Park G, Yoon B, Park J. Open innovation in SMEs—An intermediated network model. *Res Policy*. 2010 Mar 1;39(2):290–300.

- [72] Vanhaverbeke W, Cloudt M. Open innovation in value networks. *Open Innov Res New Paradigm*. 2006;13:258–81.
- [73] Kobarg S, Stumpf-Wollersheim J, Welpel IM. More is not always better: Effects of collaboration breadth and depth on radical and incremental innovation performance at the project level. *Res Policy*. 2019 Feb 1;48(1):1–10.
- [74] Mueller V, Rosenbusch N, Bausch A. Success Patterns of Exploratory and Exploitative Innovation: A Meta-Analysis of the Influence of Institutional Factors. *J Manag*. 2013 Sep 1;39(6):1606–36.
- [75] Belitski M, Rejeb N. Does open customer innovation model hold for family firms? *J Bus Res*. 2022 Jun 1;145:334–46.
- [76] Teece DJ. Competition, cooperation, and innovation: Organizational arrangements for regimes of rapid technological progress. *J Econ Behav Organ*. 1992 Jun 1;18(1):1–25.
- [77] Rajalo S, Vadi M. University-industry innovation collaboration: Reconceptualization. *Technovation*. 2017 Apr 1;62–63:42–54.
- [78] Kim M, Han YS, Cho RM. The role of cooperative R&D in innovation performance of SMEs: evidence from South Korean materials, parts, and equipment firms. *Asian J Technol Innov*. 2024 May 3;1–26.
- [79] Johan K, Turan FM, Fahami SMH. Effective Knowledge Creation for Promoting Innovative Capacity in SME Malaysia Through University-SME-Collaboration (UEC): The Interaction Model. In: Mohd. Isa WH, Khairuddin IMohd, Mohd. Razman MohdA, Saruchi S 'Atifah, Teh SH, Liu P, editors. *Intelligent Manufacturing and Mechatronics [Internet]*. Singapore: Springer Nature Singapore; 2024 [cited 2024 Aug 7]. p. 431–40. (Lecture Notes in Networks and Systems; vol. 850). Available from: [https://link.springer.com/10.1007/978-981-99-8819-8\\_35](https://link.springer.com/10.1007/978-981-99-8819-8_35)
- [80] Wellington Ribeiro F, Lazaro JC, Machado DDQ, Façanha Câmara S. Collaborative network of SMEs innovation projects: influence of scientific and technological institutions. *J Technol Manag Innov*. 2022 Sep;17(2):11–20.
- [81] Audretsch DB, Belitski M, Caiazza R, Phan P. Collaboration strategies and SME innovation performance. *J Bus Res*. 2023 Sep;164:114018.
- [82] Monsef SHA, Mohamed OY. Co-Innovation Supports the Research and Development (R&D) in Small & Medium Enterprises (SMEs). *J Art Des Music*. 2022 Jun 24;1(2):82–97.
- [83] Brem A, Wolfram P. Research and development from the bottom up - introduction of terminologies for new product development in emerging markets. *J Innov Entrep*. 2014;3(1):9.
- [84] Junni P, Sarala RM, Taras V, Tarba SY. Organizational Ambidexterity and Performance: A Meta-Analysis. *Acad Manag Perspect*. 2013 Nov;27(4):299–312.
- [85] Cao Q, Gedajlovic E, Zhang H. Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects. *Organ Sci*. 2009 Aug;20(4):781–96.
- [86] Denison DR, Hooijberg R, Quinn RE. Paradox and Performance: Toward a Theory of Behavioral Complexity in Managerial Leadership. *Organ Sci*. 1995 Oct;6(5):524–40.
- [87] O'Reilly CA, Tushman ML. Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Res Organ Behav*. 2008 Jan 1;28:185–206.
- [88] Volberda HW, Lewin AY. Co-evolutionary Dynamics Within and Between Firms: From Evolution to Co-evolution. *J Manag Stud*. 2003;40(8):2111–36.
- [89] Gupta AK, Smith KG, Shalley CE. The Interplay Between Exploration and Exploitation. *Acad Manage J*. 2006 Aug;49(4):693–706.
- [90] Tushman ML, O'Reilly CA. Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *Calif Manage Rev*. 1996 Jul 1;38(4):8–29.
- [91] Luger J, Raisch S, Schimmer M. Dynamic Balancing of Exploration and Exploitation: The Contingent Benefits of Ambidexterity. *Organ Sci*. 2018 Jun;29(3):449–70.
- [92] Venugopal A, Krishnan TN, Upadhyayula RS, Kumar M. Finding the microfoundations of organizational ambidexterity - Demystifying the role of top management behavioural integration. *J Bus Res*. 2020 Jan 1;106:1–11.

- [93] He ZL, Wong PK. Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis. *Organ Sci.* 2004 Aug;15(4):481–94.
- [94] Eisenhardt KM, Martin JA. Dynamic capabilities: what are they? *Strateg Manag J.* 2000 Oct;21(10–11):1105–21.
- [95] Venkatraman MP. Opinion leaders, adopters, and communicative adopters: A role analysis. *Psychol Mark.* 1989;6(1):51–68.
- [96] Zhao W, Feng T, Xin X, Hao G. How to respond to competitors' green success for improving performance: The moderating role of organizational ambidexterity. *Bus Strategy Environ.* 2021;30(1):489–506.
- [97] Roldán Bravo MI, Ruiz-Moreno A, Lloréns Montes FJ. Examining desorptive capacity in supply chains: the role of organizational ambidexterity. *Int J Oper Prod Manag.* 2018 Jan 1;38(2):534–53.
- [98] Chesbrough HW. Open innovation: The new imperative for creating and profiting from technology [Internet]. Harvard Business Press; 2003 [cited 2024 May 31]. Available from: <https://books.google.com/books?hl=en&lr=&id=4hTRWStFhVgC&oi=fnd&pg=PR9&dq=Chesbrough,+H.,+2003.+Open+innovation.+Harvard+Business+School+Publication+Corp.&ots=XvREUKy6AI&sig=ng40EqXYcnej3KJd kEYOEN238g8>
- [99] Wang C, Chin T, Lin JH. Openness and firm innovation performance: the moderating effect of ambidextrous knowledge search strategy. *J Knowl Manag.* 2020 Jan 1;24(2):301–23.
- [100] Nyello RM, Kalufya N. Entrepreneurial Orientations and Business Financial Performance: The Case of Micro Businesses in Tanzania. *Open J Bus Manag.* 2021 Apr 1;9(3):1263–90.
- [101] Quaye DM, Sekyere KN, Acheampong G. Export promotion programmes and export performance: A study of selected SMEs in the manufacturing sector of Ghana. *Rev Int Bus Strategy.* 2017 Jan 1;27(4):466–83.
- [102] Andreoni A. Mapping industrial production in Tanzania: a disaggregated analysis based on the 2013 mainland census. 2017 [cited 2024 Feb 27]; Available from: <http://eprints.soas.ac.uk/25112/1/2017-Andreoni-UNIDO-WP.pdf>
- [103] URT. Small and Medium Enterprise Development Policy [Internet]. United Republic of Tanzania; 2003 [cited 2023 Oct 6]. Available from: <https://www.viwanda.go.tz/uploads/documents/en-1618820071-1455890063-SME-Development-Policy.pdf>
- [104] Armstrong JS, Overton TS. Estimating Nonresponse Bias in Mail Surveys. *J Mark Res.* 1977 Aug 1;14(3):396–402.
- [105] Huang HC, Lai MC, Lo KW. Do founders' own resources matter? The influence of business networks on start-up innovation and performance. *Technovation.* 2012;32(5):316–27.
- [106] Gemünden HG, Ritter T, Heydebreck P. Network configuration and innovation success: An empirical analysis in German high-tech industries. *Int J Res Mark.* 1996;13(5):449–62.
- [107] Orozco J, Ruiz K. Quality of interactions between public research organisations and firms: lessons from Costa Rica. *Sci Public Policy.* 2010;37(7):527–40.
- [108] Shou Z, Chen J, Zhu W, Yang L. Firm capability and performance in China: The moderating role of guanxi and institutional forces in domestic and foreign contexts. *J Bus Res.* 2014;67(2):77–82.
- [109] Mondejar R, Zhao H. Antecedents to Government Relationship Building and the Institutional Contingencies in a Transition Economy. *Manag Int Rev.* 2013 Aug;53(4):579–605.
- [110] Lubatkin MH, Simsek Z, Ling Y, Veiga JF. Ambidexterity and Performance in Small-to Medium-Sized Firms: The Pivotal Role of Top Management Team Behavioral Integration. *J Manag.* 2006 Oct;32(5):646–72.
- [111] Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J Appl Psychol.* 2003;88(5):879–903.
- [112] Le PB, Lei H. Determinants of innovation capability: the roles of transformational leadership, knowledge sharing and perceived organizational support. *J Knowl Manag.* 2019 Apr 8;23(3):527–47.
- [113] Schermelleh-Engel K, Moosbrugger H, Müller H. Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods Psychol Res Online.* 2003;8(2):23–74.
- [114] Ringle CM, Wende S, Becker JM. "SmartPLS 4." Oststeinbek: SmartPLS GmbH. 2022; Available from: <https://www.smartpls.com/>
- [115] Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika.* 1951 Sep;16(3):297–334.

- [116] Hair JF, Hult GTM, Ringle CM, Sarstedt M. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). 2nd ed. Thousand Oaks: SAGE Publications, Incorporated; 2016.
- [117] Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J Acad Mark Sci*. 2015 Jan;43(1):115–35.
- [118] Hair JF, Hult GTM, Ringle CM, Sarstedt M, Thiele KO. Mirror, mirror on the wall: A comparative evaluation of composite-based structural equation modeling methods. *J Acad Mark Sci*. 2017;45(5):616–32.
- [119] Sang S, Lee J, Lee J. E-government adoption in Cambodia: a partial least squares approach. *Transform Gov People Process Policy*. 2010 Jan 1;4(2):138–57.
- [120] Ee E, Halim HA, Ramayah T. HR OUTSOURCING SUCCESS: DOES PARTNERSHIP QUALITY VARIABLES MATTER? *J Bus Econ Manag*. 2013 Sep 23;14(4):664–76.
- [121] Rahman SA, Amran A, Ahmad NH, Taghizadeh SK. Supporting entrepreneurial business success at the base of pyramid through entrepreneurial competencies. *Manag Decis*. 2015 Jan 1;53(6):1203–23.
- [122] Chin WW. The Partial Least Squares Approach to Structural Equation Modeling. In: *Modern methods for business research*. Hillsdale, NJ: Lawrence Erlbaum Associates Publishers; 1998. p. 295–336.
- [123] Cohen J. *Statistical Power Analysis for the Behavioral Sciences* [Internet]. 0 ed. Routledge; 1988 [cited 2023 Oct 14]. Available from: <https://www.taylorfrancis.com/books/9781134742707>
- [124] Haffar M, Ozcan R, Radulescu M, Isac N, Nassani AA. Hegemony of Network Capabilities, Frugal Innovation and Innovation Strategies: The Innovation Performance Perspective. *Sustainability*. 2022 Jan;14(1):2.
- [125] Barzotto M, Corradini C, Fai F, Labory S, Tomlinson PR. Chapter 11: External collaboration for innovation: firms, industry, regions and policy. In: *Handbook of Industrial Development* [Internet]. 2023 [cited 2024 Aug 21]. Available from: <https://www.elgaronline.com/edcollchap/book/9781800379091/book-part-9781800379091-20.xml>
- [126] Makanyeza C, Mabenge BK, Ngorora-Madzimure GPK. Factors influencing small and medium enterprises' innovativeness: Evidence from manufacturing companies in Harare, Zimbabwe. *Glob Bus Organ Excell*. 2023;42(3):10–23.
- [127] Song Y. How do Chinese SMEs enhance technological innovation capability? From the perspective of innovation ecosystem. *Eur J Innov Manag*. 2022 Jan 1;26(5):1235–54.
- [128] Gupta, Dey A, Singh G. Connecting corporations and communities: Towards a theory of social inclusive open innovation. *J Open Innov Technol Mark Complex*. 2017 Sep 21;3(1):17.
- [129] Wield D, Tait J, Chataway J, Mitra J, Mastroeni M. Conceptualising and practising multiple knowledge interactions in the life sciences. *Technol Forecast Soc Change*. 2017 Mar 1;116:308–15.
- [130] Feranita NV, Nugraha A, Sukoco SA. THE ROLE OF GOVERNMENT SUPPORT FOR INNOVATION AND PERFORMANCE OF SMEs. *POLITICO*. 2019;19(2):124–36.
- [131] Choi SK, Han S, Kwak KT. Innovation Capabilities and the Performance of Start-Ups in Korea: The Role of Government Support Policies. *Sustainability*. 2021 Jan;13(11):6009.