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## **The antecedents of bricolage in innovative firms: An empirical study in Tanzania**

### **Abstract**

*Resource mobilisation is challenging for Small and Medium-sized Enterprises (SMEs) operating in developing countries characterised by resource constraints and market uncertainties. In response to these challenges, many SMEs rely on bricolage to pursue innovation. This study explores the antecedents of bricolage and examines the relationship between bricolage and innovation. The study employs partial least squares structural equation modeling (PLS-SEM) to analyse data from 229 SMEs in the Tanzanian food and drink industry. The findings reveal that financial and market constraints are important antecedents of bricolage among innovative firms, and demonstrate that bricolage is positively associated with innovation. Knowledge and/or regulatory constraints do not appear to be significantly associated with bricolage among the sampled SMEs. Theoretical and practical implications of the findings include the need for support agencies and policymakers to recognise the importance of supporting SMEs to address innovation constraints by optimising bricolage behaviour.*

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**Keywords:** bricolage, innovation, constraints, developing country, SME

## Introduction

Resource mobilisation for innovation is a significant challenge for small and medium-sized enterprises (SMEs), as they often lack the competitive advantages required to attract external investment (Egbetokun *et al.*, 2016; Gassiah and Kikula, 2022; Senyard *et al.*, 2014). This disadvantage is especially acute for SMEs in developing countries, because they work in unfavourable environments characterised by resource scarcity and uncertainty (Avenyo *et al.*, 2021; Nyarku and Oduro, 2017). Evidence suggests that inadequate human capital, limited access to external finance, informal competition, limited demand for innovative products, and multiplicity and uncertainty of regulations are common challenges for SMEs in developing countries; these challenges combine to restrict firms' ability to innovate (Abbey and Adu-Danso, 2022; Alawamleh *et al.*, 2022; Satta, 2003).

Despite these challenges, research suggests that many SMEs in developing countries manage to innovate successfully (Indrawati, 2020; Kiveu *et al.*, 2019; Mpagalile *et al.*, 2008), challenging the assumption that firms need to access significant financial and other resources - for example technical expertise - in order to innovate (Barney, 1991; Shafi *et al.*, 2019). SMEs in general and across different developing market contexts are less likely to access the resources that are generally assumed to be required for innovation than are larger businesses or those operating in developed economies (Daksa *et al.*, 2018; Fowowe, 2017). The literature suggests that in situations of resource scarcity and uncertainty, bricolage becomes a potential strategic choice for innovative firms, as it involves the creative combination and configuration of existing resources (Baker and Nelson, 2005; Simba *et al.*, 2021). Bricolage has been found to assist resource-constrained firms to innovate in circumstances that other similar firms consider to be a deterrent to innovation (Atarah *et al.*, 2021).

The literature on bricolage is substantial; however, three research gaps require attention to advance theoretical and practical knowledge, especially in relation to SMEs in developing economies. First, while bricolage has been a popular theoretical framework for understanding innovation among resource-constrained firms, most prior research investigates the outcomes of bricolage rather than its antecedents (Atarah *et al.*, 2021; Senyard *et al.*, 2014; Yu *et al.*, 2019). As noted by Simba *et al.* (2021), too little attention has been paid to the underlying factors that influence firms' engagement in bricolage. Consequently, identifying the factors that facilitate and constrain bricolage would be an important step forward. Second, the literature is dominated by qualitative case studies focusing on entrepreneurs whose bricolage behaviour is shaped by the challenges they face in pursuing opportunities (Baker and Nelson, 2005; Linna, 2013; Tsilika *et al.*, 2020). However, the knowledge generated from such studies may not be generalizable to other settings (Johnson and Onwuegbuzie, 2004). Consequently, quantitative evidence would be useful in this context. Third, bricolage research in developing countries focuses primarily on social enterprises (Farhoud *et al.*, 2023; Ghalwash and Ismail, 2022; Hota *et al.*, 2019). There is a paucity of evidence regarding the application of bricolage in commercial SMEs in developing countries (An *et al.*, 2018; Bojica *et al.*, 2014).

To address the stated research gaps, this paper examines both the antecedents and the outcomes of bricolage among SMEs in a developing country, utilizing a survey-based methodology that produces more generalizable results. Building on the framework developed by Simba *et al.* (2021), this study tests the proposition that scarcity of resources and market uncertainty stimulate bricolage among some entrepreneurial firms, which in turn fosters innovation. Using a sample of 229 firms from the Tanzanian food and drink industry, the study examines the role of financial, knowledge, market and regulatory constraints in

stimulating bricolage. Furthermore, the relationship between bricolage and firm innovation performance is tested.

The food and drink industry is a suitable focus for the study because it accounts for a sizeable proportion of Tanzania's manufacturing sector. In 2016, this sector accounted for more than half of manufacturing added value (Mazungunye and Punt, 2022) and 41 percent of manufacturing employment (Andreoni, 2017). SMEs account for nearly 94 percent of all firms in this sector (NBS and MITI, 2016). The Tanzanian Government and development agencies have provided support for SMEs, including training, finance design advice, market facilitation and access to technologies (Gamba, 2019; Mpagalile *et al.*, 2008). Despite these efforts, firms in the industry continue to experience internal and external constraints to innovation, including inaccessibility and high cost of debt finance (Madatta and Chen, 2020; Mpagalile *et al.*, 2008), shortage of skilled human resources, and lack of institutional support for research and development (R&D). Other constraints include expensive packaging materials (Sutton and Olomi, 2012), counterfeiting (CTI, 2017), multiplicity and uncertainty of regulations and high compliance costs (Charles and Rweikiza, 2015).

This paper makes several contributions to the literature. First, the study advances the theory of bricolage by integrating antecedents and outcomes of bricolage into one model encompassing innovation constraints as antecedents, and innovation performance as outcomes of bricolage. This responds to concerns raised by Scazziota *et al.* (2023) and Stenholm and Renko (2016) regarding the predominant focus of previous studies on the outcomes rather than the antecedents of bricolage. Moreover, this paper provides new insights into firms' innovation behaviour, and highlights the factors that trigger bricolage in SMEs in developing country contexts. Second, the study contributes to the literature by examining the relationship between bricolage and innovation, highlighting the mechanisms that give rise to a positive relationship between the two phenomena, supporting the case for

contextually appropriate interventions (An *et al.*, 2018; Senyard *et al.*, 2014). The research complements previous findings by demonstrating that bricolage can stimulate innovation in developing country contexts (An *et al.*, 2018; Santos *et al.*, 2021). Third, this paper focuses attention on bricolage and innovation among commercial enterprises in developing countries, thereby extending our understanding of bricolage to a firm context that plays a significant role in job creation and economic growth.

## **Literature review**

### ***Bricolage in resource-constrained and uncertain environments***

Business environments in developing countries are challenging contexts for SMEs (Abbey and Adu-Danso, 2022; Alawamleh *et al.*, 2022; Satta, 2003). Scarcity of resources and market uncertainty have been shown to inhibit innovation activities, but they may also stimulate adaptive behaviour and creativity, leading to novel solutions including bricolage (Bojica *et al.*, 2014; Yu *et al.*, 2019; Yu *et al.*, 2020). Bricolage may be utilised by SMEs in circumstances where resource acquisition is constrained (Simba *et al.*, 2021; Witell *et al.*, 2017). Baker and Nelson (2005, p.33) define bricolage as “making do by applying combinations of resources at hand to new problems and opportunities”. Bricolage describes how organisations interact with their environment to access resources they need to exploit opportunities and solve problems (Scazziota *et al.*, 2023; Witell *et al.*, 2017).

For many SMEs, bricolage is a means of responding to the challenges of uncertain and risky environments (Atarah *et al.*, 2021; Korede *et al.*, 2023; Simba *et al.*, 2021). Firms that engage in bricolage can create and maintain competitive advantage, allowing them to generate heterogeneous values from ostensibly identical resources, while enhancing their capacity to adapt to market uncertainties (Salunke *et al.*, 2013; Yu *et al.*, 2019). Bojica *et al.* (2014) and Santos *et al.* (2022) demonstrate an association between bricolage and

innovation, suggesting that successful recombination is a pathway towards innovation for resource-constrained firms.

Baker and Nelson (2005) identify three core elements of bricolage: first, “making do” implies a bias towards active engagement with problems, which produces accumulated knowledge and skills to enhance the firm’s adaptability to new situations and its ability to overcome challenges (Simba *et al.*, 2021; Sunduramurthy *et al.*, 2016). Second, “recombination of resources” refers to firms’ creative responses to problems using existing resources for purposes that diverge from their initial intention (Baker and Nelson, 2005; Tsilika *et al.*, 2020). Third, “resources at hand” describes the firm’s underexplored internal and external resources, acquired at low or no cost (Santos *et al.*, 2022). These include available physical artefacts, pre-existing contacts and networks, experience, skills or ideas within an organisation (Baker and Nelson, 2005; Tsilika *et al.*, 2020). “Resources at hand” also include financial resources and cheaply available materials that may be considered worthless by others, but are potentially useful for those engaging in bricolage (An *et al.*, 2018; Tasavori *et al.*, 2018). Bricolage is therefore a relevant theoretical lens to investigate innovation activities by SMEs in developing countries.

A growing body of literature recognises bricolage as an enabler of innovation in young and small firms (Atarah *et al.*, 2021; Senyard *et al.*, 2014) and in times of crisis (Santos *et al.*, 2022; Santos *et al.*, 2021; Tsilika *et al.*, 2020) as well as a means of survival, enhanced business performance and sustained competitive advantage for resource-constrained firms (Baier-Fuentes *et al.*, 2023; Yu *et al.*, 2020; Yu *et al.*, 2019). On the other hand, bricolage is viewed as a behaviour invoked within firms by both internal and external conditions – whereby scarcity of resources and market uncertainties are considered as potential antecedents (Lee and Park, 2023; Scazziota *et al.*, 2023). For example, Santos *et al.* (2021)

find a positive correlation between market and technological turbulence and bricolage in Brazil.

Similarly, Baier-Fuentes *et al.* (2023) reveal that the human capital and social ties of business owners are significant determinants of bricolage in owner-managed Chilean SMEs. Scazziota *et al.* (2023) find that lack of environmental munificence (i.e., unavailability of resources for the firm), uncertainty and institutional complexity are key antecedents of bricolage. These hard-to-predict conditions create a situation that forces firms to diverge from conventional ways of solving problems, instead they engage in actions that promote discovery by making the best use of existing resources (Lee and Park, 2023; Senyard *et al.*, 2014).

However, research linking the two streams of literature is limited. This has fuelled calls for research to include antecedents of bricolage in analytical models. An understanding of the triggers that stimulate SMEs to engage in bricolage would strengthen the literature. Prior studies (Baier-Fuentes *et al.*, 2023; Santos *et al.*, 2022) indicate that the integration of the antecedents and outcomes of bricolage into a single analytical model represents a promising future research area.

## **Hypotheses Development**

### ***Financial constraints and bricolage***

External finance for firm-level innovation (Wellalage and Fernandez, 2019) is typically not affordable by and/or easily accessible to developing country SMEs (Runde *et al.*, 2021; Satta, 2003). Financially-constrained firms can either avoid the challenge of innovating, or attempt to overcome it through bricolage (Baker and Nelson, 2005; Yu *et al.*, 2020). Bricolage responses to financial constraints take one or more of the following forms: creative



combination of physical inputs, external networking and product redesign (Baker and Nelson, 2005; Korede *et al.*, 2023; Tindiwensi *et al.*, 2021).

When faced with financial constraints, innovative SMEs may engage in product redesign which involves reducing the number of components or changing to cheaper production materials (Baker and Nelson, 2005; Tsilika *et al.*, 2020); this may lead to lower costs, and reduce the financial resources required for innovation. Innovative SMEs have also been found to rely on relationally embedded networks, in situations where formal means of acquiring finance are absent. These networks typically comprise family members, landlords and cooperative organisations (Gbandi and Amissah, 2014). SMEs may also leverage free or low-cost labour from their social networks (Atarah *et al.*, 2021; Linna, 2013).

*Hypothesis 1: Financial constraints are positively related to bricolage in SMEs.*

### ***Knowledge constraints and bricolage***

The literature recognises knowledge as a key ingredient of firm-level innovation and a potential source of competitive advantage (Daksa *et al.*, 2018; Varis and Littunen, 2010). Wellalage and Fernandez (2019) note that SMEs typically lack the ability to attract highly qualified labour, and experienced managers that are important for SMEs' innovation activities (Daksa *et al.*, 2018; Egbetokun *et al.*, 2016).

In face of such constraints, self-taught skills and network partners become important sources of knowledge for innovative firms (Linna, 2013; Yu *et al.*, 2019). Tindiwensi *et al.* (2021) show that Ugandan entrepreneurs rely on family members, business associations and government and Non-Government Organisations (NGO) for technical and farm management skills. Such interactions provide opportunities for SMEs to learn and acquire new expertise and knowledge (Shafi *et al.*, 2019).

Moreover, innovative firms can use informal and self-taught skills to extract new value from resources at hand (Baker and Nelson, 2005; Tsilika *et al.*, 2020). Free and easily available sources of information are used to upgrade knowledge, acquire new skills and solve problems. Similarly, employees may use their skills to accomplish new tasks that may otherwise have required additional human resources (Fuglsang and Sørensen, 2011; Korede *et al.*, 2023).

*Hypothesis 2: Knowledge constraints are positively related to bricolage in SMEs.*

### ***Market constraints and bricolage***

Consumer resistance, lack of demand for innovative products, counterfeiting, informal competition, and ease of customers switching to competitors' products are examples of market constraints that have negative effects on innovation in the food and drink industry, and in developing countries (Avenyo *et al.*, 2021; Mpagalile *et al.*, 2008).

Bricolage as a strategy to address market constraints entails utilisation of existing networks to identify solutions (Baker and Nelson, 2005; Yu *et al.*, 2019). It often involves maintaining informal and close relationships with customers to form 'communities of friends' (Rönkkö *et al.*, 2014). These relationships not only help firms minimize the cost of marketing, but also stimulate demand for new products by reducing customer resistance. Business associations serve as an effective means of collective marketing, enabling access to markets, price negotiation and the establishment of reliable customer relationships (Tindiwensi *et al.*, 2021).

*Hypothesis 3: Market constraints are positively related to bricolage in SMEs.*

### ***Regulatory constraints and bricolage***

Research highlights the role of regulatory constraints in impeding innovation (Bartels *et al.*, 2016; Charles and Rweikiza, 2015; Nieuwenhuizen, 2019). Research in developed

countries has tended to exclude regulations as an innovation constraint (Akhmadi and Tsakalerou, 2022; Pikkemaat *et al.*, 2018). Developed countries are characterised by institutions that provide greater resources, promoting conducive conditions for innovation (Hernández *et al.*, 2022). When regulations are included as a distinct variable, they are proposed to act as drivers for innovation (Coad *et al.*, 2016; Demirbas *et al.*, 2011). Studies in developing countries have produced contradictory results, with some suggesting regulations as drivers for innovation but others suggesting regulations as constraints on innovation (Nieuwenhuizen, 2019; Nyarku and Oduro, 2017).

Regulatory constraints may induce firms to engage in bricolage. Firms deploying bricolage usually exercise a risk-taking mindset and seek to circumvent existing regulations to offer previously unavailable products (Baker and Nelson, 2005; Tsilika *et al.*, 2020). Through these bricolage activities, firms develop deep knowledge of how to overcome regulatory constraints (Yu *et al.*, 2019) despite penalties for violations of regulations that may discourage firms from employing bricolage (Tsilika *et al.*, 2020).

*Hypothesis 4: Regulatory constraints are positively related to bricolage in SMEs.*

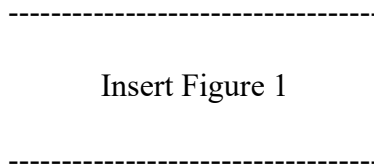
### ***Bricolage and innovation***

Research has established that firms in resource-constrained and uncertain environments deploy bricolage to improve their innovation performance (Cunha *et al.*, 2014; Santos *et al.*, 2021). Research on Kenya's innovator-entrepreneurs (Linna, 2013), Chinese firms (Wu *et al.*, 2017) and Greek SMEs (Tsilika *et al.*, 2020) reveals that bricolage hastens new product development. Quantitative studies in Brazil (Santos *et al.*, 2022; Santos *et al.*, 2021), China (Xu *et al.*, 2023) and Australia (Senyard *et al.*, 2014) indicate that resource-constrained firms with high engagement in bricolage are more innovative than firms with lower such engagement. In developing countries, bricolage contributes to SME innovation for two reasons.

First, SMEs lack the resources necessary to invest in lengthy and expensive product development and commercialization. As a consequence, they resort to creative combination of existing resources (Lee and Park, 2023; Xu *et al.*, 2023). Second, bricolage focuses on using existing resources rather than seeking new resources from external sources (Baker and Nelson, 2005). This helps firms act swiftly without awaiting availability of standard resources (Wu *et al.*, 2017).

*Hypothesis 5: Bricolage is positively related to firms' innovation.*

The full model of this study is depicted in Figure 1 below:



## **Research method**

### ***Sample and data collection***

The sample comprises food and drink firms operating in Arusha, Dar es Salaam, Dodoma, Kilimanjaro, Manyara, Mbeya, Ruvuma and Singida regions in Tanzania. These regions have the largest numbers of food and drink manufacturing firms and a higher demand for processed food, due to increasing numbers of middle-income earners (NBS, 2020; NBS and MITI, 2016). The sampling frame comprised 1,087 SMEs extracted from the databases of the Ministry of Industries, Trade and Investment (MITI) and Small Industries Development Organization (SIDO). The questionnaire, based on constructs identified through the literature review, was distributed to managers/owners of enterprises.

The questionnaire was translated into Swahili - the first official language in Tanzania - and reviewed by four experienced researchers proficient in English and Swahili, to remove

cultural bias and to ensure content validity (Vinck *et al.*, 2019; Yu *et al.*, 2019). A pilot survey was conducted on 30 randomly selected firms. Out of 379 questionnaires distributed, 261 were completed, a response rate of 69 percent. Thirty-two questionnaires were excluded because they came from firms that had not introduced any type of innovation in the previous five years. The final sample of 229 manufacturers was representative of the industry's population.

### ***Measures***

Innovation constraints were measured by 16 items representing four dimensions – financial, knowledge, market, and regulatory (Table 1). These were adapted from measures used in previous studies in developed countries, for example Madrid-Guijarro *et al.* (2009), but re-worded to reflect the developing country context.

Knowledge constraint measures were also based on Madrid-Guijarro *et al.* (2009). For example, the original item “*insufficient government support*” was modified to “*lack of knowledge support from government and research institutes*” reflecting the situation typically found in developing countries.

Market constraints were measured by four items, of which two (“competition from established and large firms” and “uncertain demand for innovative products”). were adopted from Coad *et al.* (2016) Two more items were added: “*counterfeit products*” and “*competition from informal sector*” because they are common market constraints experienced by innovative SMEs in developing countries (Mendi and Costamagna, 2017; Sengabira Ndereyimana *et al.*, 2022) and in Tanzania's food and drink industry in particular (Charles and Rweikiza, 2015; CTI, 2017). Regulatory constraints were measured by four items representing the most prevalent regulatory challenges in the food and drink industry and developing countries (Mpagalile *et al.*, 2008; Nieuwenhuizen, 2019).

Respondents were asked to rate the extent to which they perceived each item to be an innovation constraint, on a 5-point Likert scale ranging from 1= not a constraint, to 5 = very severe constraint. The Cronbach's alpha for the measurement scales were 0.775 for regulatory constraints, 0.790 for knowledge constraints, 0.835 for market constraints and 0.873 for financial constraints.

Bricolage was measured by the eight-item scale developed by Senyard *et al.* (2009). Respondents were asked to rate the extent to which their firms used various kinds of resources to deal with challenges on a 5-point Likert scale (1= Never to 5 = Always). The Cronbach's alpha for the scale was 0.945.

Innovation performance was measured by nine items adapted from previous studies (Gunday *et al.*, 2011; Madrid-Guijarro *et al.*, 2009; Oslo, 2018). These measured product, process and market innovation (Table 1). Innovation performance was operationalized to reflect the nature, type and degree of novelty of innovations in the food and drink industry and in developing countries. The OSLO manual 2018 (Oslo, 2018) recognises four types of innovation, two of which - product innovation and market innovation - are introduced on the market and the other two - process innovation and organisational innovation - relate to the firm's operations. Product, process and market innovations are the most crucial types of innovation that drive growth and competitive advantage in the food and drink industry (Mpagalile *et al.*, 2008; Trott and Simms, 2017). Organisational innovation was not included in the measures of innovation, as a larger than average proportion of firms in the sector are SMEs with limited resources to invest in R&D (Ayalew *et al.*, 2020; Trott and Simms, 2017).

Innovation in the food and drink industry in developing countries is often process-oriented and incremental (Beckeman *et al.*, 2013; Egbetokun *et al.*, 2016). Hence, the survey instrument used a broad definition of innovation to capture small improvements in products, manufacturing methods and marketing, and more significant or radical changes. The

questionnaire required respondents to indicate whether their firms had introduced a particular type of innovation during the last five years (yes = 1 and no = 0) and to rate the importance of that activity in achieving their objectives on a 5-point Likert scale (1 = not important at all to 5 = very high importance). The mean score of each firm on the three dimensions of innovation was computed by summing up the values of items of each dimension and dividing the total score by the number of indicators.

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Insert Table 1  
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### ***Common method variance***

Following Podsakoff *et al.* (2003), common method variance (CMV) was assessed by combining procedural remedies and statistical tests. First, respondents were assured of anonymity and voluntary participation in the study. Second, Harman's single factor test was performed and the six largest factors accounted for 27.2 percent of the total variance, below the 50 percent threshold suggested by Heidenreich and Kraemer (2016), providing assurance that common method bias was not a concern.

### ***Statistical analysis***

Partial least squares structural equation modelling (PLS-SEM) was performed to assess the model and test the hypotheses. PLS-SEM can deal with structural models with many constructs, indicators or model relationships (Hair *et al.*, 2019). It is also suitable for exploratory studies with a theoretical framework encompassing a construct acting as a mediator (Chang and Huang, 2022; Hooi *et al.*, 2016). Previous studies have employed PLS-

SEM to examine the antecedents and outcomes of bricolage (Baier-Fuentes *et al.*, 2023; Santos *et al.*, 2021; Santos *et al.*, 2022).

SmartPLS version 3 was used to conduct model assessment using the two-stage approach proposed by Anderson and Gerbing (1988). The first stage assessed the reliability and validity of the measurement model. The second stage tested hypothesized relationships using the bootstrapping procedure (Anderson and Gerbing, 1988).

## ***Results of analysis***

### ***Measurement model assessment***

Following Fornell and Larcker (1981), assessing the reliability and validity of the measurement model is a prerequisite for testing hypothesized relationships. The reliability of measurement scales was assessed via indicator loadings (IL), Cronbach alpha (CA), composite reliability (CR) and rho A. The reliability values reported in Table 2 indicate that IL, CA, CR and rho\_A values ranged from 0.790 to 0.954, which are high compared to the 0.70 benchmark recommended by Hair *et al.* (2019), suggesting high levels of reliability.

Both convergent and discriminant validity were examined in order to assess the construct validity. Convergent validity was assessed by examining average variance extracted (AVE) and the results in Table 2 indicate that the AVE value of each construct exceeded 0.5, a proposed lower limit for convergent validity (Fornell & Larcker, 1981). Discriminant validity was assessed by both the Fornell-Larcker criterion (Fornell and Larcker, 1981) and heterotrait-monotrait (HTMT) ratio criterion proposed by Henseler *et al.* (2015). The Fornell-Larcker criterion compares a construct's AVE to the squared correlations (SCs) of the construct with other constructs in the model. Discriminant validity is assumed when the AVE exceeds the SCs of the construct with other constructs and HTMT ratio criterion values are less than the cut-off value of 0.85. As shown in Table 3, all AVEs were larger than the SCs and HTMT ratio criterion values did not exceed the 0.85 threshold,



thus providing confirmation for discriminant validity. The above results provide evidence that the measurement model fits the data well.

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Insert Table 2  
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### **Results of hypotheses testing**

Stage 2 of the analysis tested the structural model proposed in Figure 2. This entailed examination of the path coefficients and their effect sizes ( $f^2$ ), VIF values, and coefficients of determination of the endogenous latent constructs (i.e.  $R^2$ ) (Hair *et al.*, 2019). The calculated VIF values to assess multicollinearity were lower than an acceptable upper limit of 5, suggesting absence of collinearity issues.

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Insert Figure 2.  
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The results presented in Table 4 supported  $H1$  ( $\beta = 0.155, p < 0.05$ ) and confirmed a positive relationship between financial constraints and bricolage. Similarly, the results supported hypothesis  $H3$  confirming a positive relationship between market constraints and bricolage ( $\beta = 0.294; p < 0.001$ ). However, the results did not support  $H2$  on the positive relationship between knowledge constraints and bricolage ( $\beta = 0.049; p > 0.05$ ); nor  $H4$  on the positive relationship between regulatory constraints and bricolage ( $\beta = 0.081; p > 0.05$ ). Hypothesis  $H5$  proposed a positive relationship between bricolage and innovation. As

expected, the parameter estimate was positive and significant ( $\beta = 0.303$ ;  $p < 0.001$ ) providing support for hypothesis *H5*. In addition, the Cohen's  $f^2$  effect sizes for significant coefficients were above 0.02, indicating satisfactory explanative power for the endogenous latent constructs (Henseler *et al.*, 2009; Lee *et al.*, 2016).

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Insert Table 4  
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A two-step bootstrapping procedure recommended by Hair *et al.* (2019) and Streukens and Leroi-Werelds (2016) was applied to determine the possible existence of indirect effects of financial and market constraints on innovation. Table 5 indicates that both financial constraints and market constraints indirectly influenced innovation through bricolage ( $\beta = 0.047$ ;  $p < 0.05$ , and  $\beta = 0.089$ ;  $p < 0.01$  respectively). Since the direct effects of financial and market constraints were significant, it can be concluded that bricolage mediates partially the effects of financial and market constraints on innovation.

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Insert Table 5  
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### **Discussion of findings**

Scarcity of resources and market uncertainty in developing countries poses challenges to firms' operations but despite this, many firms are still able to innovate. Bricolage, which emphasises creative combination of limited resources available for innovation, is considered a potential option in these contexts (Gbandi and Amissah, 2014; Tindiwensi *et al.*, 2021).

As noted above, the bricolage literature focuses primarily on outcomes but there is limited evidence regarding the antecedents of bricolage. Further, few attempts have been

made to integrate antecedents and outcomes of bricolage in a single model. This paper addresses these gaps in the literature by presenting antecedents and outcomes of bricolage in a single model and testing their relationships.

For the Tanzanian food and drink industry, the results show that financial and market constraints significantly drive bricolage in SMEs (H1 and H3). These findings are consistent with previous studies in developing country contexts which find that innovative firms experiencing financial shortages turn their attention to interest free or low interest financing from informal networks of family members, friends and suppliers (Linna, 2013; Santos *et al.*, 2022; Tindiwensi *et al.*, 2021). It is also consistent with empirical research suggesting that innovative firms that experience financial constraints opt for cheaply available or recycled materials to ease financial constraints (Tsilika *et al.*, 2020; Wellalage and Fernandez, 2019).

Similarly, market constraints in the food and drink industry and in developing countries stimulate bricolage as a response mechanism. Consistent with the literature (Atarah *et al.*, 2021; Linna, 2013; Tindiwensi *et al.*, 2021), this study finds that market constraints have an effective influence on bricolage. This reflects firms' desire for achievement of competitive advantage through innovation by overcoming low-demand, product counterfeiting and informality. This finding supports previous evidence that firms tend to rely on pre-existing networks as their primary response to market constraints (Baker and Nelson, 2005; Yu *et al.*, 2019).

Although lack of knowledge resources, and unpredictable and complex regulations are critical innovation challenges in developing countries, employment of bricolage to address them may not be a feasible approach. The results appear to support this view, since they show insignificant relationships between bricolage and knowledge (H2) and regulatory (H4) constraints. In other words, in the context of this study, these factors are either perceived by

innovative SMEs as being of little importance (knowledge constraints), or that they are too difficult to address through bricolage (regulatory constraints). These findings are in line with previous studies which show that knowledge constraints are of less concern for low-tech industries and in developing countries (Bartels *et al.*, 2016; Tourigny and Le, 2004). The results also corroborate the ideas of Baker and Nelson (2005) and Santos *et al.* (2022) that the use of bricolage to address regulatory constraints is challenging and risky as it often involves engaging in activities considered illegal.

Lastly, the research indicates that bricolage is positively associated with the innovation in resource-constrained firms (H5). In these contexts, bricolage contributes to innovation by playing a bridging role, translating constraints into innovation. This finding broadly supports other studies linking bricolage and innovation (Lee and Park, 2023; Santos *et al.*, 2021; Senyard *et al.*, 2014). Prior work suggests that combining limited resources in new and creative ways is a feasible option to address challenges and is a key driver of innovation (Baker and Nelson, 2005; Linna, 2013; Santos *et al.*, 2022).

### **Theoretical contribution**

This study makes three important contributions to the bricolage literature. First, research has paid little attention to the antecedents of bricolage. Building on the conceptual framework of Simba *et al.* (2021), this study combines the antecedents and outcomes of bricolage into a single model and tests their relationships. The model hypothesises financial, knowledge, market and regulatory constraints as antecedents of bricolage and innovation as an outcome of bricolage, thus bridging two lines of bricolage research. This research adds to the few studies that have taken a holistic approach to innovation among resource-constrained firms. Applying this integrative model of bricolage generates new and important insights into the innovation behaviour of SMEs in resource-constrained and uncertain environments.

Second, the study presents quantitative evidence on the innovation behaviour of resource-constrained firms. Insights from qualitative research have dominated the literature, particularly in developing countries. The results of quantitative analyses performed on a large sample of SMEs demonstrate that bricolage is an important bridge between scarcity of resources and innovation in developing country SMEs.

Third, this paper broadens the scope of research on bricolage by focusing on for-profit SMEs. Most prior research into bricolage in developing countries has focused primarily on social enterprises. An *et al.* (2018) argue that research on bricolage in the SME context is rare, which is surprising, as the entrepreneurship literature suggests that SMEs in developing countries lack the capabilities and other assets necessary for innovation (Egbetokun *et al.*, 2016; Satta, 2003; Wellalage and Fernandez, 2019). This study highlights that firms can use bricolage to innovate, especially in developing country contexts.

### **Managerial implications**

This research provides empirical evidence on the drivers of and significance of bricolage in fostering SME innovation. There are several implications that can be drawn. First, both financial and market constraints are significant drivers of bricolage in SMEs. This demonstrates that SMEs engage in resource recombination activities to circumvent problems of shortage of financial resources and market uncertainties. Therefore, SME managers are advised to be prepared to enact bricolage responses for resource mobilisation when facing shortages of financial resources. Informal financing and using available low-cost materials are two of the strategies that can be applied. Furthermore, SME managers are advised to continuously evaluate their firms' existing resources and to nurture organisational flexibility, which are key aspects for adaptability to market changes.

Second, SME managers should embrace bricolage in order to translate resources at hand into innovations. Managers need to focus on resource reconfiguration, building

networks for access to diverse resources and promoting organisational cultures that support experiments to discover new uses for available resources. Finally, policymakers, business advisors and support agencies should recognise the potential of bricolage to facilitate innovation in developing countries. For many developing country SMEs, bricolage may be a more effective and realistic innovation strategy than focusing on formal sources of resources and product development processes.

### **Limitations and future research**

This study has some limitations that inform future research. First, the sample consists of SMEs in the Tanzanian food and drink industry. Previous research has established that bricolage varies by sector (Tsilika *et al.*, 2020). Therefore, future research could replicate the conceptual framework with firms from different sectors .

Second, this study uses cross-sectional data, so it is not possible to examine the relationships over time. Future research should use longitudinal data to investigate the dynamic relationships between innovation constraints, bricolage and innovation (Baker and Nelson, 2005). Evidence suggests that the effects of bricolage vary during the firm lifecycle, with positive relationships being observed in early-stage firms and negative effects in established firms (An *et al.*, 2018). We therefore suggest future research to adopt longitudinal design to explore the changes in the hypothesized relationships.

Third, the current study measures market uncertainty through market and regulatory constraints (Charles and Rweikiza, 2015; CTI, 2017). Measures such as technological turbulence and crisis situations including the COVID-19 pandemic (Santos *et al.*, 2022; Santos *et al.*, 2021), could also be used to measure market uncertainty. Future research therefore could include similar concepts, which are potential antecedents of bricolage, as measures of market uncertainty.

Lastly, self-reported data collected through questionnaires are likely to suffer from potential effects of common bias. The procedural and statistical techniques applied in this research show the absence of common method variance in the data. Future research could consider using multiple respondents from one organisation and combining subjective and objective data.

## REFERENCES

- Abbey E and Adu-Danso E (2022) What factors hamper innovation amongst SMEs in Kenya? *Innovation and Development*. 1-30.
- Akhmadi S and Tsakalerou M (2022) Removing the Barriers to Innovation: Firm Size Matters! *2022 IEEE Technology and Engineering Management Conference (TEMSCON EUROPE)*. IEEE, 26-31.
- Alawamleh M, Al-Hussaini M and Bani Ismail L (2022) Open innovation in the food industry: trends and barriers—a case of the Jordanian food industry. *Journal of Global Entrepreneurship Research*. 1-12.
- An W, Zhang J, You C, et al. (2018) Entrepreneur's creativity and firm-level innovation performance: bricolage as a mediator. *Technology Analysis & Strategic Management* 30(7): 838-851.
- Anderson JC and Gerbing DW (1988) Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin* 103(3): 411.
- Andreoni A (2017) Mapping industrial production in Tanzania: A disaggregated analysis based on the 2013 Mainland Census. Inclusive and sustainable industrial development. *Working Paper Series WP 12/2017*. UNIDO.
- Atarah BA, Peprah AA, Okoe Amartey AF, et al. (2021) Making do by doing without: bricolage in the funding sources of female entrepreneurs in resource-constrained environments. *Journal of Global Entrepreneurship Research*. 1-18.
- Avenyo EK, Konte M and Mohnen P (2021) Product innovation and informal market competition in sub-Saharan Africa. *Journal of Evolutionary Economics* 31(2): 605-637.
- Ayalew MM, Xianzhi Z and Hailu DH (2020) The finance of innovation in Africa. *European Journal of innovation management* 23(3): 348-382.
- Baier-Fuentes H, Andrade-Valbuena NA, Gonzalez-Serrano MH, et al. (2023) Bricolage as an effective tool for the survival of owner-managed SMEs during crises. *Journal of Business Research* 157: 113608.
- Baker T and Nelson RE (2005) Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative science quarterly* 50(3): 329-366.
- Barney J (1991) Firm resources and sustained competitive advantage. *Journal of management* 17(1): 99-120.
- Bartels FL, Korla R and Vitali E (2016) Barriers to innovation: the case of Ghana and implications for developing countries. *Triple Helix* 3(1): 1-30.
- Beckeman M, Bourlakis M and Olsson A (2013) The role of manufacturers in food innovations in Sweden. *British Food Journal* 115(7): 953-974.

- Bojica AM, Istambouli A and Fuentes-Fuentes MDM (2014) Bricolage and growth strategies: Effects on the performance of Palestinian women-led firms. *Journal of Developmental Entrepreneurship* 19(04): 1450023.
- Chang C-W and Huang H-C (2022) How global mindset drives innovation and exporting performance: The roles of relational and bricolage capabilities. *Journal of Business & Industrial Marketing* 37(12): 2587-2602.
- Charles G and Rweikiza D (2015) OWNER MANAGERS' PERCEPTION OF THE IMPACT OF REGULATIONS ON THE COMPETITIVENESS OF FOOD PROCESSORS IN TANZANIA. *Business Management Review* 16(1): 71 - 101.
- Coad A, Pellegrino G and Savona M (2016) Barriers to innovation and firm productivity. *Economics of Innovation and New Technology* 25(3): 321-334.
- CTI (2017) The State of Counterfeit Goods in Tanzania Research Report. Dar es Salaam: Confederation of Tanzanian Industries.
- Cunha MPe, Rego A, Oliveira P, et al. (2014) Product innovation in resource-poor environments: Three research streams. *Journal of Product Innovation Management* 31(2): 202-210.
- Daksa MD, Yismaw MA, Lemessa SD, et al. (2018) Enterprise innovation in developing countries: an evidence from Ethiopia. *Journal of Innovation and Entrepreneurship* 7(1): 1-19.
- Demirbas D, Hussain JG and Matlay H (2011) Owner-managers' perceptions of barriers to innovation: empirical evidence from Turkish SMEs. *Journal of Small Business and Enterprise Development*.
- Egbetokun A, Atta-Ankomah R, Jegede O, et al. (2016) Firm-level innovation in Africa: overcoming limits and constraints. *Innovation and Development* 6(2): 161-174.
- Farhoud M, Bignotti A, Hamann R, et al. (2023) African perspectives on researching social entrepreneurship. *Social Enterprise Journal*.
- Fornell C and Larcker DF (1981) Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research* 18(1): 39-50.
- Fowowe B (2017) Access to finance and firm performance: Evidence from African countries. *Review of development finance* 7(1): 6-17.
- Fuglsang L and Sørensen F (2011) The balance between bricolage and innovation: Management dilemmas in sustainable public innovation. *The service industries journal* 31(4): 581-595.
- Gamba FJ (2019) SME development policies of Tanzania and Rwanda: Comparability of policy presentation on focus, significance, challenges and participation. *Journal of Development and Communication Studies* 6(1): 1-17.
- Gassiah N and Kikula J (2022) Challenges small and medium enterprises (SMEs) face in acquiring loans from commercial banks in Tanzania. *African Journal of Business Management* 16(4): 74-81.
- Gbandi E and Amissah G (2014) Financing options for small and medium enterprises (SMEs) in Nigeria. *European Scientific Journal January*.
- Ghalwash S and Ismail A (2022) Resource orchestration process in the limited-resource environment: The social bricolage perspective. *Journal of Social Entrepreneurship*. 1-28.
- Gunday G, Ulusoy G, Kilic K, et al. (2011) Effects of innovation types on firm performance. *International Journal of production economics* 133(2): 662-676.
- Hair JF, Risher JJ, Sarstedt M, et al. (2019) When to use and how to report the results of PLS-SEM. *European business review* 31(1): 2-24.



- Heidenreich S and Kraemer T (2016) Innovations—doomed to fail? Investigating strategies to overcome passive innovation resistance. *Journal of Product Innovation Management* 33(3): 277-297.
- Henseler J, Ringle CM and Sarstedt M (2015) A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science* 43: 115-135.
- Henseler J, Ringle CM and Sinkovics RR (2009) The use of partial least squares path modeling in international marketing. *New challenges to international marketing*. Emerald Group Publishing Limited.
- Hernández V, Nieto MJ and Rodríguez A (2022) Home country institutions and exports of firms in transition economies: does innovation matter? *Long range planning* 55(1): 102087.
- Hooi HC, Ahmad NH, Amran A, et al. (2016) The functional role of entrepreneurial orientation and entrepreneurial bricolage in ensuring sustainable entrepreneurship. *Management research review* 39(12): 1616-1638.
- Hota PK, Mitra S and Qureshi I (2019) Adopting bricolage to overcome resource constraints: The case of social enterprises in rural India. *Management and Organization Review* 15(2): 371-402.
- Indrawati H (2020) Barriers to technological innovations of SMEs: how to solve them? *International Journal of Innovation Science* 12(5): 545-564.
- Johnson RB and Onwuegbuzie AJ (2004) Mixed methods research: A research paradigm whose time has come. *Educational researcher* 33(7): 14-26.
- Kiveu MN, Namusonge M and Muathe S (2019) Effect of innovation on firm competitiveness: the case of manufacturing SMEs in Nairobi County, Kenya. *International Journal of Business Innovation and Research* 18(3): 307-327.
- Korede T, Al Mamun A, Lassalle P, et al. (2023) Exploring innovation in challenging contexts: The experiences of ethnic minority restaurant owners during COVID-19. *The International Journal of Entrepreneurship and Innovation* 24(1): 19-31.
- Lee C, Hallak R and Sardeshmukh SR (2016) Innovation, entrepreneurship, and restaurant performance: A higher-order structural model. *Tourism Management* 53: 215-228.
- Lee J and Park T (2023) Environmental factors, ambidexterity and performance in SMEs: does bricolage matter? *Journal of Business & Industrial Marketing*.
- Linna P (2013) Bricolage as a means of innovating in a resource-scarce environment: A study of innovator-entrepreneurs at the BOP. *Journal of Developmental Entrepreneurship* 18(03): 1350015.
- Madatta L and Chen Q (2020) Examining Challenges Facing SMEs Businesses in Dar Es Salaam Tanzania: A Case Study of Ilala and Kinondoni Municipalities. *Journal of Economics and Sustainable Development* 11(17): 59-69.
- Madrid-Guijarro A, Garcia D and Van Auken H (2009) Barriers to innovation among Spanish manufacturing SMEs. *Journal of small business management* 47(4): 465-488.
- Mazungunye PP and Punt C (2022) Industrialisation for structural transformation: Economy-wide impacts of agro-processing development in Tanzania. *Development Southern Africa* 39(3): 400-423.
- Mendi P and Costamagna R (2017) Managing innovation under competitive pressure from informal producers. *Technological Forecasting and Social Change* 114: 192-202.
- Mpagalile JJ, Ishengoma R and Gillah P (2008) Agribusiness innovation in six African countries; The Tanzanian experience. Morogoro Tanzania: FAO.
- NBS (2020) Tanzania Mainland Household Budget Survey 2017/18: Final Report. Dodoma, Tanzania: National Bureau of Statistics (NBS).

- NBS and MITI (2016) The 2013 Census of Industrial Production: Analytical Report. Dar es Salaam, Tanzania.
- Nieuwenhuizen C (2019) The effect of regulations and legislation on small, micro and medium enterprises in South Africa. *Development Southern Africa*. 1-12.
- Nyarku KM and Oduro S (2017) Effect of legal and regulatory framework on SMEs growth in the Accra Metropolis of Ghana. *The International Journal of Entrepreneurship and Innovation* 19(3): 207-217.
- Oslo M (2018) Guidelines for collecting, reporting, and using data on innovation: The measurement of scientific, technological and innovation activities. *Luxembourg: OECD Publishing, Paris: Eurostat*.
- Pikkemaat B, Peters M and Chan C-S (2018) Needs, drivers and barriers of innovation: The case of an alpine community-model destination. *Tourism management perspectives* 25: 53-63.
- Podsakoff PM, MacKenzie SB, Lee J-Y, et al. (2003) Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology* 88(5): 879.
- Rönkkö M, Peltonen J and Arenius P (2014) Selective or parallel? Toward measuring the domains of entrepreneurial bricolage. *Entrepreneurial resourcefulness: Competing with constraints*. Emerald Group Publishing Limited, pp.43-61.
- Runde DF, Savoy CM and Staguin J (2021) Supporting Small and Medium Enterprises in Sub-Saharan Africa through Blended Finance. Center for Strategic and International Studies (CSIS).
- Salunke S, Weerawardena J and McColl-Kennedy JR (2013) Competing through service innovation: The role of bricolage and entrepreneurship in project-oriented firms. *Journal of Business Research* 66(8): 1085-1097.
- Santos LL, Borini FM, de Miranda Oliveira M, et al. (2022) Bricolage as capability for frugal innovation in emerging markets in times of crisis. *European Journal of innovation management* 25(2): 413-432.
- Santos LL, Borini FM and Pereira RM (2021) Bricolage as a path towards organizational innovativeness in times of market and technological turbulence. *Journal of Entrepreneurship in Emerging Economies* 13(2): 282-299.
- Satta TA (2003) Enterprise characteristics and constraints in developing countries: evidence from a sample of Tanzanian micro and small-scale enterprises. *The International Journal of Entrepreneurship and Innovation* 4(3): 175-184.
- Scazziotto V, Serra F, Sarkar S, et al. (2023) The antecedents of entrepreneurial action: A meta-synthesis on effectuation and bricolage. *Journal of Business Research* 155: 113411.
- Sengabira Ndereyimana C, Lau AKW, Lascau D-N, et al. (2022) Luxury goods and their counterfeits in Sub-Saharan Africa: a conceptual model of counterfeit luxury purchase intentions and empirical test. *Asia Pacific Journal of Marketing and Logistics* 34(6): 1222-1244.
- Senyard J, Baker T and Davidsson P (2009) Entrepreneurial bricolage: Towards systematic empirical testing. *Frontiers of Entrepreneurship Research* 29(5): 5.
- Senyard J, Baker T, Steffens P, et al. (2014) Bricolage as a path to innovativeness for resource-constrained new firms. *Journal of Product Innovation Management* 31(2): 211-230.
- Shafi M, Sarker MNI and Junrong L (2019) Social network of small creative firms and its effects on innovation in developing countries. *Sage Open* 9(4): 2158244019898248.

- Simba A, Ojong N and Kuk G (2021) Bricolage and MSEs in emerging economies. *The International Journal of Entrepreneurship and Innovation* 22(2): 112-123.
- Stenholm P and Renko M (2016) Passionate bricoleurs and new venture survival. *Journal of Business Venturing* 31(5): 595-611.
- Streukens S and Leroi-Werelds S (2016) Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. *European management journal* 34(6): 618-632.
- Sunduramurthy C, Zheng C, Musteen M, et al. (2016) Doing more with less, systematically? Bricolage and ingenieuring in successful social ventures. *Journal of World Business* 51(5): 855-870.
- Sutton J and Olomi D (2012) *An enterprise map of Tanzania*. International Growth Centre in association with the London Publishing ...
- Tasavori M, Kwong C and Pruthi S (2018) Resource bricolage and growth of product and market scope in social enterprises. *Entrepreneurship & Regional Development* 30(3-4): 336-361.
- Tindiwensi CK, Abaho E, Munene JC, et al. (2021) Entrepreneurial bricolage in smallholder commercial farming: a family business perspective. *Journal of Family Business Management* 11(4): 423-439.
- Tourigny D and Le C (2004) Impediments to innovation faced by Canadian manufacturing firms. *Economics of Innovation & New Technology* 13(3): 217-250.
- Trott P and Simms C (2017) An examination of product innovation in low-and medium-technology industries: Cases from the UK packaged food sector. *Research Policy* 46(3): 605-623.
- Tsilika T, Kakouris A, Apostolopoulos N, et al. (2020) Entrepreneurial bricolage in the aftermath of a shock. Insights from Greek SMEs. *Journal of Small Business & Entrepreneurship* 32(6): 635-652.
- Varis M and Littunen H (2010) Types of innovation, sources of information and performance in entrepreneurial SMEs. *European Journal of innovation management*.
- Vinck P, Pham PN, Bindu KK, et al. (2019) Institutional trust and misinformation in the response to the 2018–19 Ebola outbreak in North Kivu, DR Congo: a population-based survey. *The Lancet Infectious Diseases* 19(5): 529-536.
- Wellalage NH and Fernandez V (2019) Innovation and SME finance: Evidence from developing countries. *International Review of Financial Analysis* 66: 101370.
- Witell L, Gebauer H, Jaakkola E, et al. (2017) A bricolage perspective on service innovation. *Journal of Business Research* 79: 290-298.
- Wu L, Liu H and Zhang J (2017) Bricolage effects on new-product development speed and creativity: The moderating role of technological turbulence. *Journal of Business Research* 70: 127-135.
- Xu S, He J, Morrison AM, et al. (2023) The role of bricolage in countering resource constraints and uncertainty in start-up business model innovation. *European Journal of innovation management*.
- Yu X, Li Y, Chen DQ, et al. (2019) Entrepreneurial bricolage and online store performance in emerging economies. *Electronic Markets* 29: 167-185.
- Yu X, Li Y, Su Z, et al. (2020) Entrepreneurial bricolage and its effects on new venture growth and adaptiveness in an emerging economy. *Asia Pacific Journal of Management* 37: 1141-1163.

**Table 1: Measures of the constructs**

<b>Construct</b>	<b>Abbreviation</b>	<b>Indicator</b>
Financial constraints	FINC1	Interest rates too are high
	FINC2	Lack of appropriate sources of finance
	FINC3	Innovation costs too high
	FINC4	Financial risks too high
Knowledge constraints	KNWC1	Lack of qualified personnel
	KNWC2	Lack of information on technologies
	KNWC3	Lack of knowledge support from government and research institutes
	KNWC4	Lack of information on markets
Market constraints	MKTC1	Competition from established and large firms
	MKTC2	Uncertain demand for innovative products
	MKTC3	Counterfeit products
	MKTC4	Competition from the informal sector
Regulatory constraints	REGC1	Multiple regulators
	REGC2	Unpredictability of regulations
	REGC3	Bureaucratic delays in product registration
	REGC4	High costs of compliance with regulations
Bricolage	BRIC1	We find workable solutions to new challenges by using our existing resources
	BRIC2	We gladly take on a broader range of challenges with our resources would be able to
	BRIC3	We use any existing resource that seems useful to responding to a new problem or opportunity
	BRIC4	We deal with new challenges by applying a combination of our existing resources and other resources inexpensively available to us
	BRIC5	When dealing with new problems or opportunities, we act by assuming that we will find a workable solution
	BRIC6	By combining our existing resources, we take on a surprising variety of new challenges
	BRIC7	When we face new challenges, we put together workable solutions from our existing resources
	BRIC8	We combine resources to accomplish new challenges that the resources were not originally intended to accomplish
Product innovation	PRODI1	Changes in products
	PRODI2	Changes in product packaging
Process innovation	PROCI1	Changes in ways of operating
	PROCI2	Changes in manufacturing methods
Market innovation	MKTI1	Changes in product branding
	MKTI2	Changes in distribution channels
	MKT3	Entry into new markets
	MKT4	Changes in pricing methods
	MKT5	Changes in advertising and promotion methods

**Table 2: Assessment of reliability and convergent validity**

Item	Loadings	CA	rho_A	CR	AVE
Bricolage					
BRIC1	0.869	0.945	0.954	0.954	0.723
BRIC2	0.801				
BRIC3	0.879				
BRIC4	0.888				
BRIC5	0.849				
BRIC6	0.787				
BRIC7	0.835				
BRIC8	0.886				
Financial constraints					
FINC1	0.842	0.873	0.880	0.914	0.726
FINC2	0.911				
FINC3	0.852				
FINC4	0.799				
Knowledge constraints					
KWNC1	0.693	0.790	0.874	0.849	0.586
KNWC2	0.755				
KNWC2	0.736				
KNWC3	0.867				
Market constraints					
MKTC1	0.740	0.835	0.851	0.889	0.669
MKTC2	0.835				
MKTC3	0.825				
MKTC4	0.865				
Regulatory constraints					
REGC1	0.868	0.775	0.844	0.858	0.67
REGC2	0.688				
REGC3	0.886				
Innovation performance					
MKTIV	0.891	0.827	0.834	0.896	0.742
PRODIV	0.811				
PROCIV	0.881				

**Table 3: Assessment of discriminant validity**

	BRIC	FINC	KNWC	MKTC		REGC	INV
BRIC	0.850 <sup>a</sup>						
FINC	0.274 (0.302) <sup>b</sup>	0.852 <sup>a</sup>					
KNWC	0.079 (0.090) <sup>b</sup>	0.123 (0.163) <sup>b</sup>	0.765 <sup>a</sup>				
MKTC	0.360 (0.393) <sup>b</sup>	0.336 (0.396) <sup>b</sup>	0.022 (0.099) <sup>b</sup>	0.818 <sup>a</sup>			

REGC	0.160 (0.166) <sup>b</sup>	0.180 (0.194) <sup>b</sup>	0.046 (0.06) <sup>b</sup>	0.167 (0.222) <sup>b</sup>		0.819 <sup>a</sup>	
INNV	0.303 (0.325) <sup>b</sup>	-0.218 (0.262) <sup>b</sup>	-0.041 (0.066) <sup>b</sup>	0.143 (0.175) <sup>b</sup>		-0.138 (0.2) <sup>b</sup>	0.861 <sup>a</sup>

<sup>a</sup>Fornell-Larcker ( $\sqrt{AVE}$ )

<sup>b</sup>HTMT ratio

**Table 4: Estimates of direct paths**

Direct effect	Path coefficient	t-Value	Effect size ( $f^2$ )
FINC → BRIC (H1)	0.155*	2.408	0.025
KNWC → BRIC (H2)	0.049	0.476	0.003
MKTC → BRIC (H3)	0.294***	5.022	0.090
REGC → BRIC (H4)	0.081	1.448	0.008
BRIC → INNV (H5)	0.303***	4.835	0.101

Note: Significance (two tailed test): \*\*\*Significant at  $p \leq 0.001$ ; \*\* significant at  $p \leq 0.01$ ; \* significant at  $p \leq 0.05$

FINC = Financial constraint; KNWC = knowledge constraint; MKTC = market constraint; REGC = regulatory constraint; BRIC = bricolage; INNV = innovation performance

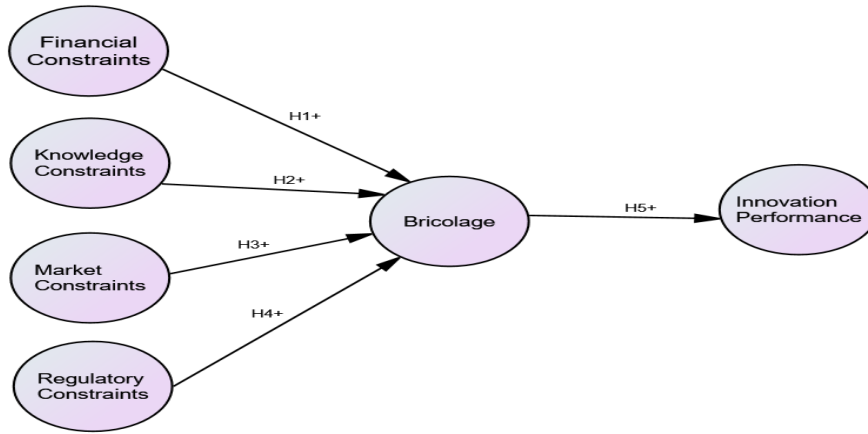
**Table 5: Estimates of indirect paths**

Indirect effect	Path coefficient	t-Value
FINC → BRIC → INNV	0.047*	2.424
KNWC → BRIC → INNV	0.015	0.458
MKTC → BRIC → INNV	0.089**	3.085
REGC → BRIC → INNV	0.025	1.321

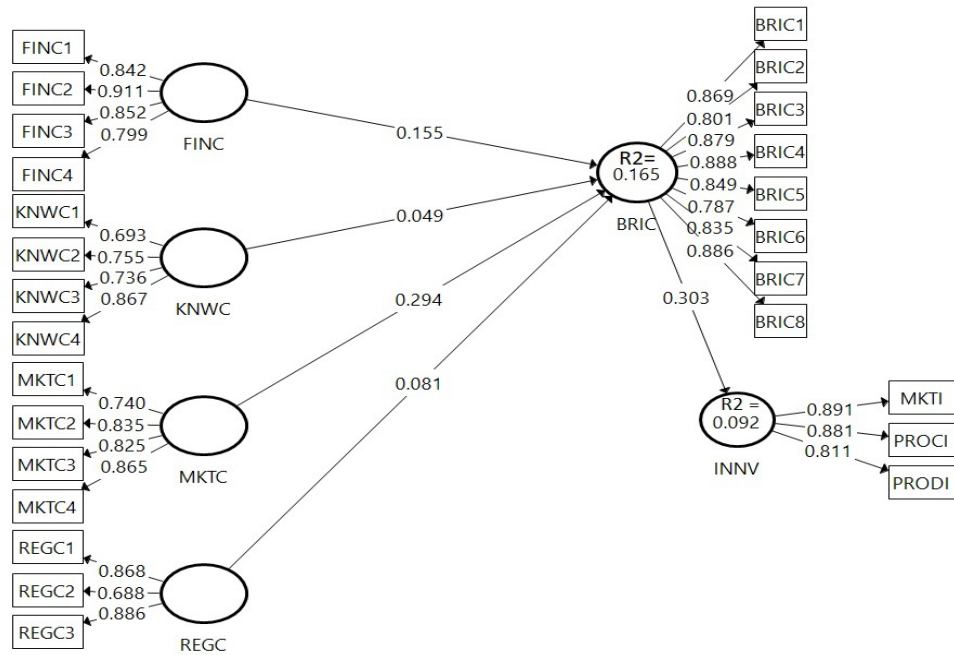
Note: Significance (two tailed test): \*\*\*Significant at  $p \leq 0.001$ ; \*\* significant at  $p \leq 0.01$ ; \* significant at  $p \leq 0.05$

FINC = Financial constraint; KNWC = knowledge constraint; MKTC = market constraint; REGC = regulatory constraint; BRIC = bricolage; INNV = innovation performance

**Figure 1: An integrative model of the relationship between antecedents of bricolage and its outcome**



**Figure 2: Structural model**



**Declaration of conflicting interest**

We have no conflicts of interest to disclose and there has been no significant financial support that would have influenced the outcome of this work.

**Data availability:** The data will be uploaded to Figshare website for accessibility by the public.