Sustainable leadership and heterogeneous knowledge sharing: the model for frugal innovation

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Abstract

Purpose – Considering the vital role of resource-constraint innovation in developing countries, the aim of the study is to examine the mechanism of internal and external heterogeneous knowledge sharing (HKS) in the relationship between sustainable leadership (SL) and frugal innovation (FI). The social exchange theory was used to develop a research framework.

Design/methodology/approach – This study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis to examine the relationship among several latent factors based on 263 participants from Pakistani SMEs.

Findings – The current findings support the significant positive impact of SL on both internal and external HKS. Moreover, this study also confirms the mediating effect of both types of HKS in the relationship between SL and FI.

Research limitations/implications – To delve further into the benefits and vital role of HKS, it is recommended to conduct further research that would examine the potential impact of heterogeneous knowledge sources on the "SL–FI relationship" and to apply the presented research methodology in other countries and organizations beyond Pakistani SMEs.

Originality/value – This study is one of the first documented attempts to demonstrate HKS as a mechanism in the relationship between a specific type of leadership and FI.

Keywords Sustainable development, Knowledge heterogeneity, Heterogeneous knowledge sharing, Resource-constraint innovation, Social exchange theory

Paper type Research paper

Introduction

As the modern-day industrial revolution requires high innovation capability, it is no longer distinct from the radical organizational transformation in the 21st century (Gong *et al.*, 2021). At both the organizational and national levels, innovation is always deemed a source of economic development and competitive advantage, a fact which has elevated it to a highly researched topic among academicians and practitioners (Iqbal *et al.*, 2022). Organizations in both developed and developing countries are facing hard times to drive innovation because of a highly turbulent market, economic instability and limited resources (Cuevas-Vargas and Parga-Montoya, 2022). Moreover, sustainable development goals emphasize a balance between economic, ecological, and social dimensions, inclusive growth, and sustainable

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production and consumption (Rosca *et al.*, 2018). In this area, frugal innovation (FI) in an emerging market has emerged as a highly effective innovative strategy for coping with environmental challenges and resource constraints (von Janda *et al.*, 2020). FI is defined as offering resource-constraint solutions to customers which provides value-added products or services with core functionalities at a lower cost than other available competitive offerings. They consume minimal necessary resources (Brem *et al.*, 2017). Despite scant empirical evidence, the extant literature has confirmed risk-taking behavior, proactiveness (Dost and Khan, 2021), leadership (Iqbal *et al.*, 2021a), university–industry relationship (Fischer *et al.*, 2021) and firm-level resource constraints (Ploeg *et al.*, 2021) as being strong antecedents of FI. However, Dwiedienawati *et al.* (2021) recommended exploring further potential predictors of FI. At this point, it is worth emphasizing that most researchers focus on innovation management in large firms and that studies covering SMEs are scarce (Ferraris *et al.*, 2020). In fact, SMEs are viewed as the backbone of the economic development of any country (AlMulhim, 2020). Therefore, it is justifiable to examine the antecedents of FI in SMEs.

Innovation is extremely dependent on the availability of knowledge; the first major role that knowledge management plays in innovation is to enable the sharing of knowledge (Lei *et al.*, 2021). Moreover, knowledge heterogeneity is the nutrient that accelerates the growth of innovation (Du, 2021) because heterogeneous knowledge plays a vital role in the generation of novel ideas (Vasudeva and Anand, 2011). More heterogeneous knowledge sharing (HKS) indicates that firms are familiar with multiple fields of knowledge and approach product solutions from different perspectives. This enables them to identify cross-domain knowledge fields and consider possible new connections between knowledge elements which exist in different fields (Xu, 2015), which are of substantial importance in innovating frugally (Dwiedienawati *et al.*, 2021). Furthermore, HKS brings higher chances of novelty (Du, 2021).

Along with the boundaries of companies, HKS can be divided into internal and external types. Internal HKS involves sharing different subjects of knowledge within the firm, whereas external HKS revolves around sharing different aspects of knowledge between a firm and its external stakeholders, such as customers, competitors, suppliers and regulators (AlMulhim, 2020). SMEs – the subject of the present study – have more difficulty finding heterogeneous knowledge beyond their organizational boundaries than large firms (Spithoven *et al.*, 2013). They are also lacking the necessary absorptive capacity in order to manage heterogeneous knowledge from multiple, diverse sources and to adopt radical innovation (Lütjen *et al.*, 2019). Taking the above into account, the first aim of this study is to fill the abovementioned research gap related to the predictors of FI in SMEs, by investigating the impact of internal and external HKS on FI.

In any organization, leaders play a vital role in effective knowledge sharing practices (Lei *et al.*, 2021). Considering the need to transform organizations toward sustainability, previous research found a link between sustainable leadership (SL) and FI (Iqbal *et al.*, 2021a). The former reflects true concern about the impact of human beings on society and the natural environment and balances organizational achievements with the needs of society, the environment and the economy (Iqbal and Piwowar-Sulej, 2022). However, an open question remains as to what mechanism functions between SL and FI (Iqbal *et al.*, 2022).

SL promotes specific high-level practices, such as teamwork, performance culture, continuous improvement initiatives, devolved decision-making and knowledge sharing (Avery and Bergsteiner, 2010, 2011). Sustainable leaders also focus on a shared vision, amicable relations with stakeholders, long-term thinking, an ongoing social and environmental sustainability program, succession planning, valuing and promoting employees, managing change systematically, an ethical workplace and independence from financial markets (Iqbal and Piwowar-Sulej, 2022). They encourage two-way communication, collaboration and trust – which are of the utmost importance for knowledge sharing practices (Lei *et al.*, 2021) and HKS in particular (Zhang *et al.*, 2020).

Drawing on the social exchange theory (SET) (Blau, 1964), which assumes that people feel obliged toward others who provide them with necessary resources, one may expect that employees will demonstrate positive organizational behaviors leading to FI – such as HKS – for a leader's support and any other resources which they receive. Furthermore, FI will be a product of exchange for HKS. Leadership has been primarily viewed as a social exchange process of motivating employees to realize goals which are shared by both leaders and employees (Lin *et al.*, 2020). However, SL can also be considered a social exchange process of motivating a wide group of company stakeholders to engage in knowledge sharing.

Although previous studies examined the direct and indirect impact of leadership on knowledge sharing (Donate and de Pablo, 2015), to the best of the authors' knowledge, no study has investigated the impact of leadership on HKS. The second aim of this study is to fill this research gap by examining the power of SL practices in spurring internal and external HKS in firms. Moreover, the limited empirical studies in the field of FI have resulted in a lack of an integrated model which would link SL, HKS and FI. Therefore, this study also investigates the potential mediating effect of internal and external HKS on the "SL–FI relationship".

This paper uses both literature studies and empirical research. The latter was conducted among Pakistani SMEs. FI is viewed as a viable approach to serving low-income consumers' sustainably in developing countries such as Pakistan (Hossain, 2021). However, a lack of skilled workers, a dysfunctional market, outdated technology and limited research and development (R&D) activities hinder Pakistani SMEs from promoting FI models (Iqbal *et al.*, 2021a, b). Therefore, it is justified to examine the "SL–HKS–FI relationship" under these specific circumstances.

This study brings clear theoretical and methodological contributions to the existing literature. Firstly, it contributes to the SL theory (Avery and Bergsteiner, 2011) and the SET by introducing internal and external HKS as a strategy that sustainable leaders of SMEs implement in order to stimulate their FI. Secondly, this study contributes to the research methodology by measuring FI as a formative construct, whereas past studies have assessed its role as a unidimensional reflective construct (Dost *et al.*, 2019) or a multidimensional reflective endogenous construct (Lei *et al.*, 2021). Thirdly, this study provides insight into SMEs in developing countries, where scant studies have been reported and where there is an absence of mature knowledge management systems. Therefore, policymakers, practitioners and academicians may find it vital to promote HKS practices to spur FI among SMEs in developing countries.

Hypothesis development

Sustainable leadership and heterogeneous knowledge sharing

As the literature shows, HKS between actors with diverse expertise and know-how enables firms to solve problems from alternative angles/perspectives (Tortoriello *et al.*, 2012). HKS refers to the sharing of knowledge which is different from the knowledge of other members within or outside a unit/firm (Rodan and Galunic, 2004). Knowledge heterogeneity deals with different domains of knowledge, forms, presentation methods and contextual meanings (Tsai *et al.*, 2014). It indicates how individuals vary in their thoughts, cognitive structures and expertise (Brown and Duguid, 2001). As knowledge management takes place collectively, knowledge heterogeneity exists in a collective gear toward a certain knowledge activity or process. If an organizational unit has a high level of knowledge heterogeneity, people establish a knowledge base with highly diversified sources and domain areas (Tortoriello *et al.*, 2012) and internal HKS can take place. In turn, external HKS facilitates firms with diverse knowledge from external networks outside the organization's boundaries (Carmeli *et al.*, 2013).

Considering that heterogeneous knowledge entails an investment of time and energy and the fear of losing a competitive advantage, employees and other stakeholders may hesitate to share their unique knowledge (Tønnessen *et al.*, 2021). In such circumstances, leaders – especially sustainable leaders – can play a vital role in encouraging different actors to share their heterogeneous knowledge using intrinsic stimulants (Janowicz-Panjaitan and Noorderhaven, 2009). The appearance of HKS may be justified according to the SET, in which people tend to reciprocate positive leaders' behavior by engaging in knowledge sharing and helping other company stakeholders.

It has been proven that strong social capital, trust and shared vision all work as intrinsic stimulants of knowledge sharing (Hu and Randel, 2014). Sustainable leaders maintain amicable relations with their employees; they value them and promote members inside their organization (Iqbal and Piwowar-Sulej, 2022) which facilitates their access to diverse knowledge and integrates those assets which are located in different units within the organization (Chuang *et al.*, 2016). Sustainable leaders do not support centralization, which in turn may limit the breadth of information sources in their organization (Damanpour, 1991). They rather focus on devolved decision-making and open communication (Avery and Bergsteiner, 2011). They also design a creative work environment where employees feel free to share their ideas, thoughts and feedback (Iqbal *et al.*, 2020b).

Sustainable leaders are viewed as social and environmentally responsible, and they maintain lasting relationships with a wide group of stakeholders (Avery and Bergsteiner, 2011). Along with this, external HKS requires focal actors' connectivity with external actors who have different (diverse) knowledge sources (Rodan and Galunic, 2004). Such an exchange of knowledge works as a stimulant for the employees to engage in knowledge sharing activities (Quigley *et al.*, 2007). As Bonner and Walker (2004) stated, strong relations between employees and their firm's external partners spur the open sharing of knowledge and enhance the likelihood of rich, complex and diverse knowledge. Furthermore, such relations lead to a competitive advantage for the firm.

As presented above, for HKS there is also a need to establish strong personal relationships and trust (Brockmann and Anthony, 2002). Trust is based on reciprocity norms among members; it enhances the cohesion of a team and facilitates cooperation among team members. It also increases dialogue (Schippers *et al.*, 2007). When individuals trust one another, they not only engage in more knowledge sharing, but the knowledge which is shared includes information that is idiosyncratic or private and thus reflects characteristics of tacit knowledge (Hu and Randel, 2014). Thus, relational social capital is expected to encourage tacit knowledge sharing due to the high-quality relationships between individuals (Janowicz-Panjaitan and Noorderhaven, 2009). Sustainable leaders develop trust among their employees, work environment and all stakeholders (Dalati *et al.*, 2017), which motivates employees to externalize their own knowledge in order to build constructive conversations with their colleagues.

Sustainable leaders run their businesses on the basis of a shared vision for all stakeholders (Avery and Bergsteiner, 2010). This provides cognitive benefits for complex collective knowledge activities (Akgün *et al.*, 2005). The shared perspectives enhance the comfortability of sharing experiences and know-how among individuals (Brown and Duguid, 2001). Open communication and cooperation enable individuals to express and comprehend their knowledge effectively. The more cognitive social capital an individual has, the better his/her ability to share heterogeneous knowledge is (Ke *et al.*, 2007). Personal experience and training also play a vital role in HKS (Hu and Randel, 2014). It is worth pointing out that sustainable leaders continuously arrange training programs for their employees to keep them up-to-date (Iqbal *et al.*, 2021a, b). Thus, the following hypotheses were proposed.

H1a. SL significantly influences internal HKS.

H1b. SL significantly influences external HKS.

Heterogeneous knowledge sharing and frugal innovation

Without knowledge, there is no innovation. Knowledge is the cornerstone for an organization to adapt to the varying circumstances in the business world. Knowledge sharing is crucial to adapt to market fluctuations (Roskes, 2015) and creative performance (Kremer *et al.*, 2019). The integration of a variety of expertise from a multitude of sources inside and outside of an organization – based on HKS – spurs creative activities in the work environment (Tønnessen *et al.*, 2021). In a highly competitive market, no one can deny the significance of HKS for an organization's success and innovation. A highly effective innovative outcome stems from a rich knowledge base and diverse knowledge portfolios (Felin and Hesterly, 2007; Rodan and Galunic, 2004). Job-related skill (knowledge) heterogeneity in a team is more beneficial to team performance than the average skill levels of individual team members (Tsai and Hsu, 2018). In this context, based on the SET, FI appears to be the product of exchange for HKS.

Currently, organizational activities naturally call for HKS, as they extend beyond cross-boundary ties and cross-domain knowledge bases (Tsai and Hsu, 2018). Multidisciplinary innovation, which includes FI (Dabić *et al.*, 2022), is highly reliant on HKS (Purkayastha *et al.*, 2021). HKS, which passes through cognitive and social boundaries, is useful in innovation (Tsai and Hsu, 2018). Firms always need a unique knowledge base to deliver value-added offerings and to sustain their position in a dynamic market (Rodan and Galunic, 2004). Knowledge heterogeneity is helpful for firms to be in line with societal changes, which keeps them ahead of their competitors (Chalkiti, 2012). The sharing of heterogeneous knowledge allows individuals to integrate diverse ideas which serve as a source for new creativity (Wang *et al.*, 2018) – this is crucial for effective innovation (Zott and Amit, 2008). Along line, firms innovate frugally by taking diverse perspectives into account, a practice which provides solutions to social issues (Iqbal *et al.*, 2020a). HKS facilitates organizations with a wide variety of possible solutions and efficiently realizes opportunities through its application (Teece, 2018). It brings a diverse understanding of an issue to the table (Rodan and Galunic, 2004). HKS, which is an amalgam of various types of expertise, disparate ideas, contextual differences and the various processes of different aspects of knowledge, provides numerous possibilities to design effective innovation activity (Tsoukas, 1996).

Internal HKS revolves around the experiences and insights possessed by employees within a firm (Carmeli *et al.*, 2013), which has substantial importance in generating ideas (Tønnessen *et al.*, 2021). It focuses on the dissemination of knowledge through a unit or department, as well as entire organizations, and indicates collaboration among employees (Cummings, 2004). Sosa (2011) claims that internal HKS has a positive impact on the creative skills of employees. However, there is always a need to access a source of expertise or external experts in order to generate new ideas and knowledge (Nonaka and Takeuchi, 1996). As Ferraris *et al.* (2020) stated, innovation is not comprehensive until there is integration between internal ideas and external knowledge. External HKS facilitates firms with diverse knowledge from networks outside the organization's boundaries (Carmeli *et al.*, 2013). It is a way to access product-related information, competitors' competence, technology information and market situations (Ye *et al.*, 2016). Drawing on the SET, positive organizational practices connected with FI will engender favorable experiences of both internal and external HKS among employees. The following hypotheses were developed from the above discussion:

H2a. Internal HKS significantly influences FI.

H2b. External HKS significantly influences FI.

The mediating role of heterogeneous knowledge sharing

Through FI, firms take advantage of opportunities in an emerging market by providing solutions with value-added services at a lower cost (Lei *et al.*, 2021). In turn, the nonredundant variety of knowledge is crucial to innovative performance. Innovative ideas come from the

knowledge stock of a firm (Brennecke and Rank, 2017), whereas HKS is useful for increasing it (Wang *et al.*, 2018).

Heterogeneous knowledge, which is hard to imitate and transfer, is the most important source of innovation and sustainable competitive advantage (Hu and Randel, 2014). Both internal and external HKS enable firms to discover new ideas, find opportunities, target new markets and employ effective strategies in relation to market trends (Rodan and Galunic, 2004; Wang *et al.*, 2018). However, external HKS is a primary source of incremental innovation (Ferraris *et al.*, 2020). To be successfully innovative, it is crucial to comprehend different aspects of the product and novel innovative strategies (Du, 2021).

Having different perspectives, as results from HKS, creates energy among individuals; this energy is transferred into new ideas and products. Moreover, from the perspective of the SET, one can state that innovation is a product of exchange for HKS, whereas knowledge sharing is the product of exchange for positive behavior from leaders. Important enablers of internal knowledge sharing are psychological safety (Rivera *et al.*, 2021) and empowerment (Abukhait *et al.*, 2019). Both of these factors are provided by SL (Iqbal *et al.*, 2020b). Heterogeneous knowledge also fosters radical innovation in the presence of strong social capital (Pérez-Luño *et al.*, 2011), and sustainable leaders believe in strong amicable relations with employees and other stakeholders (Hallinger, 2020). By considering the numerous different references and a wider set of sources (Rivas, 2012), sustainable leaders help organizations to make effective decisions through HKS. Sustainable leaders also spur HKS by focusing on the improvement initiatives and two-way communication processes, which leads to higher risk-taking capability, improved decision-making, lower agency costs and efficient solutions to conflicts (Purkayastha *et al.*, 2021).

As above presented, SL fosters internal HKS, which in turn improves employees' absorptive capacity and knowledge quality base, as well as enables them to consider diverse growth strategies (Purkayastha *et al.*, 2021). Accessing internal heterogeneous knowledge and integrating it with both the firm's knowledge base and external heterogeneous knowledge are crucial to enhancing the quality of innovation. By providing a shared vision and being social and environmentally responsible, sustainable leaders also work as a liaison to integrate internal and external heterogeneous knowledge. The latter depends on having close ties with external partners (Ferraris *et al.*, 2020).

HKS deepens the understanding and application of the firm's knowledge base, enhances the benefits of innovation and increases the efficiency of new products and technological development (Wang *et al.*, 2018). In turn, SL fosters both internal and external HKS. The sustainable leaders' sincere interest and focus on both employees and external stakeholders will bring reciprocal behavior in the form of HKS, which in turn leads to FI. Therefore, the following hypotheses were formulated:

H3a. Internal HKS significantly mediates the "SL–FI relationship."

H3b. External HKS significantly mediates the "SL–FI" relationship."

The research model is graphically presented in Figure 1.

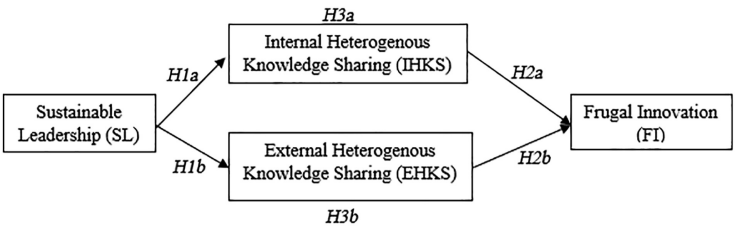

Figure 1.
Research model

Research methodology

Context, sample and data collection

In every study, researchers are to follow a set of beliefs, values and assumptions – collectively known as a paradigm, which can be categorized as positivist, interpretivist or critical (Sekaran and Bougie, 2016). A positivist approach encourages the presence of an objective truth to understand the world and works on the basis of deductive reasoning and quantitative methods of analysis. It was adopted as the research paradigm for this study, along with deductive reasoning. The study investigates the relationships between SL, FI and internal and external HKS and is correlational in nature. The hypotheses of this study were based on the SET, which follows the practices of deductive reasoning.

The format of an online survey, which was carried out in this study among Pakistani SMEs, is viewed as being highly effective at reducing costs for travel, transcription and stationery (Wright, 2005). In Pakistan, the Small and Medium Enterprises Development Authority (2011) has defined SMEs as firms with a total of up to 250 employees. In light of this definition, a screening question was added to the online survey form in order to ensure the validity of the responses. The survey form was composed of two sections, A and B. The questions in Section A were related to the demographic information of the respondents, such as gender, age, qualifications, work experience, location of the firm and control variables (R&D) expenditures and the industry). Section B included measurement items of SL, FI and internal and external HKS. Moreover, the authors applied the psychological separation of measurements, protected respondents' anonymity and reduced evaluation apprehension strategies as procedural remedies. As recommended by Podsakoff *et al.* (2012), the authors psychologically separated the measurements of SL and HKS from those of FI by creating a cover story. They also ensured respondents about their anonymous participations and that there was no right or wrong answers. Such practices are viewed effective to elicit honest, less socially desirable and lenient responses from participators.

Due to issues that can arise when generalizing data from one region, plus time and financial constraints, a cluster sampling approach was used in the study to collect data from employees of SMEs in five cities: Rawalpindi, Lahore, Faisalabad, Gujranwala and Sialkot. The authors solicited the support of their colleagues in those cities in order to garner data in their respective cities. By leveraging the power of networking, faculty members disseminated the online survey form to the email addresses of representatives of SMEs in these cities.

In order to ensure an adequate number of respondents, the study utilized the software application G*Power (Faul *et al.*, 2009), according to which a minimum of 77 participants were required to present valid empirical results. Moreover, past studies have reported 35.7% as the average response rate in social science research (Iqbal and Piwowar-Sulej, 2022). Thus, an online survey form was shared with 500 employees of SMEs. A total of 263 respondents completed the survey form, equating to a response rate of 52.6%.

Measures

In this study, measurement scales of SL, internal HKS, external HKS and FI were adopted from previous studies. The 15-item scale of SL from the study by McCann and Holt (2010) was adopted. Iqbal and Piwowar-Sulej (2022) used the same measurement scale and reported its reliability as very high (Cronbach's alpha = 0.929). The five-item measurement scale of FI, a formative construct, was adopted from a study by Iqbal *et al.* (2021a). These five-item scales were based on cheap, simple, and value-added quality, sustainable production, and efficient use of resources. Xuecheng and Iqbal (2022) confirmed the validity of this five-item formative scale in the context of Pakistani SMEs. The present research also adopted five items from Ye *et al.* (2016) to measure external HKS and three items of internal HKS from a study by Tsai *et al.* (2014). The measurement items of internal HKS cover the aspects for which the

employees of a firm share heterogeneous knowledge in terms of content, delivery and interpretation – whether it is tacit or explicit (Tsai and Yang, 2013). The measurement items of external HKS mainly address the sharing of heterogeneous knowledge in terms of technical knowledge, the professional background of the technical experts, investment in technology, product processes and market conditions. Du (2021) used these two measurement scales of internal and external HKS and found them to be highly reliable. Based on recommendations provided by Cummins and Gullone (2000), the present study employed a five-point Likert scale ranging from strongly disagree to strongly agree.

Since past studies have reported that innovative performance was significantly impacted by the industry and expenditure on R&D (Du, 2021; Lei *et al.*, 2021), this study employed these two factors as control variables. The Pakistani government has prioritized textile, information and communication technologies (ICTs), construction and the energy sector for the SMEs development and growth (Shah, 2018). Therefore, the SME industry type was coded as 1 for energy, 2 for textile, 3 for ICT, 4 for manufacturing and 5 for others. In line with the recommendations of Kirner *et al.* (2009), objective criteria were used to assess the effects of R&D expenditure. Firms were assigned to the categories of small, medium and high based on the ratio of their R&D expenditure to their annual sales.

Analytical strategy

The explanatory nature and complexity of the framework were sufficient justifications for applying PLS-SEM methodology in this study (Hair *et al.*, 2020). The application of PLS-SEM analysis required an examination of both the measurements and the structural model. Moreover, PLS-SEM required an evaluation of the measurement model prior to structural model assessment.

In order to check the distinctive nature of the variables, the authors have also run confirmatory factor analysis. Based on the chi squared value, the goodness of fit index, the comparative fit index and root mean square error of approximation values, the model fit was assessed.

Study findings

Frequency analysis

The majority of participants in this study were male (n = 227, 94.19%). Most participants (n = 131, 54.36%) fell into the 25–35 age category, followed by those who were 36–45 years old (n = 89, 36.93%). In this research, 167 out of 263 participants (69.29%) had a master's degree. There were also 13 participants with Ph.D.s (5.39% of the total respondents). Most of the respondents had 11–15 years of job seniority, followed by those with 5–10 years of job seniority. Most of the participants (n = 72, 29.88%) came from Rawalpindi, followed by those from Lahore (n = 61, 25.31%); the smallest group of respondents came from Gujranwala (n = 33, 13.69%). Most of the participants (n = 83, 31.56%) worked in the textile sector, followed by those who worked in the ICT (n = 61, 23.19%) and manufacturing firms (n = 53, 20.15%); 39 responses (14.83%) came from the energy sector. Only 27 participants fell into another category. As far as R&D expenditures are concerned, participants from small SMEs (n = 163, 61.98%) were predominant in this study. Only 41 participants (15.59%) came from companies with large R&D expenditures.

Descriptive analysis

In this study, all the variables were continuous in nature and were measured using a five-point Likert scale. The mean values of SL (M = 2.775), FI (M = 2.861) and external HKS (M = 2.924) were below 3. The mean value of internal HKS was 3.108. Considering Sekaran and Bougie's (2016) mean values criteria for a five-point Likert scale, there was a low presence

of SL practices, FI and external HKS among the surveyed SMEs in Pakistan. In turn, internal HKS was practiced at a moderate level.

Confirmatory factor analysis

Prior to analysis, the data were screened in order to examine the position of missing values, outliers, common method bias and normality. Each item in the online survey form was checked for mandatory marking, which ensured that there were no missing values. There was also an absence of univariate outliers because the Z-scores in all cases were below 3.29. Moreover, the Mahalanobis test was used to verify the lack of any multivariate outlier. The authors adopted Harman's single-factor test and correlation matrix procedure as statistical remedies to investigate common method bias issue. In this study, the first factor only accounted for 49.16% (< 50%) of the total variance. Therefore, common method bias was not an issue with reference to Harman's one-factor test (Podsakoff, 2003). Since past studies have claimed that Harman's one-factor test lacks sensitivity, the authors also adopted a correlation matrix procedure (Bagozzi *et al.*, 1991). The highest correlation between any two items in this study was 0.87 (< 0.9). These two results provided robust support for declaring the common method bias a nonissue here. Skewness and kurtosis values were found to be in the range of ±3, which is a sign of the univariate normality of the data (DeCarlo, 1997). Furthermore, the values for Mardia's skewness ($\beta = 1.079, \rho < 0.005$) and kurtosis ($\beta = 36.116\,, \rho < 0.005$) were also significant. Thus, the data in the study were also multivariate and normally distributed.

Confirmatory factor analysis also revealed the fit of the baseline model for the study, which was composed of SL, internal and external HKS and FI, as compared to alternative models (chi squared = 3,640.23, Comparative Fit Index (CFI) = 0.963 > 0.95, Goodness of Fit index (GFI) = 0.956 > 0.95, Standardized Root Mean Square Residual (SRMR) = 0.077 < 0.08 and Root Mean Squared Error of Approximation (RMSEA) = 0.072 < 0.08).

Measurement model analysis

In this study, the measurement model consisted of two reflective constructs – SL and HKS – and a formative construct, FI. Measurement model analysis examines the indicator, internal reliability and construct validity of reflective constructs (Hair *et al.*, 2017). One measurement item of SL was removed because its factor loadings were below 0.5 (Hair *et al.*, 2017). The factor loadings of all items assigned to SL and internal and external HKS ranged from 0.43 to 0.915, values which are greater than 0.4. Thus, the items of reflective constructs in this study had acceptable indicator reliability. The internal reliability was assessed by both Cronbach's alpha and composite reliability (CR). The values of these two tools of SL and internal and external HKS were found to be greater than 0.7 (see Table 1). Therefore, the reflective constructs in this study had sufficient internal reliability.

Construct validity constitutes both convergent validity and discriminant validity. In the presence of average variance extracted (AVE) values greater than 0.5 and factor loadings of items greater than 0.7, a construct has acceptable convergent validity. In this study, the AVE values of reflective constructs were greater than 0.5, which is a clear sign of acceptable convergent validity. According to the Fornell–Larcker criterion, a construct has sufficient acceptable discriminant validity provided the square root of its AVE value is greater than its inter-construct correlation values. The analysis of the measurement model in this study revealed that the square root of the AVE values of the reflective constructs were greater than their corresponding inter-construct correlation values. Thus, the reflective construct in this study had acceptable discriminant validity as well.

In the case of a formative construct, indicators do not emerge as a latent variable and do not necessarily correlate, so there is no need to report internal reliability and convergent validity values for FI. In the case of a formative construct, measurement model analysis

Reflective construct	Item	Loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
External heterogenous knowledge sharing (EHKS)	EHKS-1	0.899	0.900	0.928	0.723
	EHKS-2	0.914			
	EHKS-3	0.915			
	EHKS-4	0.843			
	EHKS-5	0.651			
Internal heterogenous knowledge sharing (IHKS)	IHKS-2	0.741	0.843	0.885	0.664
	IHKS-3	0.857			
	IHKS-1	0.841			
Sustainable leadership (SL)	SL-1	0.711	0.908	0.922	0.508
	SL-10	0.430			
	SL-11	0.486			
	SL-13	0.757			
	SL-15	0.710			
	SL-2	0.760			
	SL-3	0.711			
	SL-4	0.820			
	SL-5	0.810			
	SL-6	0.857			
	SL-7	0.875			
	SL-8	0.876			
	SL-9	0.859			
Formative Construct		*Item*	*Outer weight*	*T value*	*VIF*
Frugal innovation (FI)		FI-1	0.397	7.635	1.297
		FI-2	0.191	2.729	1.811
		FI-3	0.224	2.435	2.572
		FI-4	0.196	2.150	2.360
		FI-5	0.221	2.695	2.209

Table 1.
Validity and reliability of constructs

investigates the validity of the variable based on an indicator's weights, significance and multicollinearity values (Hair *et al.*, 2017). The item loadings of the formative constructs are considered as path coefficients between the items and it. As shown in Table 1, the indicators' weights of FI were significant. Moreover, the values of variance inflation factors in all items of FI were also less than 5 (Hair *et al.*, 2020). Therefore, there is no indication of a multicollinearity issue, and FI appears to be a reliable and valid formative construct.

Hypothesis testing

The analysis of the structural model confirmed that SL significantly influenced internal HKS ($\beta = 0.760, \rho < 0.050$) and external HKS ($\beta = 0.835, \rho < 0.050$) (see Table 2). This means that Hypotheses H1a and H1b were both accepted in this study. However, it is very significant to reveal that sustainable leaders more strongly influenced external HKS (*R Square* = 0.698) than internal HKS (*R Square* = 0.578).

The current empirical testing also provided evidence that internal HKS ($\beta = 0.501, \rho < 0.050$) and external HKS ($\beta = 0.234, \rho < 0.050$) both significantly influenced FI among SMEs in Pakistan (see Table 2), which leads to the acceptance of Hypotheses H2a and H2b. It is also an indication of the positive impact of HKS on FI.

Hypothesis	β	SD	T value	*P* values	LLCI	ULCI
Sustainable leadership → external heterogenous knowledge sharing	0.835	0.020	42.710	0.000	0.788	0.869
Sustainable leadership → internal heterogenous knowledge sharing	0.760	0.024	31.989	0.000	0.712	0.803
External heterogenous knowledge sharing → frugal innovation	0.501	0.067	7.453	0.000	0.366	0.628
Internal heterogenous knowledge sharing → frugal innovation	0.234	0.071	3.307	0.001	0.102	0.363
Sustainable leadership → external heterogenous knowledge sharing → frugal innovation	0.419	0.063	6.666	0.000	0.300	0.539
Sustainable leadership → internal heterogenous knowledge sharing → frugal innovation	0.178	0.056	3.182	0.002	0.074	0.287

Table 2.
Hypotheses results

These findings also reveal that external HKS was more significant than internal HKS while innovating frugally in the developing market of Pakistan.

Regarding the mediation analysis, the empirical findings revealed that sustainable leaders significantly influenced FI through both internal HKS ($\beta = 0.178, \rho < 0.050$) and external HKS ($\beta = 0.419, \rho < 0.050$) (see Table 2). Therefore, Hypotheses H3a and H3b were supported in this study. HKS significantly mediated the "SL–FI relationship" in the resource-constraint market.

Discussion

Main findings

This study empirically posited the impact of SL on the two types of HKS, internal and external HKS, and Hypotheses H1a and H1b were both supported. The acceptance of these two hypotheses indicates that practitioners and individuals within organizations need to develop and promote SL practices by considering all organizational employees, all stakeholders and the natural environment in order to innovate effectively. A vast body of the extant literature has highlighted the importance of leadership support and its positive impact on desirable knowledge sharing behavior within an organization (Muhammed and Zaim, 2020). This study enriches the previous research, which provided substantial evidence of the positive impact of empowering leadership, servant leadership (Luu, 2016), knowledge leadership (Zhang and Cheng, 2015), transformational leadership (Park and Kim, 2018) and charismatic leadership (Xiao *et al.*, 2017) on knowledge sharing practices inside organizations (associated with internal HKS in the current study). More importantly, this study shows that there is a direct link between a specific type of leadership and internal as well as external HKS practices. This can be justified by the SET, which holds that all stakeholders reciprocate behaviors in the form of HKS when treated appropriately by a leader.

This study has also exhibited the significant impact of both internal and external HKS on FI, which drove the confirmation of Hypotheses H2a and H2b. Past studies did not distinguish between internal and external HKS, though they did confirm that heterogeneous knowledge significantly influences exploratory and exploitative innovation (Berraies, 2019) and the effectiveness of collaborative innovation. Moreover, Malhotra and Majchrzak (2019) investigated 20 innovation challenge programs and found that the variety of knowledge associations had a greater impact on idea generation than the number of knowledge associations. In the context of innovation management, Qi and Chen (2020) found that highly crucial aspects were cross-border cooperation, and they search for markets and technical knowledge. They also provided evidence that internal and external knowledge sharing significantly influenced breakthrough innovations among high-tech firms in China.

The confirmation of Hypotheses H3a and H3b, which posited that internal and external HKS significantly mediate the relationships with SL and FI, respectively, contributes to the theory about the mediating role of knowledge sharing between leadership and innovation. The extant literature provided empirical evidence regarding the significant indirect impact of transformational leadership (Al-Husseini *et al.*, 2021), transactional leadership and ambidextrous leadership (Haider *et al.*, 2021) on organizational innovation and incremental and radical innovation through knowledge sharing. Few studies exist on the mediating impact of knowledge sharing between leadership and FI. In particular, Lei *et al.* (2021) – based on a survey among Vietnamese firms – found that tacit and explicit knowledge sharing mediates the relationship of transformational leadership with FI in the context of frugal functionality and frugal cost. In turn, Le *et al.* (2022) identified a mediating effect of active and passive knowledge sharing on the "transformational leadership–FI relationship." In the current study, SL was found to be a highly effective type of leadership and a source of social capital which influences HKS and drives FI in SMEs by generating positive exchanges with internal and external company stakeholders.

Theoretical implications

The results of this study have the following main implications to advance theory. First, this study responds to a common question in the field of FI and knowledge management: How do sustainable leaders influence FI through HKS?, considering the scant empirical findings (Tønnessen *et al.*, 2021) and the need to explore the antecedents of resource-constraint innovation (Lei *et al.*, 2021; Tsai and Hsu, 2018). In particular, this paper adds to the relatively small amount of research that examines the "leadership styles-FI" relationship.

Second, on the basis of the SET, in this study a research framework was proposed and tested to assess the indirect impact of SL on FI among Pakistani SMEs. Therefore, empirical findings support the usefulness of the analyzed theory in research on HKS and FI. They show that the knowledge sharing behavior of both employees and external company stakeholders is a result of voluntary exchanges of resources between parties when one of the parties is a sustainable leader.

Third, the applied approach, i.e. the examination of the role of both internal and external HKS in stimulating FI, enriches previous studies which addressed knowledge sharing issues and focused only on the knowledge sharing process within an organization (e.g. (Arsawan *et al.*, 2022)). In this way this study adds to the field of knowledge management.

Finally, from an empirical point of view, this study follows the methodological rigor of quantitative empirical research in order to understand the mechanism of how and when SL influences FI. In particular, the study shows how to measure FI as a formative construct, whereas past studies assessed its role as either a unidimensional reflective construct (Dost *et al.*, 2019) or a multidimensional reflective endogenous construct (Lei *et al.*, 2021). Researchers may use these research assumptions and methods to extend the current state of knowledge in organizations other than Pakistani SMEs.

Implications for practice

The empirical findings have the following main implications for practitioners. First, this study emphasizes the need for FI in SMEs. These enterprises are confronted with various difficulties related to collecting resources (Iqbal *et al.*, 2021a, b) including heterogeneous knowledge (Lütjen *et al.*, 2019). It is worth, however, emphasizing that they are also often the businesses most affected by economic crises. The recent COVID-19 pandemic has made them suffering from a shortage of resources (Nawal Abdalla and Ghadah, 2021). Therefore, SMEs should innovate frugally.

Second, this study emphasizes that performance of SMEs in terms of FI is extraordinary related to the leadership because of leaders' involvement in the day-to-day activities and more informal leadership structures than in large companies. They are the major factors of growing

the company to the maturity stage (Kindström *et al.*, 2022). Leaders should support people and emphasize building trust and maintaining open communication and cooperation. In this way, they will equip their employees with the necessary resources, which will positively contribute to internal HKS. They should also involve external stakeholders in the HKS processes through a true concern about their needs. At this stage, it is worth pointing out that HKS is not an easy job and is typically less often used (Tortoriello *et al.*, 2012). As compared to homogeneous knowledge sharing, it is generally difficult to share and integrate it with a knowledge base. However, if done effectively, it brings benefits to the companies in the form of improved jobs and proactive performance (van der Meulen *et al.*, 2019). As this study shows, it leads to FI, which is important for SMEs and contemporary emerging markets.

Third, SMEs significantly contribute to the economic growth of any country (AlMulhim, 2020). However, fulfilling the above postulates will also lead to the sustainable development of a country and have an impact on society. HKS contributes not only to company performance and competitiveness but primarily to the development of individual capabilities which build a country's human capital. Knowledge sharing processes encourage employees to increase their knowledge and creativity (Wang *et al.*, 2018) as well as to fulfill their positive work-related state of mind (Lin *et al.*, 2020). In turn, FI enables companies to cope not only with economic but also with environmental challenges, operate in the resource-constrained context and deliver required product functionalities to consumers in emerging markets.

Finally, this study demonstrated a low level of SL practices, HKS and FI in Pakistani SMEs. It is worth mentioning, however, that past studies reported a moderate presence of SL ($M = 3.200$) in Pakistani higher education (Iqbal and Piwowar-Sulej, 2022) and of FI ($M = 3.204$) in large manufacturing firms (Iqbal *et al.*, 2022). Therefore, there is a possibility of a moderate level of SL and FI practices in Pakistan in general. The above-postulated positive changes in SMEs may contribute to changes in other entities because there is a network of institutional dynamics among companies (Waddock *et al.*, 2015). Furthermore, Pakistani governmental authorities should promote SL practices and creation of bonds among employees within the organizations and with external organizational stakeholders.

Conclusions

The aim of this study was to determine – based on the SET – how SL impacts FI. It has been demonstrated that SL stimulates both external and internal HKS (H1a, H1b). In turn, both analyzed types of HKS enhance FI (H2a, H2b) and positively mediate between SL and FI (H3a, H3b). This study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis to examine the relationship among several latent factors based on 263 participants from Pakistani SMEs. The fact that all six hypotheses were accepted enhances the significance of the work.

To summarize the considerations presented, it should be stated that this study enriches the literature on SL by providing empirical evidence about the significant direct impact of SL on both internal and external HKS. It also extends the literature in the field of knowledge management by assessing the role of both types of HKS as a mechanism on the "SL–FI relationship." It contributes to the SET theory by showing its applicability in research on HKS and FI. Its methodological approach may be used by academics to conduct similar research among other types of companies and in other countries. Finally, it presents guidelines for practitioners which will contribute not only to SMEs' performance in terms of FI, but also to the development of countries and societies.

Limitations

The first limitation of this study stems from the cross-sectional data collection from SME employees in Islamabad, Lahore, Faisalabad, Gujranwala and Rawalpindi. This makes the

present findings hard to generalize inside or outside of Pakistan. Secondly, this study was conducted at the individual level: among employees. Human Resource Management (HRM) researchers have been found to rarely apply multi-level methods in their studies (Aguinis *et al.*, 2011). Therefore, future research is recommended to adopt a multi-level research approach. Thirdly, this study collected data from a single source: employees. Taking into account the managerial perspective in future studies would be valuable. Fourthly, the present research examined the role of internal HKS and external HKS as mediators. Future studies should investigate the role of HKS as a hierarchical construct in the relationship between SL and FI.

References

Abukhait, R.M., Bani-Mehlem, S. and Zeffane, R. (2019), "Empowerment, knowledge sharing and innovative behaviours: exploring gender differences", *International Journal of Innovation Management*, Vol. 23 No. 01, 1950006.

Aguinis, H., Boyd, B.K., Pierce, C.A. and Short, J.C. (2011), "Walking new avenues in management research methods and theories: bridging micro and macro domains", in Aguinis, H., Boyd, B.K., Pierce, C.A. and Short, J.C. (Eds), *Journal of Management*, Vol. 37 No. 2, pp. 395-403.

Akgün, A.E., Byrne, J., Keskin, H., Lynn, G.S. and Imamoglu, S.Z. (2005), "Knowledge networks in new product development projects: a transactive memory perspective", *Information and Management*, Vol. 42 No. 8, pp. 1105-1120, Elsevier.

Al-Husseini, S., El Beltagi, I. and Moizer, J. (2021), "Transformational leadership and innovation: the mediating role of knowledge sharing amongst higher education faculty", *International Journal of Leadership in Education*, Vol. 24 No. 5, pp. 670-693, Taylor & Francis.

AlMulhim, A.F. (2020), "The role of internal and external sources of knowledge on frugal innovation: moderating role of innovation capabilities", *International Journal of Innovation Science*, Vol. 13 No. 3, pp. 341-363.

Arsawan, I.W.E., Koval, V., Rajiani, I., Rustiarini, N.W., Supartha, W.G. and Suryantini, N.P.S. (2022), "Leveraging knowledge sharing and innovation culture into SMEs sustainable competitive advantage", *International Journal of Productivity and Performance Management*, Vol. 71 No. 2, pp. 405-428.

Avery, G.C. and Bergsteiner, H. (2010), *Honeybees & Locusts: The Business Case for Sustainable Leadership*, Allen & Unwin, Australia.

Avery, G.C. and Bergsteiner, H. (2011), "Sustainable leadership practices for enhancing business resilience and performance", *Strategy and Leadership*, Vol. 39 No. 3, pp. 5-15.

Bagozzi, R.P., Yi, Y. and Phillips, L.W. (1991), "Assessing construct validity in organizational research", *Administrative Science Quarterly*, Vol. 36 No. 3, pp. 421-458.

Berraies, S. (2019), "The effect of enterprise social networks use on exploitative and exploratory innovations: mediating effect of sub-dimensions of intellectual capital", *Journal of Intellectual Capital*, Vol. 20 No. 3, pp. 426-452.

Blau, P.M. (1964), *Exchange and Power in Social Life*, Wiley, New York.

Bonner, J.M. and Walker, O.C. Jr (2004), "Selecting influential business-to-business customers in new product development: relational embeddedness and knowledge heterogeneity considerations", *Journal of Product Innovation Management*, Vol. 21 No. 3, pp. 155-169, Wiley Online Library.

Brem, A., Agarwal, N. and Brem, A. (2017), "Frugal innovation-past, present, and future", *IEEE Engineering Management Review*, Vol. 45 No. 3, pp. 37-41.

Brennecke, J. and Rank, O. (2017), "The firm's knowledge network and the transfer of advice among corporate inventors—a multilevel network study", *Research Policy*, Vol. 46 No. 4, pp. 768-783, Elsevier.

Brockmann, E.N. and Anthony, W.P. (2002), "Tacit knowledge and strategic decision making", *Group and Organization Management*, Vol. 27 No. 4, pp. 436-455, Sage Publications Sage CA: Thousand Oaks, CA.

Brown, J.S. and Duguid, P. (2001), "Knowledge and organization: a social-practice perspective", *Organization Science*, Vol. 12 No. 2, pp. 198-213, INFORMS.

Carmeli, A., Gelbard, R. and Reiter-Palmon, R. (2013), "Leadership, creative problem-solving capacity, and creative performance: the importance of knowledge sharing", *Human Resource Management*, Vol. 52 No. 1, pp. 95-121.

Chalkiti, K. (2012), "Knowledge sharing in dynamic labour environments: insights from Australia", *International Journal of Contemporary Hospitality Management*, Emerald Group Publishing.

Chuang, M.-Y., Chen, C.-J. and Lin, M.-J.J. (2016), "The impact of social capital on competitive advantage: the mediating effects of collective learning and absorptive capacity", *Management Decision*, Vol. 54, pp. 1443-1463, Emerald Group Publishing.

Cuevas-Vargas, H. and Parga-Montoya, N. (2022), "How ICT usage affect frugal innovation in Mexican small firms. The mediating role of entrepreneurial orientation", *Procedia Computer Science*, Vol. 199, pp. 223-230, Elsevier.

Cummings, J.N. (2004), "Work groups, structural diversity, and knowledge sharing in a global organization", *Management Science*, Vol. 50 No. 3, pp. 352-364, INFORMS.

Cummins, R.A. and Gullone, E. (2000), "Why we should not use 5-point Likert scales: the case for subjective quality of life measurement", *Proceedings, Second International Conference on Quality of Life in Cities*, Vol. 74, p. 93.

Dabić, M., Obradović, T., Vlačić, B., Sahasranamam, S. and Paul, J. (2022), "Frugal innovations: a multidisciplinary review & agenda for future research", *Journal of Business Research*, Vol. 142, pp. 914-929, Elsevier.

Dalati, S., Raudeliūnienė, J. and Davidavičienė, V. (2017), "Sustainable leadership, organizational trust on job satisfaction: empirical evidence from higher education institutions in Syria", *Business, Management and Education*, Vol. 15 No. 1, pp. 14-27.

Damanpour, F. (1991), "Organizational innovation: a meta-analysis of effects of determinants and moderators", *Academy of Management Journal*, Vol. 34 No. 3, pp. 555-590, Academy of Management Briarcliff Manor, NY 10510.

DeCarlo, L.T. (1997), "On the meaning and use of kurtosis", *Psychological Methods*, Vol. 2 No. 3, p. 292.

Donate, M.J. and de Pablo, J.D.S. (2015), "The role of knowledge-oriented leadership in knowledge management practices and innovation", *Journal of Business Research*, Vol. 68 No. 2, pp. 360-370, Elsevier.

Dost, M. and Khan, M.S. (2021), "Influence of risk-taking and proactivity behaviours on frugal product innovation: the moderating role of external sources of knowledge", *International Journal of Innovation Management*, Vol. 25 No. 08, 2150087, World Scientific.

Dost, M., Pahi, M.H., Magsi, H.B. and Umrani, W.A. (2019), "Effects of sources of knowledge on frugal innovation: moderating role of environmental turbulence", *Journal of Knowledge Management*, Vol. 23 No. 7, pp. 1245-1259.

Du, L. (2021), "How knowledge affects incremental innovation in SMEs: knowledge base and knowledge heterogeneity", *Journal of General Management*, Vol. 46 No. 2, pp. 91-102.

Dwiedienawati, D., Tjahjana, D., Faisal, M., Gandasari, D. and Abdinagoro, S.B. (2021), "Determinants of perceived effectiveness in crisis management and company reputation during the COVID-19 pandemic", *Cogent Business and Management*, Vol. 8 No. 1, doi: 10.1080/23311975.2021.1912523.

Faul, F., Erdfelder, E., Buchner, A. and Lang, A.-G. (2009), "Statistical power analyses using G* Power 3.1: tests for correlation and regression analyses", *Behavior Research Methods*, Vol. 41 No. 4, pp. 1149-1160, Springer.

Felin, T. and Hesterly, W.S. (2007), "The knowledge-based view, nested heterogeneity, and new value creation: philosophical considerations on the locus of knowledge", *Academy of Management Review*, Vol. 32 No. 1, pp. 195-218, Academy of Management Briarcliff Manor, NY 10510.

Ferraris, A., Bogers, M.L.A.M. and Bresciani, S. (2020), "Subsidiary innovation performance: balancing external knowledge sources and internal embeddedness", *Journal of International Management*, Vol. 26 No. 4, 100794, Elsevier.

Fischer, B., Guerrero, M., Guimón, J. and Schaeffer, P.R. (2021), "Knowledge transfer for frugal innovation: where do entrepreneurial universities stand?", *Journal of Knowledge Management*, Vol. 25 No. 2, pp. 360-379.

Gong, L., Liu, Z., Rong, Y. and Fu, L. (2021), "Inclusive leadership, ambidextrous innovation and organizational performance: the moderating role of environment uncertainty", *Leadership and Organization Development Journal*, Vol. 42 No. 5, pp. 783-801, Emerald Publishing.

Haider, S.A., Zubair, M., Tehseen, S., Iqbal, S. and Sohail, M. (2021), "How does ambidextrous leadership promote innovation in project-based construction companies? Through mediating role of knowledge-sharing and moderating role of innovativeness", *European Journal of Innovation Management*, Emerald Publishing, Vol. 26 No. 1, pp. 99-118.

Hair, J.F., Howard, M.C. and Nitzl, C. (2020), "Assessing measurement model quality in PLS-SEM using confirmatory composite analysis", *Journal of Business Research*, Vol. 109 No. November 2019, pp. 101-110, Elsevier.

Hair, J.F., Sarstedt, M., Ringle, C.M. and Gudergan, S.P. (2017), *Advanced Issues in Partial Least Squares Structural Equation Modeling*, Sage Publications, Thousand Oaks.

Hallinger, P. (2020), "Analyzing the intellectual structure of the Knowledge base on managing for sustainability, 1982-2019: a meta-analysis", *Sustainable Development*, Vol. 28 No. 5, pp. 1493-1506, Wiley Online Library, doi: 10.1002/sd.2071.

Hossain, M. (2021), "Frugal innovation and sustainable business models", *Technology in Society*, Vol. 64, 101508, doi: 10.1016/j.techsoc.2020.101508.

Hu, L. and Randel, A.E. (2014), "Knowledge sharing in teams: social capital, extrinsic incentives, and team innovation", *Group and Organization Management*, Vol. 39 No. 2, pp. 213-243, Sage Publications Sage CA: Los Angeles, CA.

Iqbal, Q. and Piwowar-Sulej, K. (2022), "Sustainable leadership in higher education institutions: social innovation as a mechanism", *International Journal of Sustainability in Higher Education*, Vol. 23 No. 8, pp. 1-20.

Iqbal, Q., Ahmad, N.H. and Li, Z. (2020a), "Frugal-based innovation model for sustainable development: technological and market turbulence", *Leadership and Organization Development Journal*, Vol. 42 No. 3, pp. 396-407.

Iqbal, Q., Ahmad, N.H., Nasim, A. and Khan, S.A.R. (2020b), "A moderated-mediation analysis of psychological empowerment: sustainable leadership and sustainable performance", *Journal of Cleaner Production*, Vol. 262, 121429.

Iqbal, Q., Ahmad, N.H. and Halim, H.A. (2021a), "Insights on entrepreneurial bricolage and frugal innovation for sustainable performance", *Business Strategy and Development*, Vol. 4 No. 3, pp. 237-245.

Iqbal, Q., Ahmad, N.H. and Li, Y. (2021b), "Sustainable leadership in frontier asia region: managerial discretion and environmental innovation", *Sustainability*, Vol. 13 No. 9, p. 5002.

Iqbal, Q., Ahmad, N.H., Li, Z. and Li, Y. (2022), "To walk in beauty: sustainable leadership, frugal innovation and environmental performance", *Managerial and Decision Economics*, Vol. 43 No. 3, pp. 738-750.

Janowicz-Panjaitan, M. and Noorderhaven, N.G. (2009), "Trust, calculation, and interorganizational learning of tacit knowledge: an organizational roles perspective", *Organization Studies*, Vol. 30 No. 10, pp. 1021-1044, Sage Publications Sage UK: London, England.

Ke, J., Sun, J., Shi, J. and Gu, Q. (2007), "Empirical study on relationship between social capital of R&D team and team potency", *Management World*, Vol. 3, pp. 89-101.

Kindström, D., Carlborg, P. and Nord, T. (2022), "Challenges for growing SMEs: a managerial perspective", *Journal of Small Business Management*, pp. 1-24.

Kirner, E., Kinkel, S. and Jaeger, A. (2009), "Innovation paths and the innovation performance of low-technology firms—an empirical analysis of German industry", *Research Policy*, Vol. 38 No. 3, pp. 447-458, Elsevier.

Kremer, H., Villamor, I. and Aguinis, H. (2019), "Innovation leadership: best-practice recommendations for promoting employee creativity, voice, and knowledge sharing", *Business Horizons*, Vol. 62 No. 1, pp. 65-74, Elsevier.

Le, P.B., Tran, D.T., Phung, T.M.T. and Vu, K.D. (2022), "Leadership and knowledge management practices for frugal innovation of firms in the emerging market: moderating role of collaborative culture", *Asia-Pacific Journal of Business Administration*, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/APJBA-03-2021-0130.

Lei, H., Gui, L. and Le, P.B. (2021), "Linking transformational leadership and frugal innovation: the mediating role of tacit and explicit knowledge sharing", *Journal of Knowledge Management*, Vol. 25 No. 7, pp. 1832-1852, Emerald Publishing.

Lin, C.-P., Huang, H.-T. and Huang, T.Y. (2020), "The effects of responsible leadership and knowledge sharing on job performance among knowledge workers", *Personnel Review*, Vol. 49 No. 9, pp. 1879-1896.

Lütjen, H., Schultz, C., Tietze, F. and Urmetzer, F. (2019), "Managing ecosystems for service innovation: a dynamic capability view", *Journal of Business Research*, Vol. 104, pp. 506-519, Elsevier.

Luu, T. T. (2016), "How servant leadership nurtures knowledge sharing: The mediating role of public service motivation", *International Journal of Public Sector Management*, Vol. 29 No. 1, pp. 91–108, Emerald Group Publishing.

Malhotra, A. and Majchrzak, A. (2019), "Greater associative knowledge variety in crowdsourcing platforms leads to generation of novel solutions by crowds", *Journal of Knowledge Management*, Vol. 23 No. 8, pp. 1628-1651, Emerald Publishing.

McCann, J.T. and Holt, R.A. (2010), "Defining sustainable leadership", *International Journal of Sustainable Strategic Management*, Vol. 2 No. 2, p. 204.

Muhammed, S. and Zaim, H. (2020), "Peer knowledge sharing and organizational performance: the role of leadership support and knowledge management success", *Journal of Knowledge Management*, Vol. 24 No. 10, pp. 2455-2489.

Nawal Abdalla, A. and Ghadah, A. (2021), "Innovation practices for survival of small and medium enterprises (SMEs) in the COVID-19 times: the role of external support", *Journal of Innovation and Entrepreneurship*, Vol. 10 No. 1, p. 15.

Nonaka, I. and Takeuchi, H. (1996), "The knowledge-creating company: how Japanese companies create the dynamics of innovation", *Long Range Planning*, Vol. 4 No. 29, p. 592.

Park, S. and Kim, E.-J. (2018), "Fostering organizational learning through leadership and knowledge sharing", *Journal of Knowledge Management*, Vol. 22 No. 6, pp. 1408-1423, Emerald Publishing.

Pérez-Luño, A., Medina, C.C., Lavado, A.C. and Rodríguez, G.C. (2011), "How social capital and knowledge affect innovation", *Journal of Business Research*, Vol. 64 No. 12, pp. 1369-1376, Elsevier.

Ploeg, M., Knoben, J., Vermeulen, P. and van Beers, C. (2021), "Rare gems or mundane practice? Resource constraints as drivers of frugal innovation", *Innovation: Organization and Management*, Vol. 23 No. 1, pp. 93-126.

Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 885 No. 879, pp. 10-1037.

Podsakoff, P.M., MacKenzie, S.B. and Podsakoff, N.P. (2012), "Sources of method bias in social science research and recommendations on how to control it", *Annual Review of Psychology*, Vol. 63, pp. 539-569, Annual Reviews.

Purkayastha, A., Karna, A., Sharma, S. and Bhadra, D. (2021), "Board's human capital resource and internationalization of emerging market firms: toward an integrated agency–resource dependence perspective", *Journal of Business Research*, Vol. 135, pp. 391-407, Elsevier.

Qi, Y. and Chen, W. (2020), "Cross-border innovation, knowledge sharing and breakthrough innovation blur front-end performance", *Fifth International Conference on Economic and Business Management (FEBM 2020)*, Atlantis Press, pp. 751-755.

Quigley, N.R., Tesluk, P.E., Locke, E.A. and Bartol, K.M. (2007), "A multilevel investigation of the motivational mechanisms underlying knowledge sharing and performance", *Organization Science*, Vol. 18 No. 1, pp. 71-88, INFORMS.

Rivas, J.L. (2012), "Board versus TMT international experience: a study of their joint effects", *Cross Cultural Management: An International Journal*, Vol. 19 No. 4, pp. 546-562, Emerald Group Publishing.

Rivera, A.E., Rodríguez-Aceves, L. and Mojarro-Duran, B.I. (2021), "Enabling knowledge sharing through psychological safety in inter-organisational arrangements", *Journal of Knowledge Management*, Vol. 25 No. 5, pp. 1170-1193.

Rodan, S. and Galunic, C. (2004), "More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness", *Strategic Management Journal*, Vol. 25 No. 6, pp. 541-562, Wiley Online Library.

Rosca, E., Reedy, J. and Bendul, J.C. (2018), "Does frugal innovation enable sustainable development? A systematic literature review", *European Journal of Development Research*, Vol. 30 No. 1, pp. 136-157.

Roskes, M. (2015), "Constraints that help or hinder creative performance: a motivational approach", *Creativity and Innovation Management*, Vol. 24 No. 2, pp. 197-206, Wiley Online Library.

Schippers, M.C., Den Hartog, D.N. and Koopman, P.L. (2007), "Reflexivity in teams: a measure and correlates", *Applied Psychology*, Vol. 56 No. 2, pp. 189-211, Wiley Online Library.

Sekaran, U. and Bougie, R. (2016), *Research Methods for Business: A Skill Building Approach*, John Wiley & Sons, West Sussex.

Shah, S.A.H. (2018), *Framework for SME Sector Development in Pakistan*, Planning Commission of Pakistan, Islamabad.

Small and Medium Enterprises Development Authority (2011), "SME definitions".

Sosa, M.E. (2011), "Where do creative interactions come from? The role of tie content and social networks", *Organization Science*, Vol. 22 No. 1, pp. 1-21, INFORMS.

Spithoven, A., Vanhaverbeke, W. and Roijakkers, N. (2013), "Open innovation practices in SMEs and large enterprises", *Small Business Economics*, Vol. 41 No. 3, pp. 537-562, Springer.

Teece, D.J. (2018), "Business models and dynamic capabilities", *Long Range Planning*, Vol. 51 No. 1, pp. 40-49, Elsevier.

Tønnessen, Ø., Dhir, A. and Flåten, B.-T. (2021), "Digital knowledge sharing and creative performance: work from home during the COVID-19 pandemic", *Technological Forecasting and Social Change*, Vol. 170, 120866, Elsevier.

Tortoriello, M., Reagans, R. and McEvily, B. (2012), "Bridging the knowledge gap: the influence of strong ties, network cohesion, and network range on the transfer of knowledge between organizational units", *Organization Science*, Vol. 23 No. 4, pp. 1024-1039, INFORMS.

Tsai, F.-S. and Hsu, I.-C. (2018), "The effects of social capital on knowledge heterogeneity", *Management Decision*, Vol. 57 No. 5, pp. 1237-1253, Emerald Publishing.

Tsai, K.-H. and Yang, S.-Y. (2013), "Firm innovativeness and business performance: the joint moderating effects of market turbulence and competition", *Industrial Marketing Management*, Vol. 42 No. 8, pp. 1279-1294, Elsevier.

Tsai, F.-S., Baugh, G.S., Fang, S.-C. and Lin, J.L. (2014), "Contingent contingency: knowledge heterogeneity and new product development performance revisited", *Asia Pacific Journal of Management*, Vol. 31 No. 1, pp. 149-169, Springer.

Tsoukas, H. (1996), "The firm as a distributed knowledge system: a constructionist approach", *Strategic Management Journal*, Vol. 17 No. S2, pp. 11-25, Wiley Online Library.

van der Meulen, N., van Baalen, P., van Heck, E. and Mülder, S. (2019), "No teleworker is an island: the impact of temporal and spatial separation along with media use on knowledge sharing networks", *Journal of Information Technology*, Vol. 34 No. 3, pp. 243-262, SAGE Publications Sage UK: London, England.

Vasudeva, G. and Anand, J. (2011), "Unpacking absorptive capacity: a study of knowledge utilization from alliance portfolios", *Academy of Management Journal*, Vol. 54 No. 3, pp. 611-623, Academy of Management Briarcliff Manor, NY.

von Janda, S., Kuester, S., Schuhmacher, M.C. and Shainesh, G. (2020), "What frugal products are and why they matter: a cross-national multi-method study", *Journal of Cleaner Production*, Vol. 246, Elsevier, 118977, doi: 10.1016/j.jclepro.2019.118977.

Waddock, S., Meszoely, G.M., Waddell, S. and Dentoni, D. (2015), "The complexity of wicked problems in large scale change", *Journal of Organizational Change Management*, Vol. 28 No. 6, pp. 993-1012.

Wang, M.-C., Chen, P.-C. and Fang, S.-C. (2018), "A critical view of knowledge networks and innovation performance: the mediation role of firms' knowledge integration capability", *Journal of Business Research*, Vol. 88, pp. 222-233, Elsevier.

Wright, K.B. (2005), "Researching Internet-based populations: advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services", *Journal of Computer-Mediated Communication*, Vol. 10 No. 3, p. JCMC1034, Oxford University Press Oxford.

Xiao, Y., Zhang, X. and de Pablos, P.O. (2017), "How does individuals' exchange orientation moderate the relationship between transformational leadership and knowledge sharing?", *Journal of Knowledge Management*, Vol. 21 No. 6, pp. 1622-1639, Emerald Publishing.

Xu, S. (2015), "Balancing the two knowledge dimensions in innovation efforts: an empirical examination among pharmaceutical firms", *Journal of Product Innovation Management*, Vol. 32 No. 4, pp. 610-621, Wiley Online Library.

Xuecheng, W. and Iqbal, Q. (2022), "Managerial networking and frugal innovation: situational leadership perspective", *Frontiers in Psychology*, Vol. 13, p. 3495, Frontiers.

Ye, J., Hao, B. and Patel, P.C. (2016), "Orchestrating heterogeneous knowledge: the effects of internal and external knowledge heterogeneity on innovation performance", *IEEE Transactions on Engineering Management*, Vol. 63 No. 2, pp. 165-176, IEEE.

Zhang, L. and Cheng, J. (2015), "Effect of knowledge leadership on knowledge sharing in engineering project design teams: the role of social capital", *Project Management Journal*, Vol. 46 No. 5, pp. 111-124, SAGE Publications Sage CA: Los Angeles, CA.

Zhang, R., Wang, J. and Hao, J.-X. (2020), "How does knowledge heterogeneity affect transactive memory system in innovation? Evidence from a field study", *Journal of Knowledge Management*, Vol. 24 No. 8, pp. 1965-1985, Emerald Publishing.

Zott, C. and Amit, R. (2008), "The fit between product market strategy and business model: implications for firm performance", *Strategic Management Journal*, Vol. 29 No. 1, pp. 1-26, Wiley Online Library.

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