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Organizational factors, knowledge management and innovation: empirical evidence from medium- and large-scale manufacturing firms in Ethiopia

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Abstract

Purpose – The purpose of this study is to empirically investigate the mediating role of knowledge management (KM) in the linkage between organizational factors, namely, organizational culture (OGCUL) and leadership and management support (LMS) and innovation in medium- and large-scale manufacturing firms in Ethiopia.

Design/methodology/approach – A sample of 200 firms has been used to gather data using simple random sampling and to test the proposed hypotheses. Structural equation modeling and crosssectional design were used to analyze the data using LISREL 8.80 SIMPLIS program software tool. Findings - Organizational factors (i.e. OGCUL and LMS) are positively associated with KM and innovation. KM constructs, namely, knowledge sharing, knowledge conversion and knowledge storage, have a significant positive influence on innovation. Knowledge sharing mediates the relationship between organizational factors and innovation.

Research limitations/implications – This study has three potential limitations: first, this study is based on a cross-sectional research design. Future research should include longitudinal design to get in-depth insights into the causal inferences. Second, only a few Ethiopian medium- and large-scale manufacturing firms were included in the sample. As a suggestion for future research, other

researchers can include small-scale enterprises using large sample sizes and should examine the effects of organizational factors, KM and innovation across different industries. Finally, this study has only focused on investigating the mediating role of knowledge sharing between organizational factors and innovation. Future research should test the mediating role of the KM process and its constituents (knowledge acquisition, knowledge conversion, knowledge sharing and knowledge storage) between organizational factors and specific aspects of innovation to gain a full understanding of the critical role of KM in organizational innovation.

Practical implications – The findings of this study would serve as a guide for policy-makers and managers of manufacturing firms in developing countries in the formulation of policies and long-term strategies. It may also provide a better understanding of the causal relationship between organizational factors, KM and innovation, which in turn has value to directors and managers in manufacturing firms in developing countries as a reference for building a good OGCUL, serving as practical guidance for effective leadership and providing organizational or management support. Specifically, the findings would have the following practical implications: first, firms need to have a combination of KM processes (such as acquisition, storage, sharing and conversion). In practice, developing countries such as Ethiopia have based their innovation strategy on knowledge and technology acquisition through encouraging foreign direct investment. It is not in doubt that Ethiopia has been benefiting from the strategy as a lot of foreign companies have opened their subsidiaries in the country. However, in the authors' view, more emphasis on knowledge acquisition strategy would not take a firm a long time to sustain its innovative activity because it is likely available to firms operating in the same industry, as well as it may hurt a firm's competitive advantage. In addition, by its nature, knowledge may not be retained for future use; it may expire soon. Second, the current highly impulsive and rapid change in the business environment changes the way firms have to operate and deliver products or services. Knowledge (both tacit and explicit) is a resource that can provide a competitive advantage if used well for the intended purpose. In real practice, firms often face challenges in determining where to get knowledge from and how to value or manage it. Besides, knowledge can be obtained from three sources: knowledge can exist in individuals' minds (skills, experience, ideas and insight); knowledge can dwell in a group, which we can call collective knowledge (a team of scientists or researchers); and knowledge can be embodied in an organization's systems, tools, procedures, policies, etc. Knowledge cannot be a valuable resource unless it is obtained and used in designing or producing a product or service. To integrate knowledge with business strategies, there should be a platform or framework that helps to manage it properly. Firm managers, policy-makers and other concerned bodies would consider the three sources of knowledge to foster innovative activities and obtain a competitive advantage. In addition, the authors recommend more emphasis be placed on firm-specific factors (such as OGCUL, leadership, management support and KM) to enhance the innovative capacity of a firm. Finally, the most critical issue to be raised while designing an innovation strategy would be employees' willingness and passion to collaborate with others to develop new ideas, share ideas or implement policies. As knowledge resides in individuals' minds, the knowledge holder should have a passion to share it with those working with him or her. In practice, knowledge sharing depends extremely on the passion and voluntariness of the two parts: knowledge provider and receiver. Therefore, firm managers would design a platform on how to motivate individuals to share their skills, experience and ideas with others through providing incentive packages, punishment and commitment. In this regard, the authors believe that the results would help individuals who are in the position to manage or regulate the manufacturing sector in designing innovation policies, KM policies or technology management policies and business strategies.

Originality/value – This study provides new empirical insight into the relationships between organizational factors (such as OGCUL and LMS), KM and innovation in a large sample of firms. To date, the empirical research on these relationships has been mainly limited to descriptive case studies (Chen and Huang, 2009; Zack et al., 2009; Donate and Guadaumillas, 2011), and there is thus a lack of empirical evidence with large samples of firms. Furthermore, there is a scarcity of studies investigating the relationship between organizational factors, KM and innovation in developing countries, especially in Ethiopia. This paper intends to fill this gap and nurture future research studies in the area.

Keywords: Organizational culture, Innovation, Structural equation modeling, Leadership, Management support, Knowledge management, The manufacturing sector

Paper type: Research paper

Introduction

In this century of the competitive landscape, virtually, all business entities (e.g. startup ventures, major corporations, alliances and others) seek to exploit product market opportunities by using proactive and innovative behaviors (Park et al., 2019). As the business environment is uncertain and dynamic, firms need to learn quickly how to reduce the reverse effect of uncertainty and ambiguity by creating dynamic core competencies to exploit market opportunities. There has been a consensus view in the extant literature (Tidd et al., 2005; Teece, 2000; Zhou and Wu, 2010; Hashi and Stojcic, 2010; Juliao-Rossi et al., 2019) that innovation strategy does have a significant role in sustaining business growth, in particular, and achieving developmental goals, in general. Thus, firms must ensure that their business strategies are innovative to gain and maintain a competitive advantage. Although different authors define innovation in many ways (Schumpeter, 1934; OECD, 2005; du Plessis, 2007), the central concept appears to be the process of developing or exploiting and implementing a new idea or knowledge/behavior that can be transformed into a product/process/method that has a significant market or commercial value (Chin et al., 2014; Neely and Hii, 1998). Besides, any innovation activity seems to add value to a firm in terms of customer satisfaction, market share and competitive edge (Murat Ar and Baki, 2011; Rossi et al., 2019). The term innovation has become an emerging issue in connection to the competitive landscape because it is believed to be a powerful engine that enables a firm to sustain business activity and be competitive (Hashi and Stojcic, 2010). Prior research has confirmed that the degree of innovativeness of industrial firms is a critical factor in their success (Chatzoglou and Chatzoudes, 2018; Cho and Pucik, 2005). However, changing client needs, intense competitive pressure and rapid technological change have made innovation more complex (Tamer Cavusgil et al., 2003). The amount of knowledge available to organizations as a basis for innovation has also increased the complexity of innovation (du Plessis, 2007). As a result, firms are finding it more difficult to internalize innovations (Moorman and Rust, 1999). Nevertheless, innovation is not a one-off task but rather a gradual process of transforming ideas into marketable products. It would be difficult for the company to be innovative and creative in products and services that allow the company to increase profits and reinvest in the business. On the other hand, a firm's innovative capacity is highly dependent on its ability to integrate, build and reconfigure internal and external competencies (Teece, 2010).

There has been a controversial issue as to what drives innovation in recognizing the role of innovation in fostering a competitive advantage. Prior studies have identified several internal and external factors that enable or obstruct a firm's ability to innovate a product, process or method. Organizational culture (OGCUL), e.g. fosters innovation (Adelekan, 2016; Barney, 1986; Gold et al., 2001; Leonard and Sensiper, 1998). Mokhber et al. (2017), and Carayannis et al. (2003) suggest leadership and management support (LMS) encourage innovative activity and creative ideas. Moreover, knowledge management (KM) is considered in the literature as a crucial antecedent to innovation (Andries etal., 2019; Khan and Zaman, 2020; du Plessis, 2007). Contrary to popular belief, OGCUL has been identified as the primary impediment to success in organizations (De Long and Fahey, 2000; Rastogi, 2000; Ribiere and Sitar, 2003). Similarly, Ajmal and Koskinen (2008) indicate that OGCUL is a fundamental stumbling block to the success of an organization. Despite the large existing empirical evidence on the drivers of innovation, some other critical issues are not considered yet. For example, organizational factors (such as culture, leadership and management support) might not directly operate well in encouraging innovation but rather through the KM process. The linkage between organizational factors and innovation would be strengthened with the interaction of KM. In this regard, most of the prior studies have focused on examining organizational factors and the KM/innovation relationship or KM and innovation. Although the area of study is traditional with humble empirical evidence, the current study has drawn on how KM mediates the linkage between organizational factors and innovation.

Apart from the extant literature, in 2011, Ethiopia enacted a technology and innovation policy to transfer technology to domestic companies through foreign direct investment. The policy has mainly focused on external barriers to innovation, e.g. shortages of foreign currency, high rates of employee turnover and poor infrastructures such as electricity, roads, water and telecommunication. These issues are common problems for all sectors of the economy, particularly in developing countries (Erena et al., 2021). The policy has ignored the powerful internal antecedents of innovation like organizational factors (such as leadership, management support, culture and structure). Similarly, a five-year (2019-2024) innovation policy of the African Union has emphasized external factors in promoting innovation to sustain industrial growth and considers it a crucial device for building up market share and wealth creation, which may assist companies to survive (Freeman, 1995; Furman et al., 2002). On the other hand, empirical evidence shows that the Ethiopian manufacturing sector has been characterized by low technological knowhow, shortage of skilled manpower, less knowledge about the industry, lower rates of technological products and innovation, weak inter- and intra-sectorial linkages and weak linkages with universities and research institutions (Wakeford et al., 2017; Oqubay, 2018; UNDP, 2018; Erena et al., 2021). UNCTAD (2015) evident that local firms' capacity to take advantage of opportunities both inside Ethiopia and in other emerging markets is hampered by a lack of access to and sharing of research and development (R&D) facilities. To our knowledge, there is no empirical study examining the internal drivers of innovation, such as OGCUL, leadership, management support and KM. This part of an innovative device has been ignored by Ethiopian manufacturing firms. Furthermore, scholars have suggested (Donate and Guadamillas, 2011) the necessity of undertaking subsequent research into the association between organizational factors, KM and innovation to elucidate these relationships and their effects on innovation. In response to their call, we have investigated the relationship between organizational factors (such as OGCUL and LMS), KM and innovation in medium-and large-scale manufacturing firms in Ethiopia. Thus, the aim of this study is to empirically investigate the mediating role of KM in the association between organizational factors (i.e. OGCUL and LMS) and innovation using structural equation modeling (SEM) to shed light on the direct and indirect effects of these variables on innovation in medium- and large-scale manufacturing firms in Ethiopia. Specifically, this study seeks to address the following research questions:

RQ1. How do organizational factors such as OGCUL and LMS influence KM and innovation?

RQ2. Does KM mediate the relationship between organizational factors, namely, OGCUL and LMS, and innovation?

RQ2. Can organizational factors such as OGCUL and LMS foster organizational innovation directly?

The remainder of the paper is organized as follows: Section 2 provides an overview of the relevant theoretical framework and the development of hypotheses on the subject. Section 3 describes the research methodology. Section 4 presents the results of the study. Findings are discussed in Section 5. Finally, Section 6 concludes the results and discussions.

2. Theoretical framework and hypotheses

The theoretical foundation of this study has been established based on the perspectives of dynamic capabilities (Nonaka, 2007; Teece, 2007; Zhou and Wu, 2010; Tidd et al., 2005; Woodfield and Husted, 2017) and the knowledge-based view (Kogut and Zander, 1992; Grant, 1996; Spender and Grant, 1996). According to the dynamic capability perspective, for sustainable organizational success and competitive advantage, companies should be able to create and combine/reconfigure capabilities in response to changing circumstances (Teece et al., 1997; Teece, 2007), such as innovation capabilities. The perspectives of dynamic KM capabilities (Gold et al., 2001) have been based on two strands of KM capabilities:

1. knowledge infrastructure capabilities, consisting of structure, culture and technology as enabling factors; and
2. knowledge process capabilities, which include knowledge gathering, conversion, application and protection.

Thus, dynamic KM capabilities perspectives assert that knowledge infrastructure capability improves organizational performance and nourishes knowledge process capability, which enhances organizational innovation (Cho and Korte, 2014). Knowledge, according to the knowledge-based view of the firm, is an organization's most valuable strategic resource. The knowledge-based view of the firm posits that the ability to develop and use knowledge is the most important source of a firm's long-term competitive advantage. It also holds that firms can enhance innovation (Al-Sa'di et al., 2017; Darroch, 2005) and achieve superior performance by effectively and efficiently managing organizational knowledge (Zack et al., 2009). Most knowledge resources are dynamic and intangible by nature, having distinctive qualities that provide sustainable competitive advantage as knowledge offers the foundation for long-term and sustainable differentiation that is difficult to imitate or copy. Despite their complexity, Martelo-Landroguez and Cegarra-Navarro (2014) argue that the integration and alignment of intangible resources like knowledge resources in a firm are critical to innovation. Innovation has been viewed as a critical element for dealing with the problems of uncertainty and stiff competition, as well as gaining a competitive advantage to assure survival and success in the global market (Vargas, 2015). Failure to innovate can jeopardize a company's long-term viability. As a result, firms place a high priority on cultivating an environment that encourages employees to innovate (Shanker etal., 2017). Prior research identified several key antecedent factors that influence innovation, such as OGCUL (Murat Ar and Baki, 2011; Lemon and Sahota, 2004; Valencia etal., 2010; Do et al., 2018; Pedersen etal., 2018; Tellis, 2012), leadership (Makri and Scandura, 2010; Murat Ar and Baki, 2011; Rosing etal., 2011), top management support (Murat Ar and Baki, 2011), KM (Darroch and McNaughton, 2002; Khan and Zaman, 2020; Liao and Wu, 2010) and knowledge sharing (KSHR) (Lei et al., 2020; Ritala et al., 2018; Singh etal., 2019), that enhance and facilitate innovation.

Thus, by integrating the perspective of dynamic capabilities and the knowledge-based view, we argue that organizational factors such as OGCUL and LMS can positively influence KM processes (such as knowledge acquisition (KAC), knowledge conversion (KCOV), KSHR and knowledge storage (KSTR)), which in turn improves organizational innovation in medium- and large-scale manufacturing firms in Ethiopia. In the context of this study, organizational factors (such as OGCUL and LMS) and KM were considered antecedent factors of innovation. Moreover, this study also explores whether organizational factors (i.e. OGCUL and LMS) affect KM, with an emphasis on the mediating role of KSHR in the relationship between organizational factors and innovation. The proposed conceptual model for the study is portrayed in Figure 1.

2.1 Organizational culture and knowledge management

OGCUL is defined as the shared values, beliefs (Sackmann, 1992) and practices (De Long and Fahey, 2000) of the people in the organization. It is believed to be the most significant input to effective KM (Alavi and Leidner, 2001; Gold et al., 2001; Leonard, 1995). It encourages dialogue between individuals or groups or among employees, which is often the basis for the creation of new ideas and, thus, creating knowledge (Gold et al., 2001). This interaction among employees helps to transform tacit knowledge into explicit knowledge, thereby transforming it from the individual to the organization level (Nonaka 1990, 1994; Nonaka, and Konno, 1998). People would share ideas and insights in an organization with a knowledge-sharing culture because it is natural for them, rather than something they are obliged to do (McDermott and O'Dell, 2001).

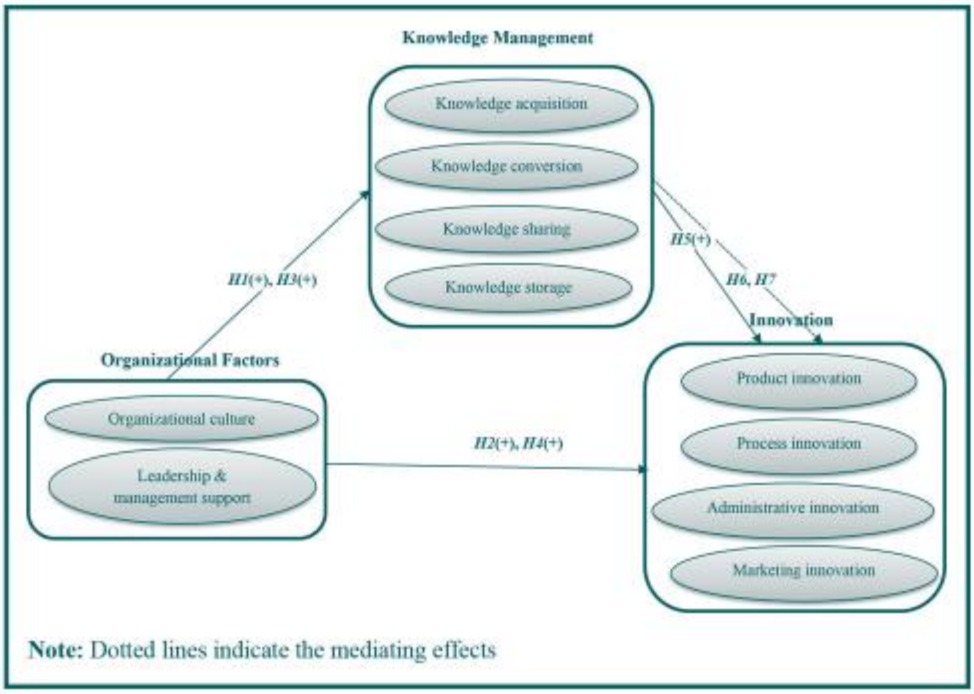

Figure 1 Conceptual model

In a similar vein, Guaderrama (2016) indicated that the lack of a sharing culture impedes KSHR and transfer in organizations.

The empirical literature on the relationship between OGCUL and KM yielded inconclusive results. One stream of literature finds OGCUL is positively associated with KM, whereas other studies indicate no such linkage. Because it influences how members acquire, learn and share knowledge, OGCUL is regarded as a critical factor in establishing and reinforcing knowledge creation and KM in organizations (Alavi and Leidner, 2001; Gupta and Govindarajan, 2000). Zheng etal. (2010) found OGCUL has a strong positive influence on KM. The authors further suggested that KM practices need to center on incorporating culture-building activities to foster an environment that is knowledge-friendly. Contrary to popular belief, OGCUL has been identified as the primary impediment to successful KM in organizations (De Long and Fahey, 2000; Rastogi, 2000; Ribiere and Sitar, 2003). Similarly, Ajmal and Koskinen (2008) indicate that OGCUL is a fundamental stumbling block to the success of the KM process. Thus, we posit that:

H1. OGCUL is positively associated with KM.

2.2 Organizational culture and innovation

The influence of OGCUL on innovation has been recognized from the perspective of the dynamic knowledge capabilities underpinning it (Nonaka, 2007; Tidd etal., 2005; Woodfield and Husted, 2017). The theory of dynamic knowledge capability stipulates that efficient operations result from the sharing of both tacit and explicit knowledge, which in turn contributes to a shared/collective understanding of how things function and could work. This is similar to how culture is defined as how we do things around here. Nonaka (2007) and Woodfield and Husted (2017) also indicate that individual employees at all levels of the organization rely on personal tacit knowledge, as well as subjective insights, intuitions and hunches/clues. Thus, only by establishing an appropriate OGCUL that supports innovation will these be made available for testing and usage by the entire organization.

The relationship between OGCUL and innovation has been extensively studied in the empirical literature, but the results are indecisive. Some scholars indicate OGCUL encourages innovation/creativity (Adelekan, 2016; Barney, 1986; Gold et al., 2001; Leonard and Sensiper, 1998), while others suggest it either promotes or impedes innovation (Li et al., 2018; Naranjo-Valencia et al., 2011; Valencia et al., 2010). OGCUL can be a source of competitive advantage if it is valuable, rare and difficult for competitors to copy or imitate (Barney, 1986), a key success factor in the KM process (Davenport et al., 1998) and a catalyst for continuous innovation (Gold et al., 2001). In a similar vein, Leonard and Sensiper (1998) pointed out that OGCUL would play a significant role in encouraging interaction between individuals, which is essential in the innovation process. Wan et al. (2005) also indicate that for employees to be driven to innovate, there must be a culture that encourages them to do so. Skerlavaj et al. (2010) also found OGCUL has a positive impact on innovation. These positive impacts appear especially strong for technical and administrative innovations (ADMINs). Hassan et al. (2012) also found a positive relationship between OGCUL and innovation. By contrast, Valencia etal. (2010) suggest OGCUL is thought to be one of the most important factors in both promoting and limiting creativity/innovation. Similarly, Naranjo-Valencia et al. (2011) indicate OGCUL can encourage or discourage innovation, which may affect the overall performance of the firm. If an organization's culture is rigid, closed and difficult to conform to, it may resist new ideas, stifling creative minds and inhibiting innovation (Li et al., 2018). Furthermore, Lemon and Sahota (2004) indicate innovation cannot be considered separately from the culture that facilitates or constrains the ability to add value because it is holistic in nature.

Based on the empirical results, we posit that:

H2. OGCUL is positively related to innovation.

2.3 Leadership and management support and knowledge management

Langton et al. (2013) defined leadership as the ability to influence a group toward the accomplishment of a vision or set of goals. Leadership is crucial in KM efforts. Leadership is one of the most important factors in the management of knowledge assets and the growth of knowledge and success of knowledge processes in a firm. Crawford (2005) found a strong link between leadership (transformational) and KM because leaders encourage information acquisition, creation and application. Similarly, top management ensures effective KM and resource allocation to boost productivity and innovation processes (Rajan et al., 2021). Top management also promotes organizational effectiveness, KM and team learning to stimulate innovation within the firms (Masa'deh et al., 2016). Management support is also viewed as a critical factor in KSHR (Connelly and Kelloway, 2003) and is fundamental in creating a culture conducive to knowledge creation and dissemination (Lin, 2006). Lin (2007) also indicates that top management support is necessary for knowledgesharing practices. Similarly, Ye§il etal. (2013) pointed out that to create a supportive climate and provide sufficient resources for organizational KSHR, top management support is essential. Drawing on these empirical findings, we propose:

H3. LMS is positively associated with KM.

2.4 Leadership and management support and innovation

Leadership is crucial in innovation activities. Leadership plays a critical role in supporting innovation by influencing firm strategic decisions, policies and procedures, and it is a key agent for promoting changes/creativity in the firm that supports innovation (Prasad and Junni, 2016). Similarly, leadership is directly linked to innovation because of its wide-ranging effects on the entire firm's operations, and it is also indirectly linked to innovation because it fosters a positive knowledge-sharing climate that encourages creativity and innovation (Lei et al., 2020). Senge (1990) also demonstrated a positive view toward innovation among leaders is necessary for implementing and developing innovation within the firm. De Jong and Den Hartog (2007) indicated that employees' innovative behavior is influenced by leaders' deliberate actions aimed at stimulating idea generation. The theoretical support for the influence of LMS is based on the perspective of the dynamic capabilities of firms, which states that the ability of an organization to innovate and learn will be influenced by the management styles used and employed (Teece, 1996, 1998).

Prior studies have confirmed a positive relationship between leadership and innovation. For example, Mokhber et al. (2017) suggest that transformational leaders encourage innovative activity within the company and also ensure that the innovations are commercially successful. Redmond etal. (1993) demonstrated that leaders (transformational) may build circumstances that inspire followers to innovate by setting group goals and managing essential resources. Singh etal. (2019) also revealed a positive effect of shared leadership and a market-oriented culture on firm innovation capability. Furthermore, Carayannis et al. (2003) revealed that management support, which is willing to take risks and encourage creative ideas, is one of the catalysts of innovation. Drawing on these empirical findings, we propose:

H4. LMS is positively associated with innovation.

2.5 *Knowledge management and innovation*

The link between KM and innovation has received much of the researchers' attention. Knowledge is widely recognized as an important weapon for sustaining competitive advantage (Lee and Choi, 2003). KM is defined as the process of acquiring, creating, sharing, storing and using knowledge (Nonaka et al., 2000). Gloet and Terziovski (2004) also describe KM as the formalization of and access to experience, knowledge and expertise that build new capabilities, enable higher performance, foster innovation and increase customer value. It is considered a crucial antecedent to innovation (Andries et al., 2019; Khan and Zaman, 2020). du Plessis (2007) indicates that KM fosters a knowledge-driven culture in which to incubate innovations. The author further states that the sharing of knowledge is enhanced by a culture that values knowledge, KM, innovation and creative thinking. Theoretical support for KM is promoted from the perspective of dynamic knowledge creation theory, which states that a shared knowledge base increases knowledge creation within society (Nonaka et al., 2000). A decent number of prior studies on KM indicate that KM is positively related to innovation (Noruzy et al., 2013; Jimenez-Jimenez et al., 2014; Pawlowsky and Schmid, 2012; Liao and Wu, 2010; Darroch, 2005; Nonaka and Takeuchi, 1995; Lee and Choi, 2003; Tamer Cavusgil etal., 2003; Chang and Lee, 2008; Andreeva and Kianto, 2011). For example, Darroch (2005) and Liao and Wu (2010) indicate that KM is positively linked to organizational innovation. Using an open innovation lens and taking a sample of 129 firms operating in a wide array of sectors in Italy, Papa et al. (2020) found a positive relationship between KAC and innovation performance. Similarly, Noruzy etal. (2013) revealed that KM directly influences organizational innovation. Hence, this study puts forward the following hypothesis:

H5. KM is positively related to innovation.

2.6 *Organizational culture, knowledge sharing and innovation*

KSHR refers to making relevant knowledge available to co-workers in the firm (Grant, 2016; Lin and Lo, 2015; Wang et al., 2014; Zhang and Jiang, 2015) to achieve innovation at the individual level (Bavik et al., 2018; Huang et al., 2014) and organizational level (Donnelly, 2018; Oyemomi et al., 2018). Alhady et al. (2011) indicate an organization that encourages employees to contribute knowledge (within groups and at firm levels) is more likely to create new and better ideas, as well as new business prospects and opportunities, hence facilitating organizational innovation. Similarly, prior studies (Donate and Guadamillas, 2011; Gold etal., 2001) indicate an OGCUL that has values oriented toward openness, collaboration and trust is more likely to foster employees' sharing of more ideas and knowledge, which means they are more likely to be innovative, responding more effectively and swiftly to changes and new market opportunities. The dynamic capability theory (Nonaka and Takeuchi, 1995) also claims that innovation occurs when employees share their knowledge, and shared knowledge leads to new or novel insights about creativity and innovation (Sheng, 2017). Previous research (Chang et al., 2017; Yang et al., 2018) suggests that KSHR mediates the relationship between OGCUL and innovation. For example, Chang et al. (2017) found KSHR mediates the association between OGCUL and innovation capability in the knowledgeintensive automobile industry in Taiwan. Furthermore, their findings revealed that OGCUL has a significant positive effect on KSHR. In a similar vein, using data collected from 77 Chinese firms, Yang etal. (2018) find that KSHR plays a mediating role between culture (collaborative) and innovation, especially with respect to product innovation (PDI) and process innovation (PCI). Hu etal. (2009) also indicated that organizations must first create/develop knowledgesharing behaviors as well as a better team culture to attain/achieve high-service innovation performance. Based on empirical studies, we propose that:

H6. KSHR mediates the relationship between OGCUL and innovation.

2.7 Leadership and management support, knowledge sharing and innovation

According to the dynamic capabilities perspective, leadership is a catalyst for the development of dynamic capabilities (Nonaka etal., 2016) and is one of the most important contextual resources that foster firms' innovation (Sheehan etal., 2020). Some studies have also supported the perspective that top management has a significant role in a company's dynamic capabilities (Helfat and Peteraf, 2015; Helfat etal., 2007). Successful knowledgesharing practices allow businesses to increase their knowledge capital and exploit and convert all available resources into dynamic competencies like innovation (Le and Lei, 2019; Darroch, 2005). Prior studies (Masa'deh etal., 2016; Zheng etal., 2017) indicate KSHR mediates the relationship between leadership and key organizational outcomes such as innovation. Using data collected from 394 participants at 88 Chinese firms, Le and Lei (2019) found leadership (transformational) positively impacted KSHR as well as PDI and PCI. Furthermore, they indicate that KSHR mediates leadership (transformational) effects on innovation. In a similar vein, Bass and Riggio (2012) demonstrated that leadership (transformational) can influence KSHR and innovation by causing followers to behave in a goal-oriented manner, hence enhancing organizational innovation and performance. Several prior studies (Choi etal., 2016; Xiao etal., 2017; Le etal., 2018) also indicate that individuals share their key knowledge, which is the source and basic driver of enhancing a firm's innovation capabilities, facilitated through leadership (transformational). Furthermore, Choi et al. (2016) found that a firm's ability to acquire and use knowledge mediates the association between leadership (transformational) and innovation behavior. Noruzy et al. (2013) also found that transformational leadership directly and positively influenced manufacturing firms' KM and organizational innovation. The authors further indicated that leadership (transformational) positively and indirectly influenced innovation through KM. Based on the above discussion, we hypothesize that:

H7. KSHR mediates the relationship between LMS and innovation.

2.8 Conceptual model

This study has developed seven hypotheses based on the theory of dynamic KM capabilities, the knowledge-based view and the empirical literature on innovation, and now proposes a framework for the relationships between the concepts discussed (Figure 1). Innovation is the dependent variable; KM is the mediator; the independent variables are OGCUL and LMS.

3. Methodology

3.1 Sample and sampling techniques

With regard to the target firm category, we followed the Ethiopian Central Statistical Agency (2014) benchmarks to classify firms into medium- and large-scale manufacturing firms. Accordingly, firms with more than ten but less than 51 employees are classified as medium scale, whereas firms with 51 or more employees are classified as large scale (Kalko et al., 2022). This study focuses on medium- and large-scale manufacturing firms because medium and large-scale firms and firms in the manufacturing sector are more likely to engage in innovative activities (Daksa et al., 2018). We obtained data on a list of medium-and large-scale manufacturing firms from the Ministry of Industry and the Central Statistical Agency. The data showed that up to the end of the year 2018, 3,520 medium- and large-scale manufacturing firms were registered and operating in Ethiopia (Erena etal., 2022). A total of 200 firms were chosen at random for this study to collect the relevant data. The simple random sampling technique has been used because it gives an equal chance to the firms under study, which would in turn reduce sample bias. There is no consensus in the literature on how large the sample size should be to get a good model fit with SEM. Several Monte Carlo studies (Anderson and Gerbing, 1984, 1988; Iacobucci, 2010) havedemonstrated that SEM can perform well with sample sizes of 100 or more. Hair etal. (2019) proposed that the number of factors would be five or less with more than three indicators per factor for a sample size of 100 to 150. With non-under-identified constructs, the maximum number of factors for a sample size of 150 to 300 would be seven. Furthermore, Wolf et al. (2013) suggest that the number of factors, the number of indicators and the strength of the indicator loadings affect the sample size. This means that as the number of factors in the model increases, so does the minimum sample size required.

3.2 Measures

Our multi-item scales were drawn generally from prior published studies. The OGCUL and LMS measuring instruments consist of eight items adopted from Kulkarni et al. (2007) and Mageswari (2014). Those items were operationalized as a five-point Likert scale ranging from “1” (strongly disagree) to “5” (strongly agree). KM was measured by using the items developed by Mageswari etal. (2017) and Gold etal. (2001). The KM dimensions scale had 14 items consisting of four interrelated processes such as KAC, KCOV, KSHR and KSTR. A five-point Likert scale ranging from “1” (very low) to “5” (very high) was used. The measures of innovation dimensions (product, process, administrative and marketing) were adopted from Hsu et al. (2014), Prajogo and McDermott (2011), Prajogo and Sohal (2006) and Vicente et al. (2021). This scale had 17 items measured using a five-point Likert scale ranging from “1” (nothing was done) to “5” (very good) that reflects firm quickness to generate novel or new ideas, new product launching, new product development, new processes, new technologies and new methods of problem-solving against key competitors. Before final administration, questionnaires were used in a pilot study. 25 manufacturing firms completed the questionnaire and provided helpful comments to examine the reliability, validity and usefulness of the measurement instruments in terms of language clarity, coherence and appropriateness. Based on the respondents' feedback, we prepared changes to the questionnaire to improve its precision and suitability. Professional data enumerators were hired and trained. Finally, 200 physical copies of the survey questionnaires were handed out face-to-face to reduce the number of people who declined to participate and enhance the response rate. The firm's middle manager completed and returned 153 of the 200 surveys that were provided. The questionnaire was distributed and collected during the year 2018. Overall, the response rate was 76.50%.

3.3 Data management and analysis

The nature of the study is quantitative, and it used cross-sectional observations, which assume observation over a single period across various firms. Co-variance-based SEM was used to assess the fit of the hypothesized model using the LISREL 8.80 program. We assessed the validity and reliability of the measurement model using confirmatory factor analysis. Traditionally, reliability is described as the correlation between the indicators of a latent variable (Bollen and Lennox, 1991). A model's reliability involves both composite reliability (CR) and individual indicator reliability. The CR assesses internal consistency, which determines whether the items measuring a latent are similar in their scores. The recommended level of acceptable fit is above 0.70 (Bagozzi et al., 1991). The individual indicator reliability is standardized loading or outer loading; it indicates how much of the variation of the item is defined by its latent construct. The rule of thumb threshold for the test is above 0.70. However, high reliability does not mean that the model is appropriate, so validity must be assessed.

Validity was tested using two methods: convergent validity and discriminant validity. The average variance extracted or retrieved (AVE) is used to determine convergent validity. Discriminant validity was tested using the correlation coefficients between latent variables. If the square root of each latent variable's AVE surpasses the correlation coefficient between the latent variables, discriminant validity is satisfied (Fornell and Larcker, 1981). The goodness of fit test is another key topic in SEM. The traditional statistical tool or method for testing absolute fitness is x2, with the null hypothesis that there is no statistically significant difference between the sample covariance matrix and the covariance matrix produced from a theoretically specified model or population covariance. The presence of a non-significant x2 suggests that the two co-variances are similar and that the model fits the data. The model does not fit the data if the x2 value is significant (a = 0.05). Steiger and Lind (1980) created root mean square error of appropriation (RMSEA) as a complement to x2 RMSEA is a measure of the average standardized residual per degree of freedom. Steiger and Lind (1980) proposed that RMSEA values below 0.05 indicate a very good model fit (close fit), and values less or equal to 0.10 suggest a reasonable or satisfactory fit, but a value greater than 0.10 shows some misfit between the model and the data. However, empirical research (Bollen, 1987; Browne and Cudeck, 1989; Cheung and Rensvold, 2002; Fan et al., 1999; Fornell and Larcker, 1981; Loehlin, 2004; Schumacker and Lomax, 2016) shows that the x2 test has various flaws, including sample size sensitivity and the lack of a stated power function. As a result, researchers devised other goodness of fit indicators in response to the chi-square test's limitations, such as goodness-of-fit index (GFI), adjusted GFI (AGFI), comparative fit index (CFI), normed fit index (NFI), non-normed fit index (NFI), and normed (x2/df). In general, a level of acceptable fit of 0.90 or greater is recommended for GFI, CFI, NFI and NNFI.

4. Results

4.1 Measurement models

The main objective of this study is to examine the mediating role of KM in the relationship between organizational factors and innovation. Three measurement models (organizational factors, KM and innovation) were separately assessed for validity and reliability using confirmatory factor analysis in LISREL 8.80, a SIMPLIS program software tool. In this study, OGCUL and LMS were used to represent organizational factors. KM constructs involve KAC, KCOV, KSHR and KSTR. The study used four constructs of innovation, namely, PDI, PCI, administrative innovation (ADMIN) and marketing innovation (MRIN). The results, summarized in Table 1 and Figures A1-A3 in Appendix 1, showed the CR values for all constructs exceeded the minimum standard norms of 0.70, as recommended by Fornell and Larcker (1981) and Hair et al. (2019). Specifically, the lowest CR value of 0.791 (for KCOV) was from the KM measurement model, whereas the highest CR value of 0.878 (for PCI) appeared in the innovation measurement model. These results indicate that all scales are inhabited with adequate internal consistency reliability.

In this study, we used item loading of more than 0.6 and significant at 0.01 to ensure convergent validity. As a result, each item loading presented in Table 1 is greater than 0.60 and significant at 0.01, which suggests convergent validity is satisfied. In addition, the AVE was manually computed to test convergent validity, and the result in Table 1 showed that each latent variable had been observed with an AVE greater than the minimum acceptable level of 0.50, recommended by Bagozzi and Yi (1988). This result also supports the convergent validity of the constructs in all models. Discriminant validity can be evaluated using two methods based on the criteria set by Fornell and Larcker (1981). The first method is by computing the correlation coefficient between two constructs and comparing the result to the AVE of each construct. If the AVE of each construct is greater than the computed correlation coefficient, discriminant validity is satisfied. Otherwise, the constructs should be merged to yield a single factor. The second approach is to compute the square root of the AVE for each construct and compare it with the shared correlation coefficient between the constructs. The value of the square root of the AVE for each construct should exceed the correlation coefficient to support discriminant validity. Table 2 presents the correlation of construct variables and the square root of AVE on the diagonal. The result shows that discriminant validity is satisfied for all construct variables.

Table 1 Summary statistics of the measurement model

Construct	*Item*	*Mean*	*Std. dev.*	*Standardized loading (λ)*	*CR*	*AVE*
OGCUL	OGCUL1	2.738	0.998	0.62	0.864	0.564
	OGCUL2	2.882	0.938	0.71		
	OGCUL3	2.980	0.899	0.90		
	OGCUL4	3.091	0.913	0.76		
	OGCUL5	3.085	0.972	0.74		
LMS	LMS1	3.098	1.080	0.61	0.830	0.555
	LMS2	3.000	1.025	0.76		
	LMS3	2.777	1.040	0.91		
	LMS4	2.921	0.949	0.67		
KAC	KAC1	2.882	0.924	0.78	0.863	0.617
	KAC2	2.882	0.993	0.90		
	KAC3	3.078	0.899	0.82		
	KAC4	3.156	0.987	0.61		
KCOV	KCOV1	2.705	0.902	0.75	0.791	0.560
	KCOV2	2.817	0.983	0.80		
	KCOV3	2.888	1.003	0.69		
KSHR	KSHR1	3.124	0.961	0.67	0.837	0.565
	KSHR2	3.091	0.941	0.77		
	KSHR3	2.947	0.985	0.76		
	KSHR4	3.032	0.941	0.80		
KSTR	KST1	2.862	0.932	0.74	0.817	0.600
	KST2	2.856	0.989	0.85		
	KST3	2.902	0.951	0.73		
PDI	PRDIN1	2.790	0.863	0.67	0.849	0.590
	PRDIN2	2.823	0.980	0.93		
	PRDIN3	2.875	0.975	0.72		
	PRDIN4	2.888	0.942	0.72		
PCI	PRCIN1	2.875	0.988	0.80	0.878	0.650
	PRCIN2	2.882	1.081	0.87		
	PRCIN3	2.934	1.086	0.90		
	PRCIN4	3.006	0.983	0.61		
ADMIN	ADMIN1	2.790	1.030	0.67	0.868	0.625
	ADMIN2	2.830	1.062	0.93		
	ADMIN3	2.954	1.065	0.79		
	ADNIN4	3.013	1.019	0.75		
MRIN	MRIN1	3.006	1.103	0.72	0.857	0.546
	MRIN2	2.973	1.038	0.77		
	MRIN3	3.032	1.102	0.76		
	MRIN4	3.039	1.044	0.77		
	MRIN5	3.058	1.046	0.67		

Notes: *Composite reliabilty* $(CR) = \frac{\left(\sum_{i=1}^{n} fl\right)^2}{\left(\sum_{i=1}^{n} fl\right)^2 + \sum_{i=1}^{n} me}$ Where $(fl)^2$ – the squared sum of standardized loadings.

$\sum_{i=1}^{n} me$ – the sum of measurement error (unexplained variance of an indicator by its latent variable).

AVE is manually computed as the sum of the variances of indicators explained by a latent construct divided by the number of indicators. Explained variance is squared standardized loading (correlation) or 1 – measurement error (unexplained variances). It is expressed as $AVE = \frac{\textit{Sum of explained variances}}{\textit{Sum of explained variances} + \textit{Sum of unexplained variances}}$

The CR of the second order shown in Figure A4 in Appendix 1 was higher than the minimum standard of 0.7, indicating adequate internal consistency reliability. The fit index statistics obtained acceptable results, which suggests the conceptual model best fits the data. KM (second-order construct) has a strong significant positive relationship with all constructs (first-order constructs): KAC, KCOV, KSHR and KSTR. The results indicate that the four constructs are important indicators of KM and support the first-order model or measurement model.

Table 2 Discriminant validity

No.	Variable	1	2	3	4	5	6	7	8	9	10
1	OGCUL	**0.75**									
2	LMS	0.55	**0.74**								
3	KAC	0.23	0.38	**0.78**							
4	KCOV	0.36	0.59	0.52	**0.74**						
5	KSHR	0.15	0.25	0.21	0.60	**0.75**					
6	KSTR	0.11	0.40	0.33	0.44	0.42	**0.77**				
7	PDI	0.11	0.23	0.22	0.28	0.20	0.24	**0.76**			
8	PCI	0.15	0.37	0.28	0.39	0.23	0.44	0.37	**0.80**		
9	ADMIN	0.20	0.22	0.15	0.46	0.28	0.37	0.47	0.36	**0.79**	
10	MRIN	0.15	0.30	0.17	0.34	0.33	0.32	0.44	0.49	0.55	**0.73**

Notes: The square root of AVE values is shown on the diagonal and printed in bold; off-diagonal elements are the construct variables correlations. OGCUL – organizational culture, LMS – leadership and management support, KAC – knowledge acquisition, KCOV – knowledge conversion, KSHR – knowledge sharing, KSTR – knowledge storage, PDI – product innovation, PCI – process innovation, ADMIN – administrative innovation, MRIN – marketing innovation, RMSEA – root mean square error of approximation, SRMR – standardized root mean square residual, NFI – normed fit index; NNFI – non-normed fit index; CFI – comparative fit index; IFI – incremental fit index; RFI – relative fit index; GFI – goodness of the fit index

Notes: The square root of AVE values is shown on the diagonal and printed in bold; off-diagonal elements are the construct variables correlations. OGCUL - organizational culture, LMS - leadership and management support, KAC - knowledge acquisition, KCOV - knowledge conversion, KSHR -knowledge sharing, KSTR - knowledge storage, PDI - product innovation, PCI - process innovation, ADMIN - administrative innovation, MRIN - marketing innovation, RMSEA - root mean square error of approximation, SRMR - standardized root mean square residual, NFI - normed fit index; NNFI - non-normed fit index; CFI - comparative fit index; IFI - incremental fit index; RFI - relative fit index; GFI -goodness of the fit index

The study further assessed the reliability and validity of the second-order innovation model. As presented in Figure A5 in Appendix 1, the value of CR exceeds the cutoff point value of 0.7, demonstrating internal consistency reliability satisfied with the model. The model fit indexes are RMSEA = 0.079, NFI = 0.92, CFI = 0.93, IFI = 0.93 and GFI = 0.90. These results were within the acceptable range, which supports the model's close fit to the data. Moreover, the path coefficients (correlations) between innovation (second-order constructs) and its constructs (first-order constructs) were strongly statistically significant. It suggests innovation can be best represented by the four constructs: PDI, PCI, ADMIN and MRIN.

The unidimensionality and multi-normality assumptions were also tested. We performed a cross-loading analysis using confirmatory factor analysis to determine whether each manifest variable only loaded on one common factor. The results presented in Appendices 3 and 4 indicate the model has no cross-loading among the observed variables or error terms, suggesting the unidimensionality assumption is met. The study used two approaches to evaluate normality assumptions. The underlying univariate normality for each item is computed using skewness or kurtosis. The bivariate normality for a pair of items was assessed using the RMSEA. The result showed the values of skewness or kurtosis for all items were less than the recommended standard value of 3, and the RMSEA values for all pairs of items were in the acceptable range of less or equal to 0.1 as suggested by Joreskog (2005). Furthermore, the fitness of the models has been tested using multistatistics indices: the x2 values for the three models are statistically significant, indicating poor fit. As x2 is very sensitive to sample size, the model's poor fit is due to the small sample size (153 in the current study). Alternatively, normed (the ratio of x2 to the degree of freedom) for all models obtained an acceptable value, which is less than the cut-off point value of 5 claimed by Wheaton etal. (1977). The models also best fit the data with respect to all other indices, such as RMSEA, standardized root mean square residual (SRMR), normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), incremental fit index (IFI), relative fit index (RFI) and GFI (Table 3).

4.2 Structural model

The study used SEM to test the hypotheses using the LISREL 8.80 SIMPLIS program with the maximum likelihood (ML) estimation technique. For the concern of model fit, which partially relies on the number of factors in a model (Anderson and Gerbing, 1988; Cheung and Rensvold, 2002; Hair et al., 2019), we separately run two models with respect to KM and innovation relationships.

Table 3 Summary of model fit indices

Indices statistics	*Model 1*	*Model 2*	*Model 3*	*Recommended cut-off rule*	*Reference*
χ^2	41.87	133.59	319.56	–	
Df	21	69	110	–	
p-value	0.004	0.000	0.000	>0.05	
χ^2/df	1.99	1.93	2.90	<5	Wheaton *et al.* (1977)
RMSEA	0.08	0.078	0.068	<0.1	Steiger and Lind (1980)
SRMR	–	0.062	0.045	<0.08	Hu and Bentler (1999)
NFI	0.96	0.91	0.90	>0.90	Bentler and Bonett (1980)
NNFI	–	0.94	0.90	>0.90	Bentler and Bonett (1980)
CFI	0.98	0.95	0.93	>0.90	Bentler (1990)
IFI	0.98	0.95	0.93	>0.90	Bentler (1990)
GFI	0.94	0.90	0.90	≥ 0.90	Jöreskog and Sörbom (1989)

Source: Adopted from Kalko *et al.* (2022)

In the first model, Figure 2, two constructs, KAC and KSHR, were assumed as endogenous latent variables, and all constructs of innovation were endogenous variables. The second model, Figure 3, used KCOV and KSTR as exogenous variables with all innovation constructs. The first task in structural model estimation is testing the goodness of fit of the model. For Model 1 (Figure 2), the fit indices are normed x2=2.87, RMSEA = 0.067, NFI = 0.91, CFI = 0.92, IFI = 0.92, GFI = 0.90. These results of model fit indexes are within the acceptable range, suggesting the hypothetical model best fits the data. Table 4 reports the detailed results of Models 1 and 2. After the model's goodness of fit was confirmed, we turned to examine the significance of each path coefficient. KAC has a significant positive effect on two constructs of innovation: PDI (unstandardized coefficient (UC) = 0.18, p-value = 0.000, f-value = 2.00) and PCI (UC = 0.24, p-value = 0.000, f-value = 2.74).

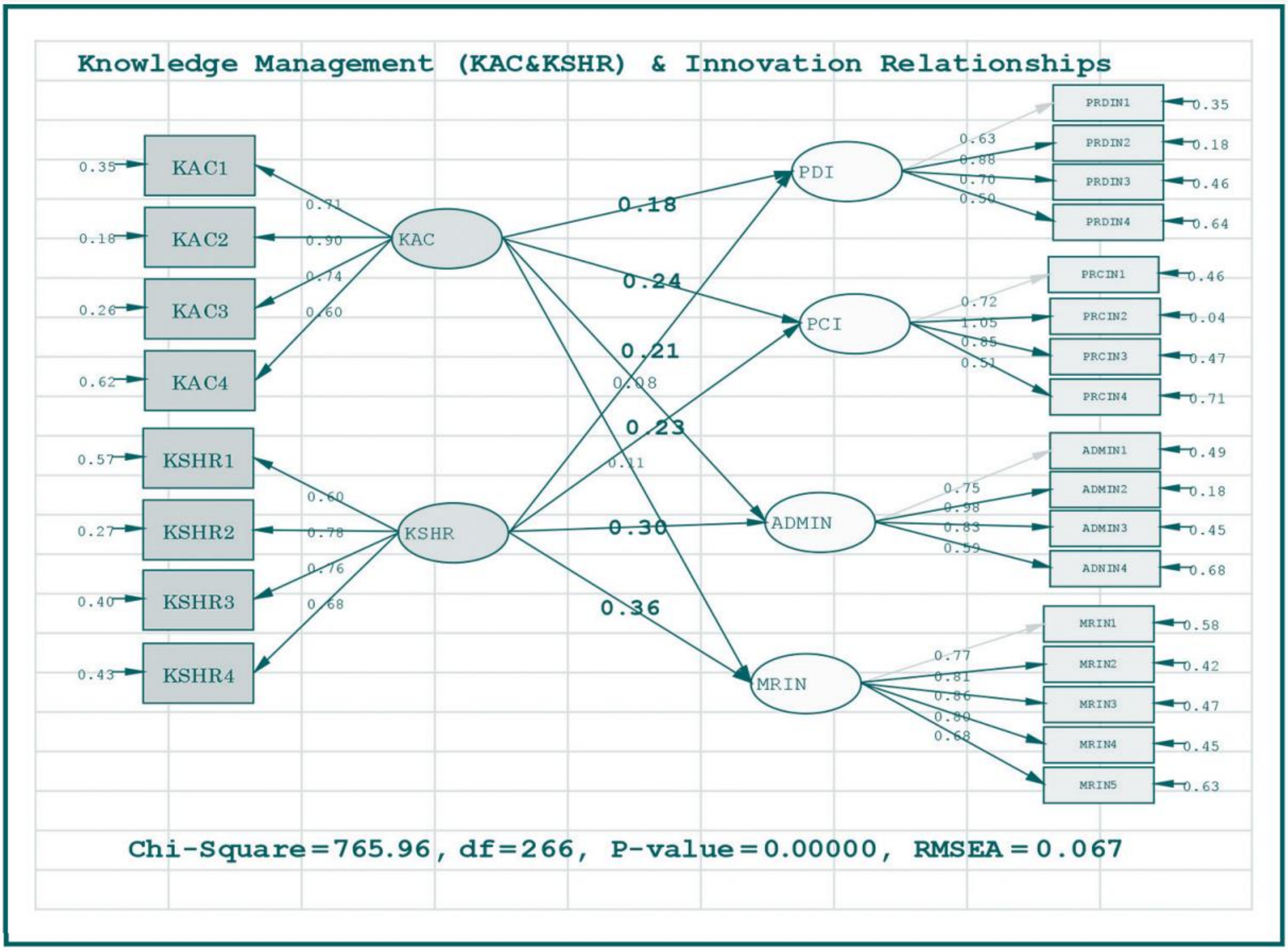

Figure 2 Effect of KM (KAC and KSHR) on innovation

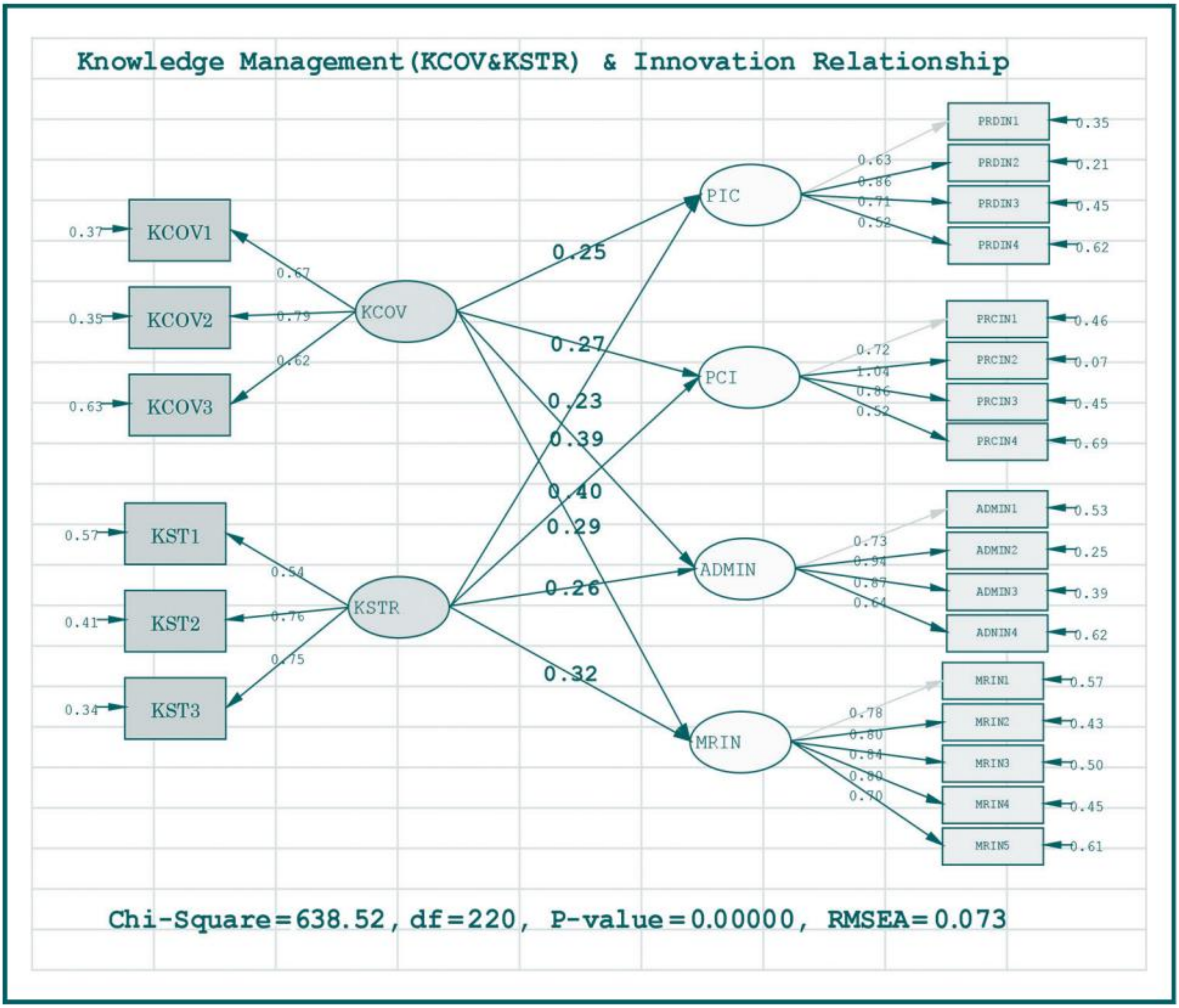

Figure 3 Effect of KM (KCOV and KSTR) on innovation

The result implies the practice of acquiring and using useful knowledge positively contributes to innovation activity in a firm. The coefficients on ADMIN and MRIN were found insignificant.

The study finds a strong significant positive relationship between KSHR and all innovation constructs: PDI (UC = 0.21, p-value = 0.000, f-value = 2.25), PCI (UC = 0.23, p-value = 0.000, f-value = 2.52), ADMIN (UC = 0.30, p-value = 0.000, f-value = 3.15) and MRIN (UC = 0.36, p-value = 0.000, f-value = 3.69). The results support the hypothesis that knowledge-sharing behavior among employees or firms is a key driver of innovation.

The goodness of fit test for Model 2 has also yielded acceptable results in all fit indexes. The normed *2=2.90, RMSEA = 0.073, NFI = 0.93, CFI = 0.94, IFI = 0.94 and GFI = 0.91. These results collectively suggest the conceptual model best fits the data. As presented in Table 4, KCOV has a potential significant positive impact on all endogenous construct variables: PDI (UC = 0.25, p-value = 0.000, f-value = 2.23), PCI (UC = 0.27, p-value = 0.000, f-value = 2.27), ADMIN (UC = 0.39, p-value = 0.000, f-value = 3.66) and MRIN (UC = 0.29, p-value = 0.000, f-value = 2.71). The hypothesis that posits KCOV, which involves converting existing or new ideas or insights into explicit knowledge, is significantly attributed to innovation is confirmed. Similarly, KSTR has a significant positive relationship with constructs of innovation: PDI (UC = 0.23, p-value = 0.000, f-value = 2.05), PCI (UC = 0.40, p-value = 0.000, f-value = 3.83), ADMIN (UC = 0.26, p-value = 0.000, f-value = 2.50) and MRIN (UC = 0.32, p-value = 0.000, f-value = 2.89). The results provide evidence that storing knowledge in a database/manual/schema and reusing it for the decision-making process has a significant influence on a firm's innovation.

Table 4 Summary of structural model results

Variable	UC	Stand. error	t-value	Hypothesis
Model 1: KM (KAC and KSHR) and innovation				
KAC → PDI	0.18	0.092	2.00*	Supported
KSHR → PDI	0.21	0.095	2.25*	Supported
KAC → PCI	0.24	0.088	2.74**	Supported
KSHR → PCI	0.23	0.090	2.52*	Supported
KAC → ADMIN	0.08	0.090	0.84	Not supported
KSHR → ADMIN	0.30	0.096	3.15**	Supported
KAC → MRIN	0.11	0.090	1.23	Not supported
KSHR → MRIN	0.36	0.098	3.69**	Supported
RMSEA = 0.067	NFI = 0.91	CFI = 0.92 IFI = 0.92	GFI = 0.90	
Model 2: KM (KCOV and KSTR) and innovation				
KCOV → PDI	0.25	0.11	2.23*	Supported
KSTR → PDI	0.23	0.11	2.05*	Supported
KCOV → PCI	0.27	0.10	2.74**	Supported
KSTR → PCI	0.40	0.10	3.83**	Supported
KCOV → ADMIN	0.39	0.11	3.66**	Supported
KSTR → ADMIN	0.26	0.10	2.50*	Supported
KCOV → MRIN	0.29	0.11	2.71**	Supported
KSTR → MRIN	0.32	0.11	2.89**	Supported
RMSEA = 0.073	NFI = 0.93	CFI = 0.94 IFI =0.94	GFI = 0.91	

Notes: *Where: KAC – knowledge acquisition, KSHR – knowledge sharing, KCOV – knowledge conversion, KSTR – knowledge storage, PDI – product innovation, PCI – process innovation, ADMIN – administrative innovation, MRIN – marketing innovation, RMSEA – root mean square error of approximation, NFI – normed fit index, CFI – comparative fit index, IFI – incremental fit index, GFI – goodness-of-fit index, unstandardized coefficient (UC) represents path coefficient, KAC, KSHR, KCOV and KSTR are KSI (exogenous latent) variables. PDI, PCI, ADMIN and MRIN are ETA (endogenous latent) variables.* Note: **,* - indicates a significant level at 1 and 5%, respectively

Notes: Where: KAC - knowledge acquisition, KSHR - knowledge sharing, KCOV - knowledge conversion, KSTR - knowledge storage, PDI - product innovation, PCI - process innovation, ADMIN - administrative innovation, MRIN - marketing innovation, RMSEA - root mean square error of approximation, NFI - normed fit index, CFI - comparative fit index, IFI - incremental fit index, GFI -goodness-of-fit index, unstandardized coefficient (UC) represents path coefficient, KAC, KSHR, KCOV and KSTR are KSI (exogenous latent) variables. PDI, PCI, ADMIN and MRIN are ETA (endogenous latent) variables. Note: **,* - indicates a significant level at 1 and 5%, respectively

The study has also done further analysis to examine the relationship between organizational factors (OGCUL and LMS) and KM. In an extension of this model, a mediation analysis has been performed where OGCUL and/or LMS are assumed as an exogenous independent variable. KM is used as a mediate variable, whereas innovation is the endogenous dependent variable. For simplicity of the model, a single mediating variable from the KM construct, KSHR, was only introduced. Two mediation models were separately run. One is OGCUL (OGCUL), and the other is LMS for the model fit concern. In Figure 4, four constructs of KM were regressed on OGCUL, and the coefficients of all endogenous constructs were significant and positive. Table 5 presents the detailed results on KAC (UC = 0.28, p-value = 0.000, t-value = 3.02), KCOV (UC = 0.41, p-value = 0.000, t-value = 3.95), KSHR (UC = 0.23, p-value = 0.000, t-value = 2.34) and KSTR (UC = 0.22, p-value = 0.000, ř-value = 2.07). It demonstrates that OGCUL is an important driver of KM.

The first mediation model examines the impact of OGCUL on innovation through KSHR. Following the common procedure of mediation analysis (Baron and Kenny, 1986), we first tested whether OGCUL, an independent variable, significantly impacts innovation, a dependent variable, without taking a mediate variable. The results in Figure 5 showed that there is a significant positive relationship between OGCUL and all innovation constructs: PDI (UC = 0.15, p-value = 0.000, t-value = 1.97), PCI (UC = 0.20, p-value = 0.000, t-value = 2.26), ADMIN (UC = 0.23, p-value = 0.000, t-value = 2.45) and MRIN (UC = 0.21, p-value = 0.000, t-value = 2.37). By this result, the first condition (the relationship between dependent and independent variables should be significant) is met. The second condition that demands a significant relationship between mediating and independent variables is shown in Figure 4.

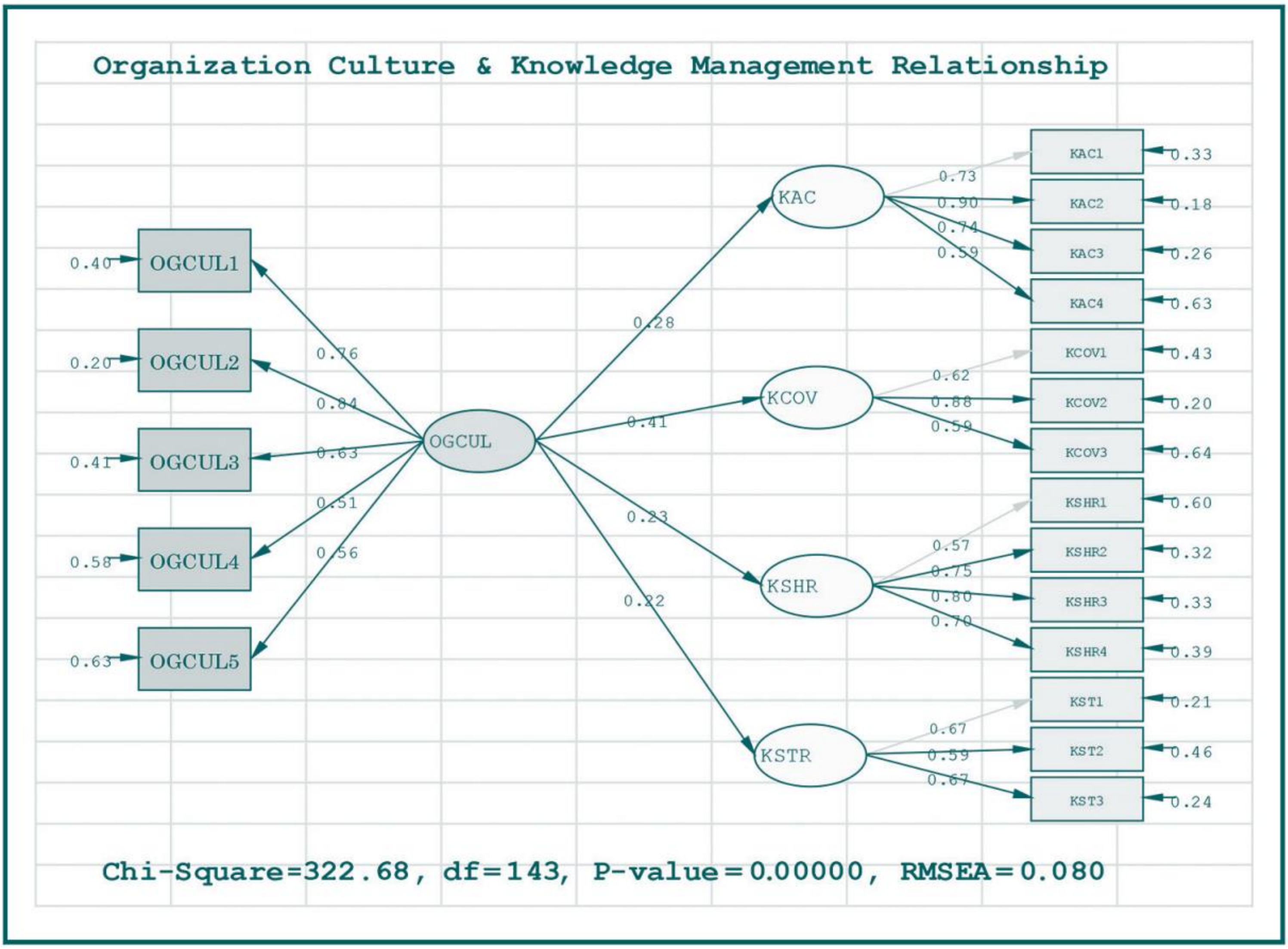

Figure 4 Effectof OGCULon KM

At the third stage, a model with a mediate variable, KSHR, was run in the LISREL 8.80 SIMPLIS program with an ML estimation technique, and the results were summarized in Figure 6 and Table 5.

The goodness of fit model test has yielded acceptable results in all fit indexes. These include normed *2=2.31, RMSEA = 0.073, NFI = 0.92, CFI = 93, I FI = 0.93 and GFI = 0.90, suggesting the hypothetical model fits the data well. It is indicated in Table 5 that OGCUL has a significant positive direct impact on the mediate variable, KSHR (UC = 0.21, p-value = 0.000, Lvalue = 1.99). However, no direct significant coefficient is found between OGCUL and dependent variables, innovation constructs. Similarly, the indirect effect of OGCUL on all dependent variables is insignificant.

Moreover, the cumulative effects of OGCUL on PCI (UC = 0.18, p-value = 0.000, Lvalue = 2.08) and ADMIN (UC = 0.21, p-value = 0.000, Lvalue = 2.32) are significant. We recalled the conditions proposed by Baron and Kenny (1986) for mediation analysis to sum up the results. The first condition that requires there to be a significant relationship between dependent and independent variables was satisfied (Figure 5). Second, the mediate variable should significantly relate to the independent variable. It was met in this study (Figure 4). The third condition requires a significant relationship between a dependent and the mediate variable; it is also confirmed (Figure 3). The present study runs three equations separately to test the conditions. Fourth, the parameter coefficient between OGCUL and dependent variables (i.e. PDI, PCI, ADMIN and MRIN) in Figure 6, the mediation diagram, may be significant or insignificant, but it should be smaller than the parameter coefficient in Figure 5. If the first three conditions are met and the coefficient in Figure 6 is significant, partial mediation is assumed. Otherwise, complete mediation is concluded. Thus, in this study, complete mediation is inferred.

We also run a separate model to examine the effect of LMS on KM, as indicated in Figure 7 and Table 6. The model has yielded an acceptable fit index, which involves normed x2 = 2.24, RMSEA = 0.091, NFI = 0.91, CFI = 92, IFI = 0.92 and GFI = 0.90.

Table 5 Summary of structural model results

Variable	UC	Std. error	t-value	Hypothesis
Model 1: the effect of organization culture on KM				
OGCUL → KAC	0.28	0.093	3.02**	Supported
OGCUL → KCOV	0.41	0.10	3.95**	Supported
OGCUL → KSHR	0.23	0.099	2.34*	Supported
OGCUL → KSTR	0.22	0.11	2.07*	Supported
RMSEA = 0.080 NFI = 0.92 CFI = 0.94 IFI = 0.94 GFI = 0.91				
Model 2: the effect of organization culture on innovation				
OGCUL → PDI	0.15	0.076	1.97*	Supported
OGCUL → PCI	0.20	0.089	2.26*	Supported
OGCUL → ADMIN	0.23	0.094	2.45*	Supported
OGCUL → MRIN	0.21	0.089	2.37*	Supported
RMSEA = 0.081 NFI = 0.95 CFI = 0.96 IFI = 0.96 GFI = 0.90				
Model 3: the effect of organization culture on innovation: the mediation of KSHR				
Variable	Total effects	Direct effects	Indirect effects	
OGCUL → KSHR	0.21 (1.99*)	0.21 (1.99*)	0.00	
OGCUL → PDI	0.15 (1.61)	0.081 (0.91)	0.06 (1.73)	
OGCUL → PCI	0.18 (2.08*)	0.11 (1.32)	0.07 (1.78)	
OGCUL → ADMIN	0.21 (2.32*)	0.12 (1.66)	0.07 (1.77)	
OGCUL → MRIN	0.15 (1.67)	0.061 (0.71)	0.09 (1.84)	
KSHR → PDI	0.30 (2.31*)	0.30 (3.16**)	0.00	
KSHR → PCI	0.33 (2.24*)	0.33 (3.52**)	0.00	
KSHR → ADMIN	0.28 (2.67*)	0.28 (3.36**)	0.00	
KSHR → MRIN	0.43 (3.34**)	0.43 (4.18**)	0.00	
RMSEA = 0.073 NFI = 0.92 CFI = 0.93 IFI = 0.93 GFI = 0.90				

Note: Where: LMS – leadership and management support, KSHR – knowledge sharing, PDI – product innovation, PCI – process innovation, ADMIN – administrative innovation, MRIN – marketing innovation, RMSEA – root mean square error of approximation, NFI – normed fit index, CFI – comparative fit index, IFI – incremental fit index, GFI – goodness-of-fit index, the value in bracket is *t*-value, OGCUL is KSI (exogenous latent) variable, KSHR, PDI, PCI, ADMIN and MRIN are ETA (endogenous latent) variables, coefficients are computed by ML estimation method. Note: the coefficient of indirect effect is computed by OGCUL direct effect on KSHR coefficient (i.e. 0.21) times KSHR direct effects on innovation construct variables. Total effect = direct effect + indirect effect. **,* - indicate a significant level at 1 and 5%, respectively

The result in Table 6 shows that LMS has a strong significant positive impact on all dimensions of KM: KAC (UC = 0.46, p-value = 0.000, f-value = 4.97), KCOV (UC = 0.64, p-value = 0.000, f-value = 5.73), KSHR (UC = 0.36, p-value = 0.000, f-value = 3.53) and KSTR (UC = 0.47, p-value = 0.000, f-value = 4.68). It supports the hypothesis that LMS strengthens/improve KM practice in a firm. In addition, OGCUL LMS are also important drivers of KM.

Furthermore, this study has examined how LMS impact innovation through KSHR intervention. Two-fold procedures were followed to do so. The first procedure was regressing innovation, dependent variables on LMS, independent variable. Figure 8 and Table 6 present the detailed results. It is clearly seen that LMS has a significant positive linkage with three dependent variables: PCI (UC = 0.30, p-value = 0.000, f-value = 3.43), ADMIN (UC = 0.30, p-value = 0.000, f-value = 3.32) and MRIN (UC = 0.24, p-value = 0.000, f-value = 2.59). The result suggests that firm LMS has a significant role in innovation practices. After assuring that Conditions 1 (Figure 8) and 2 (Figure 7) were met, we turned to run the model with a single mediate variable, KSHR. Figure 9 and Table 6 provide the detailed results. The model goodness of fit is normed x2=2.75, RMSEA = 0.077, NFI = 0.94, CFI = 94, IFI = 0.93 and GFI = 0.91. These results indicate the model fits the data well. In Figure 9, the parameter coefficients can be interpreted as direct effects, represented by the path lines pointing to the endogenous latent (ETA) variables (KSHR, PDI, PCI, ADMIN, MRIN) and indirect effects, defined by the path line going to the dependent variables (PDI, PCI, ADMIN and MRIN) through KSHR, mediating variable.

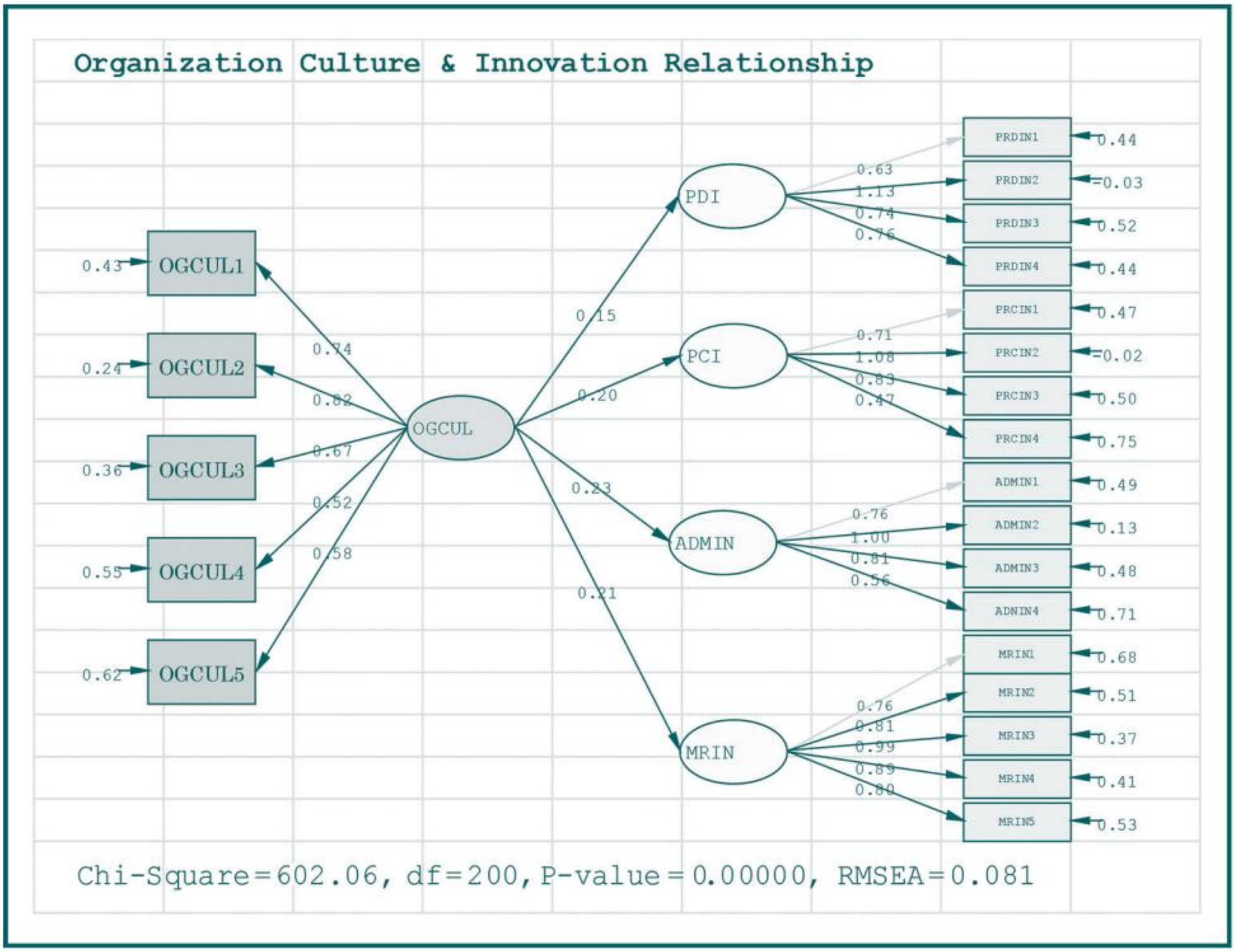

Figure 5 Effect of OGCUL on innovation

With regard to direct effects, the coefficient on the mediate variable (KSHR) (UC = 0.22, t-value = 2.29), PCI (UC = 0.29, t-value = 3.32) and ADMIN (UC = 0.26, t-value = 2.83) showed significant positive. On the other hand, LMS has an indirect significant positive impact on MRIN (UC = 0.08, t-value = 1.99). Overall results indicate a significant positive coefficient for three dependent variables: PCI (UC = 0.33, t-value = 3.71), ADMIN (UC = 0.31, t-value = 3.40) and MRIN (UC = 0.24, t-value = 2.54). In this mediation model, partial mediation is assumed for PCI and ADMIN, while complete mediation is observed for MRIN. The first condition for mediation analysis is not satisfactory for PDI; therefore, mediation analysis does not work well for the variable. It can be concluded that KSHR would mediate the analysis of organizational factors and innovation relationships. KSHR has a significant positive effect on all constructs of innovation.

5. Discussion

This study found that KAC appeared to have a significant positive impact on PDI and PCI. The result reveals that the extent to which a firm learns and acquires knowledge from different parts (Huber, 1991) has played a significant role in firm innovation activity. However, a firm's capacity to implement acquired knowledge into the production system is essential and decides the maximum benefits to be generated. In addition, KSHR appeared to be the key driving factor for all constructs of innovation, such as PDI, PCI, ADMIN and MRIN. It suggests the culture of KSHR among employees or between firms in the same industry highly encourages innovative activities. This view supports the perspective of the dynamic knowledge creation theory (Nonaka, 1994) and empirical findings (du Plessis, 2007; Lin, 2007; Wang and Noe, 2010; Lee and Choi, 2003; Gomezelj etal., 2011; Han and Chen, 2018) that confirm KM processes (such as KSHR, KSTR and KAC) encourage innovation. KCOV has a strong positive relationship with PDI, PCI, ADMIN and MRIN.

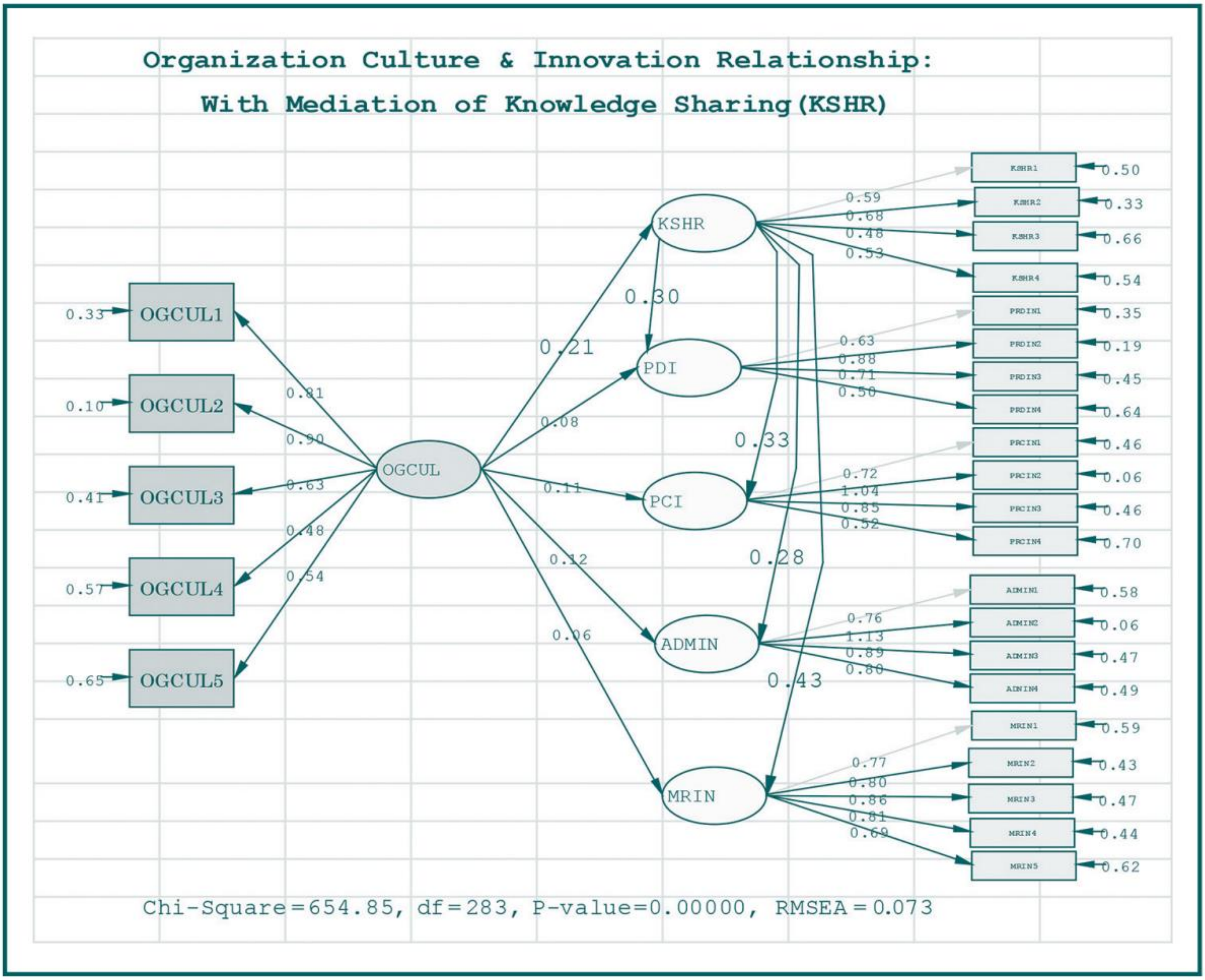

Figure 6 Effect of OGCUL on innovation: the mediating role of KSHR

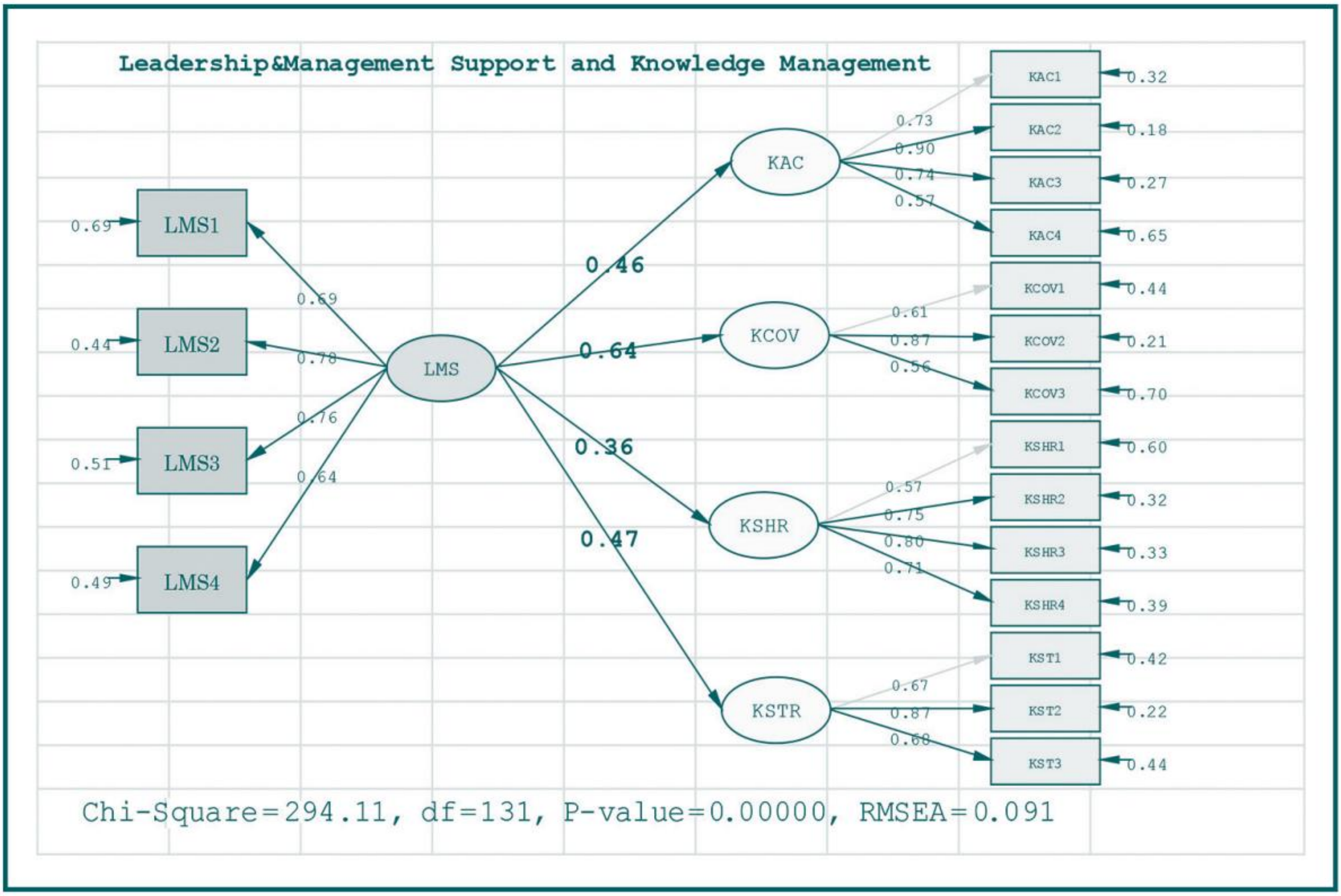

Figure 7 Effect of LMSon KM

Table 6 Summary of structural model results

Variable	UC	Std. error	t-value	Hypothesis
Model 1: LMS and KM				
LMS → KAC	0.46	0.093	4.97**	Supported
LMS → KCOV	0.64	0.11	5.73**	Supported
LMS → KSHR	0.36	0.10	3.53**	Supported
LMS → KSTR	0.47	0.10	4.68**	Supported
RMSEA = 0.091 NFI = 0.91 CFI = 0.92 IFI = 0.92 GFI = 0.90				
Model 2: LMS and innovation				
LMS → PDI	0.15	0.092	1.64	Not supported
LMS → PCI	0.30	0.088	3.43**	Supported
LMS → ADMIN	0.30	0.092	3.32**	Supported
LMS → MRIN	0.24	0.093	2.59**	Supported
RMSEA = 0.073 NFI = 0.93 CFI = 0.94 IFI = 0.94 GFI = 0.91				
Model 3: LMS and innovation: with mediation of KSHR				
Variable	*Total effects*	*Direct effects*	*Indirect effects*	
LMS → KSHR	0.22 (2.29*)	0.22 (2.29*)	0.00	
LMS → PDI	0.15 (1.58)	0.096 (1.02)	0.05 (1.69)	
LMS → PCI	0.33(3.71**)	0.29 (3.23**)	0.04 (1.68)	
LMS → ADMIN	0.31 (3.40**)	0.26 (2.83**)	0.06 (1.83)	
LMS → MRIN	0.24(2.54*)	0.16 (1.79)	0.08 (1.99*)	
KSHR → PDI	0.23 (2.31*)	0.23 (2.31*)	0.00	
KSHR → PCI	0.20 (2.24*)	0.20 (2.24*)	0 0.00	
KSHR → ADMIN	0.26 (2.67*)	0.26 (2.67**)	0.00	
KSHR → MRIN	0.34 (3.34**)	0.34 (3.34**)	0.00	
RMSEA = 0.077 NFI = 0.94 CFI = 0.94 IFI =0.93 GFI = 0.91				

Notes: Where: LMS – leadership and management support, KSHR – knowledge sharing, PDI – product innovation, PCI – process innovation, ADMIN – administrative innovation, MRIN – marketing innovation, RMSEA – root mean square error of approximation, NFI – normed fit index, CFI – comparative fit index, IFI – incremental fit index, GFI – goodness-of-fit index, the value in bracket is *t*-value, LMS is KSI (exogenous latent) variable, KSHR, PDI, PCI, ADMIN and MRIN are ETA (endogenous latent) variables, coefficients are computed by ML estimation method. Note: the coefficient of indirect effect is computed by LMS direct effect on KSHR coefficient (i.e. 0.22) times KSHR direct effects on innovation construct variables. Total effect = direct effect + indirect effect. **,* - indicate a significant level at 1 and 5%, respectively

It suggests that a firm with a higher practice of knowledge conversation (from tacit to explicit, or tacit to tacit, or explicit to explicit or explicit to tacit knowledge) is more likely to be innovative in all dimensions. As tacit knowledge is an abstract that dwells in individuals' minds, it requires reasonable experience to transform it into explicit knowledge. The result supports the theory of organizational knowledge creation (Nonaka, 1994) and is consistent with prior studies (Byosiere and Luethge, 2008; Lee et al., 2005) that have shown KCOV is an essential driver of innovation.

The findings of this study also show that organizational factors (i.e. OGCUL and LMS) have a strong significant relationship with KM dimensions. It suggests that the success of the KM process highly depends on an organization's culture, which entails a sense of security, a lack of fear, openness, trust and transparency. Moreover, good LMS create a conducive environment for KM practices such as employee interaction, which increases the culture of sharing, learning and creating new ideas. It also makes resources available for a KM strategy that leads firms to be knowledge-intensive and enhances the quality of the decision-making process. In addition, KSHR significantly mediates the relationship between organizational factors (both OGCUL and LMS) and innovation, suggesting organizational factors are a valuable source of KM and, subsequently, innovation. Our study provides consistent results with previous studies that have found organizational factors encourage dialog between employees or groups, which is the basis for knowledge creation and innovation (De Long and Fahey, 2000; McDermott and O'Dell, 2001; Lee et al., 2012; Lee and Choi, 2003; Hsu et al., 2014; Wang et al., 2011; De Long and Fahey, 2000; Kog et al., 2019; Lin, 2007; Lee et al., 2012; Noruzy et al., 2013; Lee and Choi, 2003; Chang et al., 2015). Overall, the results confirm the theoretical view that knowledge is an asset that resides in individuals' minds, groups or organizational processes.

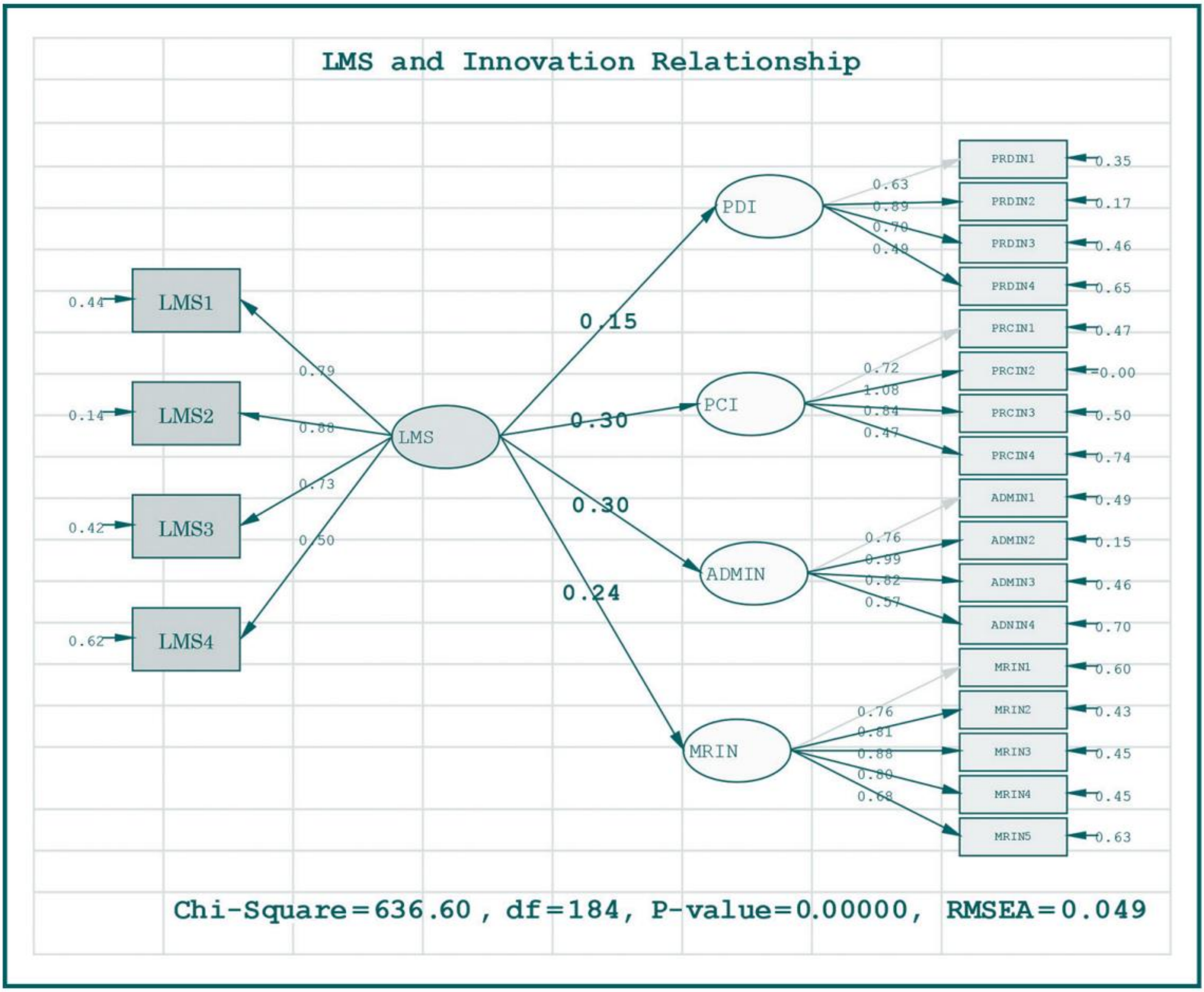

Figure 8 Effect of LMS on innovation

The role of KM is multi-faceted. For example, it initiates knowledge-based action, increases competitive advantage, creates an innovative culture and improves decision-making, customer service and productivity. Besides this, it is essential to understand the types and sources of knowledge to well link them to corporate core values. In this respect, according to De Long and Fahey, 2000, knowledge can appear in three modes:

1. human knowledge that refers to individual know-how or knows howto do;
2. social or collective knowledge-exists in social interaction, e.g. in research teams; and
3. structural knowledge-exists in a system, tools or process of an organization.

It can be concluded from this view that the effectiveness of KM relies on the firm's capacity to identify how and where knowledge can be obtained and integrated with corporate strategy.

5.1 Theoretical contributions

Theoretically, the current research extends and refines leadership, KM and the innovation literature in a variety of ways: first, the findings of this study provide empirical support for integrating the dynamic KM capability perspective (Gold et al., 2001) and the knowledge-based view (Kogut and Zander, 1992; Grant, 1996) by underscoring the mediating role of KSHR in the positive linkage between organizational factors (i.e. OGCUL and LMS) and organizational innovation.

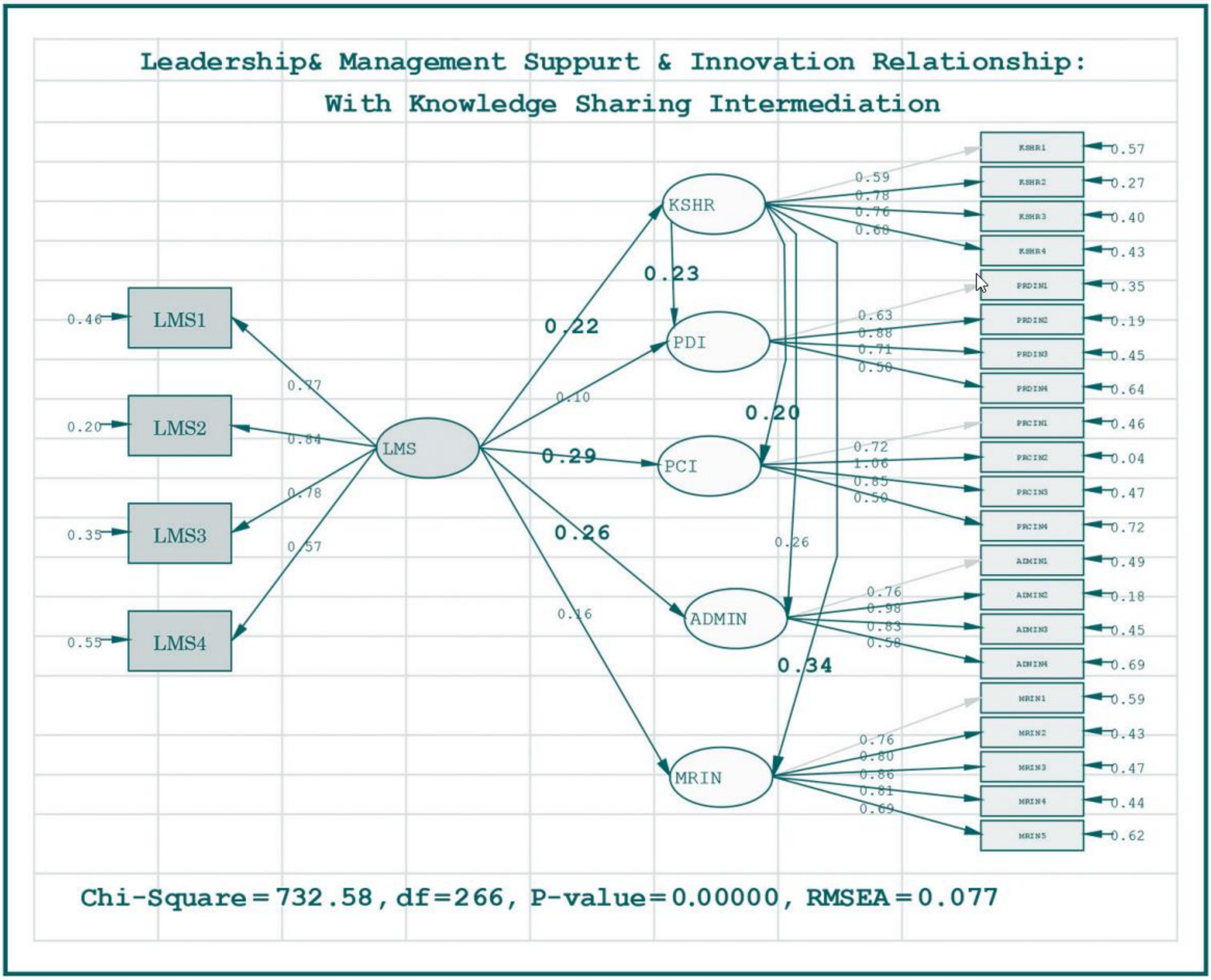

Figure 9 Effect of LMS on innovation: the mediating role of KSHR

Second, many scholars have indicated that organizational factors such as OGCUL, leadership and top management support are crucial antecedents of a company's ability to innovate. Many authors have recently explored the impact of various organizational factors on KM and various organizational outcomes. Despite the growing research interest in organizational factors, KM and innovation, only a few studies have presented empirical evidence linking various organizational factors and KM processes to innovation effectiveness. Furthermore, our results prove the complete mediating role of KM in the relationship between organizational factors and innovation. Therefore, our study contributes to the current growing literature on direct effects, indirect effects and total effect analysis (Baron and Kenny, 1986; MacKinnon etal., 2012).

5.2 Practical implications

The findings of this study would serve as a guide for policy-makers and managers of manufacturing firms in developing countries in the formulation of policies and long-term strategies. It may also provide a better understanding of the causal relationship between organizational factors, KM and innovation, which in turn has value to directors and managers in manufacturing firms in developing countries as a reference for building a good OGCUL, serving as practical guidance for effective leadership and providing organizational or management support. Specifically, our findings would have the following practical implications: first, firms need to have a combination of KM processes (such as acquisition, storage, sharing and conversion). In practice, developing countries such as Ethiopia have based their innovation strategy on knowledge and technology acquisition through encouraging foreign direct investment. It is not in doubt that Ethiopia has been benefiting from the strategy as a lot of foreign companies have opened their subsidiaries in the country. However, in our view, more emphasis on KAC strategy would not take a firm a long time to sustain its innovative activity because it is likely available to firms operating in the same industry, as well as it may hurt a firm's competitive advantage. In addition, by its nature, knowledge may not be retained for future use; it may expire soon.

Second, the current highly impulsive and rapid change in the business environment changes the way firms have to operate and deliver products or services. Knowledge (both tacit and explicit) is a resource that can provide a competitive advantage if used well for the intended purpose. In real practice, firms often face challenges in determining where to get knowledge from and how to value or manage it. Besides, knowledge can be obtained from three sources:

1. knowledge can exist in individuals' minds (skills, experience, ideas and insight);
2. knowledge can dwell in a group, which we can call collective knowledge (a team of scientists or researchers); and
3. knowledge can be embodied in an organization's systems, tools, procedures, policies, etc.

Knowledge cannot be a valuable resource unless it is obtained and used in designing or producing a product or service. To integrate knowledge with business strategies, there should be a platform or framework that helps to manage it properly. Firm managers, policymakers and other concerned bodies would consider the three sources of knowledge to foster innovative activities and obtain a competitive advantage. In addition, we recommend more emphasis be placed on firm-specific factors (such as OGCUL, LMS and KM) to enhance the innovative capacity of a firm.

Finally, the most critical issue to be raised while designing an innovation strategy would be employees' willingness and passion to collaborate with others to develop new ideas, share ideas or implement policies. As knowledge resides in individuals' minds, the knowledge holder should have a passion to share it with those working with him or her. In practice, KSHR depends extremely on the passion and voluntariness of the two parts: knowledge provider and receiver. Therefore, firm managers would design a platform on how to motivate individuals to share their skills, experience and ideas with others by providing incentive packages, punishment and commitment. In this regard, we believe that our results would help individuals who are in the position to manage or regulate the manufacturing sector in designing innovation policies, KM policies or technology management policies and business strategies.

5.3 Limitations and direction for future research

This study has three potential limitations: first, this study is based on a cross-sectional research design. Future research should include longitudinal design to get in-depth insights into the causal inferences. Second, only a few Ethiopian medium- and large-scale manufacturing firms were included in the sample. As a suggestion for future research, other researchers can include small-scale enterprises using large sample sizes and should examine the effects of organizational factors, KM and innovation across different industries. Finally, this study has only focused on investigating the mediating role of KSHR between organizational factors and innovation. Future research should test the mediating role of the KM process and its constituents (KAC, KCOV, KSHR and KSTR) between organizational factors and specific aspects of innovation to gain a full understanding of the critical role of KM in organizational innovation.

6. Conclusion

Knowledge is an intangible organizational resource that could provide a competitive advantage if properly acquired and used in a production process. Like other tangible resources, knowledge needs to be managed to get the most use out of it. KCOV, KAC, KSHR and KSTR are valuable dimensions of KM. The result gives a basis to conclude that a combination of KCOV, KSHR, KAC and KSTR would enable firms to become knowledgeintensive, which improves the quality of decisions and their ability to solve problems. Furthermore, organizational factors (i.e. OGCUL and LMS) appeared to be the essential enablers of KM. Where OGCUL encourages sharing ideas with passion among employees, more innovative ideas or knowledge will emerge and be implemented. LMS also play a vital role in encouraging KSHR, which in turn enhances innovation. On the other hand, leadership is a device that nurtures motivation, skills and competence for employees and fosters the successful generation and implementation of knowledge. From this perspective, we can infer that a KM system cannot function well without a good OGCUL and leadership and top management support.

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Appendix 1

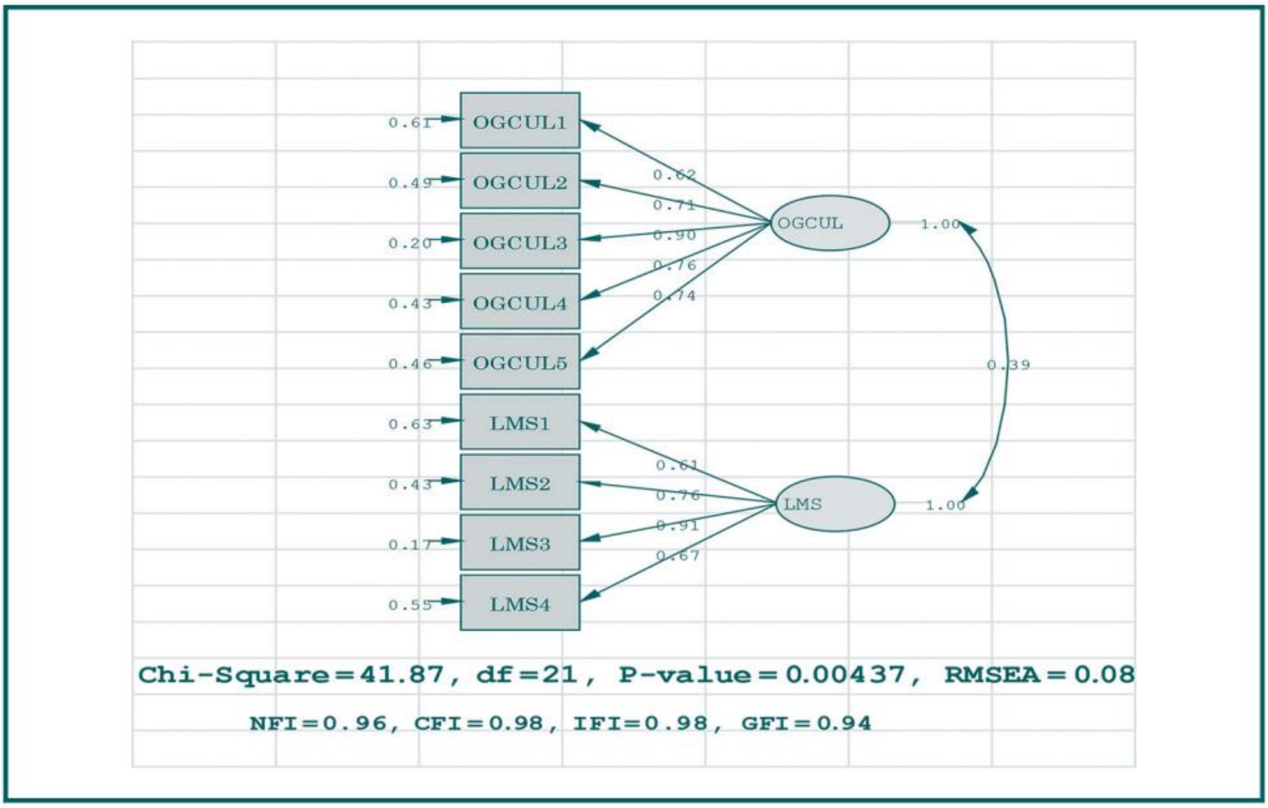

Figure A1 An organizational factors measurement model

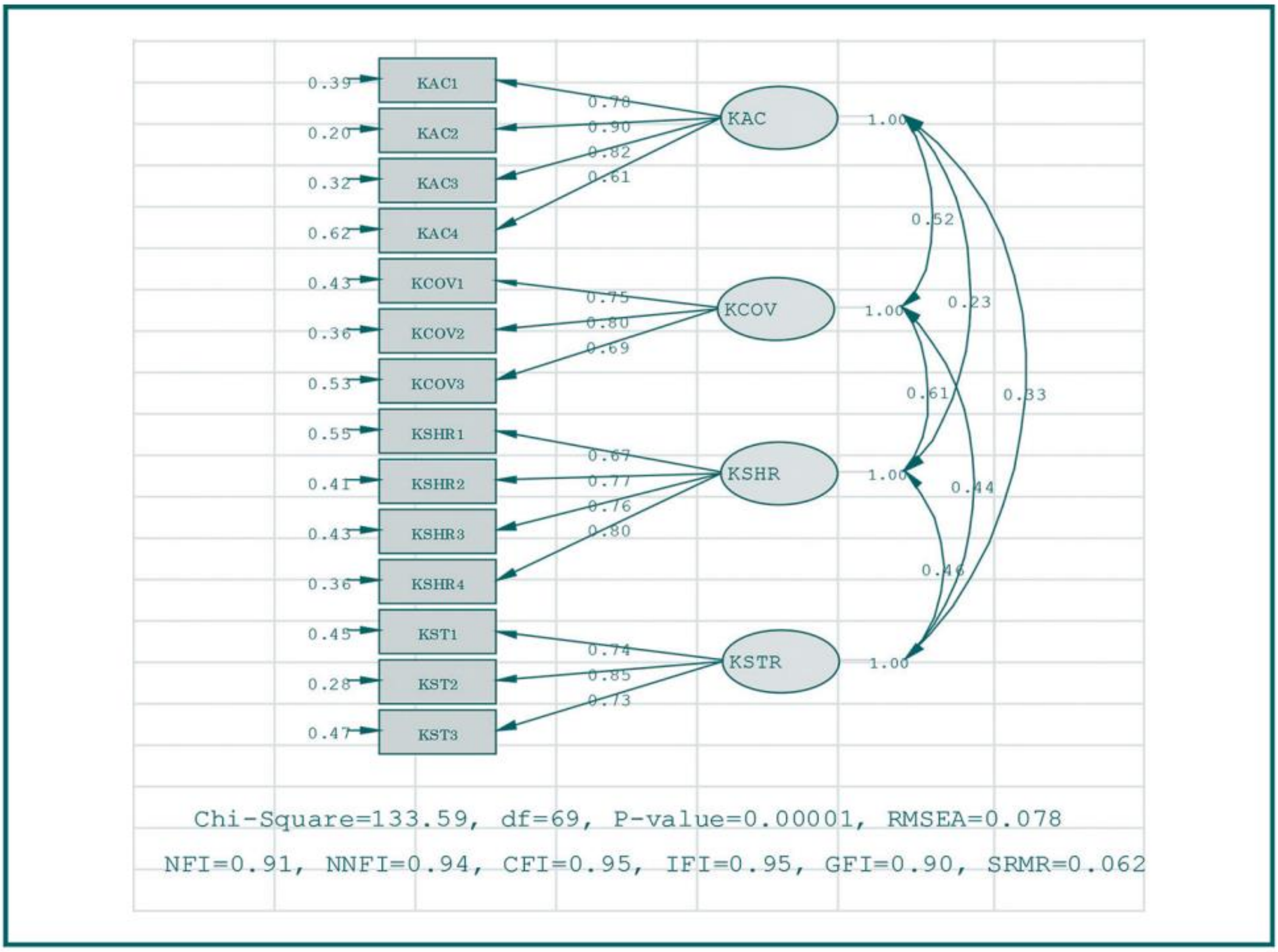

Figure A2 KM measurement model

Appendix 2

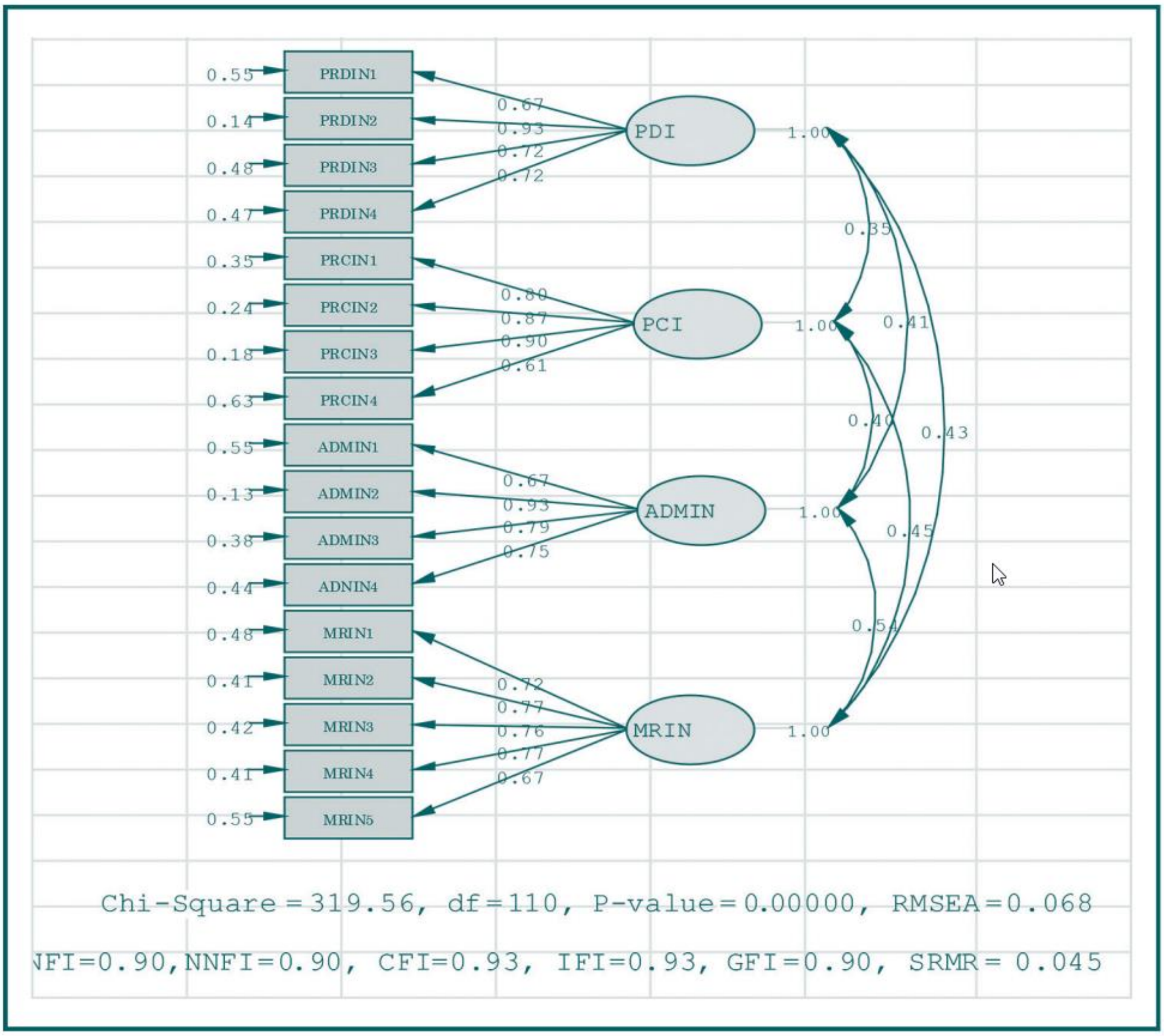

Figure A3 Innovation measurement model

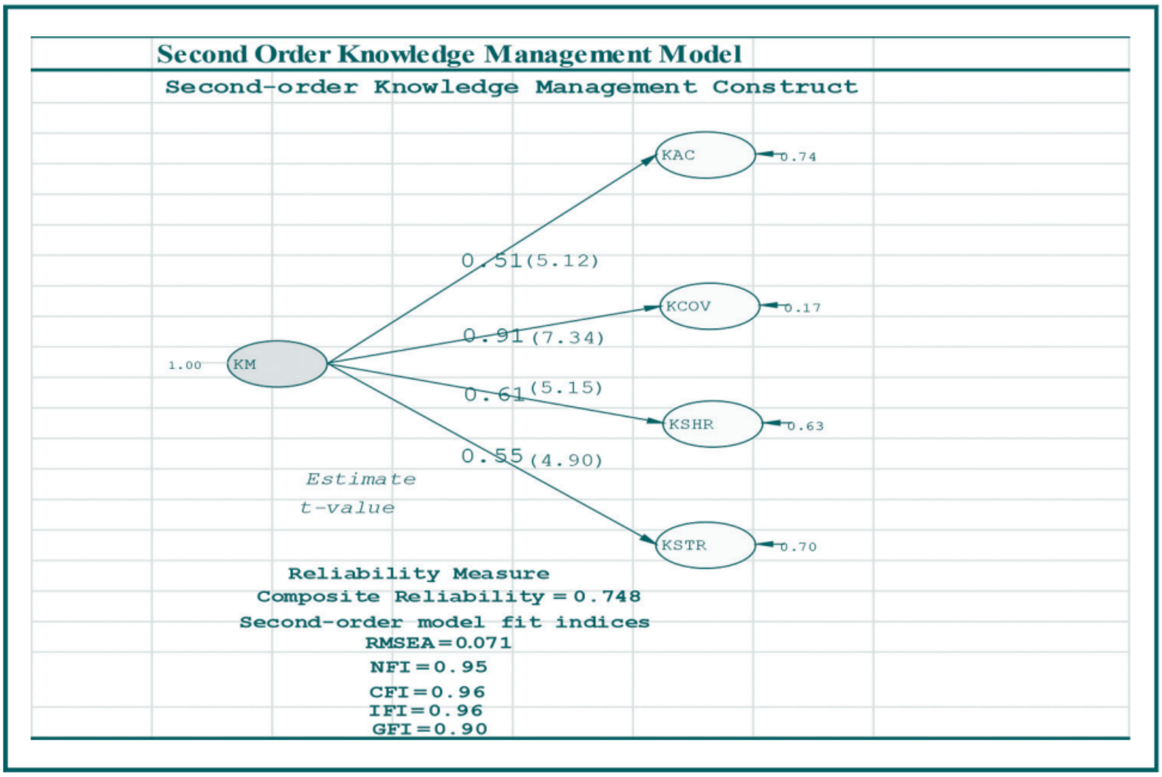

Figure A4 Second-order KM model

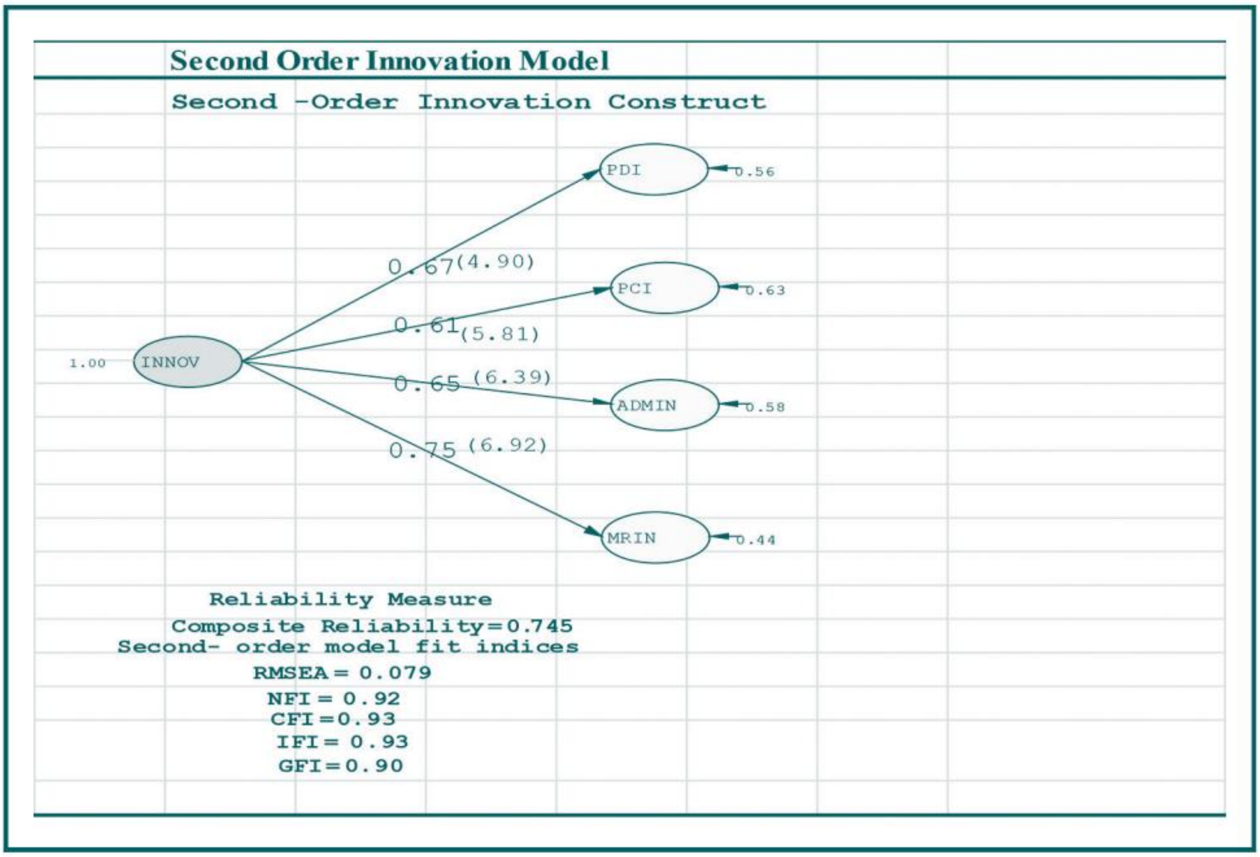

Figure A5 Second-order innovation model

Table A1 Items to measure organizational factors, KM and innovation

		Standard loading
OGCUL		
OGCUL1	Our organization established procedures for governing daily activities	0.62
OGCUL2	The speed of knowledge exchange among our organization's employees is good	0.71
OGCUL3	In our organization, open sharing of knowledge is encouraged	0.90
OGCUL4	Our organization values openness, collaboration and trust for invention and innovation	0.76
OGCUL5	Our organization values learning, sharing and applying knowledge	0.74
LMS		
LMS1	Our top management permits and creates an atmosphere for KSHR	0.61
LMS2	Our top management emphasizes the security of jobs and stability in relationships	0.76
LMS3	Leaders/managers generate high levels of motivation and commitment in the workforce	0.91
LMS4	Our organization encourages teamwork and participation	0.67
KAC dimension		
KAC1	We attend courses, seminars or other training for skill development	0.78
KAC2	We actively participate in an outside professional network like industry associations, conferences, etc.	0.90
KAC3	Exit interviews are carried out to capture critical knowledge and experience when our employees leave our organization	0.82
KAC4	We hire consultants when important skills/expertise or information about any activity is not available in our organization	0.61
KSHR dimension		
KSHR1	Problems related to processes are discussed openly in our organization	0.67
KSHR2	Mechanisms are in place to encourage members of an organization to share information	0.77
KSHR3	There is informal communication for KSHR in our organization	0.76
KSHR4	There is a structured induction program for new employees	0.80
KCOV dimension		
KCOV1		0.75

(*continued*)

Table A1

		Standard loading
	We have a team to study and communicate the market scenario to the management for further action	
KCOV2	Brainstorming sessions among employees, managers and top management are frequently used for solving problems	0.80
KCOV3	We research to explore future possibilities of expansion in terms of capacity, markets, etc.	0.69
KSTR dimension		
KST1	Our company regularly stores knowledge (has archives) on the implementation and contents of the research process	0.74
KST2	Our company has well-organized documentation on the knowledge and achievements of employees	0.85
KST3	Following the achievement of significant work results, Our company conducts interviews with operators on the work process	0.73
PDI		
PRDIN1	The level of the newness (novelty) of our firm's new products	0.67
PRDIN2	The speed of our new product development	0.93
PRDIN3	The number of new products our firm has introduced to the market	0.72
PRDIN4	The number of our new products that are first to market (early market entrants)	0.72
PCI		
PRCIN1	The technological competitiveness of our company is high	0.80
PRCIN2	The speed at which we adopt the latest technological innovations in our processes is very high	0.87
PRCIN3	There is the novelty of the technology used in our processes	0.90
PRCIN4	Our processes, techniques and technology are changing at a rapid pace	0.61
ADMIN		
ADMIN1	We designed the ISO9001 or ISO/TS16949 QMS around its business processes	0.67
ADMIN2	We have clear, standardized and documented process instructions that are well understood by our employees	0.93
ADMIN3	We make extensive use of statistical techniques to improve the processes and reduce variation	0.79
ADMIN4	We are engaged in an active competitive benchmarking program to measure our performance against the "best practice" in the industry	0.75
MRIN		
MRIN1	Our company is creative in its methods of marketing operations	0.72
MRIN2	Our company is frequently the first to introduce new products and services to the market	0.77
MRIN3	Our new product introduction has increased over the past five years	0.76
MRIN4	Our company frequently tries out new ideas	0.77
MRIN5	Our company seeks out new ways to do things	0.67

Appendix 3

Table A2 Descriptive Statistics and Univariate Normality Test

Item	*Mean*	*SD*	*Skewness*	*Kurtosis*
OGCUL1	2.7386	0.99849	−0.137	−0.459
OGCUL2	2.8824	0.93851	−0.198	−0.049
OGCUL3	2.9804	0.89935	0.094	0.115
OGCUL4	3.0915	0.91306	0.132	−0.263
OGCUL5	3.085	0.97298	−0.129	−0.58
LMS1	3.098	1.08072	−0.324	−0.527
LMS2	3	1.02598	−0.111	−0.367
LMS3	2.7778	1.04013	0.067	−0.529
LMS4	2.9216	0.94958	−0.029	−0.335
KAC1	2.8824	0.92439	−0.269	−0.49
KAC2	2.8824	0.99301	−0.047	−0.327
KAC3	3.0784	0.89978	−0.211	0.142
KAC4	3.1569	0.98754	−0.321	−0.188
KCOV1	2.7059	0.90235	0.019	−0.19
KCOV2	2.817	0.983	0.039	−0.55
KCOV3	2.8889	1.00365	0.028	−0.541
KSHR1	3.1242	0.96191	−0.207	−0.281
KSHR2	3.0915	0.94144	−0.28	−0.359
KSHR3	2.9477	0.98536	0.022	−0.256
KSHR4	3.0327	0.94185	−0.066	−0.214
KST1	2.8627	0.93231	−0.314	−0.424
KST2	2.8562	0.98954	0.005	−0.477
KST3	2.902	0.95121	−0.22	−0.352
PRDIN1	2.7908	0.86339	−0.016	−0.046
PRDIN2	2.8235	0.98085	0.15	−0.35
PRDIN3	2.8758	0.97549	0.037	−0.308
PRDIN4	2.8889	0.94281	0.034	−0.697
PRCIN1	2.8758	0.98889	0.294	−0.123
PRCIN2	2.8824	1.08179	0.174	−0.718
PRCIN3	2.9346	1.08624	−0.025	−0.611
PRCIN4	3.0065	0.98339	0.071	−0.23
ADMIN1	2.7908	1.03016	0.284	−0.311
ADMIN2	2.8301	1.06246	0.079	−0.676
ADMIN3	2.9542	1.06586	0.059	−0.553
ADNIN4	3.0131	1.01946	−0.14	−0.456
MRIN1	3.0065	1.10321	−0.073	−0.54
MRIN2	2.9739	1.03839	0.017	−0.614
MRIN3	3.0327	1.10274	0.054	−0.439
MRIN4	3.0392	1.0443	−0.044	−0.381
MRIN5	3.0588	1.04652	−0.119	−0.456

Appendix 4

Table A3 Underlying bivariate test for some observed variables

(PE=Pearson Product Moment, PC=Polychoric, PS=Polyserial)

		Test of Model			Test of Close Fit	
Variable vs Variable	*Correlation*	*Chi-Squ.*	*D.F.*	*P-Value*	*RMSEA*	*P-Value*
KAC2 vs LMS3	0.187 (PC)	29.745	15	0.013	0.080	0.760
KAC2 vs LMS4	0.181 (PC)	27.660	15	0.024	0.074	0.823
KAC2 vs KAC1	0.812 (PC)	17.413	15	0.295	0.032	0.986
KAC3 vs OGCUL1	0.114 (PC)	8.737	15	0.891	0.000	1.000
KAC3 vs OGCUL2	0.193 (PC)	16.189	15	0.370	0.023	0.991
KAC3 vs OGCUL3	0.093 (PC)	19.168	15	0.206	0.043	0.974
KAC3 vs OGCUL4	0.127 (PC)	27.379	15	0.026	0.073	0.831
KAC3 vs OGCUL5	0.037 (PC)	13.149	15	0.591	0.000	0.998
KAC3 vs LMS1	0.333 (PC)	8.658	15	0.895	0.000	1.000
KAC3 vs LMS2	0.278 (PC)	21.759	15	0.114	0.054	0.947
KAC3 vs LMS3	0.174 (PC)	19.179	15	0.206	0.043	0.974
KAC3 vs LMS4	0.166 (PC)	22.976	15	0.085	0.059	0.928
KAC3 vs KAC1	0.687 (PC)	24.559	15	0.056	0.065	0.899
KAC3 vs KAC2	0.816 (PC)	6.033	15	0.979	0.000	1.000
KAC4 vs OGCUL1	0.144 (PC)	11.585	15	0.710	0.000	0.999
KAC4 vs OGCUL2	0.274 (PC)	15.706	15	0.402	0.018	0.993
KAC4 vs OGCUL3	0.098 (PC)	10.805	15	0.766	0.000	0.999
KAC4 vs OGCUL4	0.045 (PC)	15.101	15	0.444	0.007	0.994
KAC4 vs OGCUL5	0.059 (PC)	22.306	15	0.100	0.056	0.939
KAC4 vs LMS1	0.320 (PC)	27.046	15	0.028	0.072	0.840
KAC4 vs LMS2	0.155 (PC)	19.073	15	0.210	0.042	0.975
KAC4 vs LMS3	0.122 (PC)	32.729	15	0.005	0.088	0.658
KAC4 vs LMS4	0.191 (PC)	23.263	15	0.079	0.060	0.923
KAC4 vs KAC1	0.430 (PC)	33.291	15	0.004	0.089	0.638
KAC4 vs KAC2	0.551 (PC)	28.592	15	0.018	0.077	0.796
KAC4 vs KAC3	0.661 (PC)	21.533	15	0.121	0.053	0.950
KCOV1 vs OGCUL1	0.312 (PC)	9.525	15	0.849	0.000	1.000
KCOV1 vs OGCUL2	0.310 (PC)	17.791	15	0.274	0.035	0.984
KCOV1 vs OGCUL3	0.110 (PC)	21.414	15	0.124	0.053	0.951
KCOV1 vs OGCUL4	0.221 (PC)	23.104	15	0.082	0.059	0.926
KCOV1 vs OGCUL5	0.322 (PC)	18.593	15	0.233	0.040	0.979
KCOV1 vs LMS1	0.344 (PC)	26.113	15	0.037	0.070	0.864
KCOV1 vs LMS2	0.246 (PC)	13.189	15	0.588	0.000	0.998
KCOV1 vs LMS3	0.385 (PC)	19.448	15	0.194	0.044	0.972
KCOV1 vs LMS4	0.355 (PC)	21.705	15	0.116	0.054	0.947
KCOV1 vs KAC1	0.314 (PC)	11.815	15	0.693	0.000	0.999
KCOV1 vs KAC2	0.339 (PC)	24.255	15	0.061	0.064	0.905
KCOV1 vs KAC3	0.347 (PC)	19.192	15	0.205	0.043	0.974
KCOV1 vs KAC4	0.359 (PC)	30.750	15	0.009	0.083	0.727
KCOV2 vs OGCUL1	0.288 (PC)	10.595	15	0.781	0.000	1.000
KCOV2 vs OGCUL2	0.255 (PC)	18.004	15	0.262	0.036	0.982
KCOV2 vs OGCUL3	0.183 (PC)	23.448	15	0.075	0.061	0.920
KCOV2 vs OGCUL4	0.214 (PC)	13.427	15	0.569	0.000	0.997
KCOV2 vs OGCUL5	0.210 (PC)	15.772	15	0.397	0.018	0.992
KCOV2 vs LMS1	0.372 (PC)	20.532	15	0.152	0.049	0.961
KCOV2 vs LMS2	0.371 (PC)	12.740	15	0.622	0.000	0.998
KCOV2 vs LMS3	0.415 (PC)	18.553	15	0.235	0.039	0.979
KCOV2 vs LMS4	0.459 (PC)	9.463	15	0.852	0.000	1.000
KCOV2 vs KAC1	0.349 (PC)	15.343	15	0.427	0.012	0.994
KCOV2 vs KAC2	0.404 (PC)	26.896	15	0.030	0.072	0.844
KCOV2 vs KAC3	0.317 (PC)	11.982	15	0.680	0.000	0.999
KCOV2 vs KAC4	0.459 (PC)	26.366	15	0.034	0.070	0.858
KCOV2 vs KCOV1	0.652 (PC)	28.469	15	0.019	0.077	0.800
KCOV3 vs OGCUL1	0.115 (PC)	15.793	15	0.396	0.019	0.992

(*continued*)

Table A3

Correlations and Test Statistics (PE=Pearson Product Moment, PC=Polychoric, PS=Polyserial)						
	Test of Model				Test of Close Fit	
Variable vs Variable	Correlation	Chi-Squ.	D.F.	P-Value	RMSEA	P-Value
KCOV3 vs OGCUL2	0.197 (PC)	14.774	15	0.468	0.000	0.995
KCOV3 vs OGCUL3	0.136 (PC)	22.810	15	0.088	0.058	0.931
KCOV3 vs OGCUL4	0.225 (PC)	17.763	15	0.275	0.035	0.984
KCOV3 vs OGCUL5	0.162 (PC)	14.118	15	0.517	0.000	0.996
KCOV3 vs LMS1	0.151 (PC)	14.043	15	0.522	0.000	0.997
KCOV3 vs LMS2	0.193 (PC)	26.660	15	0.032	0.071	0.850
KCOV3 vs LMS3	0.254 (PC)	28.829	15	0.017	0.078	0.789

Table A3

Indices statistics	Model 1	Model 2	Model 3	Recommended cut-off rule	Reference
χ^2	41.87	133.59	319.56	–	
Df	21	69	110	–	
p-value	0.004	0.000	0.000	> 0.05	
χ^2/df	1.99	1.93	2.90	< 5	Wheaton *et al.* (1977)
RMSEA	0.08	0.078	0.068	< 0.1	Steiger and Lind (1980)
SRMR	–	0.062	0.045	< 0.08	Hu and Bentler (1999)
NFI	0.96	0.91	0.90	> 0.90	Bentler and Bonett (1980)
NNFI	–	0.94	0.90	> 0.90	Bentler and Bonett (1980)
CFI	0.98	0.95	0.93	> 0.90	Bentler (1990)
IFI	0.98	0.95	0.93	> 0.90	Bentler (1990)
GFI	0.94	0.90	0.90	≥ 0.90	Jöreskog and Sörbom (1989)

Source: Adopted from Kalko *et al.* (2022)