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Article

Linking knowledge management practices with innovation through the lens of team creativity: Moderating role of proactiveness

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Abstract: Current study examines the intervening role of team creativity for the relationship of four kinds of KM practice with innovation and the moderating effect of proactiveness in IT companies based on a Knowledge-Based View (KBV). Data was collected from 316 employees of IT companies who engage in software development in teams with the help of a simple random sampling method. Results indicate that KM practices have a positive impact on innovation. Also, team creativity plays mediating role in the relation of two KM practices i.e., knowledge sharing and knowledge application with innovation. Whereas proactiveness plays a positive moderating role in the relation of knowledge application and knowledge generation with innovation. Moreover, it plays a negative moderating role in relation of Knowledge sharing with innovation. This research adds to the body of literature by suggesting a framework of knowledge diffusion, knowledge storage, knowledge generation, knowledge application, team creativity, proactiveness, and innovation in a single model. This research also adds to the body of literature by proposing the intervening role of team creativity in the relationships of knowledge diffusion, knowledge storage, knowledge generation, and knowledge application, with innovation. The results of this research help the managers to use the team creativity concept to intervene in relation of knowledge diffusion, knowledge storage, knowledge generation, and knowledge application, with innovation. The results of the current study also give valuable insights to managers into why they can use the proactiveness to moderate the relations of knowledge diffusion, knowledge storage, knowledge generation, and knowledge application, with innovation. Current study adds in the body of literature by proposing the entire manuscript on the basis of two theories i.e., Knowledge-Based View (KBV) builds on and expands the RBV.

Keywords: KM practices; knowledge diffusion; knowledge storage; knowledge generation; knowledge application; innovation; team creativity; proactiveness

1. Introduction

Modern organizations operate in a knowledge-based environment, where the ability to harness and spreading knowledge has emerged as a critical driver of competitive advantage (Chan and Lau, 2021). Knowledge management practices, encompassing creating, storing, retrieving, and disseminating have been identified as critical mechanisms for fostering innovation (Nurnaninsih and Muthmainah, 2023). However, despite the extensive literature on knowledge management and innovation, the specific mechanisms through which these practices influence innovative outcomes remain a subject of ongoing investigation. According to previous research, innovation is a crucial concept that promotes long-term economic progress and competitive

advantage for both a country and individuals (Chen et al., 2018). Because of increased rivalry driven by globalization and the growth of global and regional economies, firms must innovate to stay in competition (Chen et al., 2018; Gu, 2022). One of the major characteristics of dynamic, competitive, and progressive firms is the capability of innovate (Dickel and Moura, 2016; Vovk et al., 2021). Due to importance of innovation, researchers are looking for mechanisms for enhancing the level of innovation (Donate and Pablo, 2015; Donate and Guadamillas, 2011; Hamdoun et al., 2018). In recent researches, researchers have recently found out how knowledge management (KM) techniques foster innovation (Lopez-Nicolás and Merono-Cerdán, 2011; Lai and Lin, 2012; Mardani et al., 2018). Some studies claim that KM is a key factor of a company's which enhance the level of innovation (Chaithanapat et al., 2022; Donate and Pablo, 2015). Organizations can gain a long-term competitive advantage by applying knowledge for new products and services, manufacturing processes, organizational practices, marketing tactics, and innovation (Costa and Monteiro, 2016; Trivedi and Srivastava, 2022). Indeed, with the increasing attention on KM and innovation, only a few research in developing countries have been done empirically about association of knowledge management practices with innovation in the context of IT companies. A recent bibliometric study found that very few studies found out the relationship of KM practices with innovation in developing nations (Gaviria-Marin et al., 2018).

Organizational rivalry is inevitable, and in order to effectively compete with each other, organisations constantly strive to understand what is happening in the marketplace, what their customers' demands are, and how the environment is changing (Kuncoro and Suriani, 2018). As a result, businesses try to figure out what to do with and how to manage a range of capacities in order to win the competition and get a competitive advantage through innovation (Kuncoro and Suriani, 2018). As a result, innovation is one of the primary forces behind value creation, which is crucial for both organisational success and the continuous survival of business (Alani, 2019). According to Hisrich and Ramadani (2017) and Singh et al. (2022), innovation is seen as a crucial component of an organizational future advances. Innovation is an important for organizational success and survival in the dynamic market situation (Lee and Trimi, 2021).

The current study considers the SMEs of IT companies as the target population. Information technology (IT) has an abundance of potential to boost a nation's economic growth through a variety of means, such as increased capital and labour productivity, more effective governance, and easier availability of services (Singh and Kaur, 2017; Singh and Singh, 2022). According to Biryukova and Matiukhina (2019), the IT sector has direct effects on spreading of information technology and services to remote parts of a nation, while its indirect effects include increasing labour productivity, the development of innovative clusters, and an influx of foreign direct investment. IT-based innovations give businesses access to larger markets, which boosts their growth, revenues, and client base (Javed, 2020). The information technology industry in Pakistan is a comparatively recent contributor to the country's GDP, but it has rapidly established itself as a significant portion of the economy, playing important roles in the industrial and service sectors, as well as agriculture. Pakistan's economy is having a difficult fiscal year in 2019–2020. Despite the

economic downturn, Pakistan's IT industry is growing quickly, offering enhanced services at affordable prices to the general public. According to the World Economic Forum, Pakistan is one of the most cost-effective countries for IT outsourcing (Mushtaq et al., 2022).

The IT industry is now one of the state's leading five net exporters, with the highest service sector export revenues (Global Services Location Index, 2019). Pakistani IT sector has experienced rapid expansion (Mustafa et al., 2018). With the government's support, Pakistan's IT sector has tremendous potential for expansion and has the potential to reach $10 billion in revenue (Javed, 2020). A startup culture is being fostered in Pakistan by the more than 300,000 English-speaking IT workers who are knowledgeable about both new and existing IT products and technologies, as well as the more than 20,000 IT graduates and engineers that are generated annually (Sadiq et al., 2021). In general, the IT industry boosts the economy by creating jobs, attracting foreign investment, and generating income for the government (Javed, 2020). These are the main reason that authors consider the SMEs of IT the sector as the target population.

Current research identifies the following gaps. From the best of researcher's knowledge, no previous research has presented the entire model in which present four dimensions of KM practices, innovation, team creativity and proactiveness in a single model. Secondly, this research initial effort to propose proactiveness as a mediator for the relation of different KM dimensions with innovation. Thirdly, from best of researcher knowledge, no previous research examined the dimensional effect of KM practices with innovation in IT firms in the Pakistani cultural context. Fourthly, no previous research had applied the RBV and Knowledge-Based View (KBV) to explain the entire model.

1.1. Contribution

This research contributes in literature and theory due to following reasons. Firstly, the article presents how four dimensions of KM practices interact with innovation via the team creativity path. Secondly, this research adds to the body of literature, by proposing proactiveness as a mediator for the relation of different KM dimensions with innovation. Thirdly, the research examines how dimensions of KM practices link with innovation in IT firms in the Pakistani cultural context. Fourthly, the RBV is built and extended by the Knowledge-Based View (KBV) in the current study.

1.2. Objectives

Following are the research objectives.

To check the impact of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application on innovation.

To check the impact of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application on team creativity.

To check the impact of team creativity on innovation.

To check the mediating impact of team creativity for the relation of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application with innovation.

To check the moderating impact of team creativity for the relation of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application with innovation.

2. Literature review

2.1. Theoretical background of knowledge management

The firm's Knowledge-Based View (KBV) builds on and expands the RBV, focusing on how companies develop, protect, acquire, use and transfer Knowledge (Grant, 1996; Nonaka and Toyama, 2015). The basic function of the organization, according to Nonaka (1994), is to generate and utilize Knowledge. It is observed that the alignment and intangible resources like knowledge resources is critical to innovation, despite its complexity (Silvia and Juan-Gabriel, 2014).

Practitioners and academics are growing more interested in KM as a field due to the importance of Knowledge (Gaviria-Marin et al., 2018), and organizations are increasing efficiency, gaining a sustainable competitive edge, and producing and safeguarding a company's intangible assets (Gaviria-Marin et al., 2018; Lopes et al., 2017). Despite their complexity, Silvia and Juan-Gabriel (2014) argue that the configuration and integration of intangible resources like knowledge-based resources are critical to innovation. Zhu et al. (2021) explain the term proactiveness on the basis of KBV.

2.2. Hypothesized research model

Figure 1 is about the hypothesized research model. Which shows the independent, mediator, moderator and dependent variables.

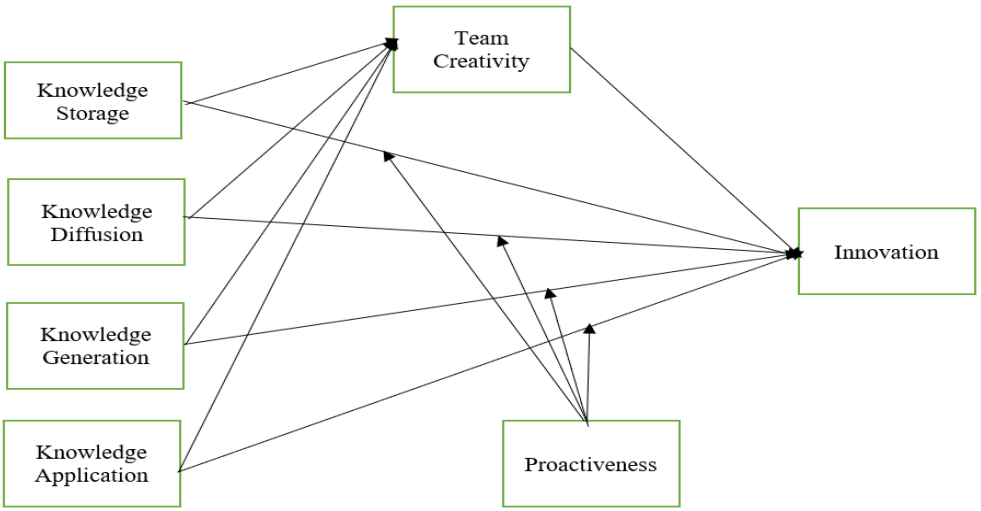

Figure 1. Hypothesized research model.

2.3. Relationship of knowledge management practices with innovation

According to Alegre et al. (2013), KM is organizational practices that describe the application and utilize the Knowledge. The process of knowledge generation and transmission was described about the conceptualizations of KM processes, with focus on explicit and tacit Knowledge (Dalmarco et al., 2017). While some researches

identify that storage and dissemination are the most important KM practices (Alegre et al., 2013), others have recognized assimilation, transformation, acquisition, and exploitation KM practices (Alegre et al., 2013; Xie et al., 2018).

Lai and Lin (2012) described three dynamic processes that reflect KM practices: (a) knowledge acquisition and creation, (b) knowledge storage (c) knowledge integration, and diffusion. Knowledge creation, application, and transfer were highlighted as the core KM processes by Al-Emran et al. (2018). The KM processes consist of storage, acquisition, sharing, codification, application, and creation (Costa and Monteiro, 2016). Knowledge creation has been identified as a precondition for innovation (Costa and Monteiro, 2016). Moreover, knowledge exploitation refers to how methods like knowledge transmission, application, and leverage of existing knowledge domains (Menaouer et al., 2015; Stankovic´ and Micic, 2018).

"Processes that facilitate the distribution of knowledge from one person, place, or ownership to the other is called knowledge transfer" (Hamdoun et al., 2018). Knowledge storage refers to a set of systems and methods for managing and storing information (Alegre et al., 2013). Knowledge storage has an impact on innovation (Lai et al., 2014). Knowledge application is a significant predictor of innovation (Hamdoun et al., 2018; Mardani et al., 2018).

Knowledge application, according to Boateng and Agyemang (2015), is a collection of activities within firms that allow them to apply and exploit Knowledge in ways that enhance operations, generate new Knowledge and create new products.

The central aspect of KM is knowledge application (KA), which makes Knowledge more applicable and proactive for the generation of company worth (Choi et al., 2010). Due to the sticky and implicit character of Knowledge, the KBV believes that its value is gained from its implementation (Jugend et al., 2015). Shujahat et al. (2017) argue that KA is more important than other procedures such as knowledge creation or shared Knowledge since Knowledge is worthless without application. According to Sarin and McDermott (2003), KA enables employees of a firm to achieve their goals.

Innovation in services is defined as "a new service experience or service solution that consists of one or several of the following dimensions: new service concept, new customer interaction, new value system/business partners, new revenue model, new organizational or technological service delivery system" (Hertog et al., 2010). A combination of people, technologies, existing services, and techniques to satisfy current and potential clients can also result in service innovation (Chen et al., 2016). In the view of Ode and Ayavoo (2020) innovation is defined as "the process of developing something new or a combination of existing services in new ways that are beneficial to a target audience".

It is also unclear how different knowledge management strategies affect innovation. A set of strategies, initiatives, and actions used by businesses to transfer, generate, store and apply, Knowledge is referred to as knowledge management practices (Donate and Pablo, 2015). Knowledge and KM roles in innovation are described by Plessis (2007) as facilitating the sharing of tacit Knowledge and codification. Previous research has found that effectively managing Knowledge improves a company's ability to innovate (Donate and Pablo, 2015; Donate and Guadamillas, 2011). KM procedures have an impact on innovation (Darroch and

McNaughton, 2002). KM practices have positive impact on innovation (Donate and Guadamillas, 2011; Nawab et al., 2015; Sadeghi and Rad, 2018). Donate and Guadamillas (2011) conducted their research on 111 Spanish companies which involve in innovation and find that KM practices have positive impact on innovation. Similarly, Nawab et al. (2015) conducted their research on middle management of SMEs and find that KM practices have positive impact on innovation. It is also noted that KM practices can help to increase product innovation. KM practices mediate the relation of diverse constructs with innovation, despite of direct relation between KM practices and innovation (Costa and Monteiro, 2016). According to López-Nicolás and Meroño-Cerdán (2011) KM practices (persuasion and codification) has positive impact on innovation. Knowledge acquisition and knowledge dissemination both has positive impact on innovation (Darroch, 2005). Research which was carried out on Fars governor in Iran and find that Knowledge acquisition, knowledge sharing and knowledge application has positive impact on innovation (Sadeghi and Rad, 2018).

Previous studies about KM and innovation have yielded varied results. For example, Inkinen et al. (2015) discovered that while KM can help promote innovation, not all of the activities are linked directly to innovation performance. While some data suggest that knowledge protection procedures have no significant impact on innovation (Inkinen et al., 2015), others indicate that every component of Knowledge increases a firm's ability to innovate (Wang et al., 2018). Knowledge acquisition has a strongly favorable effect on innovation (Xie et al., 2018); nevertheless, Darroch and McNaughton (2002) found that KM practices (acquisition, responsiveness to Knowledge, and dissemination) positively enhance innovation (Darroch and McNaughton, 2002). Shujahat et al. (2017), on the other hand, discovered that knowledge creation had an indirect impact on innovation. Knowledge-sharing techniques improve innovation (Wang and Wang 2012). According to Mardani et al. (2018), KM activities have a direct impact on innovation. The findings show that knowledge integration, creation, and application are all beneficial for innovation (Mardani et al., 2018). Organizations with the ability to manage Knowledge, will use resources more efficiently, be more inventive, and perform better than other organizations (Darroch, 2005). According to Ode and Ayavoo (2020), knowledge diffusion, storage, generation, and application are considered the dimensions of KM practice that can increase the level of innovation. So current study presents the following hypothesis in this regard.

H1: (a) Knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application have a positive impact on innovation.

2.4. Knowledge management (KM) practices and team creativity

Knowledge research has argued that knowledge content offers the raw ideas for developing new information (Cruz et al., 2007; Mathieu and Schulze, 2006), while knowledge processes allow teams to apply actual expertise and trigger the worth of certain Knowledge in team performance. According to Sung and Choi (2012), KM practices have a s positive impact on team creativity. Based on these facts current study argues the following hypothesis.

H2: (a) Knowledge diffusion, (b) storage, (c)generation and (d) application have a positive impact on team creativity.

2.5. Team creativity on innovation

Team creativity results in committed and motivated employees who become the source of creative behaviors which results in more innovations in their organizations (Yong et al., 2019). Research indicates that team creativity enhances the level of product innovation (Chan et al., 2016; Chen et al., 2018). Team creativity enhances the level of innovation (Somech and Drach-Zahavy, 2013). Sethi (2001) observed the impact of team creativity on product innovation. Moreover, Çokpekin and Knudsen (2012) studied the influence of organizational creativity on the process and product innovation and they find that creativity is at the team level and has a strong impact on product innovation and a weak impact on process innovation Thus, current research, argues the following hypothesis.

H3: Team creativity has positive impact on innovation.

2.6. Mediating role of team creativity

Team creativity results in committed and motivated employees who become the source of creative behaviors which result in more innovations in their organizations (Yong et al., 2019). Team creativity enhances the level of innovation (Somech and Drach-Zahavy, 2013). Sethi (2001) observed the impact of team creativity on product innovation. Moreover, Çokpekin and Knudsen (2012) studied the influence of organizational creativity on the process and product innovation. In most cases, team creativity is act as the dependent variable. But in a few cases this variable is treated as mediating variable e.g., Bornay-Barrachina and Herrero (2018) used this variable as a mediator for the relation of coworker relationships with performance. Similarly, Ogbeibu et al. (2020) used team creativity for the relation of HRM practices with product innovation. According to Greiner et al. (2007), KM practices may have an impact on both process and product innovation.

Research which was carried out by Waribugo et al. (2016) found that the impact of three kinds of knowledge management practices (i.e., knowledge acquisition, knowledge conversion, and knowledge application) had a positive impact on product innovation. Innovation is very in the shape of product and process innovations (Abbas et al., 2020; Saunila, 2020). Product and process innovation are two main kinds of innovation. So, the current study uses the combined variable of these kinds as innovation. Al-Sa'di et al. (2017) found that the impact of the unidimensional construct of KM practices had a positive significant impact on product and process innovation but this relation is stronger for product innovation as compared to process innovation. Similarly, Ashok et al. (2016) examines that impact of the unidimensional construct of KM practices has a positive significant impact on process innovation. Due to the above-mentioned facts current research proposes the following mediating hypothesis.

H4: Team creativity mediated the relation of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application with innovation.

2.7. Proactiveness as moderator

In organizations, creating a feeling of ownership towards the firm could be a

cause for proactive inquiry of innovation (e.g., Corbetta and Salvato (2004); Hernandez (2012); Pittino et al. (2018)). Proactivity stimulates participation in benefit initiatives by fostering a sense of common purpose (Chirico, 2008; Eddleston et al., 2010). This entrepreneurial environment will help businesses develop new ways to more effectively apply Knowledge (Martnez et al., 2016) that has historically been stored in a repository for creative concepts (Norrgren and Schaller, 1999) and hence enhance the company's current innovation (Li et al., 2006).

Innovation is a time-consuming, high-risk, resource-intensive, and unexpectedly unpredictable process that requires matching technologies to market opportunities and exchanging data with businesses (Li and Atuahene-Gima, 2001; Subramaniam and Youndt, 2005). Organizations are frequently associated with a risk-averse and conservative attitude (Huybrechts et al., 2013), which reinforces their proclivity to employ exploiting innovation techniques that focus on evolutionary advances (Fuetsch, and Suess-Reyes, 2017). Furthermore, according to the results of many types of research, companies invest less than in innovation but have a better conversion rate of innovation input to output (De Massis et al., 2013; Duran et al., 2016; Fuetsch and Suess-Reyes, 2017; Roed, 2016).

Few types of research have examined the role of proactiveness as a moderating variable in KM practices and innovation (Serrano-Bedia et al., 2018). According to García-Piqueres et al. (2019), proactiveness moderates the relationship between KM practice and kinds of innovation i.e., product and process innovation, allowing KM practices to have a positive impact on innovation. The current study considers the dimensions of KM practices (knowledge diffusion, storage, generation, and application) and find their impact on innovation. On the basis of stated facts current research proposes the moderating hypothesis as;

H5: Proactiveness positively moderates the relationship of (a) knowledge diffusion, (b) knowledge storage, (c) knowledge generation and (d) knowledge application with innovation

3. Research methodology

3.1. Target population, sample and data collection

To obtain the responses of respondents for analysis, this study uses a survey questionnaire. The target population consists of 1123 IT companies in Pakistan. The list was obtained from listed and regulated service firms on the website of P@SHA (P@SHA, 2023). This is official website of IT companies present in Pakistan. These organizations are engaged in innovative ideas by providing better solutions in different domains of IT sectors. The IT sector of Pakistan is very relevant for conducting this research because it is very significant for gaining more wealth in the Pakistan economy. Pakistan is the fifth most economically enticing place in the world for offshore production (Global Services Location Index, 2019). The Pakistani IT sector has experienced rapid expansion, with the world's largest firm among its regular clientele (Mustafa et al., 2018). The IT companies are very eager for innovation and knowledge management practices which is why these companies are very suitable for finding the relationship between KM practices and innovation.

As the list of IT companies are available at website of P@SHA (P@SHA, 2023),

So with the help of this site researchers make the list of 1123 IT companies. After that we choose 47 organizations that are located in the city of Lahore, and then data was collected from the employees of these selected IT firms who doing job in selected IT companies. The sampling procedure followed in this research are stages recommended for Structural Equation Modelling (SEM) investigations (Blunch, 2013). For SEM research, a sample size of 200 is considered fair, and 300 is considered good (Anderson and Gerbing, 1988; Iacobucci, 2010). That is why minimum sample of employees is good one. Overall, 474 questionnaires were distributed. Among these 327 returned. Eleven questionnaires were incomplete and excluded from the final analysis. So, 316 complete questionnaires were used in the final analysis.

3.2. Scale and measurements

This study proposed a scale to assess KM practices by adopting assessment statements of previous studies. A 7-point Likert type scale was used to assess all of the items. A 4 kinds of KM practices are used to assess KM practices (knowledge diffusion (KD), knowledge generation (KG), knowledge application (KA) and knowledge storage (KS)). To evaluate KG used a 12-item scale derived from Gold et al. (2001). Sample item: "Our company has processes for exchanging knowledge with our business partners." The alpha is 0.91 (Ode and Ayavoo, 2020). And there's a 12-statements test to test knowledge application (Gold et al., 2001). Sample item is "Our company has processes for using knowledge in development of new products/services". Alpha of reliability is 0.90 (Ode and Ayavoo, 2020).

Four items from Villar et al. (2014) and Alegre et al. (2011) were used to measure knowledge diffusion practices. Sample item is "Our company seeks out new ways to do things". Alpha of reliability is 0.82 (Ode and Ayavoo, 2020).

This study used 10 questions from Villar et al. (2014) and Alegre et al. (2011) (3 statements); Gold et al. (2001) (4 statements); and Lee (2014) (2 statements) to measure knowledge storage. Sample item is "Our company has processes to protect knowledge from inappropriate use outside the organization". Alpha of reliability is 0.88 (Ode and Ayavoo, 2020). To assess team creativity, six questions were adopted from (Mittal and Dhar 2016). Sample statement of this scale is "This team member suggests new ways to accomplish environmental goals". Cronbach's Alpha is 0.94 (Mittal and Dhar 2016). The three questions were used to assess proactiveness (Cronbach's alpha = 0.786) (Saha et al., 2017). Sample item is "We seek to exploit anticipated changes in future market conditions ahead of our rivals".

4. Results and discussions demographic table

Table 1 provides the information about the demographic variables of current study. These variables are treated as control variable in this research.

Table 1 provide the information about demographic characteristics which are present in shape of frequencies and percentages.

Table 1. Demographics findings.

Criteria	Category	Frequency (*n* = 316)	Percentage
Gender	Male	212	67.1
	Female	104	32.9
Age	21 to 30 years	156	49.4
	31 to 40 years	124	39.2
	41 to 50 years	25	7.9
	51 to 60 years	11	3.5
Education	Bachelor	186	58.9
	Master	117	37.0
	MS/MPhil	11	3.5
	PhD	2	0.6
Marital Status	Married	114	36.1
	Unmarried	196	62.0
	Divorced	4	1.3
	Widow	2	0.6
Income	Rs. 20K and Below	22	7.0
	Rs. 21K to Rs. 30K	44	13.9
	Rs. 31K to Rs. 40K	48	15.2
	Rs. 41K to Rs. 50K	59	18.7
	Above Rs. 50K	143	45.2

Note: $1~Rs. 185; *n*—316 Final Responses for Data Analysis.

4.1. Common method variance

The data for this study was collected in a single sitting over the course of four months and two days beginning in December 2021. Podsakoff et al. (2003) argued that CMV might arise when a researcher collects data in a single sitting. To circumvent this difficulty, both a priori and post-hoc remedies were used. Priori remedies included attachment of a cover letter, the use of different rating scale, and questionnaire pre-testing which help to reduce informant effort in responding. As post-hoc remedies, Harman single factor analysis and full collinearity test were used (Podsakoff et al., 2003). Harman single component analysis revealed that the first factor accounted for just: 20.685% which is less than 50% (Akter et al., 2017). Although, the calculated total variance of first factor was below 50%, it was close to the threshold. Therefore, the full collinearity test was also used to validate the findings of Harman single factor analysis. The VIF values of all constructs were between 1.000 and 1.909 (≤3.3), indicating that No CMV found in data in the data.

4.2. PLS-SEM findings measurement model assessment PLS-SEM analysis

The PLS-SEM analysis was applied using Smart PLS-4 (Ringle et al., 2015). Two stages process consisting the assessment of the measurement model and assessment of the structural model were followed as suggested by Hair et al. (2021).

4.3. Measurement model assessment

Cronbach's alpha, factor loadings, composite reliability (CR), discriminant validity and AVE, are all evaluated for the measurement model analysis phase. The results suggest that the first four parameters satisfied Hair et al threshold's criterion (i.e., α >0.7, AVE > 0.5, CR > 0.7, and Loading > 0.7), as shown in **Table 2**. It indicates that the model is reliable and has convergent validity.

In Factor loading we take the value of those items whose values greater than or equal to 0.60. On the bases of this fact we exclude one item of TC i.e., TC3, Two items of KG i.e., KG2 and KG8, one item KD i.e., KD2 because all these items have vale less than 0.60.

Table 2. Measurement model: VIF, reliability and convergent validity.

Construct	Code	Factor Loading	VIF	Cronbach's Alpha	Composite Reliability	Average Variance Extracted(AVE)
Innovation	IN1	0.753	1.910	0.915	0.928	0.539
	IN2	0.717	1.873			
	IN3	0.721	1.856			
	IN4	0.708	1.738			
	IN5	0.780	2.116			
	IN6	0.697	1.746			
	IN7	0.713	1.876			
	IN8	0.775	2.116			
	IN9	0.719	1.834			
	IN10	0.762	2.046			
	IN11	0.727	1.902			
Knowledge application	KA1	0.701	1.767	0.913	0.926	0.510
	KA2	0.708	1.682			
	KA3	0.690	1.714			
	KA4	0.718	1.955			
	KA5	0.696	1.695			
	KA6	0.758	1.995			
	KA7	0.695	1.792			
	KA8	0.751	1.938			
	KA9	0.728	1.908			
	KA10	0.710	1.704			
	KA11	0.712	1.921			
	KA12	0.702	1.866			
Knowledge diffusion	KD1	0.658	1.307	0.684	0.800	0.503
	KD3	0.647	1.307			
	KD4	0.709	1.252			
	KD5	0.810	1.300			

Table 2. (*Continued*).

Construct	Code	Factor Loading	VIF	Cronbach's Alpha	Composite Reliability	Average Variance Extracted(AVE)
Knowledge generation	KG1	0.711	1.759	0.892	0.911	0.508
	KG3	0.727	1.814			
	KG4	0.680	1.600			
	KG5	0.717	1.714			
	KG6	0.696	1.769			
	KG7	0.715	1.683			
	KG9	0.741	1.847			
	KG10	0.702	1.596			
	KG11	0.738	1.775			
	KG12	0.694	1.589			
Knowledge storage	KS1	0.707	1.675	0.903	0.920	0.534
	KS2	0.729	1.804			
	KS3	0.721	1.758			
	KS4	0.744	1.863			
	KS5	0.762	1.973			
	KS6	0.727	1.778			
	KS7	0.744	1.871			
	KS8	0.730	1.843			
	KS9	0.731	1.805			
	KS10	0.710	1.705			
Proactiveness	PA1	0.749	1.262	0.667	0.818	0.600
	PA2	0.790	1.347			
	PA3	0.785	1.299			
Team creativity	TC1	0.715	1.422	0.767	0.842	0.517
	TC2	0.724	1.367			
	TC4	0.714	1.459			
	TC5	0.703	1.419			
	TC6	0.737	1.398			

Note: VIF—Variance inflation factor, CR—Composite reliability, AVE—Average variance extracted.

Discriminant validity was also looked into to guarantee that each notion is significantly different from the others. To establish discriminant validity of the constructs, the HTMT technique is judged more reliable than cross-loading and the Fornell-Larcker criterion (Hair et al., 2021). **Table 3** demonstrated that each construct's HTMT value was less than 0.85, indicating that each construct in this research has sufficient discriminant validity. Further, the VIF test was used to identify collinearity before going on to structural model evaluation. Because all VIF values were less than 3, no collinearity issues in measurement models were discovered (Hair et al., 2021).

Table 3. HTM Matrix (HTMT < 0.85).

Construct	IN	KA	KD	KG	KS	PA	TC
IN							
KA	0.257						
KD	0.170	0.097					
KG	0.280	0.212	0.151				
KS	0.758	0.110	0.130	0.180			
PA	0.768	0.091	0.143	0.088	0.670		
TC	0.738	0.162	0.140	0.168	0.444	0.530	

Note: IN—Innovation, KA—Knowledge application, KD—Knowledge diffusion, KG—Knowledge generation, KS—Knowledge storage, PA—Proactiveness, TC—Team creativity.

4.4. Structural model assessment hypotheses testing

Once the measurement model was determined to be accurate and valid, the structural model was assessed. At this point, hypotheses are usually tested. Effect sizes, prediction relevance and coefficients of determination were all tested as well.

4.5. Structural model assessment

Figure 2 describe pictorial results of proposed model without moderation.

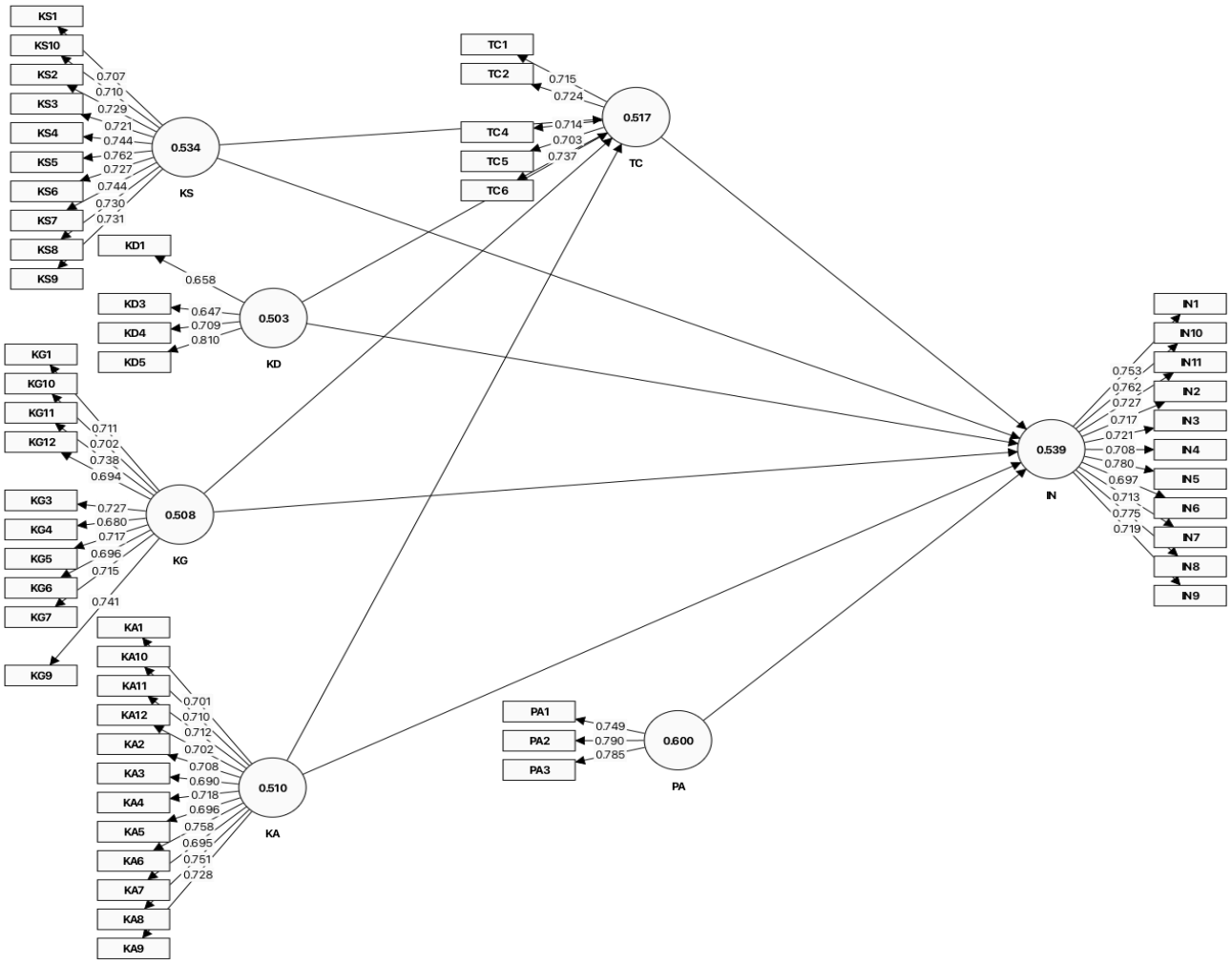

Figure 2. Structural model figure (without moderation).

Figure 3 describe pictorial results of proposed model with moderation.

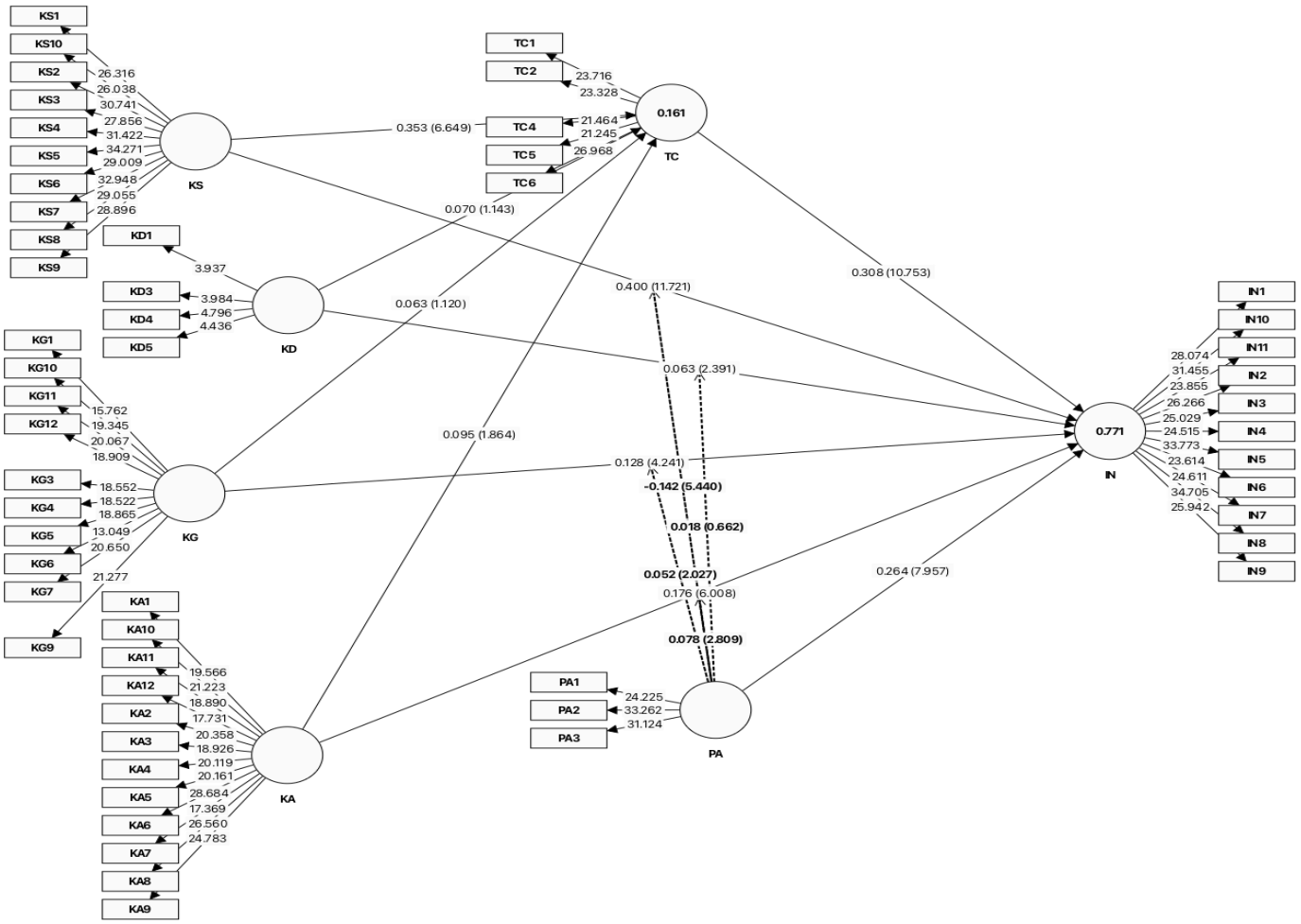

Figure 3. Structural model figure (with moderation).

As bootstrap method with 5000 iterations was used to test the indirect and direct relation (Hair et al., 2021). **Table 4** summarizes the findings. Results indicates that knowledge storage, and knowledge application have a positive impact on team creativity and knowledge diffusion and knowledge generation has positive insignificant impact on team creativity. As in previous researches Sung and Choi (2012) examined that impact of KM practices (other two kinds two kinds i.e., team knowledge stock and team knowledge utilization) has positive impact on TC. The of nature of impact is the same as the results of Sung and Choi (2012). But for the relationships of two kinds, it is insignificant i.e., for the relationships of knowledge diffusion and knowledge generation with team creativity.

While the hypotheses about the impact of kinds of KM practices on innovation are accepted. These results are similar to the results of Ode and Ayavoo (2020) about the impact of kinds of knowledge management on innovation. Because the study of Ode and Ayavoo (2020) also provides similar results as the three results are positive significant impact and one positive insignificant impact.

Table 4. Structural model: Hypotheses relationships.

Direct Relationships					
Relationship	**Path Coefficient**	**S.D**	***t*-value**	***p*-value**	**Decision**
KA →IN	0.141	0.030	4.745	0.000	Accept
KA → TC	0.095	0.051	1.864	0.031	Accept
KD → IN	0.052	0.027	1.891	0.030	Accept
KD → TC	0.070	0.061	1.143	0.127	Reject
KG → IN	0.111	0.030	3.661	0.000	Accept
KG → TC	0.063	0.056	1.120	0.132	Reject
KS → IN	0.403	0.036	11.257	0.000	Accept
KS → TC	0.353	0.053	6.649	0.000	Accept
PA → IN	0.276	0.032	8.602	0.000	Accept
TC → IN	0.345	0.029	11.792	0.000	Accept
Mediation					
Relationship	**Path Coefficient**	**S.D**	***t*-value**	***p*-value**	**Decision**
KA → TC → IN	0.033	0.018	1.817	0.035	Accept
KD → TC → IN	0.024	0.021	1.154	0.124	Reject
KG → TC→ IN	0.022	0.019	1.139	0.128	Reject
KS → TC → IN	0.122	0.021	5.717	0.000	Accept
Moderation					
Relationship	**Path Coefficient**	**S.D**	***t*-value**	***p*-value**	**Decision**
PA ×KA → IN	0.078	0.028	2.809	0.003	Accept
PA × KD → IN	0.018	0.028	0.662	0.254	Reject
PA × KS → IN	−0.142	0.026	5.440	0.000	Accept
PA × KG → IN	0.052	0.026	2.027	0.022	Accept

Note: IN—Innovation, KA—Knowledge application, KD—Knowledge diffusion, KG—Knowledge generation, KS—Knowledge storage, PA—Proactiveness, TC—Team creativity.

Similarly, two mediation hypotheses are positively significant in **Table 5**. These are the findings of this research as from the best of the researcher's Knowledge this research is an initial effort to check the mediational effect of team creativity for the four dimensions of knowledge management with innovation.

Table 5. Results of mediation.

Mediation					
Relationship	**Path Coefficient**	**S.D**	***t*-value**	***p*-value**	**Decision**
KA → TC → IN	0.033	0.018	1.817	0.035	Accept
KD → TC → IN	0.024	0.021	1.154	0.124	Reject
KG → TC → IN	0.022	0.019	1.139	0.128	Reject
KS → TC → IN	0.122	0.021	5.717	0.000	Accept

Table 6 provides the results of moderation. Likewise, two sub moderation hypotheses about the positive moderating effect of proactiveness for the relationship of knowledge application and knowledge storage with knowledge storage are accepted.

While two sub hypotheses are rejected about the moderating effect of proactiveness for the relationship of knowledge diffusion and knowledge generation with knowledge storage. Proactiveness negatively moderates the relationship of knowledge generation and innovation.

Table 6. Results of moderation.

Moderation					
Relationship	**Path Coefficient**	**S.D**	***t*-value**	***p*-value**	**Decision**
PA × KA → IN	0.078	0.028	2.809	0.003	Accept
PA × KD → IN	0.018	0.028	0.662	0.254	Reject
PA × KS → IN	−0.142	0.026	5.440	0.000	Reject
PA × KG → IN	0.052	0.026	2.027	0.022	Accept

Again, these are also findings because from the best of the researcher's knowledge, this research is an initial effort to check the moderation effect of proactiveness for the four dimensions of knowledge management with innovation. As, in the research García-Piqueres et al. (2019), proactiveness moderates the relationship between KM practice and kinds of innovation (product and process innovation) and gives the mix results.

4.6. Effect size (f^2), coefficient of determination (R^2), and predictive relevance (Q^2)

Table 7 additionally included effect size (f^2) values for each exogenous component based onthe PLS-SEM findings. It reveals that the exogenous variables in this study had a small, medium and large effect size on the endogenous constructs (Cohen, 2003).

Table 7. Effect size (f^2), coefficient of determination (R^2), and predictive relevance (Q^2).

Construct	f^2		R^2	Q^2
	IN	**TC**		
IN	-	-	0.771 (large)	0.664 (large)
KA	0.123 (small)	0.010 (small)	-	-
KD	0.017 (small)	0.006 (small)	-	-
KG	0.064 (small)	0.004 (small)	-	-
KS	0.465 (large)	0.144 (medium)	-	-
PA	0.188 (medium)	-	-	-
TC	0.310 (large)	-	0.161 (medium)	0.129 (small)

Note: IN—Innovation, KA—Knowledge application, KD—Knowledge diffusion, KG—Knowledge generation, KS—Knowledge storage, PA—Proactiveness, TC—Team creativity.

5. Conclusion

According to several authors, Knowledge is a crucial predictor of innovation. Several authors have currently explored the impact of various practices of knowledge management on different consequences. Despite the growing interest of researchers in

KM and innovation, only a few researchers have demonstrated quantitative evidence tying knowledge management practices to innovation effectiveness, specifically in the context of developing countries. This study covers gaps in the literature by offering a model that shows the impact of knowledge storage, diffusion, generation, and application with company innovation. The quantitative results of results confirm hypotheses about KM practices. This study demonstrates the mediating role of team creativity in IT organizations. This research not only proves that the impact of knowledge management practices (generation, application, storage, and diffusion) on innovation but also looks at how team creativity can assist to enhance the level of innovation. The current study also describes the role of proactiveness as a moderator for the relation of knowledge management practices with innovation. This study also broadens the domain of RBV by explaining all the proposed variables with the help of RBV.

Research limitations/implications—The results are based on self-reported data. This might result in common method variation. In future researches, mix method approach will be used for better understanding. Second, the method utilized in this research is cross-sectional. In future researches longitudinal research will provide the results after specific interval of time. Third, knowledge management is muti-dimensional contract. Only four knowledge management dimensions were examined in this study i.e., knowledge storage, knowledge generation, knowledge application, and knowledge diffusion. In future more dimensions like assimilation, transformation, acquisition, and exploitation may include. Additional researchers could investigate the impact of other knowledge management practices on business innovation in various sectors in the future.

Practical implications—Following are the managerial implications of current research. Among all the kinds of KM, KS is the better predictor of KM. So, managers of IT companies in Pakistan must maintain the current pace of KS so that this will maintain a better level of innovation. Similarly, among all the kinds of KM, KS is the better predictor of TC. So, managers of IT companies in Pakistan must maintain the current pace of KC so that this will maintain a better level of TC. TC is maintaining the relationship of KS with innovation. So, managers must sustain at least the current level of TC to maintain the relationship of KS with innovation.

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References

Abbas, J. (2020). Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. Journal of Cleaner Production, 244, 118806. https://doi.org/10.1016/j.jclepro.2019.118806

Afacan Fındıklı, M., Yozgat, U., & Rofcanin, Y. (2015). Examining Organizational Innovation and Knowledge Management Capacity the Central Role of Strategic Human Resources Practices (SHRPs). Procedia—Social and Behavioral Sciences,

181, 377–387. https://doi.org/10.1016/j.sbspro.2015.04.900

Alani, E., Kamarudin, S., Alrubaiee, L., et al. (2019). A model of the relationship between strategic orientation and product innovation under the mediating effect of customer knowledge management. Journal of International Studies, 12(3), 232–242. https://doi.org/10.14254/2071-8330.2019/12-3/19

Alegre, J., Sengupta, K., & Lapiedra, R. (2011). Knowledge management and innovation performance in a high-tech SMEs industry. International Small Business Journal: Researching Entrepreneurship, 31(4), 454–470. https://doi.org/10.1177/0266242611417472

Al-Emran, M., Mezhuyev, V., Kamaludin, A., et al. (2018). The impact of knowledge management processes on information systems: A systematic review. International Journal of Information Management, 43, 173–187. https://doi.org/10.1016/j.ijinfomgt.2018.08.001

Al-Sa'di, A. F., Abdallah, A. B., & Dahiyat, S. E. (2017). The mediating role of product and process innovations on the relationship between knowledge management and operational performance in manufacturing companies in Jordan. Business Process Management Journal, 23(2), 349–376. https://doi.org/10.1108/bpmj-03-2016-0047

Arif, M. (2018). ICTs and development in Pakistan: A review. Journal of Innovations and Sustainability, 4(3), 7-25.

Ashok, M., Narula, R., & Martinez-Noya, A. (2016). How do collaboration and investments in knowledge management affect process innovation in services? Journal of Knowledge Management, 20(5), 1004–1024. https://doi.org/10.1108/jkm-11-2015-0429

Backman, C. A., Verbeke, A., & Schulz, R. A. (2016). The Drivers of Corporate Climate Change Strategies and Public Policy. Business & Society, 56(4), 545–575. https://doi.org/10.1177/0007650315578450

Biryukova, O. V., & Matiukhina, A. I. (2018). ICT Services Trade in the BRICS Countries: Special and Common Features. Journal of the Knowledge Economy, 10(3), 1080–1097. https://doi.org/10.1007/s13132-017-0517-6

Boateng, H., & Agyemang, F. G. (2015). The effects of knowledge sharing and knowledge application on service recovery performance. Business Information Review, 32(2), 119–126. https://doi.org/10.1177/0266382115587852

Bornay-Barrachina, M., & Herrero, I. (2017). Team Creative Environment as a Mediator Between CWX and R&D Team Performance and Moderating Boundary Conditions. Journal of Business and Psychology, 33(2), 311–323. https://doi.org/10.1007/s10869-017-9495-8

Cabrera-Suárez, K., De Saá-Pérez, P., & García-Almeida, D. (2001). The Succession Process from a Resource- and Knowledge-Based View of the Family Firm. Family Business Review, 14(1), 37–46. https://doi.org/10.1111/j.1741-6248.2001.00037.x

Chaithanapat, P., Punnakitikashem, P., Khin Khin Oo, N. C., et al. (2022). Relationships among knowledge-oriented leadership, customer knowledge management, innovation quality and firm performance in SMEs. Journal of Innovation & Knowledge, 7(1), 100162. https://doi.org/10.1016/j.jik.2022.100162

Chan, H. K., Yee, R. W. Y., Dai, J., et al. (2016). The moderating effect of environmental dynamism on green product innovation and performance. International Journal of Production Economics, 181, 384–391. https://doi.org/10.1016/j.ijpe.2015.12.006

Chan, I., & Lau, Y. Y. (2021). Learning from the greats: Identifying three Knowledge sharing pillars to direct Knowledge Management initiatives in higher education institutions. Learning, 15(2), 415-430.

Chen, J., Yin, X., & Mei, L. (2018). Holistic Innovation: An Emerging Innovation Paradigm. International Journal of Innovation Studies, 2(1), 1–13. https://doi.org/10.1016/j.ijis.2018.02.001

Chen, K. H., Wang, C. H., Huang, S. Z., et al. (2016). Service innovation and new product performance: The influence of market-linking capabilities and market turbulence. International Journal of Production Economics, 172, 54–64. https://doi.org/10.1016/j.ijpe.2015.11.004

Chen, T., Li, F., Chen, X. P., et al. (2018). Innovate or die: How should knowledge-worker teams respond to technological turbulence? Organizational Behavior and Human Decision Processes, 149, 1–16. https://doi.org/10.1016/j.obhdp.2018.08.008

Chirico, F., & Salvato, C. (2016). Knowledge Internalization and Product Development in Family Firms: When Relational and Affective Factors Matter. Entrepreneurship Theory and Practice, 40(1), 201–229. https://doi.org/10.1111/etap.12114

Choi, S. Y., Lee, H., & Yoo, Y. (2010). The Impact of Information Technology and Transactive Memory Systems on Knowledge Sharing, Application, and Team Performance: A Field Study. MIS Quarterly, 34(4), 855. https://doi.org/10.2307/25750708

Çokpekin, Ö., & Knudsen, M. P. (2012). Does Organizing for Creativity Really Lead to Innovation? Creativity and Innovation Management, 21(3), 304–314. https://doi.org/10.1111/j.1467-8691.2012.00649.x

Corbetta, G., & Salvato, C. (2004). Self–Serving or Self–Actualizing? Models of Man and Agency Costs in Different Types of

Family Firms: A Commentary on "Comparing the Agency Costs of Family and Non–family Firms: Conceptual Issues and Exploratory Evidence." Entrepreneurship Theory and Practice, 28(4), 355–362. https://doi.org/10.1111/j.1540-6520.2004.00050.x

Costa, V., & Monteiro, S. (2016). Key knowledge management processes for innovation: a systematic literature review. VINE Journal of Information and Knowledge Management Systems, 46(3), 386–410. https://doi.org/10.1108/vjikms-02-2015-0017

Cruz, N. M., Perez, V. M., & Fernandez Ramos, Y. (2007). Transactive memory processes that lead to better team results. Team Performance Management: An International Journal, 13(7/8), 192–205. https://doi.org/10.1108/13527590710842529

Dalmarco, G., Maehler, A. E., Trevisan, M., et al. (2017). The use of knowledge management practices by Brazilian startup companies. RAI Revista de Administração e Inovação, 14(3), 226–234. https://doi.org/10.1016/j.rai.2017.05.005

Darroch, J. (2005). Knowledge management, innovation and firm performance. Journal of Knowledge Management, 9(3), 101–115. https://doi.org/10.1108/13673270510602809

Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. Journal of Intellectual Capital, 3(3), 210–222. https://doi.org/10.1108/14691930210435570

De Massis, A., Frattini, F., & Lichtenthaler, U. (2012). Research on Technological Innovation in Family Firms. Family Business Review, 26(1), 10–31. https://doi.org/10.1177/0894486512466258

den Hertog, P., van der Aa, W., & de Jong, M. W. (2010). Capabilities for managing service innovation: towards a conceptual framework. Journal of Service Management, 21(4), 490–514. https://doi.org/10.1108/09564231011066123

Dickel, D. G., & Moura, G. L. de. (2016). Organizational performance evaluation in intangible criteria: a model based on knowledge management and innovation management. RAI Revista de Administração e Inovação, 13(3), 211–220. https://doi.org/10.1016/j.rai.2016.06.005

Donate, M. J., & Guadamillas, F. (2011). Organizational factors to support knowledge management and innovation. Journal of Knowledge Management, 15(6), 890–914. https://doi.org/10.1108/13673271111179271

Donate, M. J., & Sánchez de Pablo, J. D. (2015). The role of knowledge-oriented leadership in knowledge management practices and innovation. Journal of Business Research, 68(2), 360–370. https://doi.org/10.1016/j.jbusres.2014.06.022

du Plessis, M. (2007). The role of knowledge management in innovation. Journal of Knowledge Management, 11(4), 20–29. https://doi.org/10.1108/13673270710762684

Duran, P., Kammerlander, N., van Essen, M., et al. (2016). Doing More with Less: Innovation Input and Output in Family Firms. Academy of Management Journal, 59(4), 1224–1264. https://doi.org/10.5465/amj.2014.0424

Eddleston, K. A., Kellermanns, F. W., & Zellweger, T. M. (2011). Exploring the Entrepreneurial Behavior of Family Firms: Does the Stewardship Perspective Explain Differences? Entrepreneurship Theory and Practice, 36(2), 347–367. https://doi.org/10.1111/j.1540-6520.2010.00402.x

Fuetsch, E., & Suess-Reyes, J. (2017). Research on innovation in family businesses: are we building an ivory tower? Journal of Family Business Management, 7(1), 44–92. https://doi.org/10.1108/jfbm-02-2016-0003

García-Piqueres, G., Serrano-Bedia, A. M., & Pérez-Pérez, M. (2019). Knowledge Management Practices and Innovation Outcomes: The Moderating Role of Risk-Taking and Proactiveness. Administrative Sciences, 9(4), 75. https://doi.org/10.3390/admsci9040075

Gaviria-Marin, M., Merigó, J. M., & Baier-Fuentes, H. (2019). Knowledge management: A global examination based on bibliometric analysis. Technological Forecasting and Social Change, 140, 194–220. https://doi.org/10.1016/j.techfore.2018.07.006

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge Management: An Organizational Capabilities Perspective. Journal of Management Information Systems, 18(1), 185–214. https://doi.org/10.1080/07421222.2001.11045669

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. Strategic Management Journal, 17(S2), 109–122. https://doi.org/10.1002/smj.4250171110

Greiner, M. E., Böhmann, T., & Krcmar, H. (2007). A strategy for knowledge management. Journal of Knowledge Management, 11(6), 3–15. https://doi.org/10.1108/13673270710832127

Griffith, T. L., & Sawyer, J. E. (2009). Multilevel knowledge and team performance. Journal of Organizational Behavior, 31(7), 1003–1031. https://doi.org/10.1002/job.660

Gu, J. (2020). Spatiotemporal dynamics of the patent race: empirical evidence from listed companies in China. Asian Journal of Technology Innovation, 30(1), 106–133. https://doi.org/10.1080/19761597.2020.1830813

Hamdoun, M., Chiappetta Jabbour, C. J., & Ben Othman, H. (2018). Knowledge transfer and organizational innovation: Impacts

of quality and environmental management. Journal of Cleaner Production, 193, 759–770. https://doi.org/10.1016/j.jclepro.2018.05.031

Haque, I. U., Rashid, A., & Ahmed, S. Z. (2021). The Role of Automobile Sector in Global Business Case of Pakistan. Pakistan Journal of International Affairs, 4(2). https://doi.org/10.52337/pjia.v4i2.195

Hernandez, M. (2012). Toward an Understanding of the Psychology of Stewardship. Academy of Management Review, 37(2), 172–193. https://doi.org/10.5465/amr.2010.0363

Huybrechts, J., Voordeckers, W., & Lybaert, N. (2012). Entrepreneurial Risk Taking of Private Family Firms. Family Business Review, 26(2), 161–179. https://doi.org/10.1177/0894486512469252

Inkinen, H. T., Kianto, A., & Vanhala, M. (2015). Knowledge management practices and innovation performance in Finland. Baltic Journal of Management, 10(4), 432–455. https://doi.org/10.1108/bjm-10-2014-0178

Javed, A. (2020). The scope of information and communication technology enabled services in Promoting Pakistan Economy. Asian Journal of Economics, Finance and Management, 165-173.

Jugend, D., da Silva, S. L., Oprime, P. C., et al. (2015). Organizational issues for integration of high-technology in new product development: framework proposal and case studies in Brazilian companies. Innovation, 17(2), 217–231. https://doi.org/10.1080/14479338.2015.1013428

Kuncoro, W., & Suriani, W. O. (2018). Achieving sustainable competitive advantage through product innovation and market driving. Asia Pacific Management Review, 23(3), 186–192. https://doi.org/10.1016/j.apmrv.2017.07.006

Lai, Y. L., & Lin, F. J. (2012). The Effects of Knowledge Management and Technology Innovation on New Product Development Performance An Empirical Study of Taiwanese Machine Tools Industry. Procedia - Social and Behavioral Sciences, 40, 157–164. https://doi.org/10.1016/j.sbspro.2012.03.176

Lee, S. M., & Trimi, S. (2021). Convergence innovation in the digital age and in the COVID-19 pandemic crisis. Journal of Business Research, 123, 14–22. https://doi.org/10.1016/j.jbusres.2020.09.041

Lee, S. M. T. P. S. (2014). The effect of knowledge management capability and dynamic capability on organizational performance. Journal of Enterprise Information Management, 27(2), 158-179. https://doi.org/10.1108/JEIM-05-2012-0025

Li, H., & Atuahene-Gima, K. (2001). Product Innovation Strategy and the Performance of New Technology Ventures in China. Academy of Management Journal, 44(6), 1123–1134. https://doi.org/10.2307/3069392

Li, Y., Liu, Y., & Zhao, Y. (2006). The role of market and entrepreneurship orientation and internal control in the new product development activities of Chinese firms. Industrial Marketing Management, 35(3), 336–347. https://doi.org/10.1016/j.indmarman.2005.05.016

Lin, R., Che, R., & Ting, C. (2012). Turning knowledge management into innovation in the high-tech industry. Industrial Management & Data Systems, 112(1), 42–63. https://doi.org/10.1108/02635571211193635

Lopes, C. M., Scavarda, A., Hofmeister, L. F., et al. (2017). An analysis of the interplay between organizational sustainability, knowledge management, and open innovation. Journal of Cleaner Production, 142, 476–488. https://doi.org/10.1016/j.jclepro.2016.10.083

López-Nicolás, C., & Meroño-Cerdán, Á. L. (2011). Strategic knowledge management, innovation and performance. International journal of information management, 31(6), 502-509. https://doi.org/10.1016/j.ijinfomgt.2011.02.003

Mardani, A., Nikoosokhan, S., Moradi, M., & Doustar, M. (2018). The relationship between knowledge management and innovation performance. The Journal of High Technology Management Research, 29(1), 12-26. https://doi.org/10.1016/j.hitech.2018.04.002

Martelo-Landroguez, S., & Cegarra-Navarro, J. G. (2014). Linking knowledge corridors to customer value through knowledge processes. Journal of Knowledge Management, 18(2), 342–365. https://doi.org/10.1108/jkm-07-2013-0284

Martínez, A. B., Galván, R. S., & Palacios, T. M. B. (2016). An empirical study about knowledge transfer, entrepreneurial orientation and performance in family firms. European Journal of International Management, 10(5), 534-557. https://doi.org/10.1504/EJIM.2016.078790

Mathieu, J. E., & Schulze, W. (2006). The Influence of Team Knowledge and Formal Plans on Episodic Team Process-Performance Relationships. Academy of Management Journal, 49(3), 605–619. https://doi.org/10.5465/amj.2006.21794678

Menaouer, B., Khalissa, S., Abdelbaki, B., & Abdelhamid, T. (2015). Towards a new approach of support innovation guided by knowledge management: Application on FERTIAL. Procedia—Social and Behavioral Sciences, 210, 260-269. https://doi.org/10.1016/j.sbspro.2015.11.366

Mittal, S., & Dhar, R. L. (2016). Effect of green transformational leadership on green creativity: A study of tourist hotels. Tourism

Management, 57, 118–127. https://doi.org/10.1016/j.tourman.2016.05.007

Mushtaq, I., Umer, M., Khan, M. A., et al. (2022). Customer Prioritization Integrated Supply Chain Optimization Model with Outsourcing Strategies. Big Data. https://doi.org/10.1089/big.2021.0292

Nawab, S., Nazir, T., Zahid, M. M., & Fawad, S. M. (2015). Knowledge management, innovation and organizational performance. International Journal of Knowledge Engineering, 1(1), 43-48. https://doi.org/10.7763/IJKE.2015.V1.7

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. Organization Science, 5(1), 14–37. https://doi.org/10.1287/orsc.5.1.14

Nonaka, I., & Toyama, R. (2015). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. In: The essentials of knowledge management. Palgrave Macmillan, London. pp. 95-110.

Norrgren, F., & Schaller, J. (1999). Leadership Style: Its Impact on Cross-Functional Product Development. Journal of Product Innovation Management, 16(4), 377–384. https://doi.org/10.1111/1540-5885.1640377

Nurnaninsih, A., & Muthmainah, H. N. (2023). Knowledge Management in the Digital Age: Harnessing Information and Innovation with Knowledge Management Systems. The Eastasouth Journal of Information System and Computer Science, 1(01), 25-34. https://doi.org/10.58812/esiscs.v1i01.131

Ode, E., & Ayavoo, R. (2020). The mediating role of knowledge application in the relationship between knowledge management practices and firm innovation. Journal of Innovation & Knowledge, 5(3), 210–218. https://doi.org/10.1016/j.jik.2019.08.002

Ogbeibu, S., Emelifeonwu, J., Senadjki, A., et al. (2020). Technological turbulence and greening of team creativity, product innovation, and human resource management: Implications for sustainability. Journal of Cleaner Production, 244, 118703. https://doi.org/10.1016/j.jclepro.2019.118703

P@SHA (2023). Industry stats. Available online: https://www.pasha.org.pk/ (assessed on 6 June 2023).

Pittino, D., Martínez, A. B., Chirico, F., & Galván, R. S. (2018). Psychological ownership, knowledge sharing and entrepreneurial orientation in family firms: The moderating role of governance heterogeneity. Journal of Business Research, 84, 312-326. https://doi.org/10.1016/j.jbusres.2017.08.014

Ritala, P., Olander, H., Michailova, S., et al. (2015). Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study. Technovation, 35, 22–31. https://doi.org/10.1016/j.technovation.2014.07.011

Röd, I. (2016). Disentangling the family firm's innovation process: A systematic review. Journal of Family Business Strategy, 7(3), 185–201. https://doi.org/10.1016/j.jfbs.2016.08.004

Sadeghi, A., & Mostafavi Rad, F. (2018). The role of knowledge-oriented leadership in knowledge management and innovation. Management Science Letters, 151–160. https://doi.org/10.5267/j.msl.2018.1.003

Sadiq, M., Usman, M., Zamir, A., et al. (2021). Nexus between economic growth and foreign private investment: Evidence from Pakistan economy. Cogent Economics & Finance, 9(1). https://doi.org/10.1080/23322039.2021.1956067

Saha, K., Kumar, R., Dutta, S. K., et al. (2017). A content adequate five-dimensional Entrepreneurial Orientation scale. Journal of Business Venturing Insights, 8, 41–49. https://doi.org/10.1016/j.jbvi.2017.05.006

Sarin, S., & McDermott, C. (2003). The Effect of Team Leader Characteristics on Learning, Knowledge Application, and Performance of Cross-Functional New Product Development Teams. Decision Sciences, 34(4), 707–739. https://doi.org/10.1111/j.1540-5414.2003.02350.x

Saunila, M. (2020). Innovation capability in SMEs: A systematic review of the literature. Journal of Innovation & Knowledge, 5(4), 260–265. https://doi.org/10.1016/j.jik.2019.11.002

Serrano-Bedia, A. M., Palma-Ruiz, J. M., & Flores-Rivera, C. (2019). Innovation and Family Firms: Past and Future Research Perspectives. In: Handbook of Research on Entrepreneurial Leadership and Competitive Strategy in Family Business. IGI Global. pp. 371-398. https://doi.org/10.4018/978-1-5225-8012-6.ch018

Sethi, R., Smith, D. C., & Park, C. W. (2001). Cross-Functional Product Development Teams, Creativity, and the Innovativeness of New Consumer Products. Journal of Marketing Research, 38(1), 73–85. https://doi.org/10.1509/jmkr.38.1.73.18833

Shujahat, M., Sousa, M. J., Hussain, S., et al. (2019). Translating the impact of knowledge management processes into knowledge-based innovation: The neglected and mediating role of knowledge-worker productivity. Journal of Business Research, 94, 442–450. https://doi.org/10.1016/j.jbusres.2017.11.001

Singh, I., & Kaur, N. (2017). Contribution of Information Technology in Growth of Indian Economy. International Journal of Research—GRANTHAALAYAH, 5(6), 1–9. https://doi.org/10.29121/granthaalayah.v5.i6.2017.1986

Singh, I., & SinGH, N. (2022). Performance of Indian Information Technology Sector. Economic & Political Weekly, 57(11), 25-39.

Somech, A., & Drach-Zahavy, A. (2011). Translating Team Creativity to Innovation Implementation. Journal of Management, 39(3), 684–708. https://doi.org/10.1177/0149206310394187

Stanković, N., & Micić, Ž. (2018). Innovating and management of the knowledge base on the example of IT applications. Telematics and Informatics, 35(5), 1461–1472. https://doi.org/10.1016/j.tele.2018.02.010

Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. Academy of Management journal, 48(3), 450-463. https://doi.org/10.5465/amj.2005.17407911

Sung, S. Y., & Choi, J. N. (2012). Effects of team knowledge management on the creativity and financial performance of organizational teams. Organizational Behavior and Human Decision Processes, 118(1), 4-13. https://doi.org/10.1016/j.obhdp.2012.01.001

Tarafdar, M., & Gordon, S. R. (2007). Understanding the influence of information systems competencies on process innovation: A resource-based view. The Journal of Strategic Information Systems, 16(4), 353-392. https://doi.org/10.1016/j.jsis.2007.09.001

Trivedi, K., & Srivastava, K. B. L. (2022). The role of knowledge management processes in leveraging competitive strategies to achieve firm innovativeness. The Bottom Line, 35(2/3), 53–72. https://doi.org/10.1108/bl-06-2021-0071

Valaei, N., Rezaei, S., Bressolles, G., et al. (2021). Indispensable components of creativity, innovation, and FMCG companies' competitive performance: a resource-based view (RBV) of the firm. Asia-Pacific Journal of Business Administration, 14(1), 1–26. https://doi.org/10.1108/apjba-11-2020-0420

Villar, C., Alegre, J., & Pla-Barber, J. (2014). Exploring the role of knowledge management practices on exports: A dynamic capabilities view. International Business Review, 23(1), 38–44. https://doi.org/10.1016/j.ibusrev.2013.08.008

Vovk, O., Kravchenko, M., Popelo, O., et al. (2021). Modeling the Choice of the Innovation and Investment Strategy for the Implementation of Modernization Potential. Wseas Transactions on Systems and Control, 16, 430–438. https://doi.org/10.37394/23203.2021.16.38

Wang, M. C., Chen, P. C., & Fang, S. C. (2018). A critical view of knowledge networks and innovation performance: The mediation role of firms' knowledge integration capability. Journal of Business Research, 88, 222–233. https://doi.org/10.1016/j.jbusres.2018.03.034

Waribugo, S., Ofoegbu, W., & Akpan, E. (2016). The impact of knowledge management on product innovation of manufacturing firms in Nigeria. Information and Knowledge Management, 6(6), 78-87.

Xie, X., Wang, L., & Zeng, S. (2018). Inter-organizational knowledge acquisition and firms' radical innovation: A moderated mediation analysis. Journal of Business Research, 90, 295–306. https://doi.org/10.1016/j.jbusres.2018.04.038

Yong, J. Y., Yusliza, M. Y., Ramayah, T., et al. (2019). Nexus between green intellectual capital and green human resource management. Journal of Cleaner Production, 215, 364–374. https://doi.org/10.1016/j.jclepro.2018.12.306

Zhu, S., Hagedoorn, J., Zhang, S., et al. (2021). Effects of technological distance on innovation performance under heterogeneous technological orientations. Technovation, 106, 102301. https://doi.org/10.1016/j.technovation.2021.102301