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Role of Inter-organizational Knowledge Acquisition in Bringing Green Innovation in Manufacturing SMEs: An investigation of Green Organizational Culture and Absorptive Capacity

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Abstract

This study focus upon the significant issue that how inter-organizational knowledge acquisition (IOKA) enhances the green innovation (GI) through mediating role green organizational culture (GOC) and moderating role of absorptive capacity (AC). Contextualizing manufacturing SMEs, this study empirically tested model of green innovation to entail comprehensive mechanism to analyze its imperative determinants. Survey method was employed, and data was gathered from CEOs, owners and managerial level employees of manufacturing SMEs. Hierarchical regression was applied to verify the proposed hypotheses. Study finding confirmed the positive association between inter-organizational knowledge acquisition, green organizational culture, and green innovation. Findings also approved that GOC mediates the association of IOKA, and GI. Additionally, AC strengthens the relationship between IOKA, and GI. Study contributes to theory through entailing insights relating influence of IOKA, GOC and AC on GI of enterprise along with mediating role of GOC and moderating role of AC in relationship of IOKA and

GI. This study is useful for SMEs' management to devise strategies of adopting green practices in current environment.

Keywords: Inter-organizational knowledge acquisition, green organizational culture, absorptive capacity, green innovation, manufacturing SMEs, ISO9001, ISO14001.

1. Introduction

In line with the knowledge-based view (KBV), the knowledge is the most strategically imperative resource for the organization, and that the capability of organization of combining, re-combining, generating, regenerating, and exploiting the knowledge is vital for organizational ability to innovate in the period where sustainability is the call of the day (Atakhan-Kenneweg, Oerlemans & Raab, 2021). However, according to Liu and Zhang (2021), organizations do not possess all the knowledge they needed. In the era of knowledge economy where novelty in knowledge is frequently emerges, it is imperative for organizations to ensure a continuous inflow of contemporary and innovative knowledge for the accumulation and renewal of their knowledge stock portfolios in order to accomplish sustainable competitive advantage (Hemmert, 2019).

Fast transition of the information and communication technologies have resulted in bringing the circumstances in which the knowledge required for innovation by organizations might be originated exterior to the organizational boundaries (Liu & Zhang, 2021; Xie, Wang & Zeng, 2018). Therefore, the notion of inter-organizational collaboration is increasingly acknowledged as the device to expand the organizational knowledge base as well as to craft novel and innovative knowledge sets founded upon the partner organizations knowledge (Xie, Wang & Zeng, 2018). Consequently, IOKA that is accomplished by mutual associations has emerged as a significant strategy for organizations to attain essential knowledge and to obtain innovative advances, thus accomplishing sustainable performance (Atakhan-Kenneweg, Oerlemans & Raab, 2021).

In recent times, the continuously increasing significance of knowledge acquisition has produced several studies associated to its antecedent and consequences (Yang, Chen & Hao, 2020). Some of the studies emphasizedupon the antecedents and consequences of knowledge acquisition. Whereas, some other studies have focused on the facets that affects knowledge acquisition, like trust between partner (Micheli, Berchicci & Jansen, 2020), internal R&D (e.g.,Hemmert, 2019), institutional characteristics (e.g., Qian, et al., 2019) and strategic orientation (e.g., Ma & Huang, 2016) etc. On the other side, some of the researchstudies also evaluated the indirect association of the knowledge acquisition (e.g.,Xie, Wang & Zeng, 2018).

Literature is also evident of the examination of the outcomes of knowledge acquisition on both organizational innovation and organizational performance in the era where organizations are continuously struggling for the environmental issues (Arfi, Hikkerova & Sahut, 2018). However, little evident is available in the existing body of knowledgerelating

to the detailed perspective upon the knowledge acquisition effectiveness through inter organizational collaboration. Even though few of the qualitative and conceptual research studies linked the notion of knowledge acquisition from exterior sources to organizational innovation (Micheli, Berchicci & Jansen, 2020). However, a detailed and systematic evaluation along with relative setting of the association among IOKA and organizational innovation considering the environmental aspects in the processes of innovation that is termed as GI is still missing.

These prevailing gaps in the available body of knowledge restricts the understanding of the definite role that IOKA plays to ensure organizational GI for the purpose of attaining sustainable performance goals. One specific gap that is still unclear that how technical knowledge that organization acquired from its surrounding environment and partners adds to the processes of GI. Even though the inter-organizational knowledge is imperative for the organizational innovation, this does not suggest that the knowledge acquisition from partners can be utilized efficiently and effectively by the organizations. So, knowledge acquisition is imperative but not solely enough to add to organizational innovation outcomes (Abbas & Sagsan, 2019; Xie, Wang & Zeng, 2018). Even though the existing body of knowledge suggest that inter-knowledge acquisition is positively associated to organizational innovative outcomes (e.g, Micheli, Berchicci & Jansen, 2020), however, previous investigations donot evaluate theinner mechanism that may be implicated in this association.

Based upon the available literature, it has been noticed that there are various outcomes of IOKA other than GI. These outcomes create a bond between the relationship of knowledge acquisition and GI. In this regard, GOChas appeared as a strong intervening mechanism that create a strong bond between IOKA and GI (Qu, Khan, Yahya, Zafar & Shahzad, 2022). The green culture of the enterprises enables employees to feel more fretful regarding environmental issues (Gürlek & Tuna, 2018). Whether it is prevention of pollution, sustainable development or product stewardship, the employees of the enterprises will show further concern for the protection of environment. In order to address this gap, a resource-based view is adopted to overcome the limitation of failing to explain the relationship of enterprises and their natural environment. Lastly, AC entails constructive insights to enterprises to adopt environmentally friendly alteration to enterprise operations (Pacheco, Alves & Liboni, 2018). It is anticipated that the addition of AC as the moderating variable will act as a catalyst and strengthen the effect of IOKA on GI.

Based upon the research gap highlighted above, this study anticipates that the influence of IOKA upon GI should be measured jointly with organizational green culture, additionally, the contingent role of AC on this relationship is also anticipated. Therefore, this research evaluates that how GOC mediates, and AC moderates the relationship of the IOKA and GI of organization. In the perspective of inter-organizational collaboration, this research contributes to the sustainable development and GI research by evaluating and integrating the mechanism that how IOKA may be subjugated to enhance organizational GI by

realizing the role of green organizational culture. Additionally, by evaluating the moderating role of AC on the association of IOKA and GI, this research gives further augmented explanations of the contingent influence of AC on the association of IOKA and GI of SMEs. This study adds to the literature by focusing on the mediating role that how IOKA can be translated in GI for organizations through GOC. Furthermore, the outcomes of this study contribute in understanding the contingent role of AC on this association.

The remainder of this paper is structured as follows. Section 2 elaborates the development of research hypotheses. Section 3 elaborates the methodology used in this research. Section 4 discussed the data analysis of this research. The last section discusses the findings, theoretical and managerial implication, limitation, and future research directions.

2. Literature Review and Hypotheses Development

2.1 Inter-organizational Knowledge Acquisition and Green Innovation

In contemporary knowledge-based business environment, enterprises are striving to pull their relationships for acquisition of novel knowledge progressively from outside of their own organizational boundaries for the development of new knowledge with stakeholders in order to support innovation output (Abbas & Sagsan, 2019; Micheli, Berchicci & Jansen, 2020). In this perspective, Xie, Wang and Zeng (2018) defined IOKA as the set of interactive and continuous procedures of organizations related to acquisition of knowledge and new technologies from external partners and sources. Furthermore, these external sources in general ranges from contract-based agreements like patents, licenses, technological supports and patents, to equity-based measures like joint ventures and strategic alliances (Radziwon & Bogers, 2019). IOKA facilitates the enterprises in implementing the innovative strategies to cope with the environmental changes to accomplish environmental performance (Al-Jabri & Al-Busaidi, 2020). Enterprises irrespective of their age, size and nature putting focus upon the introductions of green products, services and procedures to satisfy the environmental needs (Gupta & Barua, 2018).

GI defined as the set of all kinds of innovation that adds to the production of vital products/services, systems, or procedures in order to eliminate the negative effects, harms and deterioration to natural environment at the same instant it optimizes the utilization of natural resources (Aboelmaged & Hashem, 2019). According to Yousaf (2021) GI is the introduction of any novel or considerably augmented good or services (products), procedures, organizational alteration or marketing strategies which eliminates or minimizes the utilization of natural resources (comprising energy, materials, land and water) and diminishes the discharge of destructive materials across the complete life cycle. In line with knowledge-based view, enterprises' knowledge base influence their capacity and scope of comprehending and applying new knowledge in order to augment GI

(Muangmee, Dacko-Pikiewicz, Meekaewkunchorn, Kassakorn & Khalid, 2021; Rodrigues & Franco, 2023).

It is established fact that no enterprise internally has all the essential resources, and it is injudicious to take into the account the entire activities related to innovation alone (Aboelmaged & Hashem, 2019; Yousaf, 2021). According to Anik and Sulistyo (2021) acquisition of knowledge from external resources becomes as a gainful approach for inspiring the innovative processes. In this perspective, the IOKA can support an enterprise in obtaining and accumulating exterior knowledge and expanding their knowledge base in order to initiate innovative processes in order to cope with environmental alterations, hence acknowledged as a basic device for augmenting GI (Singh, Del Giudice, Chierici, & Graziano, 2020).

On the other side, IOKA may support enterprises in accessing the wide range of knowledge resources and competencies of partners that might augment the extent of enterprises knowledge base (Albort-Morant, Leal-Millán, Cepeda-Carrion & Henseler, 2018). Hence, IOKA can support enterprises in gaining multi-channel access to novel technologies and new exterior knowledge, facilitating enterprises in better utilization of prevailing knowledge resources (Cherifi, M'Bassègue, Gardoni, M., Houssin & Renaud, 2019). In this vein, IOKA plays a significant role in new knowledge creation (Shahzad, Qu, Zafar, Ding, & Rehman, 2020).

In line to resource-based view a wide range of knowledge can enhance the capability of enterprises to understand the novel information and possible alteration. Moreover, it also, decrease the cost associated to bringing innovation which ultimately increases their competencies of sensing remote market and technological opportunities for GI (Wijaya & Suasih, 2020). On the other side, as a mutual procedure is poised of a wide degree knowledge flow between the employees of various partner enterprises (Muangmee, et al., 2021), and the acquired knowledge from external partners enables employees inside the enterprise to enhance their judgment and augment employees' innovative ideas in line to environmental concern (Singh, et al., 2020), which resultantly increase the GI process (Yousaf, 2021). In addition, the knowledge acquisition through external mutual and collaborative associations enriches directly an enterprise technological knowledge base related to the developmental actions (Radziwon & Bogers, 2019), hence enhances the competency and willingness of the enterprises to carry out experimentation, creativity, development and generation of new ideas and novel innovation (Micheli, Berchicci & Jansen, 2020).

Summarizing the above discussion, it is anticipated that higher interorganizational knowledge acquisition is useful for the improvement and initiation of GI. This study postulated the subsequent hypothesis based on above discussion.

- H_1: Inter-organizational knowledge acquisition is positively related to green innovation.

2.2 Inter-organizational Knowledge Acquisition and Green Organizational Culture

Prevailing literature enlighten the significance of IOKA in augmenting the innovativeness in enterprises (Sancho-Zamora, Hernández-Perlines, Peña-García & Gutiérrez-Broncano, 2022). Effective knowledge integration is needed to transform the acquired knowledge from the network members in to substantive innovation (Lyu, Peng, Yang, Li & Gu, 2022). In line to the organizational learning view, enterprises innovative outcomes are dependent upon enterprise GOC (Shahzad, et al., 2020). GOC of the enterprises is described as pattern of widely held fundamental beliefs about environmental planning and sustainable concerns to craft higher values for enterprises (Cherifi, M'Bassègue, Gardoni, Houssin& Renaud, 2019; Lyu, et al., 2022).

GOC is defined as a common system of beliefs, concepts, and values formed by a management team with the intention of directing behavior and attitude toward achieving a shared corporate goal (Hussain, Chaudhary, Arshad &Akram, 2020). GOC is the multi-dimensional construct which comprises of the transformation and application of the externally acquired knowledge (Radziwon & Bogers, 2019). GOC comprises of the firm's transformational capabilities that permit enterprises to craft novel procedures and introduce alteration to prevailing procedures (Wijaya & Suasih, 2020).

It is evident from the literature that enterprises IOKA is related to GOC of the enterprise. In the perspective of resource-based view IOKA is acknowledged as a vital antecedent for the GOC (de Araújo Burcharth, Lettl, & Ulhøi, 2015; Xie, Wang & Zeng, 2018). IOKA practices are vital due to the reason that it makes externally acquired knowledge acquired relevant and as a result augment the GOC of enterprises (Xie, Wang & Zeng, 2018). Additionally, IOKA enhances the enterprises knowledge which in result affects the enterprises GOC (Marrucci, Iannone, Daddi, & Iraldo, 2022). Based on the above arguments the following hypothesis was developed.

- H_2: Inter-organizational knowledge acquisition is positively related to green organizational culture of enterprises.

2.3 Green Organizational Culture and Green Innovation

Enterprises require dynamic capabilities to respond to the rapidly changing business environment (Zhou, Govindan, Xie & Yan, 2021). GOC being dynamic capability facilitates enterprises in acquisition and assimilation of exterior knowledge with interior knowledge in order to transform it into important device for innovation (Marrucci, Iannone, Daddi & Iraldo, 2022). Innovation literature acknowledges GOC as a vital dynamic facet for bringing innovation in products, services and operations (Qi, Jia & Zou, 2021). Still, the evaluation of the relationship of GOC in relation to GI is relatively new (Yousaf, 2021).

GOC enhances the ability of enterprises to hold culture related to environment in a constructive manner to extend green innovative capabilities of enterprises (Pacheco, Alves & Liboni, 2018). Contextualizing the traditional innovation, integration of exterior

knowledge along with interior competencies is undertaken as essential component for innovation (Huber, Wainwright & Rentocchini, 2020). In similar manner, for GI enterprises require identification, acquisition, integration and exploitation of GOC in order to enhance GI (Mahmood & Mubarik, 2020). Additionally, it is established that an enterprise dose not solely requires a system for the acquisition and exploitation of external knowledge but also requires a vigorous system of GOC to pull out creative and innovative ideas.

GOC facilitates to expand environment related knowledge across various units of enterprises which strengthen the enterprise collaborations, research and development, and managerial procedures to further augment GI (Miroshnychenko, Strobl, Matzler & De Massis, 2021). Additionally, theory postulates that through utilization of knowledge related to environment, GOC might enhance GI in form of green products and green services (Khan, Majid, & Yasir, 2021). GOC can be supportive in the development of green product and green services. Additionally, in the perspective of green procedures, GOC can facilitate the enterprises in reduction of the harmful environmental effects of manufacturing, production, and processing. Based on above narration, the following hypothesis was formulated.

- H_3: Green organizational culture is positively related to green innovation of enterprises.

2.4 Mediating Role of Green Organizational Culture

Organizational culture is defined as a system of mutual belief, values and ideas formulated through managerial groups with the basic aim of determining attitude and organizational behaviors associated to accomplish of mutual corporate goals (Gürlek, & Tuna, 2018). Based upon this perspective, GOC might be described as the culture of the enterprises that undertakes protection of environment as the basic and fundamental value of the enterprise (Sepahvand, Nazarpoori, Sepahvand & Arefnezhad, 2022), incorporated in enterprises mission statement in a manner that a sense of environmental responsibility is embodied by each member of team within enterprises (Qu, et al., 2022). Such organizational cultural alterations have an imperative contribution in reorganizing the enterprises attitude associated to environmental demands, and employees of the enterprises become more sensitized towards environmental issues.

The GOC will prosper if the management illustrates further motivation for the protection of the natural environment (Shah, et al., 2021). GI culture alters traditional methods of viewing employees and considered them as change agents (Azeem, Ahmed, Haider & Sajjad, 2021). Therefore, GOC plays a significant role in engaging employees of the enterprises in addressing environmental associated concerns critically (Sengullendi, Bilgetürk & AfacanFındıklı, 2023). The basic mechanism of GOC is founded upon the value of eco-system might entail valuable to enterprises for adopting environment friendly alterations in enterprise operations (Afum, Agyabeng-Mensah & Owusu, 2020).

Sepahvand et al., (2022) argued that GOC can transform pro-environmental strategies into GI. Still, GOC may merely be valuable if enterprises have the knowledge base to address the issues related to natural environment (Gürlek, & Tuna, 2018). Available body of knowledge recommend that new knowledge acquired from outside the enterprise's boundaries augment the enterprises abilities of attaining GI (Al-Swidi, Gelaidan & Saleh, 2021; Qu, et al., 2022). So, it is anticipated that if enterprises acquire the new knowledge required to deal with the environment related issues, organizational culture will enhance the organizational capabilities needed for the protection of environment, as available literature advocates that GOC enhances the pro-environmental behavior in enterprises to protect the environment. Therefore, more the enterprises are inclined towards green culture, more they focus on the environmental issues. Khammadee and Ninaroon, (2022) are also in favor of the argument that GOC facilitates enterprises in applying new knowledge acquired from the outside of the enterprises' boundaries will augment the operation to produce GI. Founding on the above discussions this study infers that:

- H_4: Green organizational culture mediates the association of inter-knowledge acquisition and green innovation in enterprises.

2.5 Moderating Role of Absorptive Capacity

AC enables enterprises by providing the competencies required for the implementation of strategies in effective manners (Huber, Wainwright & Rentocchini, 2020). AC helps in integration and enhancement of skills by linking externally acquired knowledge with interior knowledge (Qi, Jia & Zou, 2021). This enhances enterprises prevailing competencies and resultantly improve the organizational performance (Khan, Majid, & Yasir, 2021).

In continuously shifting business environment AC provides an enterprise with the competency to explore and acquire exterior knowledge important for the enterprise functioning and operation as well as binging eco-friendly innovation (Javeed, Teh, Ong, Lan, Muthaiyah & Latief, 2023; Zhou, et al., 2021). AC also entails strategic flexibility required essentially, for example, setting assessable environmental targets, conducting training programs related to environment and its plans and action etc. (Ghobakhloo et al., 2022). Marrucci, et al., (2022) argued that AC enables enterprises with the competencies of sensing right directions to address environmental concerns. Additionally, it is advocated that only acquiring the new knowledge might not be sufficient to enhance the environmental related innovation strategies (Qi, Jia & Zou, 2021). Nonetheless, enterprises need to possess the competencies to exploit new knowledge for bringing the innovation in-line to environmental concerns in their product, services and operations.

For the effective use of newly acquired knowledge to enhance the innovation, it is foremost important for enterprises to developed competences and motivates employees regularly for considering knowledge related to environmental issues (Khan, Majid, Yasir & Javed,

2021). Therefore, this study posits that AC is much needed facet that leads to implement GI through appropriate management of newly acquired knowledge through external sources including partners, customers, and competitors as well. This study confers the subsequent hypothesis:

- H_5: Absorptive capacity moderates the association between inter-organizational knowledge acquisition and green innovation in enterprises.

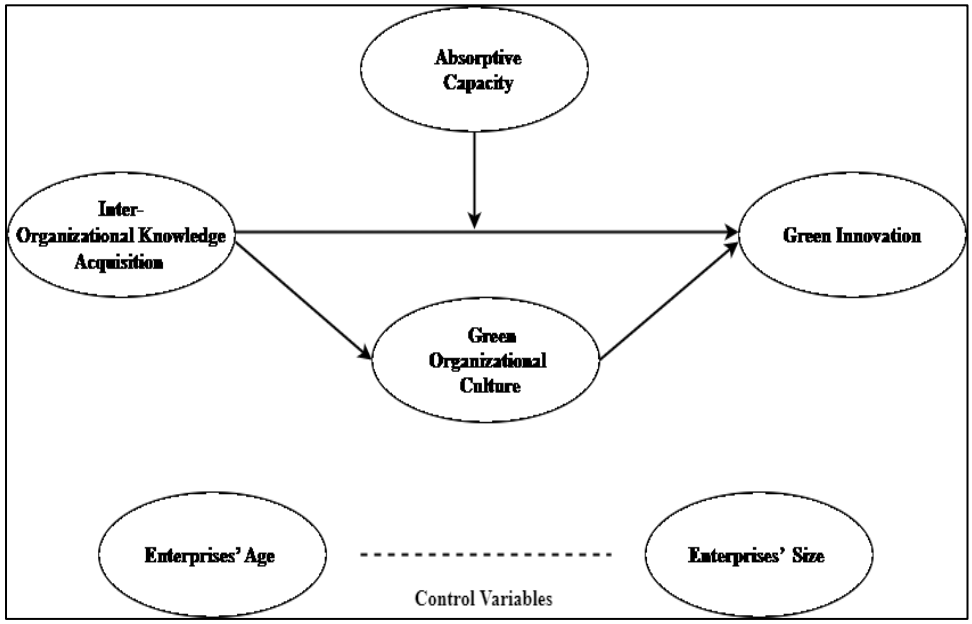

Figure 1: Theoretical Framework

3. Methods

This cross-sectional study adopted the survey approach for the collection of data. The manufacturing industry was the target population of the study that includes SMEs from textile, fertilizers, tobacco, surgical instruments, sports goods and food and beverages possessing the certification of ISO 9001 and ISO 14001 along with valid registration with SECP (Securities & Exchange Commission of Pakistan) and SMEDA (Small and Medium Enterprise Development Authority). Manufacturing SMEs have a vital and imperative role in boosting the economy of the developing countries (Khan, et al., 2021). More than 70 percent of SMEs of Pakistan are involved in the manufacturing concerns (Ali, Bilal, Ahmad & Hussain, 2020). Manufacturing sector of Pakistan has a share of 13percent in overall GDP and provide employment to 17 percent of the workforce. Small scale manufacturing sector was chosen in this study. Although the small-scale manufacturing industry is contributing a lot in the national economy, however, on the other hand it also has a negative

side that adversely affect the natural environment. Same issue has been highlighted by Rehman, Razaq, Farooq, Zohaib and Nazri, (2020).

In this research, 979 SMEs operational in nine small industrial estates (Peshawar, Mardan, Kohat, Karak, Nowsehra, Haripur, Mansehra, Abbottabad and Dargai) of Khyber Pakhtunkhwa province registered with small industrial development board (SIDB), SMEDA and SECP, were approached and contacted, and data was collected from CEOs, owners and managerial level employees to form sampling frame. The sample frame comprises of the 867 owners, CEOs and managerial level of employees of SMEs from textile, fertilizers, tobacco, surgical instruments, sports goods and food and beverages. For the purpose of gathering data, systematic random sampling technique was utilized. Data was collected from the CEOs, Owners and managerial level employees of SMEs that consider the environmental concern in their policies. Data collection for this study was a lengthy process and was based on three phases.

In the first phase, questionnaires were distributed along with covering letter through surface mail to the respondents. In this stage, response rate was very disturbing. While in second phase, after a period of 5 months, respondents were contacted through emails and phone calls who did not respond in first phase. Lastly, in third stage, 7 research assistants were hired for the collection of data who personally visited the respondents for the collection of data. On the basis of above discussed efforts a total 485 valid and completely filled questionnaire were received back. 56 percent was the response rate achieved in his study, which is categorized as good response rate, taken in account the research culture in economies such as Pakistan. 23 percent of the respondents were from textile sector, 26 percent respondents were from fertilizers sector, 9 percent were from tobacco sector, 16 percent respondents were from surgical instruments, 14 percent from sport manufacturing goods and 12 percent respondents were from beverages sector. 51 percent of the SMEs were functional from last ten years, 33 percent were functional from above ten years and less than 20 years, and 16 percent were functional from above 20 years. Furthermore, 43 percent SMEs were possessing more than 200 employees, 27 percent SMEs were possessing employees ranges from 100 to 200 employees and 30 percent SMEs were possessing less than 100 employees. In order to test the study hypotheses inline to the recommendation of prevailing theory correlation, hierarchical regression, Baron and Kenny test was used.

3.1 Measures

For the collection of data in this study structured questionnaire was used and responses of the respondents were recorded on 5-point Likert scale. A 4 items scale measuring IOKA was adapted from Xie, Wang and Zeng (2018), which generated Cronbach's α value of 0.86. For the measurement AC 5 items scale was adapted from Khan, Majid and Yasir (2021), which computed the Cronbach's α value of 0.79. For the measurement of GOC 5 items scale was adapted from Qu, Khan, Yahya, Zafar and Shahzad (2022), which

computed Cronbach's α value of 0.81. Lastly, for the measurement of GI 6 items scale was adapted from Aboelmaged and Hashem (2019), which computed Cronbach's α value of 0.84. SMEs size and SMEs Age were incorporated as control variable in this study.

Cronbach's alpha coefficient and CITC (corrected item- total correlation) were computed for confirming the constructs' reliability which outcomes are entailed in table 1. The statistical results revealed in table 2 advocates that the value of Cronbach's alpha coefficient for study constructs were higher than 0.7 and the statistical values for CITC were greater than threshold value 0.5. Construct validity was evaluated through computation of convergent and discriminant validity. AVE and CR were utilized for the evaluation of convergent validity. The statistical outcomes of CR were greater than acceptable value of 0.70. Similarly, the statistical output predicted that AVE value was greater than the acceptable value of 0.50. In table 1 the results for factor loading, CITC, Cronbach's alpha coefficient, CR, AVE and t-values are presented. As per recommendations of Fornell and Larcker (1981) for verifying the discriminant validity the comparison of the square root of AVE of each variable and their correlation coefficients with other variable was computed. Results shown in table 1 entailed that the AVE square roots were greater than the coefficient of correlation of other variable of study. In addition, this study used the statistic of VIF to verify and reduce the chances of multi-collinearity among study constructs. The results revealed that there is no issue of multi-collinearity as VIF value for study constructs were no exceeding the acceptable level that is 0.5. CFA was taken in account for the verification of the model fitness using AMOS, v.12. In this regard, several tools that included CFI, GFI, NNFI, RMSEA and Chi-square were undertaken. Results suggested that four factors model fulfill all the parameters of model-fitness ($\chi 2$ /df=4.521, CFI=0.906, GFI=0.908, IFI=0.932, RMSEA=0.068 and p=0.000).

Table 1: Construct Measurement and Confirmatory Factor Analysis

Construct		CITC	FL	t-Value	Cronbach's alpha	AVE	CR
IOKA	IOKA1	0.680	0.854	12.93			
	IOKA2	0.643	0.896	11.88			
	IOKA3	0.611	0.859	14.66			
	IOKA4	0.677	0.892	12.42	0.86	0.750	0.901
GOC	GOC1	0.587	0.877	11.37			
	GOC2	0.672	0.833	14.97			
	GOC3	0.633	0.791	13.22			
	GOC4	0.691	0.766	12.87			
	GOC5	0.599	0.854	13.91	0.79	0.764	0.921
AC	AC1	0.597	0.893	13.22			
	AC2	0.603	0.876	14.11			
	AC3	0.660	0.823	15.66			
	AC4	0.622	0.897	12.09	0.81	0.701	0.939
	AC5	0.677	0.800	13.88			
GI	GI1	0.655	0.782	12.87			
	GI2	0.592	0.871	13.91			
	GI3	0.667	0.899	14.02			
	GI4	0.611	0.855	14.54			
	GI5	0.597	0.833	13.98			
	GI6	0.688	0.861	13.66	0.84	0.711	0.953

Notes: model fit indices $\chi 2$ /df=4.521, CFI=0.906, GFI=0.908, IFI=0.932, RMSEA=0.068 and p=0.000, Significance level: *p < 0.05; **p < 0.01; ***p < 0.00; CITC= corrected item correlation, FL= Factor loading, AVE=average variance extracted, CR= composite reliability

4. Results

In order check the association among IOKA and GI by the mediating effects of AC the statistical test of correlation and regression analyses were undertaken. The table 2 entailed the statistical output for mean, standard deviation, and correlation coefficient value among study constructs. The value of correlation coefficient between IOKA, absorptive capacity, GOC and GI all were associated significantly and positively to each other. IOKA has produced a positive value of correlation with GI as the statistical output advocates (r=0.192**, p<.001) and with AC (r=0.350**, p<.001). In similar way, the AC has positive correlation with GI as results revealed (r=0.378**, p<.001). The deduced theory is supported by the statistical results of correlation test. The mean values of control variables of study that are enterprises' age and enterprises' size are 1.26 and 3.07 respectively, which are clearly evidenced in table 2.

Table 2: Descriptive Statistics, Correlation, AVE

Construct	M	SD	1	2	3	4	5	6
Enterprises' Age	1.26	0.86	1					
Enterprises' Size	3.07	0.85	0.11	1				
IOKA	3.91	0.88	0.14*	0.13	1*(0.866)*			
AC	3.63	0.83	0.08	0.16*	0.350**	1*(0.874)*		
GOC	3.49	0.92	0.12	0.08	0.270**	0.704**	1*(0.837)*	
GI	3.77	0.89	0.05	0.09	0.192**	0.378**	0.505**	1*(0.843)*

M (Mean), SD (Standard Deviation), The diagonal data (in italics) are the square roots of AVE

For the verification of study hypotheses 1 to 4, this study applied regression analysis test, and results of regression analysis are given in table 3. In H1 of this study it was anticipated that IOKA is positively associated to GI of enterprises. H1 of the study approved as result depicted in table 3 that β value is 0.304 and p= 0.000. H2 of the study anticipated that IOKA is positively related to GOC of enterprises. Statistical results depicted in table 3 approved the H2 of the study on the basis or results entailed that β value is 0.509 and p= 0.000. H3 of the study anticipated GOC is related positively to GI of enterprises and result confirmed the H3 of the study on the basis of results entailed that β value is 0.434 and p= 0.000. Results confirmed a positive association of GOC and GI of enterprises.

4.1 Mediating Role of Green Organizational Culture

In line to previous researches such as Rasoolimanesh, Wang, Roldan and Kunasekaran (2021) Baron and Kenny (1986) four steps method was performed for the evaluation of the mediating role of GOC between the association of IOKA and GI of enterprises. For the computation of results first IOKA should be associated to GI. Second IOKA should be associated to green organizational culture. Third condition is that GOC should be associated to GI. Lastly there should be majorly reduced or non-significant association required among IOKA and GI when GOC is introduced as mediating variable. The statistical output for step 1 to step 4 entailed in table 3. The output of analysis revealed that when GOC in included in model as mediating, variable the output of IOKA become non-significant as β value reduces to 0.058 and p=0.126 from 0.304 (p=0.000). Consequent upon results H4 of the study was confirmed, which anticipated that GOC has a mediating role in the association of IOKA and GI in enterprises.

Table 3: Regression Analysis for Testing H_1 to H_4

Hypo-theses	Details	R^2	F	B	T	Sig.	Remarks
H_I	IOKA→GI	0.182	24.634	0.304	11.260	0.000	Approved
H_2	IOKA→GOC	0.352	101.097	0.509	9.091	0.000	Approved
H_3	GOC→GI	0.378	121.09	0.434	14.825	0.000	Approved
H_4	IOKA→GOC→GI	0.382	61.838	0.058 0.339	1.544 9.879	0.126	Full mediation

4.2 Moderating Role of Absorptive Capacity

For testing H5 which postulated that AC moderates the association of IOKA and GI in enterprises, the statistical test of hierarchical regression was applied as per suggestions of available theory such as Memon, et al., (2019). The statistical output of hierarchical regression analysis is depicted in table 4. The statistical output for model 1, model 2 along with model 3 is shown in table 4. Control variables were regressed in first model, while in model-2 IOKA and AC were incorporated. The statistical output generated a significant degree variation in GI from AC as R2=0.260 and p<0.001. For model-3 the interaction term was computed for IOKA and AC and included to the model for regression, which generated significant variations in GI (β 5 0.052 and p < 0.001). Consequently, H5 of this study was confirmed.

Table 4: Moderating effects of Absorptive Capacity

Factors and research resumes	**Model 1**		**Model 2**		**Model 3**	
	B	t-value	B	t-value	B	t-value
Enterprises' Age	-0.033	-0.817	0.07	0.160	0.017	0.450
Enterprises' Size	0.051	1.293	0.121	3.649	0.137	4.085
IOKA			0346**	8.233	0.338**	8.16
AC			0.459**	9.060	0.142**	20.418
IOKAXAC					0.056**	3.107
Model resumes						
R			0.510***			0.517***
ΔR^2			0.260***			0.010***
R^2		0.007	0.260***			0.267***
F-Statistics		0.994	161.09			

Note(s): Significance level ***p < 0.001, **p < 0.01. *p < 0.05, p < 0.1

In line to the guidelines suggested by Lam, Chuang, Wong and Zhu (2019) in this study the technique of slope analysis was also used through presenting distinct values for GI at lower IOKA and greater level of IOKA and similarly through showing the AC effects at

lower as well as higher values, hence it is incorporated in analysis as moderating variable. The below figure 2 presents that AC has positive and higher degree relationship with GI when AC support was higher (β value=0.334, p-value < 0.001) comparatively than lesser (β value=0.142, p-value < 0.001)), in support of H5 of this study. As a result, it is approved that AC enhances relationship of IOKA and GI of enterprises.

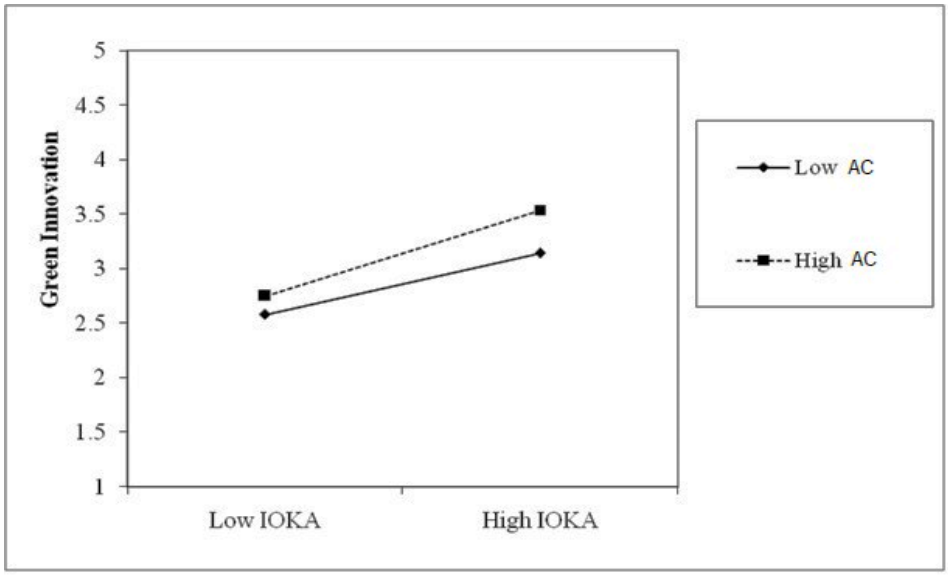

Figure 2: Moderating Role of AC upon the association of IOKA and GI

5. Discussion and Conclusion

5.1 Discussion

The basic aim of this study was to evaluate the mechanism involve in transforming the IOKA into GI in enterprises. This study deduced the model from prevailing literature and empirically tested the mediating role of GOC in the association of IOKA and GI of enterprises along with moderating role of absorptive capacity. Based on the review of existing literature and analyzing the arguments of resource-based view; dynamic capability view and knowledge-based view a total of five hypotheses were formulated, tested, and confirmed statistically.

Statistical results in relation to H1 of this study approve the direct link between IOKA and GI of enterprises. These results are in-line with the study finding of Xie, Wang and Zeng (2018), which established the fact that IOKA adds to the innovative outcomes through facilitation of the continual and discrete innovative processes. For the hypothesis 2 of this study, statistical results confirm the direct link between IOKA and GOC in enterprises. These findings provide support to the findings already established by Pacheco, Alves and

Liboni (2018) and Zhou, Govindan, Xie and Yan (2021), which make contribution to the prevailing theory of dynamic capability and claimed that new knowledge acquisition from external partners enhances the competencies and motivation of employees within boundaries of enterprises to bring new ideas for addressing the environmental concerns that resultantly enhances the green organizational performance in enterprises. In relation to H3 of the study, the statistical analyses approve the positive link between GOC and GI in enterprises. These results of the study provide support to the findings of Miroshnychenko, Strobl, Matzler and De Massis (2021), who argued that the enterprise with augmented GOC is more agile in bringing innovation in their product/services and operation through active implementation of new knowledge acquired from external networks of the enterprises. Study hypothesis 4 as associated to the mediating role of GOC in the association of IOKA and GI of enterprises was confirmed through statistical results. H5 of this study approved the moderating role of AC on the interrelation of IOKA and GI of enterprises. These findings bestow to the knowledge-based view (Atakhan-Kenneweg, Oerlemans &Raab, 2021), dynamic capability view (Wijaya & Suasih, 2020) and resource-based view (Khan, Majid, & Yasir, 2021) of the enterprises.

5.2 Theoretical Contributions

This research assumes the understandable view of the internal mechanism and configuration in which IOKA enhance the strategies and processes related to GI. This study makes contributions to existing theory in following manners. Firstly, this study added to the knowledge management, innovation management and environmental management literature through evaluation of the link between IOKA and GI. In this study, the constructs of IOKA and GI are explicitly operationalized and accordingly interlinked. Linking these two imperative constructs of knowledge management and innovation management in the context of environmental management was a new avenue in the prevailing theory. Secondly, the mediating role of GOC in the relationship of IOKA and GI was not examined previously; due to this reason, this investigation strives to deal with this problem through analyzing this prevailing gap in detailed manner; so in the perspective of dynamic capability view, to clarify how IOKA might be utilized to increase GI by suggesting GOC is an imperative addition in the field. Thirdly, this study examined empirically the edging situation in relation to the mechanism that how AC strengthens the relationship among IOKA and GI in enterprises. As mentioned earlier that, AC is acknowledged as imperative notion in prevailing theory for IOKA and GI by suggesting its moderating role (Micheli, Berchicci & Jansen, 2020; Singh, et al., 2020). Findings of this study recommended that the direct effects of IOKA on GI are higher with higher level of absorptive capacity. This view is in agreement with the contribution of Al-Swidi, Gelaidanand Saleh, (2021) and Qu, et al., (2022), which depicts that AC is the stronger component in increasing the innovative performance of enterprises by providing culture of transforming and implementing new

knowledge to address the environmental concerns while adopting the strategies of bringing innovation in product, services and operations.

5.3 Managerial Implications

This study presents several momentous recommendations for CEOs, owners and managerial level employees of SMEs. First, appropriate management and new knowledge and technology acquisition from outside the enterprise boundaries will leads to formulation of effective strategies of bringing innovation in products, services and enterprise procedures while considering the environmental concerns in order to reduce negative effect on the eco-systems. It is foremost significant for owners, CEOs and managers of enterprises irrespective of age, nature and size to appropriately manage and implement augmented knowledge base and relationships with partners to take mutual benefits of opportunities to bring innovation in enterprise' products, services and procedures in-line with environmental perspective. Secondly, enterprise relationships with partners outside the boundaries of the enterprises are the key sources of new knowledge and new technologies for the augmentation of innovative culture in the environmental specific situations (Sepahvand et al., 2022; Zhou, Govindan, Xie & Yan, 2021); so, it is much needed for top management to divert their focus upon the appropriate management of mutual relationships with different partners. Furthermore, this study also suggests top management and owners of the enterprises to enhance the relational competencies and motivate the employees to enhance the implementation and transformation of novel knowledge in order to augment the strategies of innovation while considering the environmental aspects carefully (Qi, Jia & Zou, 2021). Additionally, study findings claim that acquisition of exterior knowledge solely is not enough for SMEs for promoting GI; the basic mechanism is to increase GOC within the organization. Therefore, managers, CEOs and owners of enterprises should concentrate on developing green organizational culture. On one extreme, managers, CEOs and owners should require to develop system for integration of exterior knowledge with the prevailing knowledge base of the enterprise, and on the other extreme, CEOs and owners should arrange meeting on regular basis to confer probable strategies of exploiting novel exterior knowledge base for enterprise innovation with the focus to reduce the negative effects upon ecosystem. On the whole, the study findings recommend that continuous acquisition of exterior knowledge and keep updating the interior stock of knowledge are exceptional solutions for the augmentation of GI. So, practically, enterprises should not solely acquire novel knowledge from exterior to enterprise boundaries but also establish the AC to exploit and manage the knowledge continuously through transforming it into the new products/services and procedures development. Finally, this study suggests that the processes of interactions that how AC impacts the association of IOKA and GI probably will be stronger through acquiring and implementing new knowledge inside enterprises as this competency is acknowledged as absorptive capacity.

5.4 Limitations and Future Research

This study has few limitations, which may be taken in account while conducting research in this field in future. Firstly, in this study findings were consequent from data collected through application of survey method in the context of manufacturing SMEs of developing economy as Pakistan, study findings might be both sector-and economy-specific. So, the findings of the study should be generalized in a protective manner to other sectors of economies or other transitional economies. Nevertheless, the extension of this study finding to other sector of industries and other economies will be beneficial stream of inquiry. Second, even though this study evaluated intervening role of GOC in the association of IOKA and GI in enterprises, there might have been some other facets such as the institutional distance, dynamic capabilities, and internal research and development that might have influence on these associations. In future research might explore few of other components to confer this research further. Moreover, the findings if this study leads to believe that this study results entail significant insights related to the subjected area through theoretical and empirical evaluation of the underlying mechanism among IOKAs and GI. It is expected that this study will instigate future research on how multi-facet strategies of IOKA, GOC and AC outlines innovative products, services and operations in-line to ecosystem. This study utilized quantitative method for testing the causal relationship among study variables for further explanation of this phenomenon in future mix methodologies might be useful in this area.

5.5 Conclusion

The findings of current study brought forward noteworthy insight into the knowledge management and environmental management theory by analyzing empirically and theoretically the causal relationships among IOKAs and GI in enterprises. It is postulated that this study will drive future research that how multi-dimensional knowledge acquisition, green organizational culture, and AC suggests the innovative culture of enterprises in line to the perspective of environmental concerns.

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