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Investigating the Relationship between Sustainable Knowledge Acquisition with Competitive Advantage: Mediating and Moderating Analysis

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Abstract

Purpose: The primary objective of this paper is to investigate the relationship between sustainable knowledge acquisition and competitive advantage. This study investigates the mediating effects of sustainable supply chain management practices and the moderating effects of institutional pressure (market pressure) on the path between sustainable supply chain management practices and competitive advantage. **Design/Approach/Methodology:** The present research is quantitative. The research strategy used was the survey approach**.** For the purpose of Exploratory Factor Analysis (EFA), the Statistical Package for the Social Sciences (SPSS) was used. Confirmatory Factor Analysis (CFA) was conducted using Analysis of Moment Structures (AMOS). A structured questionnaire was used to get information from 373 managers in Pakistani manufacturing industries. Among those targeted were people who work in industries that face sustainability issues, such as the leather, steel, textile, and rice industries. Primary data is collected via filled-out questionnaires. The current study is based on the Knowledge Based View (KBV) theory. **Findings:** The findings of this study indicate that sustainable knowledge acquisition has a substantial direct effect on competitive advantage. In addition, sustainable knowledge acquisition has a direct relationship with sustainable supply chain management practices. Similarly sustainable supply chain management practices have a direct relationship with competitive advantage. Further, sustainable supply chain management practices mediate between sustainable knowledge acquisition and competitive advantage. Besides, institutional pressure (market pressure) has also significant moderating relationship between sustainable supply chain management practices and competitive advantage. **Practical Implication:** The findings of this study will be helpful to managers and practitioners in achieving long-term corporate sustainability, vital business performance, sustainable competitive advantage, and value creation. **Originality/Value:** The purpose of this investigation is to make a key contribution to the current body of knowledge. This is the first research that has been conducted with the goal of determining how sustainable knowledge acquisition may be used to apply sustainable supply chain management practices in Pakistan's industrial sector. By understanding the contextual relationship between pressures and sustainable supply chain management practices, stakeholders may effectively apply sustainable knowledge acquisition and sustainable supply chain management practices in day-to-day operations to gain a competitive advantage in the market. This research provides more empirical evidence for the KBV theory.

Keywords: Sustainable knowledge acquisition, sustainable supply chain management practices, institutional pressure-market pressure, competitive advantage, manufacturing industry.

Introduction

Sustainability and sustainable development have emerged as significant phenomena, gaining immense popularity in both academia and industry globally over the past 20 years (Pata et al. 2025). This phenomenon first comes up with the name by "*the World Commission on Environment and Development"* (*WCED-1987*), which intrigued many scholars and ignited their curiosity about its significance. Subsequently, John Elkington (1997) proposed that the concept of sustainability is based on three foundational pillars: economics, ecology, and society. He examined the triple bottom line of contemporary businesses and refers to these three pillars as the "Triple Bottom Line (TBL)." Following, Dyllick and Hockerts (2002) investigated using specified trilateral foundational elements: social, natural, as well as business. Afterwards, these three pillars were renamed profit, planet, and people by Asif, Searcy, Zutshi, and Ahmed (2011).

The economic performance is often assessed using metrics including sales, market share, operational effectiveness, and modernization. (Jia, Zuluag-Cardona, Bailey, & Rueda, 2018 cited Gimenez & Tachizawa, 2012; Marchi, Maria, & Micelli, 2013). Moving toward eco-efficiency, green purchasing, resource efficiency, and managing waste in reverse logistics and operations are all part of the environmental bottom line. (Jia et al., 2018 refers to Hsu, Tan, Zailani, & Jayaraman, 2016; Sen, 2009). The ideas of "connectedness," "diversity" and "equality" are most strongly associated with social sustainability. This association extends to the phrases "labor conditions," "wellbeing," and "quality of life." (Orji, & Ojadi, 2021 refers Mani, Agrawal, & Sharma, 2016).

Sustainability cannot be maintained until sustainable practices are put into place. (Ahmad, Rezaei, & Sadaghiani, 2017). Implementing sustainable practices enhances the social and environmental efficacy of a firm and its supply chain. Furthermore, it allows enterprises to build a new set of capabilities that may help them achieve a competitive edge by employing sustainable operations both inside and outside the organization's limits (Saeed & Kersten, 2019). The decision to adopt sustainable practices or implement sustainability-related measures is often influenced by various internal and external elements (Paulraj, Chen & Blome, 2017). As a result, the responses to the needs of different stakeholders may have an

influence on the link between implementing sustainable programs and the efficacy of such efforts on the supply chain's performance in terms of sustainability (Zhu, & Sarkis, 2007).

A sustainable supply chain incorporates environmental and social concerns plus economic issues into a traditional supply chain (Wittstruck & Teuteberg, 2012; Turker & Altuntas, 2014; Ciliberti, Pontrandolfoa, & Scozzi, 2008; Dyllick & Hockerts, 2002). The term "sustainable supply chain" was originally used by academics Seuring and Müller (2008). They emphasized how crucial it is to integrate sustainability concepts into business practices across the supply chain in order to reap long-term financial rewards.

Organizations are looking for ways to improve their ability to deal with uncertainty (Hallstedt, Thompson, & Lindahl, 2013) and to remain abreast of the market's rapid shifts (Buys, Mengersen, Johnson, Buuren, & Chauvin, 2014), being compelled to move through a dynamic market that is driven by knowledge. Knowledge is an intangible asset that is vital to every organization's success or failure (Ooi, 2014). Organizations view it as an instrument that allows them to improve customer satisfaction (Attia & Salama, 2018) while also successfully competing in the market (Mothe Nguyen-Thi, & Triguero, 2017), to ensure organizational sustainability, businesses should concentrate their efforts on knowledge management.

The majority of knowledge management systems have shown to be unsustainable, demonstrating poor quantities and quality of knowledge, with systems falling into disuse. Only moderate successes have been observed in the vast majority of instances (Lichtenstein, & Swatman, 2002). Conversely, sustainability requires that organizations learn a lot through trial and error and build up an organizational knowledge base for solving problems. (Leblanc, Thomson, Cameron, 2015). Considering Snowden's (2002) findings, sustainable knowledge management is "as a collection of technologies, techniques, and procedures that are used to facilitate the creation, access, and reuse of knowledge in a collaborative environment. Its goals include formalizing and accessing experience, developing new capabilities based on knowledge and expertise, enabling superior performance, encouraging innovation, and increasing the value provided to customers".

Furthermore, sustainable knowledge management is the continuation of knowledge management practises without direct management or other forms of control attempts (Hutajulu & Harisno, 2019). Likewise, sustainable knowledge management requires less reliance on knowledge champions, employee incentive programmes, and monitoring and

reconstruction (Snowden, 1999).

For organizational sustainability, sustainable knowledge management capabilities are crucial in evaluating if a business is successful or cut out. Furthermore, "sustainable supply chain management strategies" enable firms to differentiate themselves from their competition. Subsequently, if organizations are failed to implement institutional pressures resulting competitive advantage would not be able to be maintained. This article covers one aspect of capabilities for sustainable knowledge management: sustainable knowledge acquisition and one aspect of institutional pressure, which is market pressure. However, the subsequent questions for research are the chief emphasis of the research:

1) What is the impact of sustainable knowledge acquisition on *"competitive advantage"?*
2) Does *"sustainable supply chain management practices"* mediate the relationship between *"sustainable knowledge acquisition"* and "*competitive advantage"*?
3) Does *"institutional pressure-market pressure"* moderate the relationship between *"sustainable supply chain management practices"* and *"competitive advantage"*?

The current study conducts an empirical survey among individuals employed in manufacturing firms located in the Faisalabad, Sialkot, and Lahore districts to address these challenges. Since the questionnaire is thought being the most effective research instrument for evaluating research questions and hypotheses. It was adopted and adapted for the current investigation. With regard to methodology, the investigators use structural equation modelling to model important interactions.

The remainder of the manuscript is divided into the subsequent parts: Section two outlines earlier research efforts and formulates hypotheses for the current investigation. The methodology for the research is outlined in Section 3. Within Section 4, the empirical results are presented. The discussion of the study's results, their implications, and potential avenues for further research is the main emphasis of Section 5.

Review Of Literature

The Relationship Between Sustainable Knowledge Acquisition On Competitive Advantage

According to Lichtenstein, and Swatman, (2002) studied elements that initiated sustainable knowledge management systems with special attention gave it to email and a case study research as a research methodology. The model was applied with focus on attention, integration, personalization, context, knowledge development lifecycle, and outcomes. And found that in this age of too much information, employees have little time and attention to

give. Further, a sustainable knowledge management system is one that commands high levels of employee attention at all times. To came to the conclusion that email is capable of integrating work practice and knowledge work in a seamless manner, and that its content, administration, and operation are highly individualised and contextualised. To sum up that the foundations of a sustainable knowledge management system were likely to consist of the integration, personalization, and contextualization of knowledge management systems.

Robinson, Carrillo, Anumba, and Al-Ghassani, (2005) investigated how successful in implementing knowledge management efforts in construction organizations and found that if appropriate considerations were given to strategy formulation, implementation issues addressed.

Marques and Simon (2006) studied the significance of knowledge management as providing companies with long-term competitive advantages and the analysis of how the implementation of knowledge management techniques results in improved company performance. Marques and Simon (2006) found that knowledge management capabilities positively impact firm performance, by adopting knowledge management capabilities obtained better results than their competitors. Research by Choi, Poon, and Davis(2008) examined the link between knowledge management capabilities and organization performance that leads to competitiveness. In their research, Choi et al. discovered that firms might profit from knowledge management by applying either an either internal or externally focused approach, or with the integration of the explicit-external-oriented and tacit-internal-oriented knowledge management skills.

Knowledge management capabilities have the potential to increase performance of the organization regarding customer satisfaction, interpersonal connections, creativity, employee performance, financial success, and productivity (Gholami, Asli, Shirkouhi, & Noruzy, 2013). Jayasingam, Ansari, Ramayah, and Jantan, (2013) found that knowledge management was to the foundation for gaining a competitive edge of the firm. Kianto, Ritala, Spender, and Vanhala, (2014) found that intellectual capital and knowledge management, both of these were needed in organizational value creation. Achieving competitive advantages in the company management environment is considered to be one of the most important factors that can be achieved through knowledge management (Lim, Tseng, Tan, and Bui, 2017).

Hutajulu and Harisno (2019) investigated the effect of social media in promoting sustainable knowledge management inside businesses. Most workers use Instagram, Twitter,

and Facebook, which make them facilitators of a sustainable knowledge management system since they help employees gain knowledge.

Based on the above observations, it is therefore hypothesize that:

H1: Sustainable knowledge acquisition positively impacts on *the "competitive advantage of the organization".*

"Sustainable supply chain management practices" mediate the relationship between sustainable knowledge acquisition and "competitive advantage".

In the event of a company's reputation being tarnished, managing suppliers for performance and risk, as well as overseeing the supply chain for sustainable products, are two of the most crucial issues noted by (Seuring, & Müller, 2008). Paulraj, Chen, and Blome (2017) discovered that relational and moral motivations were significant drivers and that organisations with a strong sense of moral duty outperform those motivated solely by moral considerations. Furthermore, sustainable management can assist policymakers, stakeholder groups, and academics in developing more rigorous methods to encourage businesses to engage in sustainable supply chain management.

According to Kusi-Sarpong, Gupta, and Sarkis (2018), the most important and critical sub-criteria for fostering sustainable supply chain management and sustainable development are financial availability for innovation, operational capability developments, green manufacturing and investment in research and development for green practices, as well as technical expertise available. Additionally, it was obvious that cultural, social, and normative values were the least important factor.

Prasad, Pradan, Gaurav, Chatterjee, Kaur, Dash, and Nayak (2018) found that organizational factors have a greater impact on SSCMP, which leads to improved sustainability performance, and that they are more relevant than external factors. The commitment and encouragement of upper management also contribute significantly to the development of a healthy work environment. Furthermore, the company is in a position to permit sustainable supply chain activities due to its adherence to safety requirements (OHSAS1801) and environmental standards (ISO14001). Yet, the business could not afford to overlook the ever-changing market and consumer sensitivities.

Dyck, Walker, and Caza, (2019) examined (1) how a hierarchical culture is related with financially sustainable organization and with a superior financial outcome, (2) how a clan culture is linked to socially sustainable organization and improved social results, (3) how

a market culture is linked to environmentally sustainable organizing and improved environmental results, (4) how an adhocracy culture is linked to holistically sustainable organization and superior holistic results. The complexity of the relationship between culture and sustainability was uncovered by Dycket et al. (2019), who used this information to create more nuanced typologies of sustainable enterprises. Additionally, understanding which organisational cultures are linked to particular sustainability outcomes could help managers and investors make wise resource commitments and identify which partners and stakeholders are most likely to share their values. Additionally, it was found that a firm's emphasis on a particular aspect of sustainable organising did not always translate into better performance in that aspect of sustainable organising.

The following hypothesis is based on the aforementioned observations:

H2: *"Sustainable supply chain management practices"* mediate the relationship between sustainable knowledge acquisition and *"competitive advantage"*.

The institutional pressure (market pressure) moderates the relationship between "sustainable supply chain management practices" and "competitive advantage".

A study by Zhu and Sarkis, (2007) demonstrated how environmental concerns have increased pressure on Chinese companies to put green supply chain management into practice techniques. Businesses are also more likely to improve their environmental performance when they are subjected to market (normative) factors, especially if these forces lead to the adoption of green purchasing practices along with eco-design.

Wu, Ding, and Chen, (2012) investigated moderating effects of the institutional pressure i.e. market pressures about green supply chain drivers and practices. Wu et al., (2012) found a positive moderating effect almost all of the relationships between green supply chain practices and green supply chain drivers. Hsu, Tan, Zailani, Jayaraman, (2013) initiated that one of the main forces behind the execution of a green supply chain is regulatory measures in manufacturing organizations.

Mathiyazhagan, Govindan, and Haq, (2014) studied how firms were compelled to use eco-friendly procedures to enhance their green image, and pointed out that in Indian industries, implementing green supply chain operations is strongly influenced by internal market forces.

Based on the observations above, it is hypothesized that:

H3: Institutional pressure (market pressure) moderates the relationship between *"sustainable supply chain management practices"* and *"competitive advantage"*.

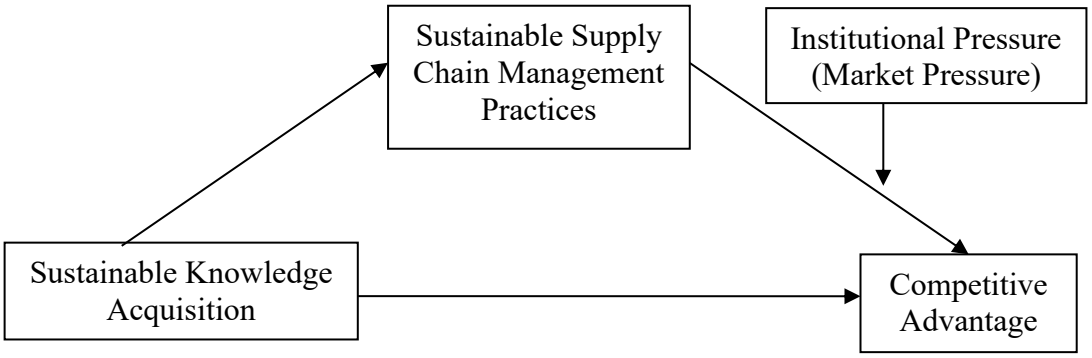

Figure 1: Shows the *"Research Model"*

Methodology For Conducting Research

Operationalisation Of Variables

Since the goal of the study is to determine how sustainable knowledge acquisition can be extended to gain a competitive edge through *"sustainable supply chain management practices",* as well as why and when businesses embrace *"institutional pressure"* (market pressure) to expand their use of *"sustainable supply chain management practices"* into competitive positions, the research being done is quantitative. In order to meet the main goals of the research and provide answers to the research questions, a survey method was selected as the research methodology. The current study employed the questionnaire as it considered being the best research tool for evaluating research questions and hypotheses. The investigators adapted the measurement instruments as needed to better suit Pakistani circumstances. The authors utilised a Likert scale, 1 represented "strongly disagree" and 5 represented "strongly agree." for all of the multi-item concept measures. Every construct was given an operational definition and a reflective measurement model was utilised.

To measure sustainable knowledge acquisition the study adopted 3 items scale. The scale was initially developed and validated by Roy, Silveste and Singh (2020) and adapted on the ongoing research. The scale was assessed using three items: (i)-"*new ideas and approaches based on sustainability experiment"*, (ii)-"*research and development policy for sustainability,"* (iii) - *"employees regularly participate in knowledge symposiums"*. Likert scales with five points were employed to measure the scale; one point denoted strongly disagreeing and five denoted highly agreeing. The study used a nine-item scale for evaluating

"sustainable supply chain management practices". The scale used in this investigation was created and verified by Ni and Sun (2019). The scale was evaluated using nine categories item respectively (i)-*"supplier's sustainability performance assessment through formal evaluation- monitoring -and auditing"* (ii)-" *training/education in sustainability issues for suppliers' personnel* "(iii)-*"joint efforts with suppliers to improve their sustainability performance"* (iv)-*"environmental certifications" (*v)-*"energy and water consumption reduction programs"* (vi)-*"pollution emission reduction and waste recycling programs",* (vii)-*"formal sustainability-oriented communication- training programs- involvement"* (viii)- *"win orders from customers with higher contributions to the development and welfare of society ",* (ix)-*" win orders from customers with more environmentally sound products and processes"*. A five-point Likert scale was used to evaluate the scale, where one represented no implementation and five represented a high level of implementation.

In order to measure institutional pressure-market pressure, the researchers used a three-item scale. The scale was created and validated by Wu, Ding, and Chen (2012), and it was used in this investigation. Three elements on the scale were used to measure the following: (i)-"firm considered the effect on environmental awareness of local customers", (ii)-"firm considered the effect on sales of foreign customers," (iii)- "respond to green environmental protection tendency". The Likert scale, which has five points—one denoting does not exist at all, whereas five reflect a significant amount of existence. The study used a six-item scale to measure competitive advantage. The scale was created and validated by Tracey, Vonderembse, and Lim (1999) and used in the current investigation. The scale was determined using six items associated with offer competitive prices, able to compete based on quality provide customized products, deliver products to the market quickly, provide dependable delivery, offering high quality products to our customers. To measure the scale, a 5-point Likert scale was employed, where 1 denoted strongly disagreeing and 5 denoted strongly agreeing.

Data Collection, Sampling, and Population

The target population refers to the whole set of units from whom qualifying samples are taken (Bryman and Bell, 2011). Therefore, the target population for the study consists of individuals working in manufacturing firms in the Faisalabad, Sialkot, and Lahore districts. The non-probability sampling approach, namely snowball sampling, was used in the current investigation. The primary respondents in manufacturing organizations for the current

investigation are operations/logistics and supply chain managers, who also serve as the study's unit of analysis.

The right sample size for regression analysis is determined by Burmeister and Leanne (2012). The right sample size for this type of study may be found using the 20:1 rule, according to which a regression model's sample size to parameter count ratio should be at least 20 to 1. Kaplan (2000) also claimed that better results are obtained with more samples for structural equation modeling. To support the results, the current study requires 20 samples for each observed variable. Each of the four theoretical constructs in the current study model has an average of five observable variables. It suggests that the researcher require a minimum of 420 samples in order to conduct the structural equation modeling analysis properly (4 (number of constructs)*20 (number of observed variables)* 5.25 (number of required samples per observed variables) = 420. In order to ensure that the researcher could safely meet the minimum sample size requirement, the sample size threshold was set at 500 samples. As recommended by Hair et al. (2019), this sample size is sufficient for the recommended statistical method of structural equation modeling. A response rate of almost 74.6 percent was obtained from the approximately 500 questionnaires that were distributed, of which 373 were returned in a usable condition.

In business and management research, two types of questionnaires were used, according to Saunders, Lewis, and Thornhill (2009): self-administered questionnaires, including those that were mediated online, postal questionnaires, and delivery and collection questionnaires as well as interviews, such as organized interviews and telephone questionnaires. A self-administered questionnaire with an emphasis on delivery and collection was employed for the current investigation. Since respondents could complete the questions at their own pace and without the researcher's influence, self-administered questionnaires were the best methods for gathering data in this instance. A cover note explaining that data will be kept private and used exclusively for research was included with every questionnaire.

Approach to Data Analysis

To achieve the objectives of the study as indicated and to identify relationships among the variables; sustainable knowledge acquisition, *"sustainable supply chain management practices",* and *"institutional pressures-market pressure", "competitive advantage"*, suitable technique for analysis were used. Exploratory Factor Analysis (EFA), which uses *"the maximum likelihood"* approach with *"Varimax rotation"*, is used to examine the factor

structure and relationships between the items on the scale. "Confirmatory Factor Analysis (CFA)" was employed to examine the variables' psychometric properties in this investigation. A number of indices were employed to assess the model's goodness of fit, including two incremental fit indices, the "Comparative Fit Index (CFI)" and the "Goodness of Fit Index (GFI)" and two absolute fit indices, the "chi-square" and the "Root Mean Squared Error of Approximation (RMSEA)". The "Statistical Package of Social Sciences (SPSS)" version 30 software was used to perform the descriptive statistics. To evaluate the mediating and moderating analysis using "Analysis of Moment Structures (AMOS)" software version 26.

Analysis Of Data And Outcomes

Analysis of Correlation

Finding zero-order correlation between the variables in the research, the aim of correlation analysis. The research used Pearson Correlation analysis to ascertain the inter-correlation among all of its variables. Table 1 below displays the bivariate correlation coefficients for each of the primary research variables. Bivariate correlation shows how variables are related to one other. A small effect size is defined by Cohen (1988, 1992) as "r" fluctuating between 0.1 and 0.3, a medium effect size as "r" changing between 0.3 and 0.5, and a big effect size as "r" being greater than 0.5. According to the results, which are summarized in Table 1, reveal that competitive advantage is positively related to all other observable variables, with a substantial positive correlation. The correlation value indicates that SKA with CA has a significant relationship with (r = 0.482**). The value of correlation of IPMP with CA is significant (r = 0.452**) and SSCMP is also directly correlated to CA (r = 0.461**).

Table 1 shows Correlations.

		SKA		SSCMP	CA
SKA	Pearson Correlation.	1			
	Sig. 2-tailed				
	N	373			
IPMP	Pearson Correlation.	.452**	1		
	Sig. 2-tailed	.000			
	N	373	373		
SSCMP	Pearson Correlation.	.496**	.437**	1	
	Sig. 2-tailed	.000	.000		

	N	373	373	373	
CA	Pearson Correlation.	.482**	.464**	.461**	1
	Sig. 2-tailed	.000	.000	.000	
	N	373	373	373	373

**. The significance of correlation at the 0.01 level (2-tailed).

Analysis of Descriptive Data

Features of the sample are characterized by demographics. SPSS 30 was utilized for the analysis of all demographic data to produce percentages. The relationship between the important parameters was determined using descriptive statistics. A self-administered survey was done. There were around 440 responses out of 500, which included questions about demographic attributes in addition to independent, moderating, and dependent variables. Of the submitted surveys, roughly 74.6 percent were operable, yielding 373 replies.

Participants were drawn from a variety of demographic groups, including age, gender, and other demographics. The study included males and females and obtained 373 responses, with 7.2 percent being female and 92.8 percent being male. The study's participants ranged in age from 20 to over 50 years old. Table 2 presents the descriptive statistics regarding features of the population.

Table 2: Presents Demographic Statistics for the Respondents.

S No.	Demographics	Categories	Percentage
i	Gender	Female	7.2%
		Male	92.8%
ii		51 Or above	16.1.2%
	Age	41 - 50	42.6%
		31 - 40	31.1%
		20-30	10.2%
		Others	1.3%
iii	Education	PHD	0.3%
		Masters	7.2%
		Graduates	90.1%
		Undergraduates	1.1%

iv	Location	Sialkot	21.2%
		Lahore	51.2%
		Faisalabad	27.6%
v	Present Experience in the Organization	21 or Above	------
		16-20	------
		11-15	3.2%
		6-10	67.8%
		0-5	29%
vi	Overall Experience	21 or Above	7.8%
		16-20	35.4%
		11-15	30.3%
		6-10	7.5%
		0-5	19.5%
vii	Type of Industry	Rice Industry	2.9%
		Textile Industry	17.2%
		Steel Industry	25.5%
		Leather Industry	54.4%

Model Measurement

The three phases of analyzing and measuring data are as follows: In the initial stage of the procedure, the investigators conducted a preliminary assessment of the scale using EFA with SPSS's Maximum likelihood and Varimax rotations. The second stage entailed completing further validation of the factor structure, which was produced by EFA and then passed to CFA, which AMOS was used to perform. The final phase involved testing the hypotheses by examining the structural model with AMOS.

Exploratory Factor Analysis

EFA was performed by the researchers utilizing the "maximum likelihood" technique with "Varimax Rotation" in order to investigate the factor structure and inter-item relationship. Presented are the results of the rotated factor matrices in Tables 3 and 4.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.945
Bartlett's Test of Sphericity	Approx. Chi-Square	6983.936
	Df	210
	Sig.	.000

The prerequisites for suitable sampling have been met when the "KMO" value is greater than 0.50. The intended outcome is achieved since our correlation matrix differs significantly from an identity matrix, as indicated by the statistical significance of the Bartlett test of sphericity (P <.05).

Table 4: Rotated Component Matrix[a]

	Component			
	1	**2**	**3**	**4**
SKA1			.806	
SKA2			.808	
SKA3			.763	
IPMP1				.793
IPMP2				.779
IPMP3				.752
SSCMP1	.808			
SSCMP2	.827			
SSCMP3	.829			
SSCMP4	.825			
SSCMP5	.871			
SSCMP6	.822			
SSCMP7	.769			
SSCMP8	.866			
SSCMP9	.576			
CA1		.724		
CA2		.854		
CA3		.848		
CA4		.808		

CA5	.833
CA6	.811

The Principal Component Analysis method of extraction.

Varimax with Kaiser Normalization is the rotation method.

a. Rotation converged after 5 iterations.

As expected, the findings of the exploratory factor analysis indicate that the solution is based on four factors, and each item loads in accordance with its own factors. As of present, the four-factor solution can explain 76% of the overall variation. The findings of the exploratory factor analysis demonstrate the high level of validity of our factors. Table 5 below shows the total variation accounted for by the four factors.

Table 5: Explained by Total Variance

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.793	51.393	51.393	10.793	51.393	51.393	6.509	30.995	30.995
2	2.796	13.313	64.706	2.796	13.313	64.706	4.739	22.568	53.563
3	1.349	6.425	71.131	1.349	6.425	71.131	2.394	11.399	64.962
4	1.086	5.172	76.303	1.086	5.172	76.303	2.382	11.341	76.303

The researcher carried out a CFA which is going to be discussed in the next section in order to validate our findings even further.

Confirmatory Factor Analysis

When using quantitative research methods, it is strongly advised to confirm the validity and reliability of a scale already tested by other researchers. A scale's validity determines its accuracy, but its reliability determines its consistency. Using both the CFA and the "Cronbach alpha" reliability analysis, the validity and reliability of the scales utilized for the study's variables were determined. To verify the validity and convergence of the discriminant components, a CFA was conducted. Discriminant validity is the degree to which one construct can be identified from another, whereas convergent validity is the degree of evidence that a latent construct shares a percentage of variance with another construct. The CFA final estimated model's graphical representation is displayed below, and table 6 presents

the findings.

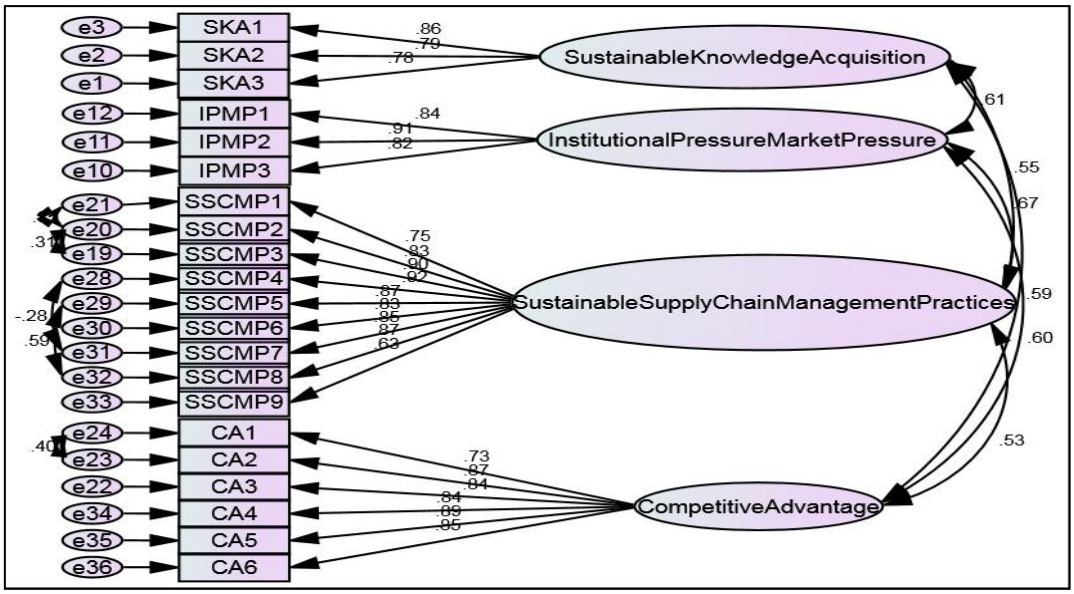

Figure 2: CFA Model

Table 6: Convergent Validity and Reliability

Factors/ Constructs	Items	Loadings of Standardized Factors	The Cronbach Alpha	The Composite Reliability	The Average Variance Extracted	Maximum Shared Variance
Sustainable Knowledge Acquisition	SKA1	.858	.845	.850	.654	.371
	SKA2	.786				
	SKA3	.780				
Institutional Pressure-Market Pressure	IPMP1	.838	.889	.891	.732	.443
	IPMP2	.909				
	IPMP3	.818				
Sustainable Supply Chain Management Practices	SSCMP1	.752	.954	.953	.693	.443
	SSCMP2	.836				
	SSCMP3	.909				
	SSCMP4	.910				
	SSCMP5	.876				
	SSCMP6	.834				
	SSCMP7	.836				

	SSCMP8	.873				
	SSCMP9	.632				
Competitive	CA1	.752	.937	.934	.707	.367
Advantage	CA2	.886				
	CA3	.855				
	CA4	.839				
	CA5	.872				
	CA6	.825				

Fitness of the final model:X2=309.84, df=178, X2/df= 1.74, RMSEA=.045, RMR=.037, GFI=.927, CFI=.981

The result of CFA demonstrate that the model has statistics on good fit include x2/df=1.74, RMSEA of 0.045, RMR of 0.037, as well as CFI of .981. In accordance with the suggestions that were provided by Hu and Bentler (1999), Browne and Cudeck (1992), the values are enclosed in brackets, (RMSEA<.08, RMR<.05, CFI>.90). It is an indication of excellent convergent validity when all items' standardised factor loading was over 0.60 and their average variance explained was likewise above 0.50 (Hair, Sarstedt, Ringle, & Gudergan, 2017). Convergent validity is further demonstrated by the fact that for all variables, the "Maximum Shared Variance (MSV)" is smaller than the matching "Average Variance Extracted (AVE)". All variables demonstrated excellent reliability as evidenced by Composite reliability and Cronbach alpha scores are more than 0.70.

Hypotheses Testing

With the use of AMOS, a structural model was employed to investigate the connection between the research hypotheses. To provide precise insights, each hypothesis was tested using a different structural model. Three different structural models were therefore used for the estimate procedure. The model's graphical, equational, and structural representation is displayed below, along with its results.

Structural Model 1

$$CA_i = \beta_0 + \beta_1 SKA_i + \varepsilon_i \qquad (1)$$

The constant term in this model is represented by β0, β1 represents the coefficient of sustainable knowledge acquisition (SKA), CA represents competitive advantage, and Ɛ represents the error term. Figure 3 shows the impact of SKA on CA within this structural

model. The model successfully accounted for the data, as indicated by the equation "X2/df = 1.606", indicating the model's overall good fit with the data. Furthermore, the "GFI = 0.981", "AGFI = 0.958", "CFI = 0.995", "TLI = 0.991", and "NFI = 0.987" scores are within the ideal range of greater than 0.90 (Hair, Black, Babin, Anderson, 2013). The present model's "RMR = 0.036" and "RMSEA = 0.040" fall below Steiger's (1990) suggested criterion of 0.09.

The preliminary structural model estimate shows that the SKA has a substantial linear positive impact on CA ("β = 0.57, p < 0.05"), supporting hypothesis H1. According to the findings, enterprises and organisations with a high degree of sustainable knowledge acquisition are better positioned to achieve a higher CA than those without. The R2 result indicates that an organization's competitiveness varies by 36% can be explained by SKA.

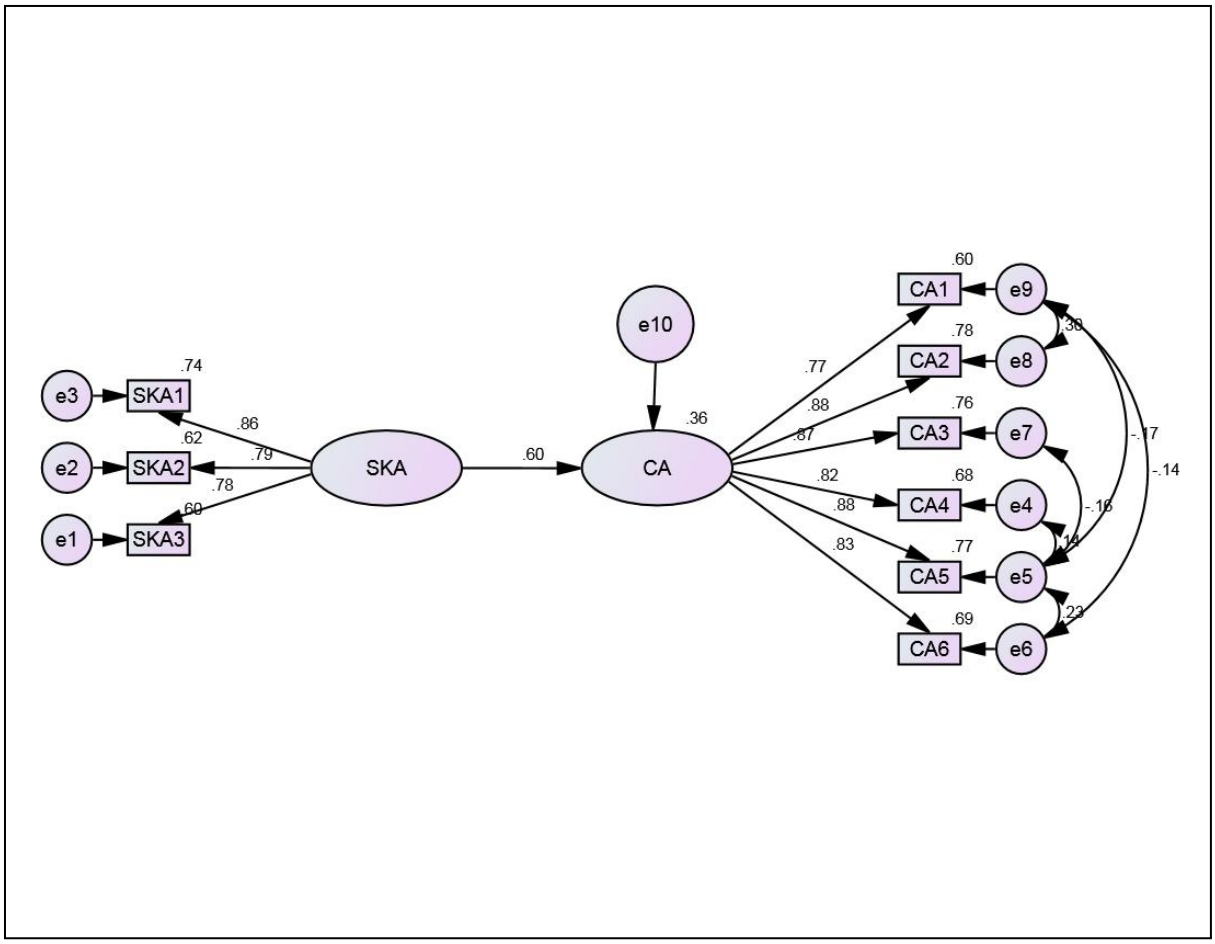

Figure 3: Model 1 Structural

Model 2 Structural for Mediation Analysis

$$CA_i = \beta_0 + \beta_1 SSCMP_i + \beta_2 SKA_i + \beta_3(C.Exp) + \beta_4(I.Typ) + \varepsilon_i \quad (2)$$

In the equation, β0 represents the constant term, β1 represents the mediator variables of

"*sustainable supply chain management practices (SSCMP)*", β2 represents the coefficient of sustainable knowledge acquisition (SKA), CA represents competitive advantage, β3 and β4 represent the control variables of current experience and industry type, and Ɛ is the error term. Figure 4 shows the predicted mediating effect of SSCMP between SKA and CA within this structural model. The model successfully accounted for the data, as indicated by the equation "X2/df = 1.361", indicating the model's overall good fit with the data. Furthermore, the "GFI = 0.954", "AGFI = 0.935", "CFI = 0.993", "TLI = 0.991", and "NFI = 0.974" scores are within the ideal range of greater than 0.90 (Hair, Black, Babin, Anderson, 2013). The present model's "RMR = 0.036" and "RMSEA = 0.031" both fall below Steiger's (1990) suggested criterion of 0.09.

To investigate the mediation hypotheses, the researcher used the bootstrapping technique recommended by Hays and Preacher (2014). The key assumptions of conventional methods for calculating indirect effects, including Sobel's (1982), have been contested by academics (Preacher & Hays, 2013). The method that is currently most frequently advised for testing mediation and conditional process models is bootstrapping (Preacher, Rucker, & Hays, 2007).The estimation bootstrapping procedure was used with 2000 samples, a 90% confidence interval, and the results of the second structural model are shown in table 7. This proves that when the company implements sustainable supply chain management practices, the indirect path of SKA significantly affects CA "(β = 0.365, p 0.05)", hence confirming hypothesis H2. Similarly, SKA and comparative advantage have a statistically significant association "(β = 0.436, p = 0.05)". These important pathways suggest that SSCMP could act as a mediator between competitive advantage and SKA. The findings provide strong support for hypothesis H2. The results suggests that high sustainable knowledge acquisition stimulates organizations to build effective SSCMMP and improve competitive advantage. The value of R2 indicates that SKA causes 31% changes in CA in the presence of SSCMP.

Table 7: Mediating Role of SSCMP

Hypothesis	Path	Direct Effects	Indirect Effects	Total Effects	Remarks
H2	SKA>SSCMP>CA	.436***	.156***	.591***	Hypothesis supported since indirect effects are statistically

	significant

*<.05, **<.01, ***<.001

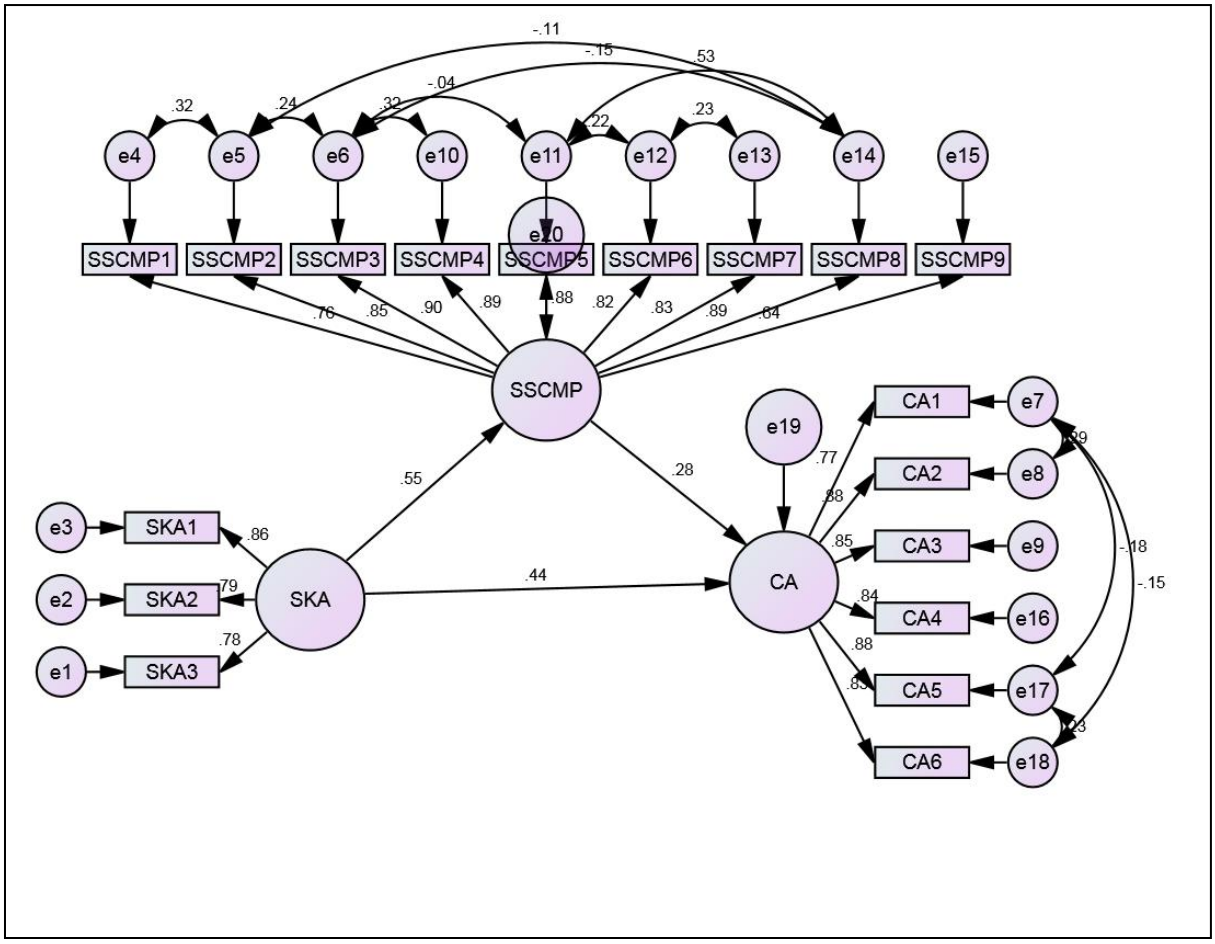

Figure 4: Model 2 Structural

Model 3 of Structural Analysis for Moderation

$$CA_i = \beta_0 + \beta_1 SSCMP_i + \beta_2 IP - MP_i + \beta_3 (SSCMP\ X\ IP - MP)_i + \beta_3(C.Exp) + \beta_4(I.Typ) + \varepsilon_i \qquad (3)$$

The equation is as follows: β0 represents the constant term, β1 represents the coefficient of the variables, specifically *"SSCMP"*, β2 represents the coefficient of the moderator, institutional pressure-market pressure, and β3 represents the coefficient of interaction between sustainable "*SSCMP*" and "*institutional pressure*". β3 along with β4 are the control variables, current experience and industry type, and Ɛ is the error term. The moderation analysis (See Figure 5) is conducted by treating sustainable supply chain management practices as independent variables, CA as dependent variable, and institutional pressure-market pressure as moderator. Using SPSS, the findings are computed by generating

interaction terms from the variables' standardized scores. In the set of data, the interaction term was created, by multiplying the SSCMP with institutional pressure (SSCMP x IPMP). The results of the moderation analysis displayed in table 8 shows that the SSCMP (β =0.439, p = 0.05) was a significant predictor of CA and institutional pressure-market pressure (β = 0.382, p = 0.05) significantly related to CA.

The relationship between the interaction term (β = 0.146, p = 0.05) and sustainable supply chain management practices was found significant, showing that the relationship between SSCMP is being moderated by institutional pressure. Thus the results show that there is moderating effect of institutional pressure-market pressure on the SSCMP and *competitive advantage*. Therefore, hypothesis H3 is approved.

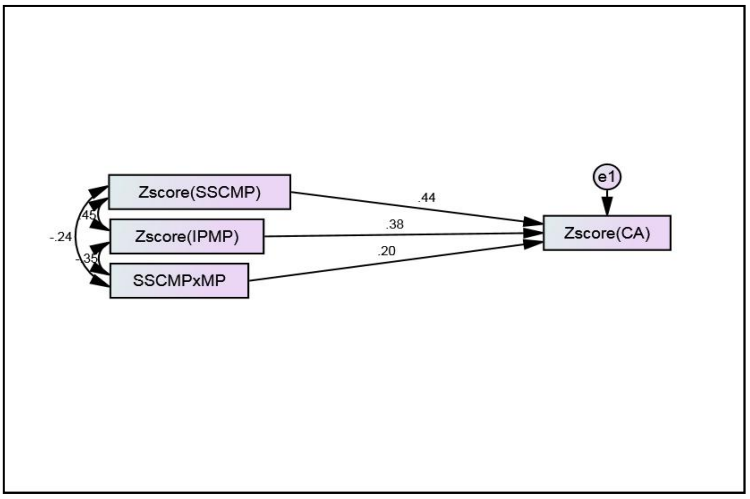

Figure 5: Structural Model 3

Table 8: The Results of Moderation Analysis

			Estimate	S.E.	C.R.	P	Label
ZCA	<---	ZSSCMP	.439	.044	9.976	***	
ZCA	<---	ZIPMP	.382	.046	8.369	***	
ZCA	<---	SSCMPxMP	.146	.030	4.877	***	

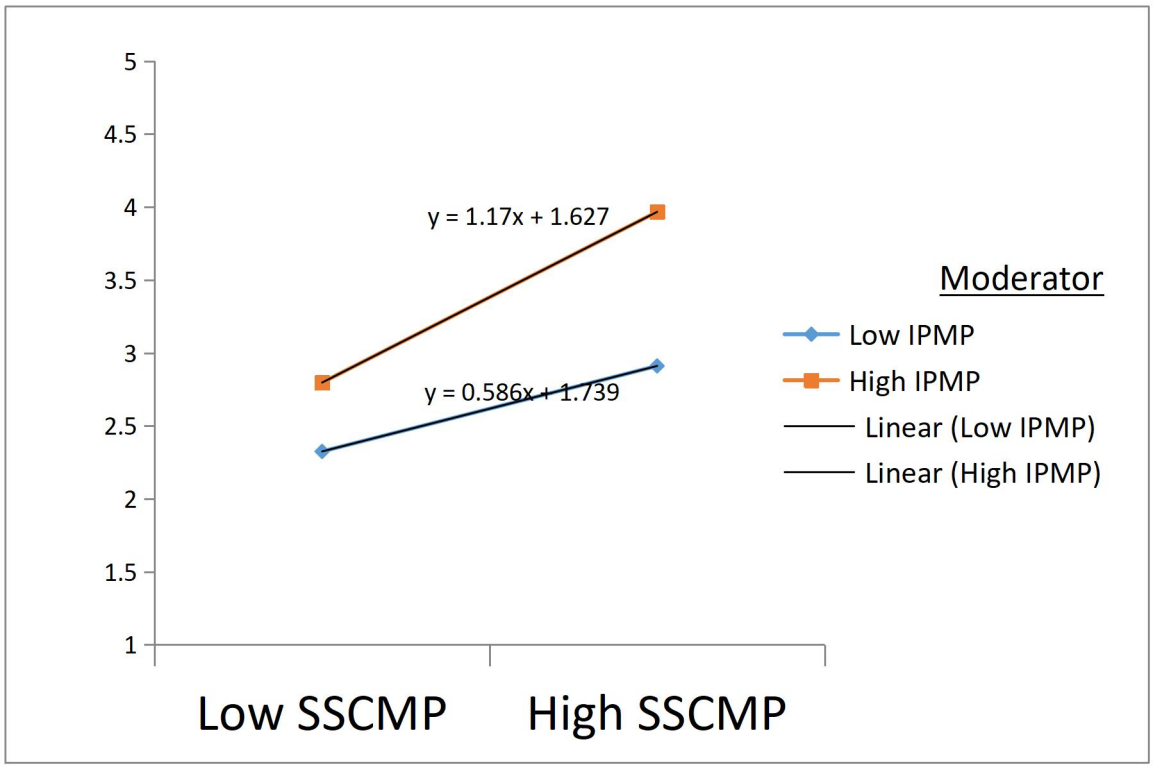

Figure 5: IPMP strengthens the positive relationship between SSCMP and CA.

Table 15. Research Hypotheses Summary

Hypothesis	Remarks
H1: Sustainable knowledge acquisition positively impacts on the CA of the organization.	**Supported**
H2: SSCMP mediates the relationship between *sustainable knowledge acquisition* and *competitive advantage.*	**Supported**
H3: *Institutional pressure (market pressure)* moderate the relationship between SSCMP and *Competitive advantage.*	**Supported**

Discussion

In order to meet the study's main objectives and provide answers to the research questions, the present investigation is quantitative and uses a survey technique employing a cross-sectional research design. The researchers used snowball sampling, a non-probability sampling approach, in the current investigation. Key respondents include operations/logistics and supply chain managers in the manufacturing businesses serve as the analytical unit in this study.

The questionnaire is most effective in explanatory and analytical research because it allows

researchers to analyse and explain cause and effect relationships between variables (Saunders et al., 2016). Therefore, the questionnaire was used for the current study because it is thought to be the best research tool for evaluating hypotheses and research questions. A response rate of almost 74.6 percent was obtained from the approximately 500 questionnaires that were distributed, of which 373 were returned in a usable condition.

To respond to the research questions and determine the relationships between the variables; sustainable knowledge acquisition, SSCMP, *competitive advantage*, and *institutional pressures-market pressure*, suitable analytical procedures were used. EFA was performed using SPSS version 30" software, while AMOS version 26 was used to analyze CFA, mediating, and moderating analysis.

Taking into consideration the dynamics of the present research variables, the present investigation employs KBV theory since it efficiently controls and organizes organizational resources. To obtain CA in the market, this paradigm uses an internal method to acquire and employ organizational resources. Thus, KBV theory serves as the main theoretical framework for the current investigation.

Structured equation models in AMOS have been used to examine the impact of SKA on CA, taking into account the moderating influence of institutional- market pressure as well as the mediating function of SSCMP.

Hypothesis H1 was created and investigated in order to find the answer to research question number 1. The results showed an intense direct relationship between SKA and CA, which validated hypothesis H1. Additionally, SKA can account for 36% of the variance in an organization's competitiveness. The current investigation is based on the KBV theory as both views of the theory i.e. SKA (sustainable knowledge acquisition) and CA support the claims and hypotheses made by the present investigation. This indicates that the variable in this situation has a high positive significant association, meaning that a firm will eventually earn CA in the market when they apply or have SKA.

Does SSCMP mediate the relationship between SKA and competitive advantage? Hypothesis H2 was created and investigated in order to determine the research question's number 2. Furthermore, SKA induces 31% alterations in CA in the presence of SSCMP. The results supported hypothesis H2 by confirming a mediation role of SSCMP between SKA and competitive advantage. SSCMP is basically an explanatory variable for sustainable knowledge management capabilities. When an organization implements sustainable

knowledge management capabilities, as a result SSCMP enhanced. This result conforms the results of (Lim et al., 2017; Attia & Salama, 2018; Wong & Wong, 2011), due to SSCMP organizations can achieve competitive advantage. All of this psychologically indicates that SKA establishes SSCMP throughout the company, which eventually improves competitive advantage. KBV theory states that when a business employs intangible assets such SKA, its capabilities increases, which supports the mediating variable i.e. SSCMP which can seen an optimum mediating effect in the current study's context.

Does *institutional pressure* (market pressure) moderate the relationship between SSCMP and CA? To find out what the answer is, investigate the third research question, and hypothesis H3 was formulated and tested. The findings indicate that the moderating role has been statistically supported by institutional pressure (market pressure) between SSCMP and CA in our data which is similar to hypothesized nature of relationship.

The Study's Contribution

This research has expanded the body of knowledge for academic researchers and practitioners.

Theoretical Contribution

This study aims to significantly add to the body of existing research on several sustainability perspectives. First of all, this study is distinct since it has looked into; how sustainable knowledge acquisition affects the firm CA and how SKA impact the SSCMP. This research is the first one of its sort in this field to investigate the direct relationship. It has been discovered that SKA has a significant influence on the company's competitive edge. Because of changing market trends, firms may enhance their supply chains by improving their knowledge-based operations in order to gather the essential information and respond quickly to changing client needs in order to maintain a competitive market position.

Second, this research examined the mediating function of SSCMP between SKA and the firm competitive advantage. Accordingly, SSCMP is best suited mediator for the current study. SSCMP is basically an explanatory variable for sustainable knowledge management capabilities. When an organization implement sustainable knowledge management capabilities, as a result SSCMP enhanced (Lim et al., 2017; Attia & Salama, 2018; Wong & Wong, 2011), due to SSCMP organizations can achieve competitive advantage. All of this psychologically indicates that SKMC develops SSCMP inside the company, which eventually improves *competitive advantage*. Such a study has never been conducted before, thus this survey differs from previous surveys.

Thirdly, this investigation also looked into the moderating role of institutional pressure (market pressure) between SSCMP and CA. The outcome demonstrates that the moderating role has statistical validity of institutional pressures-market pressure between SSCMP and CA in our data which is similar to hypothesized nature of relationship.

Fourthly, According to Hong, Zhang, Ding, (2018 as citied Khan, Golpira, Sharif, Mardani, 2021) there is currently relatively little study on sustainability in emerging nations. This study answers this need by shedding light on sustainability concerns in a developing nation such as Pakistan.

Fifth, under the framework of KBV theory, this study is the first to analyze the relationship between sustainable knowledge acquisition, SSCMP, institutional pressure, and competitive advantage. The variables: SKA (sustainable knowledge acquisition) is the firm intangible resources and SSCMP, are the firm capabilities, and firm competencies resulted in order to achieve a competitive edge. Further in the scenario of KBV theory, institutional pressures exert external strategic factor that influences in the form of market pressure the organizational capabilities increases like SSCMP that ultimately gain competitive advantage. Possessing valuable, rare, and unique things (Barney, 1991) like SSCMP that are difficult to copy and have a big impact on earning CA in the business world is another approach for the company to be more competitive.

Sixthly, by demonstrating the importance of sustainable knowledge acquisition and SSCMP that result in a *competitive advantage*, the KBV theory is empirically supported by this investigation and broadens its application.

Practical Contribution

The results of the present investigation have provided guidance to the firm's supply chain and operations managers in overcoming the firm's ongoing challenges by managing sustainable knowledge management capabilities that can be acquired from both internal and external sources, which will aid in improving the firm's SSCMP and enhancing performance.

Managers of the company will be able to determine which sustainable knowledge management capabilities have the most impact on the company's success. In addition, it will assist managers in determining which sustainable knowledge management capabilities have the greatest impact on the SSCMP of the organization.

Conclusion

The results of the numerous studies that have been done to investigate the direct and indirect

relationship between sustainable knowledge acquisition and competitive advantage are inconclusive. This is despite the fact that a great deal of study effort has been done on the topic. Furthermore, studies have missed the impact of sustainable knowledge acquisition on the path between SSCMP and competitive advantage, as well as how institutional pressure (market pressure) moderated the relationships. The goal of this investigation was to investigate areas that have not been investigated yet in order to improve the readers' overall comprehension.

This study, which drew on the RBV theory, investigated the relationship between sustainable knowledge acquisition and competitive advantage, with the function of SSCMP as a mediator and institutional pressure-market pressure as a moderator. Data was gathered from 373 managers in Pakistan's industrial sector using a standardized questionnaire. Individuals working in sectors dealing with sustainability challenges, such as rice, textile, steel, and leather, are among the target audience. Screening tests were run in SPSS, and structural equation modeling was done in AMOS.

The findings revealed that sustainable knowledge acquisition have an important influence on the company's sustainable supply chain management procedures and competitive advantage. Conversely, competitive advantage can be considerably increased through the development of sustainable knowledge acquisition. Further, SSCMP mediate the relationship between sustainable knowledge acquisition and *competitive advantage*. The outcome demonstrates that the moderating effect of institutional pressure-market pressure between competitive advantage and SSCMP is statistically supported in our data which is similar to hypothesized nature of relationship.

Limitation And Future Avenues

Despite the fact that this work has contributed significantly both theoretically and practically, it has some limitations that can be addressed in future study.

I. The researchers pay particular emphasis to the relationship between sustainable knowledge acquisition and *competitive advantage* within the framework of the current study. Other sustainable knowledge management capabilities may be included in future research.

II. The study focuses on the mediating function of SSCMP, and nine factors were included. Future research will incorporate more elements to further investigate the outcomes.

III. Specifically, this research looks into the moderating role of institutional pressure-market pressure. Future research may examine how other institutional pressures i.e. regulatory pressure, competitive pressure affects the relationship.

IV. While longitudinal studies could be carried out in the future, the current research is cross-sectional in nature.

V. Three districts in Pakistan—Lahore, Faisalabad, and Sialkot—were selected to be the subject of this investigation. Future research might concentrate on other areas.

VI. Participants in four different industrial sectors served as the primary data sources for this investigation, including the rice, textile, leather, and steel industries. As a result, the findings appear to be relevant for same sectors but may not apply to other manufacturing industries. Future studies might thus be carried out some other manufacturing industries.

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