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The Effect of Supply Chain Management Practices on Competitive Advantage in Manufacturing Industry in Pakistan: The Moderating Role of Big Data Analytics

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Abstract

The purpose of the current study is to examine that what big data analytics (BDA) may have a moderating effect on the relationship between supply chain management practices (SCMPs) and competitive advantage (CA) in Pakistani manufacturing companies. Data was gathered quantitatively from several manufacturing businesses located industrial in Karachi. The study hypothesis was tested using SPSS method and linear regression analysis, sample size is 154 persons working in small, medium and large sized manufacturing companies with multiple categorizations based on enterprise size, job & experience. The findings demonstrate that SCMPs have a major favorable impact on competitive advantage (CA). In particular, information quality (IQ), customer relationship management (CRM), and strategic supplier partnerships (SSP) all significantly improve competitive advantage (CA), information sharing (ISh) not significantly on competitive advantage (CA). Furthermore, investigates the association between SCMPs and CA in Pakistani manufacturing enterprises, as well as the moderating effect of big data analytics (BDA). The findings validate H1, H2, and H3 and demonstrate the beneficial effects of Supplier Strategic Partnership (SSP), customer relationship management (CRM), and information quality (IQ) on competitive advantage (CA). This study is to look at how big data analytics (BDA) may be able to moderate the relationship between supply chain management practices (SCMPs) and competitive advantage (CA) in Pakistani manufacturing companies. The findings demonstrate that SCMPs significantly improve CA. Information quality (IQ), customer relationship management (CRM), and strategic supplier partnerships (SSP) in particular significantly improve competitive advantage (CA). Information sharing (ISh), on the other hand, had no effect on competitive advantage (CA). Some flaw in the way the firms under investigation handle big data analytics (BDA). It emphasizes that for big data analytics (BDA) systems to produce the intended outcomes, managers must integrate them with other business systems and capabilities.

Keywords: Supply chain management practices (SCMP); competitive advantage (CA); big data analytics (BDA); information sharing (ISh); customer relationship management (CRM); information quality (IQ).

INTRODUCTION

Supply chains play a crucial role in all types of organizations as they effectively link manufacturers, suppliers, and customers in a network focused on producing and distributing goods and services. Supply chains require efficient management to effectively align supply with demand, encompassing factors such as managing warehouses, procurement, transportation, and marketing (Awwad, Kulkarni, & Marathe, 2018) & (Stevenson, 2014). The intricacies of these supply chains in the manufacturing sector require adept planning, implementation, and control of

operational activities. Various strategies are utilized to effectively link the management of suppliers, manufacturers, storage facilities, and products in order to ensure the timely production and delivery of goods and services (Waghmare & Mehta, 2014). As markets and communities embrace technological advancements, the specialization and expertise embedded in the supply chain become increasingly vital. Companies today understand that trying to manage every detail in-house is impossible, therefore they use knowledge from experts throughout the supply chain to generate value at every turn (Heizer & Render, 2011). In this era of technological advancement and globalization, the strategic application of IT methodologies and Big Data Analytics (BDA) becomes paramount for organizations to maintain a competitive edge. BDA is essential to how information moves and how supply chain operations change. Its significance in supply chain management is heightened by the relentless development of information technology (Tamym, El Oaudghiri, Benyoucef, & Moh, 2020). The expanded supply chain network includes suppliers, consumers, manufacturers, traders, retailers, service providers, and carriers, and it extends beyond the confines of particular businesses (Naway & Rahmat, 2019).

As a result, regardless of what is currently known about its moderating function in the relationships between supply chain management practices (SCMPs) and organizational competitive advantage (CA), BDA stands out as a major contributor to CA. At the moment, Pakistan's manufacturing sector faces significant obstacles in both the international and domestic markets. The competitive environment has changed due to free trade agreements and alliances, which have taken away the protection that local businesses used to have. This situation has gotten worse once Pakistan joined international trade associations, mirroring the difficulties Jordanian producers faced (Nimeh, Abdullah, & Sweis, 2018). The research now in publication clarifies the connection between SCMPs and CA, but it pays little attention to how BDA increases the effect of SCMPs on CA. Moreover, previous research frequently addressed SCMPs as a collective concept, failing to analyze the contributions of specific supply chain strategies to CA. There is still much to learn about BDA's function in controlling the interaction between SCMPs and CA, especially in Pakistan and the Middle East. In order to close the gap, this study looks at how BDA influences the association between SCMPs and CA in Pakistani manufacturing companies.

The manufacturing industry in Pakistan faces an urgent challenge in establishing and maintaining competitive advantage. Despite the acknowledged importance of Supply Chain Management (SCM) practices in enhancing competitiveness, there is a significant gap in understanding the direct influence of these practices on gaining competitive advantage within the context of Pakistani manufacturing. Furthermore, with the increasing relevance of Big Data Analytics, there is a need to explore its potential moderating role in this relationship. This research study focuses to address these gaps to investigate the specific ways in which SCM practices contribute to competitive advantage in the Pakistani manufacturing sector. Additionally, it will study how Big Data Analytics moderates on this relationship. The findings will provide actionable insights for companies striving to improve their competitive position and leverage emerging technologies for strategic advantage in the dynamic business landscape of Pakistan.

- What is the impact of strategic supplier partnership on competitive advantage?
- What is the impact of customer relationship management on competitive advantage?

- What is the impact of information quality on competitive advantage?
- What is the impact of information sharing on competitive advantage?
- Does big data analytics play moderating role between supply chain management practices and competitive advantage?

LITERATURE REVIEW

Supply Chain Management Practices (Scmp)

Supply chains, also referred to as value chains are integral to organizations as they add value by offering goods and services. Overcoming organizational borders, managing the entire chain requires unique components to achieve strategic goals (Arredondo & Alfaro Tanco, 2021). The two main components of a supply chain are supply and demand. Supply chains are intricate, comprising numerous business entities. The demand dimension begins when goods are received by the client, while the supply element starts at the origin of the chain and concludes with internal operational operations (Stevenson, 2014). In order to satisfy consumer demands and guarantee that items are accessible when and where they are needed, effective supply chain management (SCM) is essential (Iqbal, 2020).

In order to combine supply and demand supply chain management (SCM) entails strategically coordinating functions inside the organization and its supply chain (Prajogo, Oke, & Olhager, 2016) & (Stevenson, 2014). SCM uses a variety of strategies to connect manufacturers, suppliers, and warehouses for effective product production and distribution, with the goal of reducing costs and improving service levels (Azevedo & Reis, 2019) & (Heizer & Render, 2011). Supply Chain Management (SCM) functions as a mediator that connects the firm with its retailers, suppliers, and intermediaries. Supply chain management practices, also known as SCMPs, refer to the operational tasks performed by organizations to evaluate the efficacy and effectiveness of their supply chains, as stated by Sandhu, Helo, and Kristianto (2013). SCMPs are essential for optimizing competitive advantage and customer advantages (Chileshe & Phiri, 2022) & (Heizer & Render, 2011).

There are several metrics for SCMPs in the literature. (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006) for example, recommended six dimensions: postponement, information quality, information sharing, customer relationship, strategic supplier partnership, and internal lean practices According to Ram Kumar, Sridharan, and Narayanan (2019), supplier relationships, quality are additional metrics. Nonetheless, internal lean practices are not included in (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006) according to (Sandhu, Helo, & Kristianto, 2013). The main elements of SCMPs chosen by this study are information sharing (ISh), customer relationship management (CRM), information quality (IQ), and strategic supplier partnership (SSP).

DIMENSIONS OF SCMPS

Strategic Supplier Partnership (Ssp)

An organization and its suppliers can establish a long-term partnership through SSP, which emphasizes direct, cooperative planning and problem-solving activities (Agus & Hassan, 2008) & (Koh, Demirbag, Bayraktar, Tatoglu, & Zaim, 2007). Strong ties and effective communication between buyers and suppliers are essential to the supply chain network's success, especially in upstream supply chains that frequently rely on outsourcing and the acquisition of raw materials. Reaching organizational objectives requires strengthening operational and strategic competencies through SSP (Li, Ragu-Nathan, & Rao, 2006).

Customer Relationship Management (Crm)

CRM refers to the procedures and actions that businesses undertake to maintain strong, long-lasting relationships with their clients. This entails exchanging product details, collaborating with clients to handle and meet their needs, placing and monitoring orders, and delivering goods (Lee, Kwon, & Severance, 2007). CRM also helps with complaint handling, building enduring relationships, and guaranteeing customer satisfaction by collecting data from customers about products, market demands, inventory, and operational procedures (Koh, Demirbag, Bayraktar, Tatoglu, & Zaim, 2007) & (Mentzer, Myers, & Stank, 2006).

Information Quality (Iq)

IQ includes aspects like timeliness, sufficiency, correctness, and reliability of information that is communicated (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). Effective supply chain management requires high-quality information interchange, which improves overall performance and fosters improved supply chain coordination (Li & Lin, 2006), (Marinagi, Trivellas, & Reklitis, 2014).

Information Sharing (Ish)

ISh is concerned with how much confidential and important information is shared between supply chain participants. In industrial organizations, it is essential for raising productivity, cutting expenses and inventories, boosting visibility, and expanding efficiency (Koh, Demirbag, Bayraktar, Tatoglu, & Zaim, 2007) & (Lotfi, Mukhtar, Sahran, & Zadeh, 2013) & (Shamout & Elayan, 2018).

Competitive Advantage (Ca)

Competitive Advantage (CA) refers to the extent to which an organization may establish a durable competitive edge over its competitors due to distinctive characteristics and intricate managerial decisions (Kankaew, et al., 2021). It entails developing a system that has a distinct edge over rivals and offering organizational qualities that set it apart from the competition (Heizer & Render, 2011). Increasing the organization's standing, competing with primary entrants, and examining the connection between design and product growth are all necessary to achieve CA (Vargas, Mantilla, & de Sousa Jabbour, 2018). Offering distinctive services or goods at a low cost to target market segments is one way to gain this advantage (Sadalia, Muharam, & Mulyana, 2021). Quality, delivery, and adaptability are just a few of the competitive characteristics that have been identified as critical for organizations (Li, Ragu-Nathan, & Rao, 2006). Time to market and product innovation are seen as critical elements as well.

For instance, quality draws in customers and promotes regular product use, which helps businesses gain a competitive edge by taking up a sizable portion of the market and dominating on the basis of superior quality. Reducing waste and reworks, high quality also contributes to distribution, and other areas (Phan, Abdallah, & Matsui, 2011). Delivering the right time allows an organization to compete and demonstrate that it can supply the quantity and kind of products on schedule (Jin, Vonderembse, Ragu-Nathan, & Smith, 2014). Product novelty states to an organization's capacity to create and improve manufacturing processes for both new and current products, giving it a competitive edge while utilizing its current resources (Khaddam, Irtaimeh, & Bader, 2020) & (Saleem, et al., 2020). Time to market refers to an organization's capacity to launch new products ahead of major rivals by efficiently utilizing superior

resources and capabilities (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006) & (Agha, Alrubaiee, & Jamhour, 2012). On the other hand, businesses risk difficulties if they disregard vital supply chain success elements including promptness, adaptability, and high quality (Wu, Chuang, & Hsu, 2014). The dependent variable in this study is these competitive capabilities, which stand for the various ways that businesses can gain and preserve a competitive edge.

Big Data Analytics (Bda)

Big Data's potential to produce strategic values and benefits for organizations has made it more significant within businesses (Saleem, et al., 2020). The creation and application of technologies that retrieve pertinent data from enormous databases and provide it to the appropriate user at the appropriate moment is referred to as "big data" (Riahi & Riahi, 2018). Three essential components Volume, Velocity, and Variety often referred to as the 3Vs—define big data. Volume is the amount of current datasets; velocity is the rate at which data is collected; and variety is the amount of unstructured data that is created from various sources (Laney, 2001). It includes vast volumes of real-time, accessible, structured, and unstructured data, yet it can be difficult to handle due to its complexity (Provost & Fawcett, 2013). Big Data Analytics (BDA) is a technique for managing large amounts of data. It processes and analyses the three vectors (Vs) to provide outcomes that give a business a competitive edge and make decision-making easier (Garmaki, Boughzala, & Wamba, 2016) & (Tsai, Lai, Chao, & Vasilakos, 2015). BDA helps organizations solve a variety of issues by collecting, organizing, and analyzing massive datasets using methods that reveal hidden values from large, complicated datasets (Verma, Agrawal, Patel, & Patel, 2016). As a result, BDA is essential to improving how well businesses comprehend the wants of their clients and allowing them to provide better services (Darvazeh, Vanani, & Musolu, 2020).

RESEARCH FRAMEWORK

The study model was developed based on the current research on supply chain administration approaches and their impact on competitive advantage. Additionally, it elucidates the moderating impact of big data analytics on the interplay between SCMPs and CA, as evidenced by the research problem. Below is a visual representation of the study model depicted in Figure 1.

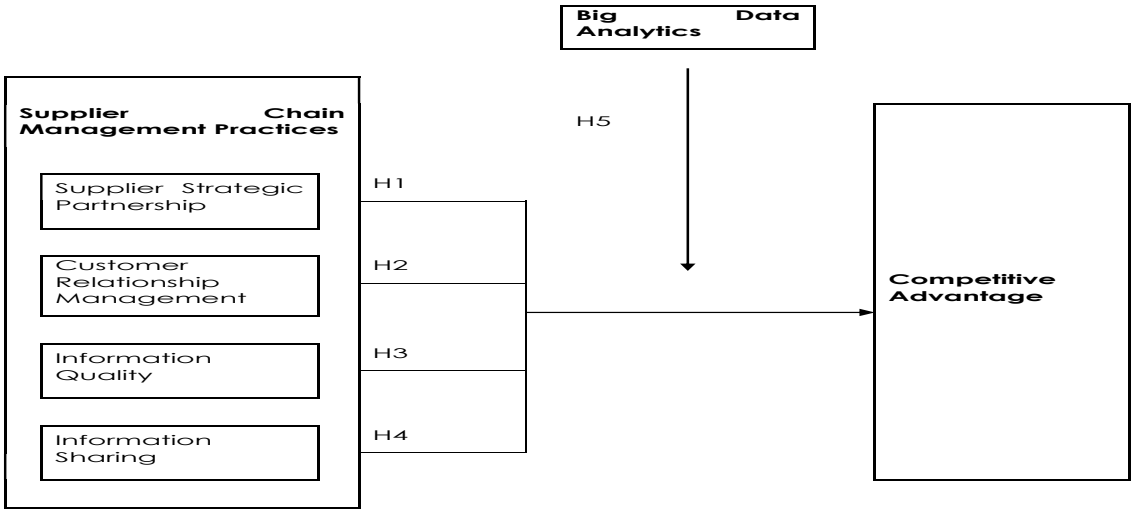

Figure 1.
Research Model

HYPOTHESIS DEVELOPMENT

It has been demonstrated that an efficient supply chain may give businesses a competitive edge by controlling consumer needs, providing flexibility to cut costs, and raising product quality (Iqbal, 2020). According to a recent study, SCMPs significantly reduce CA in Kenya's dairy supply chain (Kankaew, et al., 2021). Organizations' flexibility and capacity to adjust to changes in the environment can be improved by SCMPs (Koh, Demirbag, Bayraktar, Tatoglu, & Zaim, 2007). The supply chain fosters better supplier cooperation and contributes to the development of long-lasting competitive advantage. Thus, the following is the initial hypothesis:

H_{01}. SSP has no impact on CA.

H_1. SSP has impact on CA.

Establishing enduring partnerships with suppliers and customers fosters mutual understanding between them, which in turn increases the supply chain's flexibility (Chang et al., 2005). In order to enhance quality performance, save costs, and satisfy customers, organizations should also involve suppliers and customers (Phan, Abdallah, & Matsui, 2011). Thus, the following is the second hypothesis:

H_{02}. CRM has no impact on CA.

H_2. CRM has impact on CA.

The performance of the organization has been impacted by technology and the caliber of the shared information, giving them a competitive edge (Guesalaga et al., 2018). Organizational managers can take the lead and streamline the decision-making process when they have access to high-quality information (Khare, 2006). Thus, the following is the third hypothesis:

H_{03}. IQ has no impact on CA.

H_3. IQ has impact on CA.

Lastly, information exchange facilitates supply chain integration by improving manufacturing companies' responsiveness to the shifting needs of their clients and their collaboration with suppliers (Li & Lin, 2006), and coordination with the suppliers (Tarafdar & Qrunfleh, 2017). Thus, the following is the fourth hypothesis:

H_{04}. ISh has no impact on CA.

H_4. ISh has impact on CA.

The moderating role of BDA

These days, businesses use cutting-edge skills, such as data analytics, to boost sales, delivery, efficiency, and acquire a competitive edge (Darvazeh, Vanani, & Musolu, 2020). Technology, for example, improves and makes supply chain planning easier by giving quick information about manufacture necessities like delivery and inventory (Chen & Paulraj, 2004). Due to its ability to improve data clarity and accuracy during the supply chain, BDA has grown in importance for businesses (Darvazeh, Vanani, & Musolu, 2020). Businesses can gather, handle, examine, store, and share operational data thanks to BDA (Oncioiu, et al., 2019). These are useful data that provide insights that give an advantage over competitors (Rowe & Pournader, 2017).

As a result, businesses use big data to remain creative and competitive in rapidly evolving industries (Saleem, et al., 2020, Heisterberg & Verma, 2014; Kamioka & Tapanainen, 2014). Furthermore, according to (Oncioiu et al. 2019), BDA is crucial in helping with distribution optimization, demand prediction, supply decisions, product development, and customer feedback. The explanation above suggests that implementing BDA improves supply chain practice integration and creates a competitive advantage. As a result, the purpose of this study is to examine how BDA influences the interaction between SCMPs and CA in Pakistani manufacturing companies. Thus, the following is the fifth hypothesis:

H_{05}. BDA does not play moderating role between SCMPs and CA.

H_5. BDA plays moderating role between SCMPs and CA.

RESEARCH METHODOLOGY

Population And Research Sample

The Karachi manufacturing companies based in the Port Qasim, Korangi Industrial Area, and SITE industrial parks make up the population of the current study. Questionnaires were distributed to 177 people. A total of 162 responses were received and 8 were excluded leaving 154 valid questionnaires. The sample was selected from Karachi only because the participants were easily approached. As an inclusion criterion only, those participants were approached whose ages were ranging above 25 years and individuals who can read and understand English language. Exclusion criteria were participants below the age of 25 years.

Questionnaire Design/ Instruments and Data Collection

The researchers explained the purpose of the research to the participants in considerable detail. The research was conducted under a supervision of the professor Dr. Muhammad Umar. As the study tool, a questionnaire based on the research literature was created on Google and then distributed to the professional community through LinkedIn and social media. The questionnaire was divided into two sections: demographic questions and questions about the factors pertaining to SCMPs, CAs, and BDAs. The 34 statements that comprised the questionnaire items were broken down into four sections: four for SSP, four for CRM, four for IQ, four for ISh, thirteen for CA, and five for BDA.

Demographic Information Form

Demographic information sheet was used to gain information related to participant's gender, age, education, position & work experience.

Research Design

The research approach of this study is both causal and cross-sectional, focusing on a given time period. We have aimed to gather details as much as possible to show the link between factors affecting the competitive advantage of an organization.

Data Analysis

The study is quantitative in nature and required statistical analysis; hence, a detailed analysis of the gathered data was required, and for that purpose, the analysis was

done using SPSS 29. The analysis included frequency, pie charts, descriptive statistics, correlation, and regression analysis.

Sampling

Convenience non-probability sampling techniques has been used in our study as they are easily accessible to us. Our sample size is 154 people working in small, medium and large sized manufacturing companies with multiple categorizations based on enterprise size, job & experience.

DISCUSSION AND FINDING

This chapter will detail the results based on the multiple tests performed on the primary data gathered through survey questionnaire.

Gender

The distribution of respondents' genders, necessary for completing the questionnaires and participating in the study, is presented in the table below. We have collected responses from 68.84% male respondents and 31.16% responses from female respondents.

Table1. Gender, Frequency, Cumulative Percent

Gender	Frequency	Percent	Cumulative Percent
Male	106	68.84	68.84
Female	48	31.16	100
Total	154	100	

Age

The age group of 26-30 years accounted for 37.01% of the respondents, followed by the age group of 31-35 years with 31.17% and the age group of 36-40 years with 20.78%. The respondents aged 41 and above constituted 11.04% of the total 154 responses.

Table 2. Age Bracket

Age Bracket	Frequency	Percent	Cumulative Percent
26-30	57	37.01	37.01
31-35	48	31.17	68.18
36-40	32	20.78	88.96
41 and above	17	11.04	100
Total	154	100	

Education

We have collected data from the following mentioned educational levels. We have collected the number of responses from those who belong to post graduate level = 32.47%. The highest number of responses we have collected from those who belongs to Graduate level = 61.04%. The number of responses collected from Ph.Ds. = 6.49%. These are the responses collected out of 154 responses.

Table 3. Education

Education	Frequency	Percent	Cumulative Percent
Graduate	94	61.04	61.04
Post Graduate	50	32.47	93.51
Ph.D.	10	6.49	100
Total	154	100	

Position

The data was collected from the following positions. The highest number of responses were received from middle management = 53.24% and the lowest response were received from lower management = 11.04%.

Table 4.
Position

Position	Frequency	Percent	Cumulative Percent
Executive / Officer	33	21.43	21.43
Lower Management	17	11.04	32.47
Middle Management	82	53.24	85.71
Higher Management	22	14.29	100
Total	154	100	

Work Experience

In terms of experience, the highest responses were received from the persons who have experience bracket of 2 – 5 years. However, the responses received from professionals who have experience of 11 – 15 years were only 9.74%.

Table 5.
Work Experience

Work Experience (In Years)	Frequency	Percent	Cumulative Percent
Less Than 2	19	12.34	12.34
2 – 5	49	31.82	44.16
6 – 10	38	24.68	68.83
11 – 15	15	9.74	78.57
More Than 15	33	21.43	100
Total	154	100	

Frequency Distribution

The descriptive statistics reveal insightful characteristics for each variable within the framework of the study examining the intersection of supply chain management practices and competitive advantage in the Pakistani manufacturing industry. SSP exhibits a moderate standard deviation of approximately 0.59, indicating variability in responses with a range from 2.00 to 5.00. CR demonstrates a moderate standard deviation of around 0.66, showcasing diversity with responses ranging from 1.50 to 5.00. IQ manifests a moderate standard deviation of about 0.75, indicating varied opinions with a range from 1.75 to 5.00. Is showcases moderate variability with a standard deviation of approximately 0.58 and a range from 2.00 to 5.00. BDA presents a moderate standard deviation of roughly 0.63, signifying diverse perspectives with a range from 2.00 to 5.00. CA reveals a moderate standard deviation of about 0.54, reflecting variability in responses with a range from 2.17 to 4.90. Together, these statistics offer a detailed understanding of the distribution and variety of responses across the main factors, which lays the foundation for extensive analysis within the larger study framework.

Table 6.
Frequency Distribution

Statistics		SSP	CR	IQ	IS	BDA	CA
N	Valid	154	154	154	154	154	154
	Missing	0	0	0	0	0	0
Std. Deviation		0.59176	0.66471	0.74876	0.57667	0.62543	0.53885

Variance	0.350	0.442	0.561	0.333	0.391	0.290
Range	3.00	3.50	3.25	3.00	3.00	2.73
Minimum	2.00	1.50	1.75	2.00	2.00	2.17
Maximum	5.00	5.00	5.00	5.00	5.00	4.90

Correlation

Measured were the Pearson correlations among both account and its influence to ensure internal consistency. Every statement showed a significant (0.01) connection with the proposed factor, and all correlations were higher than the acceptable internal consistency criterion of r = 0.40. A robust SSP demonstrates substantial positive correlations with CR, IQ, IS, BDA, and CA. Similarly, positive correlations are observed among other variable pairs, emphasizing the interconnectedness of these dimensions within the Pakistani manufacturing industry. The findings suggest that the factors of SCMPs are very well interconnected with each other as well as with BDA and CA. Below table below shows internal consistency results.

Table 7.
Correlations

		SSP	CR	IQ	IS	BDA	CA
SSP	Pearson Correlation	1					
CR	Pearson Correlation	.477**	1				
IQ	Pearson Correlation	.515**	.503**	1			
IS	Pearson Correlation	.473**	.506**	.729**	1		
BDA	Pearson Correlation	.436**	.556**	.735**	.546**	1	
CA	Pearson Correlation	.584**	.644**	.687**	.610**	.573**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Reliability Statistics

Cronbach alpha values were used to evaluate the scale's reliability; a threshold of greater than 0.60 was used, and more recently, guidelines recommended a value of greater than 0.70 to confirm the scale's reliability (Sekaran & Bougie, 2016). In this case, the scale's dependability is supported by the value exceeding the minimum threshold. Below table shows the Cronbach alpha values.

Table 8.
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.887	0.889	6

Factor Analysis

The correlation matrix provides valuable insights into the relationships among important variables within the study's environment. Looking at the upper triangular section of the matrix, which displays Pearson correlation coefficients, several noteworthy patterns emerge. Firstly, Strategic Supplier Partnership (SSP) shows a positive correlation of 1.000 with itself, as expected. Moving to Customer Relationship (CR), there is a positive correlation of approximately 0.477 with SSP, indicating a moderate positive relationship. Information Quality (IQ) reveals a positive correlation of about 0.515 with SSP and 0.503 with CR, signifying positive associations. Similarly, Information Sharing (IS) exhibits positive correlations of 0.473, 0.506, and 0.729 with SSP, CR, and IQ, respectively, suggesting interconnectedness among these variables. Big Data Analytics (BDA) showcases positive correlations with all variables, with

coefficients ranging from 0.436 to 0.735, underlining the potential interconnectedness of BDA with the entire supply chain and competitive advantage. Finally, Competitive Advantage (CA) displays positive correlations with all variables, with coefficients ranging from 0.573 to 0.644, indicating potential associations between each supply chain management aspect and the ultimate competitive advantage.

Table 9.
Correlation Matrix

Correlation Matrix						
		SSP	**CR**	**IQ**	**IS**	**BDA**	**CA**
Correlation	SSP	1.000					
	CR	.477	1.000				
	IQ	.515	.503	1.000			
	IS	.473	.506	.729	1.000		
	BDA	.436	.556	.735	.546	1.000	
	CA	.584	.644	.687	.610	.573	1.000

The KMO value is greater than 0.8 and sig. value below 0.05 indicates that the sampling is adequate and there is substantial correlation in the data.

Table 10.
KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.838
Bartlett's Test of Sphericity	Approx. Chi-Square	508.592
	Df	15
	Sig.	<.001

Regression Analysis

Multiple linear regression was used to evaluate the research hypotheses in order to determine whether BDA amplifies the effect of SCMPs on CA and how they affect it. R (0.791) indicates a strong positive correlation between the predictors (SSP, CR, IQ & ISh) and the dependent variable (CA). The model with SCMPs dimensions explains a substantial portion (62.6%) of the variance in the dependent variable CA. Durbin Watsin (2.150) indicates that there is no autocorrelation in the residuals.

Table 11.
Model Summary

					Change Statistics				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**df1**	**df2**	**Sig. F Change**	**Durbin-Watson**
1	.791[a]	.626	.616	.33412	.626	62.236	4	149	<.001	2.150

a. Predictors: (Constant), IS, SSP, CR, IQ
b. Dependent Variable: CA

The ANOVA table provides essential information regarding the regression model's ability to explain the variability in the variable that is dependent, Competitive Advantage (CA). The overall model's significance is evidenced by an F-statistic of 62.236, with a corresponding p-value of less than 0.001, denoted by <.001b. The regression sum of squares (27.791) represents the portion of variance attributed to the predictors, while the residual sum of squares (16.634) reflects the unexplained variance. The mean square for regression (6.948) and residual (0.112) provides insights into the average amount of variance explained by predictors and the unexplained variance, respectively. With four predictors—ISh, SSP, CR, and IQ—the degrees of freedom for regression and residual are 4 and 149, respectively. The total sum of squares (44.424) encompasses both explained and unexplained variance in CA.

Overall, the ANOVA table confirms the statistical significance of the regression model in predicting CA.

Table 12.
ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.791	4	6.948	62.236	<.001[b]
	Residual	16.634	149	.112		
	Total	44.424	153			

a. Dependent Variable: CA
b. Predictors: (Constant), ISh, SSP, CR, IQ

Below table indicates that SSP, CRM & IQ were found significant predictors of CA as the sig. value is lesser than alpha hence supports H_1, H_2 & H_3. However, ISh was found non-significant predictor of CA as sig. value is greater than alpha results in accepting H_{04}.

Table 13.
Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.848	.219		3.870	<.001		
	SSP	.186	.056	.205	3.326	.001	.664	1.506
	CR	.261	.050	.323	5.210	<.001	.656	1.525
	IQ	.252	.056	.350	4.531	<.001	.421	2.374
	ISh	.089	.071	.095	1.253	.212	.438	2.285

The SCMPs were found to be a significant predictor for CA, as shown in the table below. Furthermore, the moderating influence interaction term, SCMP x BDA, failed to have a substantial impact because accepting H_{05} requires a sig. value bigger than alpha.

Table 14.
Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.198	.851		.233	.816		
	SCMP	.954	.239	.924	3.997	<.001	.048	21.000
	BDA	.170	.224	.197	.759	.449	.038	26.596
	Moderator	-.041	.058	-.307	-.701	.484	.013	75.357

a. Dependent Variable: CA

CONCLUSION

The objective of this study is to examine how big data analytics (BDA) can influence the relationship between supply chain management practices (SCMPs) and competitive advantage (CA) in manufacturing enterprises based in Pakistan. Data was collected from multiple manufacturing enterprises located in industrial parks to gather quantitative information. The study hypothesis was assessed using linear regression and the SPSS approach. The findings indicate that SCMPs have a substantial and favourable impact on CA. More precisely, the effectiveness of CA is significantly improved by the quality of information (IQ), the management of customer relationships (CRM), and the establishment of strategic partnerships with suppliers (SSP). Conversely, the influence of information sharing (ISh) on CA was low.

However, the investigation determined that BDA had no additional effect on the way SCMPs influence CA. This study contributes to the existing knowledge in the field, both in a general sense and specifically in the context of Pakistan. It expands the available information regarding the relationship between BDA and its moderating effect on the connection between SCMPs and CA. This research investigates the link between SCMPs and CA in Pakistani manufacturing companies, as well as how BDA influences this relationship. The findings validate the beneficial effects of CRM, SSP, and IQ on CA (supporting H1, H2, and H3). On the other hand, the ISh (H4) theory was not supported. Additionally, there is no evidence that BDA moderates this association. A flaw in the way the questioned firms handle BDA is shown by the report. It emphasizes that in order to guarantee that BDA systems provide the intended outcomes, managers must integrate them with other firm systems and capabilities.

MANAGERIAL IMPLICATION

Companies' use of big data analytics in supply chains is essential to understanding consumer demands and sales patterns. Decisions about production, pricing, inventory control, and other critical areas are guided by this insight. These strategic plans frequently involve several partners in the supply chain, which shapes and influences the competitive advantages these businesses possess over their rivals. The examined literature also highlights the direct impact that supply chain management practices especially those involving supplier and customer interactions have on overall performance, which in turn influences competitive advantages. As such, the utilization of big data analytics approaches becomes essential for businesses to plan their operations. For example, they can use the results of big data analytics reports to identify sales patterns and optimize ordering procedures accordingly. The goal of this strategic strategy is to reduce waste in terms of excess inventories and surplus items. The present study's results, however, suggest that big data analytics does not enhance the effect of supply chain management practices on competitive advantage when it comes to Pakistani manufacturing companies. This result could be ascribed to possible obstacles including inadequate comprehension and efficient application of supply chain management practices. Furthermore, poor data gathering practices or problems with big data analytics methodologies could result in erroneous market reports, which would ultimately impede performance improvement.

LIMITATION AND FUTURE RESEARCH DIRECTION

Future research could examine other businesses that use big data analytics, but for now, it focuses on Pakistani manufacturing companies. Another drawback is that, despite the existence of alternative techniques, only four supply chain management approaches were taken into account. Finally, rather of focusing only on competitive advantage, future research might examine the impact of big data analytics on overall performance.

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