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Examining The Role of Big Data Analytics and Data Availability on Sustainable Competitive Advantage and Business Performance: Mediating Role of Innovative Capabilities

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Abstract

The purpose of this investigation is to examine the role of big data analytics and data availability on sustainable competitive advantage and business performance. Furthermore, the researchers also investigate the mediating role of innovative capabilities between observed variables. The current research used quantitative research design and positivism philosophy to conduct this research. The population of the study, comprised of managers working in different manufacturing companies in Pakistan, the researchers used an adopted questioner to collect data from respondents. Furthermore, a structural equational model was used to test the hypothesis of the study. The research findings indicate that there is a significant mediating influence of innovative capabilities (IC) in the relationship between big data analytics (BDA) and data availability. This mediating effect has a favourable impact on both sustainable competitive advantage (SCA) and firm performance. This highlights the crucial significance of IC in converting data-derived insights into innovative strategies, thereby contributing to improved competitiveness and the overall performance of the organization. This study is significant for manufacturing organisations and policymakers to make appropriate decisions regarding the usage of big data analytics. This study is limited to manufacturing organisations and selected variables. Future studies may use government policies as a moderator to test the model of current research.

Keywords Big Data Analytics and Data Availability, Sustainable Competitive Advantage and Business Performance, Innovative Capabilities.

INTRODUCTION

In the present day, contemporary firms have recognized and assigned significance to the strategic economic and environmental benefits associated with the digital economy (Bi et al., 2023). The field of big data analytics (BDA) is widely recognized as an essential aspect in the current era, which is marked by notable technological progress (Makhloufi et al., 2023). In the context of Economic Digital Transformation (EDT), emerging firms are actively engaged in the process of digitizing their operations and using substantial data to facilitate informed decision-making. The use of large-scale datasets requires the implementation of technological support and efficient administration to ease the production, retention, and distribution of critical data. It is crucial to ensure the accuracy of risk and opportunity projections and to successfully adapt to changing dynamics in the area of eco-business (Rusch et al., 2023).

The use of Big Data Analytics (BDA) is crucial for facilitating a number of organisational procedures. It helps cut down on the amount of time needed for decision-making processes, makes it easier to make decisions that are accurate, makes it possible to track customer preferences and behaviour, analyse complex data, predict market demands and fluctuations, and equips businesses with the tools they need to effectively respond to competitors' moves and alternative products (Baqleh & Alateeq, 2023). Big Data analytics (BDA) expertise has the potential to be very beneficial, especially when it comes to knowledge management (KM) procedures. The utilisation of Big Data Analytics (BDA) unquestionably helps senior executives to make well-informed decisions based on empirical data and objective facts, as opposed to only relying on intuition (Morimura & Sakagawa, 2023). Therefore, using Big Data Analytics (BDA) provides significant benefits to businesses looking to modernize their established business models and boost the effectiveness of data collection processes in a manner that is both economical and efficient (Waqas & Tan, 2023). In the present context, the use of Big Data Analytics (BDA) allows organizations to efficiently analyze enormous amounts of data, leading to the finding of valuable insights that may aid in the identification of potential risks and the exploitation of environmentally friendly business opportunities (AL-Khatib, 2023).

Despite the allocation of resources by businesses towards Big Data Analytics (BDA), a significant number of them failed to achieve the desired strategic value. This may be attributed to their excessive focus on technological issues, while neglecting the importance of addressing organisational demands and strategic functions (Himeur et al., 2023). Hence, it is essential for enterprises to thoroughly analyse additional factors in order to build a data-driven strategy that effectively harnesses the potential value of big data (Bag et al., 2023). Within this particular context, a considerable number of previous research papers have examined the management and organisational aspects of this subject in order to assist professionals in effectively using Big Data Analytics (BDA) to attain value (Bi et al., 2023). Data availability (DA) is a prominent topic that businesses must address when considering the use of Big Data Analytics (BDA). Data availability (DA) refers to the consistent accessibility of pertinent data at the required time and place (Rajaraman, 2016). However, some organisations play a more crucial role in the field of data analytics than others. Therefore, the storage of data on cloud platforms and servers may contribute to problems related to data analytics (Tulasi, 2013). In this regard, it is essential that all sources of data, including as systems, devices, machines, and sensors, be integrated with Big Data Analytics (BDA) and interconnected with the Internet of Things (IoT) in order to generate data (Shah et al., 2018).

A seamless link between various data sources and cloud storage systems is also made possible by the introduction of upgraded networks, including 5G, making it possible to analyse data in real time (Shah et al., 2018). The relationship between big data analytics (BDA) and sustainability should also be taken into account. It is crucial for companies in the modern day to connect their goals and operations with sustainability principles, which include social, environmental, and economic factors (Qi et al., 2023). Achieving sustainable competitive advantage (SCA) depends on this alignment. The term "strategic competitive advantage" (SCA) refers to the extensive collection of tangible and intangible assets, skills, and distinctive qualities that a company has. These characteristics make it difficult for rivals to copy or replicate them (Ricardianto et al., 2023). Organisations must use their capabilities wisely in order to gain sustainable competitive

advantage (SCA), notably via the use of big data analytics (BDA) (Algarni et al., 2023). Sustained Competitive Advantage (SCA) implementation faces considerable obstacles due to a lack of big data analytics (BDAC) expertise and an inability to keep up with the newest developments in big data technology (Horng et al., 2023) .

The availability of innovation capabilities (IC), in conjunction with BDAC, is essential for boosting sustainable competitive advantage (SCA). The term "innovation capability" (IC) refers to a company's capacity to generate, define, and apply novel ideas in order to create new goods or improve existing ones (Jum'a et al., 2023). The Satupa et al. research offered actual evidence in favour of the idea that innovation is essential for maintaining a competitive advantage. Additionally, many businesses concur that big data is a priceless resource that encourages innovation and gives them a competitive advantage (AL-Khatib, 2023). Recent scholarly study has posited that the acquisition of sustainable new skills, such as Big Data Analytics (BDA), plays a pivotal role in the innovation process. This is due to the potential of such skills to facilitate positive outcomes of big data in terms of sustainability in innovation (Horng et al., 2023). Numerous scholarly investigations have examined the impact of innovation on the performance and competitive advantage of corporations (Elgarhy & Abou-Shouk, 2023). However, to this day, the existing body of research has been insufficient in providing substantial empirical evidence that establishes the relationship between big data analytics (BDA), innovative performance, and firm performance as a metric for determining competitive advantage.

The major research gap pertains to the influence of Big Data Analytics (BDA) and data availability on sustainable competitive advantage (SCA) and firm performance within the manufacturing sector of emerging countries, specifically in the case of Pakistan. This study also considers the potential mediating effect of inventive capabilities. Numerous scholarly investigations have been conducted to examine the individual associations among BDA, data availability, SCA, firm performance, and innovation capabilities in diverse settings. However, there is a notable scarcity of comprehensive research that systematically examines the interconnections among these factors within the distinct socio-economic and industrial framework of developing economies. Understanding the intricate relationship among these variables is imperative in formulating efficacious data-centric approaches that promote innovation, increase performance, and augment sustainable competitive advantage (SCA). This identified research gap necessitates comprehensive empirical investigations to explore the combined influence of big data analytics (BDA) and data availability on innovative capabilities, sustainable competitive advantage (SCA), and firm performance.

This research will provide insights into the specific mechanisms and strategies that can facilitate success in manufacturing sectors within developing economies, such as Pakistan. This research offers useful insights for manufacturing enterprises and policymakers by examining the strategic implementation of Big Data Analytics (BDA), emphasizing the crucial significance of data accessibility, and highlighting the potential of innovation in fostering competitive advantage within the dynamic digital environment. This research ultimately provides valuable insights into the utilisation of data-driven strategies by firms operating in developing economies, with the aim of improving their sustainability, competitiveness, and overall economic growth. By shedding light on

this topic, it facilitates informed decision-making and strategic planning in this dynamic and ever-changing sector.

R1: Does Big Data Analytics and data availability effect on sustainable competitive advantage and firms' performance.

R2: What is the mediating effect of innovative capabilities between Big Data Analytics and data availability on sustainable competitive advantage and firms' performance

LITERATURE REVIEW

Theoretical Background

The present research is firmly rooted in two fundamental theoretical frameworks: Organizational Information Processing Theory (OIPT) and Information Technology (IT). The Organizational Information Processing Theory, first introduced by Galbraith (1974), serves as a foundational framework for understanding the intricacies of information processing within organisational contexts. Based on the findings of the Organisational Information Processing Theory (OIPT), decision-makers are required to engage in substantial information processing in order to achieve a desired level of performance when confronted with activities that are characterized by significant degrees of uncertainty (Yu et al., 2021). The theory proposed by Zhu et al. (2018) has three fundamental theoretical components: the demands of information processing, the capacities of information processing, and the congruence or correspondence between the accessible information and the organisational requirements.

Within the framework of our study, which examines the effects of Big Data Analytics (BDA) and the availability of data on sustainable competitive advantage and firm performance, with the mediating role of inventive capacities, the use of OIPT provides significant and relevant insights. In light of the intricate and ever-changing characteristics of data-driven decision-making within the manufacturing industry of emerging nations, it is crucial to understand the interaction between the demands of information processing, the capabilities of the organization, and the alignment between the available information and the needs of the organization (Shi et al., 2023). Big Data Analytics (BDA), as a technological tool capable of efficiently handling large volumes of data, exhibits a close connection with the underlying principles of OIPT. Consequently, BDA presents itself as a very intriguing perspective to investigate its impact on organizational performance (Srinivasan & Swink, 2018).

Concurrently, this research is grounded in the concept of Information Technology (IT), acknowledging the essential role that technology plays in facilitating data-driven initiatives and fostering innovation within organizational contexts (Agarwal & Dhar, 2014). In the current period of Economic Digital Transformation (EDT), there is a growing trend among enterprises in emerging countries, such as Pakistan, to embrace digitalization and data analytics. Consequently, it becomes imperative to include IT theories into our research endeavours (Pappas et al., 2018). The establishment of this theoretical framework enables us to explore the complex interrelationships among big data analytics (BDA), the availability of data, the capacities for innovation, and their combined influence on sustainable competitive advantage and firm performance in the manufacturing industry.

HYPOTHESIS DEVOLPEMENT

Big data analytics (BD) is a commonly used technology and service in the business domain, used to grow and sustain a competitive advantage. Additionally, scholars have also suggested that firms have the capacity to gain a competitive advantage and efficiently respond to unanticipated circumstances in the digital marketplace via the use of big data (Lutfi et al., 2023). The term "big data" is often defined as a comprehensive compilation of subject-specific data that encompasses information from a designated timeframe and aids in the process of managerial decision-making (Li et al., 2023). Existing literature suggests that businesses may enhance their performance by using big data as a robust framework. The majority of studies indicate a positive relationship between the effectiveness of big data initiatives and their influence on company performance (Belhadi et al., 2023). Major firms have effectively used big data to accomplish a diverse range of goals, including but not restricted to the anticipation of emerging market trends and the evaluation of client behaviour and satisfaction in order to identify potential areas for enhancement (Grover et al., 2018). In conclusion, the achievement of competitive advantage occurs when a company surpasses its existing or future rivals in terms of its level of success (Jiao et al., 2023). So, the use of modern technologies such as Big Data Analytics (BDA) serves as a catalyst for achieving sustainable performance by facilitating the adoption of data-driven strategies

H1: Big Data analytics has significant effect on sustainable competitive advantage and firms' performance

The essential basis of Big Data Analytics Capabilities (BDAC) is on the availability of data. BDAC is widely recognized as a dynamic capability, exhibiting qualities such as repeatability that are inherent to dynamic capabilities. When correctly used, this dynamic capacity has the potential to provide unique experiences that are difficult for rivals to replicate, hence creating valuable assets that enhance competitive advantage (Ramadan et al., 2020). In order to fully harness the capabilities of Big Data Analytics (BDA), it is crucial to ensure the accessibility and availability of data (Aidara et al., 2021). The lack or insufficiency of data may have significant ramifications for the entire functioning of an organisation, and therefore, its competitive edge. The irretrievable nature of lost data, which was previously seen as a crucial need, emphasises the importance of optimizing data accessibility. As a result, companies endeavour to maximize the availability of their data by tackling challenges associated with data sources, volume, and collecting methodologies (Zhang et al., 2022).

The availability of data is not only a basic need for Big Data Analytics; rather, it plays a crucial role in enabling organisations to harness the strategic value of data-driven decision-making, therefore influencing their competitive advantage and overall performance (Jum'a et al., 2023). Hence, the hypothesis pertaining to the significant impact of data availability on sustainable competitive advantage and firm performance is well-supported, as it corresponds with the extant body of literature and the complex interplay between data availability and the development of Big Data Analytics Capabilities (BDAC) in the age of digital transformation.

H2: Data availability has significant effect on sustainable competitive advantage and firms' performance

Previous research has shown a significant relationship between innovativeness and competitive advantage. The capacity for innovation allows organizations to quickly adjust to shifts in the market, so providing them with a competitive advantage (Gobena & Kant, 2022). This is consistent with the notion that companies with robust inventive skills have the ability to develop unique products or services that differentiate them from competitors, hence enhancing their competitive edge (Arsawan et al., 2022). Moreover, existing scholarly research indicates that the presence of innovative abilities has a substantial impact on the overall performance of a corporation. Companies that have a strong ability to generate and implement creative ideas often achieve better performance compared to their competitors. The relationship between a company's capacity for innovation and its level of achievement has been thoroughly examined and recorded in academic literature (Fatonah & Haryanto, 2022).

The successful use of dynamic capabilities, such as big data analytics (BDA), in conjunction with innovation, has been recognized as a strategic method for firms to address external challenges and sustain their competitive edge (Alkhatib & Valeri, 2022). Dynamic capabilities, such as the use of big data analytics (BDA), enable enterprises to effectively gather, manage, and derive meaningful insights from large and complex information. Consequently, this amplifies their ability to make well-informed judgements and effectively adapt to changes in the market (Zhang et al., 2022). Simultaneously, the possession of innovative talents empowers firms to proficiently use the knowledge obtained from data analysis to formulate and implement inventive ideas and strategies that confer a competitive edge (Alkhatib & Valeri, 2022). Previous study has emphasized the need of using empirical data to highlight the role of Business Data Analytics (BDA) and innovation in improving the performance and competitiveness of firms. The aforementioned research propose that the integration of Big Data Analytics (BDA) and innovative skills has a positive impact on enhancing decision-making efficiency, monitoring market trends, and attaining a competitive edge (Behl, 2022).

Based on the robust theoretical and empirical basis, it is justifiable to propose the hypothesis that the mediating role of innovative capabilities exists in the association between Big Data Analytics and data availability, and their impact on sustainable competitive advantage and organizations' performance. The presence of innovative capabilities serves as a means of connecting and enabling the conversion of data-driven insights into inventive strategies and activities, hence playing a pivotal role in determining a firm's competitive stance and overall success within the marketplace (Zhang et al., 2022). Hence, the proposition of a substantial mediating influence of innovative capabilities within the framework of this investigation is well supported.

H3a: There is a significant mediating effect of innovative capabilities between Big Data Analytics, sustainable competitive advantage and firms' performance

H3b: There is a significant mediating effect of innovative capabilities between data availability, sustainable competitive advantage and firms' performance**.**

METHODOLOGY

The data used in this research was collected from a range of enterprises situated in Lahore, Pakistan, including the chemical, plastic and PVC, automobile, leather, and textile sectors. The Punjab province is widely acknowledged as the largest province in

Pakistan, characterized by its substantial spread of land and sizable population. The Lahore Chamber of Commerce has a prominent position within the province, accommodating a significant number of enterprises in comparison to other Chambers. Furthermore, it is important to acknowledge that Lahore serves as the second-largest financial hub in Pakistan, with a significant presence of around 9,000 industrial establishments. Hence, data was collected from the Lahore Chamber of Commerce and Industry. The study sample includes managers who are currently working in the firms stated above. A preliminary examination was undertaken to ascertain the validity of the variables, and the questionnaire was subjected to an assessment in order to evaluate its clarity, coherence, and validity. To accomplish the goal, a sample size of nine participants was chosen. Out of the total nine persons, five individuals possess industrial competence, whilst the remaining four individuals possess academic expertise. The input given by the expert was used to improve the content quality of the questionnaire. The examination of concept cross-loadings is a crucial component in the assessment of content validity within the SmartPLS framework. According to Comrey and Lee (1992), a sample size that surpasses 1000 is considered to possess high quality. A total of 1000 questionnaires were distributed to the respondents for the purpose of data collection. A total of 478 questionnaires were gathered, out of which 472 were deemed suitable for inclusion in the final analysis. The data collecting approach used the use of a basic random sample technique in order to get information from the participants.

The survey comprised of a series of 21 questions, where participants assessed each question using a five-point Likert scale that ranged from "1: strongly disagree" to "5: strongly agree". The selection of the questionnaire was based on the existing literature, specifically the studies conducted by (Makhloufi et al., 2023; Ramadan et al., 2020). The present study employed partial least squares–structural equation modelling (PLS-SEM) as a statistical software tool for data analysis and hypothesis testing. The choice to employ Partial Least Squares Structural Equation Modelling (PLS-SEM) was motivated by its capacity to efficiently analyse limited sample sizes and its robustness in investigating mediating variables and indirect relationships. SmartPLS can also be utilized for the direct assessment of convergent validity, discriminant validity, and reliability. The software features an intuitive interface that enhances user-friendliness and promotes ease of use. Furthermore, it presents visually captivating graphical outcomes. The software programme exhibits a notable level of versatility in its output, surpassing that of other software products of similar nature.

Demographic Analysis

The demographic data provided offers insight into the demographics of the sample population under examination. In terms of gender distribution, the study sample mostly comprises male participants (97.7%), whereas females are substantially underrepresented (2.3%). In terms of hierarchical distribution, it is evident that senior managers have a substantial majority in the sample, accounting for 79.4% of the participants. Conversely, junior managers make up the remaining 20.6% of the sample. Textile firms constitute the majority (51.1%) in terms of company type, followed by leather and tanneries (15.0%), with various other industries comprising the remaining portion. The majority of persons in education has a master's degree (72.7%), while a smaller proportion have a bachelor's degree (23.5%). In conclusion, the analysis of business sizes reveals that a notable number of companies hire a workforce ranging from 101 to 500 employees,

accounting for 54.4% of the total. Conversely, there is a comparatively lesser presence of enterprises in the other size categories. The inclusion of demographic variables within the study sample is essential for establishing contextual relevance, hence facilitating understanding of the generalizability and possible implications of the research findings.

Reliability Analysis

The table provides a comprehensive overview of reliability and validity measurements pertaining to distinct constructs within a research study, mostly within the realm of business or management. Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE) are often used statistical measures for evaluating the soundness and reliability of constructs in a questionnaire or survey. Each row inside the table represents a distinct concept, namely Big Data Analytics (BDA), Data Availability, Firm Performance, Innovation Capabilities (IC), and Sustainable Competitive Advantage (SCA). The numbers shown for each construct indicate the evaluation of its internal consistency, as measured by Cronbach's Alpha. Additionally, the construct reliability (rho_A), composite reliability, and average variance extracted are also assessed. In general, it can be observed that all constructs demonstrate satisfactory levels of internal consistency and reliability. The Composite Reliability and Average Variance Extracted (AVE) values indicate that the constructs effectively capture the variability present in the data. However, it is worth noting that certain constructs may exhibit higher levels of reliability and validity compared to others. The inclusion of this table is crucial in assessing the reliability and validity of the data and constructs used in the study.

Tabel 1.
Reliability Analysis

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Big Data Analytics (BDA)	0.7695	0.7985	0.8526	0.5939
Data Availability	0.7416	0.7631	0.7826	0.5250
Firm Performance	0.7422	0.7662	0.7655	0.5530
Innovation Capabilities (IC)	0.7202	0.7551	0.7851	0.5082
Sustainable Competitive Advantage (SCA)	0.7010	0.7252	0.8039	0.5062

The presented factor loading table illustrates the associations among several variables, including Big Data Analytics (BDA), Data Availability (DA), Firm Performance (FP), Innovation Capabilities (IC), and Sustainable Competitive Advantage (SCA), as seen by a factor analysis. The numerical values shown in the table represent the magnitude and direction of the relationship between each variable and the underlying components. For instance, the variables BDA1, BDA2, BDA3, and BDA4 have significant positive loadings on the initial factor, indicating a strong association with this particular part. Likewise, the variables labeled as DA1, DA2, DA3, DA4, and DA5 exhibit substantial loading on the second component, and so forth. The loadings used to understand the latent structure of the data and the influence of various variables on the noticed aspects in the investigation.

Table 2.
Outer Loading

	Big Data Analytics (BDA)	Data Availability	Firm Performance	Innovation Capabilities (IC)	Sustainable Competitive Advantage (SCA)
BDA1	0.7064				
BDA2	0.8336				
BDA3	0.8585				
BDA4	0.6669				
DA1		0.7203			
DA2		0.6941			
DA3		0.6715			
DA4		0.696			
DA5		0.435			
FP1			0.6058		
FP2			0.6304		
FP3			0.6292		
FP4			0.8074		
IC1				0.6891	
IC2				0.6451	
IC3				0.6738	
IC4				0.7534	
SCA1					0.7327
SCA2					0.7026
SCA3					0.6934
SCA4					0.7167

Validity Analysis

The HTMT ratio, employed in the validity table, is utilized to assess the discriminant validity between constructs within a structural equation model (SEM). The values presented in the table depict the HTMT ratios pertaining to distinct constructs. A discriminant validity value that is in close proximity to or below 0.85 is commonly regarded as an indication of favorable discriminant validity. This suggests that the constructs under consideration are distinct from each other and exhibit low levels of correlation. The HTMT ratios in the provided table indicate that all construct pairs have values below 0.85. This suggests that there is reasonable discriminant validity between the constructs.

Tabel 3.
Validity Analysis (HTMT)

	Big Data Analytics (BDA)	Data Availability	Firm Performance	Innovation Capabilities (IC)
Big Data Analytics (BDA)				
Data Availability	0.4032			
Firm Performance	0.4541	0.4444		
Innovation Capabilities (IC)	0.2623	0.4016	0.3432	
Sustainable Competitive Advantage (SCA)	0.3137	0.4385	0.3489	0.492

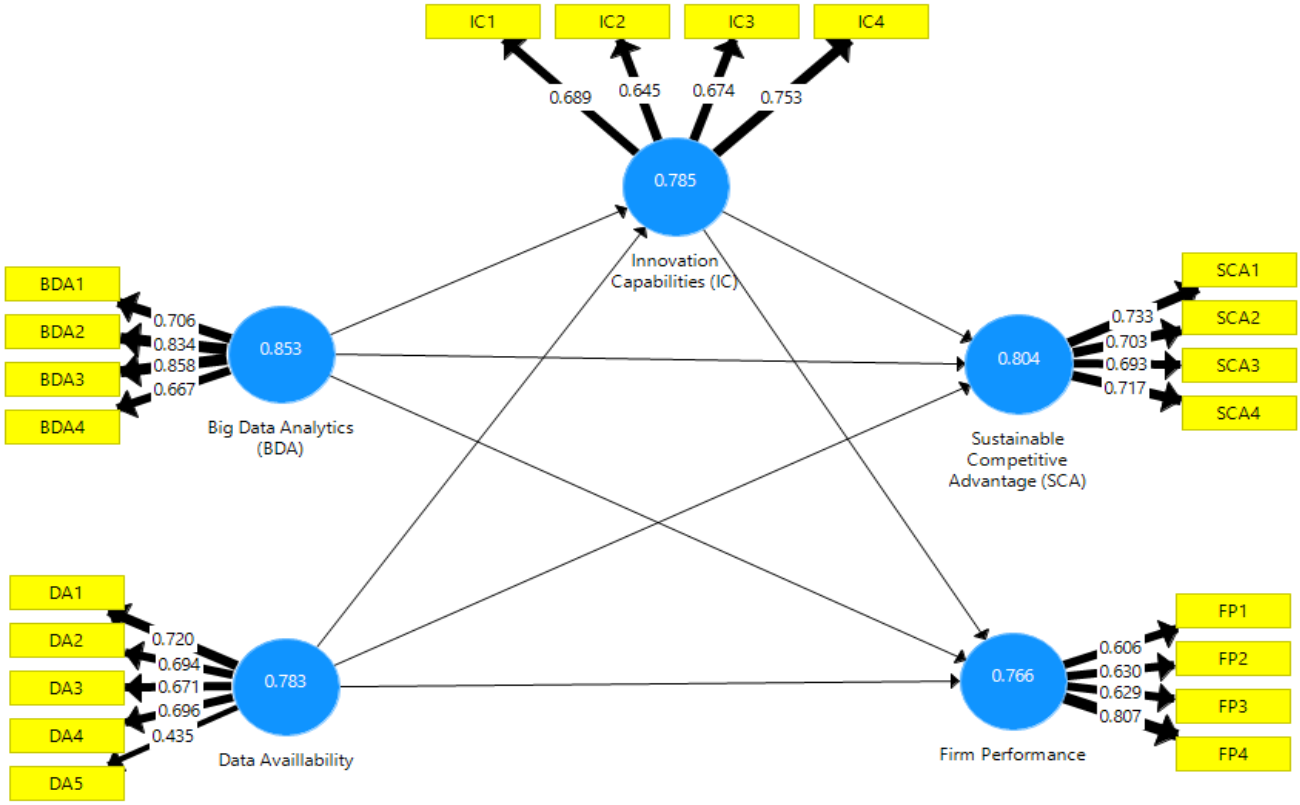

Figure 1.
Reliability Analysis

HYPOTHESIS TESTING

According to the findings of the study, there is an association between "Big Data Analytics (BDA)" and "Firm Performance," as shown by a coefficient of 0.5954. This correlation is statistically significant. The T statistic for this data comes in at 27.2163, which indicates a high degree of statistical significance (p-value = 0.000). The relationship between "Big Data Analytics" (BDA) and "Innovation Capabilities" (IC) is also significant, but to a lower degree; the coefficient for this association is 0.0975, and the T statistic for it is 3.1005 (the p-value for this correlation is 0.0112).

In addition, a substantial relationship can be shown to exist between Big Data Analytics (BDA) and Sustainable Competitive Advantage (SCA), as demonstrated by a coefficient of 0.0297 and a T statistic of 4.7358 (p-value = 0.0008). This suggests that the relationship is statistically significant. The variables known as "Data Availability" and "Firm Performance" have been proven to have a relationship that is statistically significant, as shown by a coefficient of 0.0869 and a T statistic of 2.5242 (p-value = 0.0302) respectively. With a coefficient of 0.4037 and a T statistic of 10.0855 (p-value = 0.000), the link between "Data Availability" and "Innovation Capabilities (IC)" is very significant.

In a similar vein, there is a substantial link between "Data Availability" and "Sustainable Competitive Advantage (SCA)" as shown by a coefficient of 0.4280 and a robust T statistic of 17.7618 (p-value = 0.000). This association is supported by the fact that there is a significant relationship between the two variables. The statistical analysis reveals that

there is a connection between "Innovation Capabilities (IC)" and "Firm Performance" that may be considered statistically significant. The coefficient was computed to be 0.0770, which indicates a positive connection between the two variables. Additional evidence in favour of the significance of the observed correlation is provided by the T statistic that was obtained, which was 2.3489. A p-value of 0.0407 lends more credence to this finding. In addition, it is possible to demonstrate that there is a strong and statistically significant association between the concept of "Innovation Capabilities (IC)" and the notion of "Sustainable Competitive Advantage (SCA)". Both the coefficient, which is measured at 0.1090, and the T statistic, which is measured at 12.6034, point to the fact that the supplied link has a high degree of significance (p-value = 0.000).

According to the results, there seems to be a significant mediating impact exerted by "Big Data Analytics" (BDA) on both "Innovation Capabilities" (IC) and, as a consequence, "Firm Performance." There is a considerable association between BDA and IC, as shown by the value of the coefficient, which is 0.0075. The value of the T statistic that was acquired, which was 2.489, provides strong evidence that the coefficient that is being considered has statistical significance. In addition, the p-value that was found to be 0.032, which was acquired, offers more evidence in support of the statistical significance of the mediation effect. The results of this study indicate that there is a presence of a mediating impact of "Data Availability" on the link between "Innovation Capabilities (IC)" and its subsequent influence on "Firm Performance." This was shown by the fact that "Data Availability" played a role in both of these relationships. This particular mediation effect is statistically significant, as shown by the fact that its coefficient is 0.0311, its T statistic is 2.0837, and its p-value is 0.0638. In this particular instance, there is a decrease in the amount of significance that was noticed.

The findings point to the possibility that the connection between "Big Data Analytics (BDA)" and "Innovation Capabilities (IC)" is mediated, and that this mediation, in turn, has an effect on "Sustainable Competitive Advantage (SCA)". The coefficient of 0.0107, the T statistic of 3.3591, and the p-value of 0.0073 all provide support to the idea that the impact that was seen is real. The research shows that "Data Availability" has a powerful and statistically significant mediating influence on the connection between "Innovation Capabilities (IC)" and "Sustainable Competitive Advantage (SCA)". The significance of these results is further supported by further evidence provided by the coefficient value of 0.0442, the T statistic of 6.0111, and the p-value of 0.0001, all of which are shown below.

Tabel 4.
Structural Equational Modeling

	Original Sample (O)	**T Statistics (|O/STDEV|)**	**P Values**
Direct Effect			
Big Data Analytics (BDA) -> Firm Performance	0.5954	27.2163	0.000
Big Data Analytics (BDA) -> Innovation Capabilities (IC)	0.0975	3.1005	0.0112
Big Data Analytics (BDA) -> Sustainable Competitive Advantage (SCA)	0.0297	4.7358	0.0008
Data Availability -> Firm Performance	0.0869	2.5242	0.0302
Data Availability -> Innovation Capabilities (IC)	0.4037	10.0855	0.000
Data Availability -> Sustainable Competitive Advantage (SCA)	0.4280	17.7618	0.000
Innovation Capabilities (IC) -> Firm Performance	0.0770	2.3489	0.0407

Innovation Capabilities (IC) -> Sustainable Competitive Advantage (SCA)	0.1090	12.6034	0.000
Mediation Analysis			
Big Data Analytics (BDA) -> Innovation Capabilities (IC) -> Firm Performance	0.0075	2.489	0.032
Data Availability -> Innovation Capabilities (IC) -> Firm Performance	0.0311	2.0837	0.0638
Big Data Analytics (BDA) -> Innovation Capabilities (IC) -> Sustainable Competitive Advantage (SCA)	0.0107	3.3591	0.0073
Data Availability -> Innovation Capabilities (IC) -> Sustainable Competitive Advantage (SCA)	0.0442	6.0111	0.0001

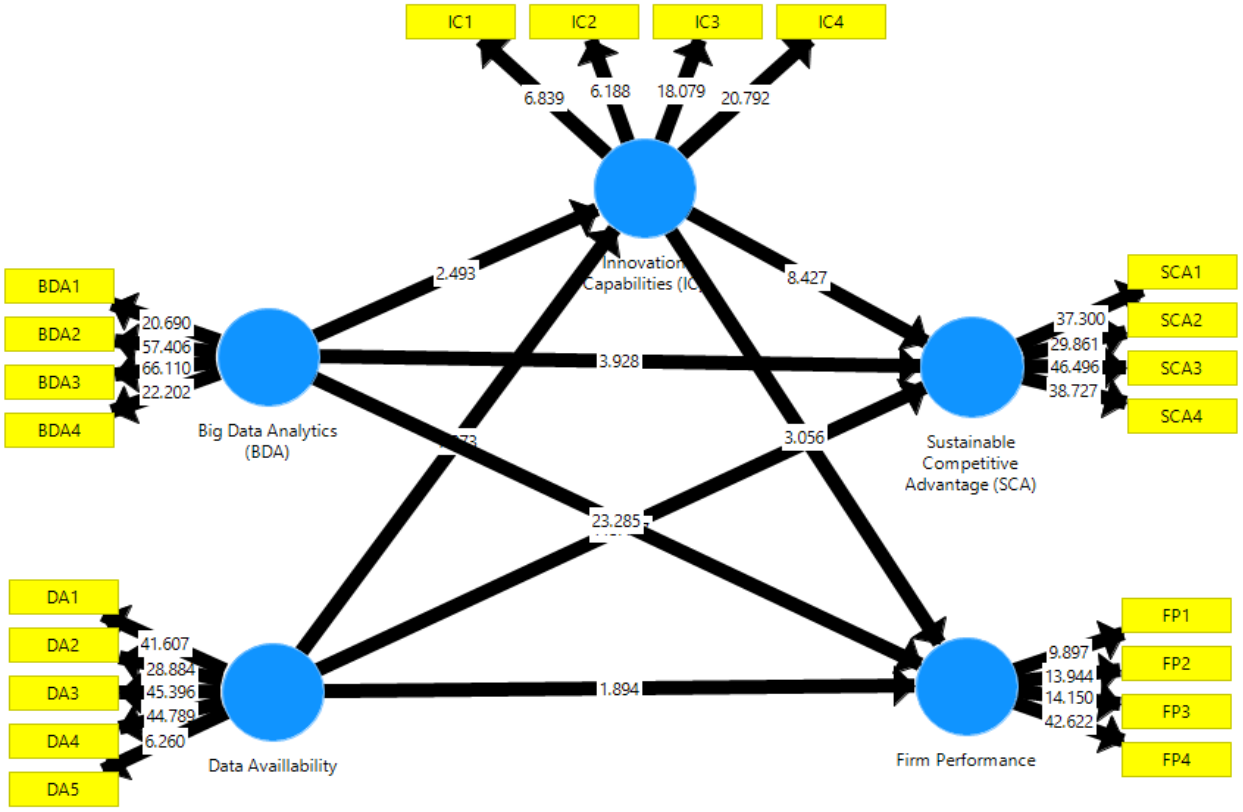

Figure 2.
Structural Equational Model

DISCUSSION AND CONCLUSION

The findings of the hypothesis testing analysis, as depicted in the table, provide insights into the interconnections among crucial variables within the framework of structural equation modeling. Upon closer examination of the direct effects, it becomes apparent that "Big Data Analytics (BDA)" assumes a crucial role in various aspects of organizational performance. The robust and significant association between Big Data Analytics (BDA) and "Firm Performance" highlights the importance of utilizing big data to improve overall business performance. Additionally, the association between Big Data Analytics (BDA) and "Innovation Capabilities (IC)" underscores its significant role in promoting innovation within organizations. The aforementioned findings emphasize the strategic significance

of integrating big data analytics into business operations to enhance performance and foster innovation. The findings of current research are in line with the findings of previous researches (Shah et al., 2018; Shi et al., 2023; Yu et al., 2021).

Furthermore, the factor of "Data Availability" also arises as an essential factor with notable direct impacts. The correlation between "Data Availability" and "Innovation Capabilities (IC)" indicates that the availability of data significantly contributes to the development of innovation. The impact of data availability on achieving a Sustainable Competitive Advantage (SCA) is underscored by its significant influence. This emphasizes the crucial role that data accessibility plays in attaining a competitive edge. The aforementioned findings underscore the significance of ensuring data accessibility as a crucial driver for fostering innovation and sustaining a competitive advantage within the contemporary business environment. The findings of current research are in line with the findings of previous researches (Huang & Luo, 2014; Wilkin et al., 2020).

Regarding the mediation effects, it is worth mentioning the intriguing observation that both "Big Data Analytics (BDA)" and "Data Availability" serve as mediators in the relationship between "Innovation Capabilities (IC)" and "Firm Performance." This suggests that the presence of innovation capabilities serves as a mediator between these factors, ultimately influencing the overall performance of the firm. The mediation effect of BDA demonstrates a moderate level of significance, whereas the mediation effect of "Data Availability" is less prominent. This indicates that the former exerts a stronger influence on the relationship The findings of current research are in line with the findings of previous researches (Jum'a et al., 2023).

Moreover, the mediation analysis elucidates the indirect impact of Big Data Analytics (BDA) on Sustainable Competitive Advantage (SCA) by means of its influence on Innovation Capabilities (IC). The observed mediation effects exhibit statistical significance, suggesting that organizations have the potential to utilize big data analytics as a means to bolster their sustainable competitive advantage through the cultivation of innovation capabilities. The importance of these intermediary relationships highlights the strategic ramifications of utilizing data analytics to foster innovation and, consequently, attain a competitive advantage in the market (Mikalef et al., 2019).

In conclusion, the results of this investigation underscore the significant importance of big data analytics and data accessibility in facilitating innovative capabilities, enhancing company performance, and establishing a lasting competitive advantage. The findings of this study have significant implications for enterprises aiming to use data-driven approaches and improve their overall effectiveness and competitiveness within the contemporary and ever-changing business landscape.

IMPLICATIONS OF THE STUDY

The research done in the manufacturing sector of Pakistan has substantial implications for academics and business in developing nations. The results emphasize the significant importance of integrating big data analytics and assuring data accessibility inside manufacturing companies, as these aspects are clearly associated with improved innovation capabilities, firm performance, and sustained competitive advantage. This implies that enterprises operating within comparable emerging markets have to contemplate the allocation of resources towards the establishment of data analytics

infrastructure, as well as the cultivation of a corporate culture that prioritizes data-driven decision-making. These measures are crucial for sustaining competitiveness and promoting innovative practices. It is imperative for policymakers and industry stakeholders to acknowledge these findings, as they emphasize the significance of establishing a conducive atmosphere for the advancement of data analytics and technology integration in the manufacturing industry. This, in turn, can foster economic progress, generate employment opportunities, and enhance Pakistan's global competitiveness. Furthermore, the findings of this research have the potential to contribute to the formulation of strategies pertaining to the adoption of technology, support for innovation, and creation of industrial policies within the manufacturing sector of Pakistan. Ultimately, these efforts may contribute to the advancement of the nation's economic growth and enhance its worldwide standing.

LIMITATIONS AND FUTURE DIRECTIONS

It is important to realize that the research has many limitations. The study is primarily focused on a particular industry within an emerging country, hence limiting the applicability of the results to other sectors or geographical areas. Moreover, the cross-sectional design used in this research may not adequately reflect the temporal dynamics inherent in these associations. Moreover, the study mostly depends on quantitative data, which, while useful, fails to provide an in-depth understanding of the underlying processes or qualitative subtleties. Potential avenues for future study may include longitudinal studies aimed at evaluating the progression of these interactions through time. Additionally, the integration of qualitative methodologies might be used to get a more profound understanding of the underlying mechanisms involved. Conducting comparative study across various industries and economies might potentially provide valuable insights into the variances in the significance of data analytics and its accessibility. In conclusion, a comprehensive analysis of contextual factors, including government policies and industry-specific features, would enhance our understanding of the interplay between data-driven strategies and company performance in emerging countries.

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