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Data-Driven Innovation Imperatives: Investigating Mediating Pathways from Intelligence to Blockchain Entrepreneurship

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Abstract. This empirical research examines the crossover between business intelligence, analytics, strategic management and entrepreneurial orientation in enabling blockchain business model innovation. Quantitative survey analysis of 352 pharmaceutical managers in Jordan reveals significant indirect effects of intelligence systems in driving blockchain-powered transformations, advancing academic comprehension of data-to-decision translation mechanisms for entrepreneurial goals. Practically, the applied insights assist practitioners in synergizing analytical tools with blockchain platforms to bolster organisational agility, transparency and competitive differentiation.

Keywords: Business Intelligence and Analytics, Strategic Management, Entrepreneurship, Business Analytics, Blockchain-based Business Model Innovation, Jordan.

1. Introduction

Attention towards blockchain technology and its applications in different industries has increased significantly. Therefore, businesses continuously look for innovative ways to adapt their business model to suit emerging needs and accommodate rapid changes. Untraditional and entrepreneurial ways of doing business nowadays pressure businesses to adopt innovation. Especially, in terms of doing business and designing it (Duan et al., 2019). Therefore, businesses must implement dynamic and intelligent ways of integrating their business process to achieve the utmost value presented to the customers. Hence, adopting an innovative business model requires a suitable infrastructure. Subsequently, blockchain technology can establish a trustworthy communication channel with the stakeholders and raise funds securely. Additionally, it unlocks the power of innovation (Chen, 2018). Furthermore, blockchain technologies lean towards creating innovative business models that enable entrepreneurial firms to find new business means to deliver value propositions of their products to the market (Casadesus-Masanell et al., 2013; Chen & Bellavitis, 2020; Foss et al., 2017; McDonald & Eisenhardt, 2020).

Data analytics (DA) and business intelligence (BI) are quite helpful for businesses. Specifically, in identifying marketing trends and customer purchasing habits. Securities are valuable in today's corporate sector. As a result, blockchain-based systems are in high demand (Mishra & Mishra, 2022). There is a connection between strategic management (SM) and business intelligence (BI). Subsequently, strategic management is vital for assessing the effects of digital advances on the company model. Maintain a competitive edge by staying ahead of new technological developments. Blockchain technology allows organizations to transmit digital data across firms by changing how participants participate in digital transactions, validate transactions, eliminate intermediaries, and increase trust (Kersten et al., 2017; Romano & Schmid, 2017; Tijan et al., 2019).

Integrating blockchain-based business model innovation (BBMI) with business intelligence (BI) and data analytics (DA) is a strategic imperative for organizations seeking to unlock the full potential of decentralized technologies. The marriage of blockchain's transparent, secure, and decentralized ledger with the analytical power of business intelligence allows for a comprehensive understanding of operations, customer interactions, and market dynamics. This synergy enables real-time data analysis, empowering businesses to make informed decisions promptly. The transparent nature of blockchain transactions facilitates traceability, while smart contract analytics ensure compliance and performance monitoring. By using advanced analytics to study blockchain data, organizations can discover useful patterns, trends, and anomalies. This helps them make proactive decisions based on accurate information. Moreover, the integration enhances supply chain visibility, customer analytics, and security monitoring, ultimately driving operational efficiency, cost optimization, and strategic agility in an ever-develop business landscape.

However, researchers need to conduct additional studies to understand the downsides and develop methods to increase adoption (Coskun-Setirek & Tanrikulu, 2021). The extant research on blockchain business model innovation (BBMI) is mostly concerned with the technical aspects. Multiple studies have looked at how blockchains affect the growth of strategic abilities (Kersten et al., 2017; M. Wang et al., 2021). Supply chain management is one business activity where blockchain might offer ways of overcoming the existing challenges. Consequently, an investigation is necessary to ascertain how blockchain technology generates, distributes, and gathers value, as well as how technological factors may change business models (M. Wang et al., 2021). In addition to the fact that theorists have not given enough consideration to the influence of blockchain technology on business models, blockchain companies also fall short of delivering the anticipated commercial benefits (Romano & Schmid, 2017). Blockchain has the potential to speed up management and business growth substantially. However, the intersection of business intelligence, analytics and blockchain for entrepreneurial innovation lacks rigorous empirical scrutiny (Mishra & Mishra, 2022).

This study aims to bridge the gap in the current literature by investigating the factors that influence blockchain-based business model innovation (BBMI). The current study aims to make key theoretical

contributions to the literature. It advances the understanding of the role of business intelligence, unlocking the potential of strategic management, data analytics and entrepreneurship to shape business model innovation. Especially with the presence of blockchain. This contributes to the current literature by providing a quantitive model that links vital concepts. Furthermore, this study will be a stepping stone for further research that addresses entrepreneurship and blockchain-based technologies.

Pharmaceutical industries heavily depend on supply chains to get their raw material as well as deliver their product to their clients. The supply chain system is at the centre of the success of pharmaceutical companies considering the critical nature of the products (Haq & Muselemu, 2018). Therefore, they are investing heavily in finding solutions to boost trust and transparency in their supply chain processes. This is why it is very sensitive and suitable for being a study context. Pharmaceutical companies in Jordan have been studied extensively, which gives the right motivation to consider it as the study context.

for this study to consider it as a context (Akour et al., 2024; Barakat & Al-Zagheer, 2021; Jum'a, 2023; Sharabati, 2021).

This study is organised as the following: First, the literature review. Then, describe the method and the data collection and analysis. Followed by the result where the finding from the data analysis are presented. Finally, the discussion section, where the outcomes of the study are presented in light of other studies in the same respect, limitations, implications, and future research.

2. Literature Review

Recent years have seen an enormous increase in interest in blockchain technology. This is due to its potential to revolutionize a variety of industries. However, business intelligence has long been a crucial tool for organizational decision-making (Awamleh & Bustami, 2022; George et al., 2019; Ji & Tia, 2021). Therefore, by fusing these technologies with strategic management, organizations may create a solid foundation that fosters growth and success.

Strategic management refers to the process of formulating goals, creating strategies, and putting plans into action to accomplish corporate objectives. Organizations require strategic management to remain competitive and adapt to changing market conditions. It comprises investigating the effects of both internal and external elements on the organizations and then basing decisions on this analysis (Zwerenz, 2020). For instance, organizations may utilise strategic management to find new markets to enter or create brand-new items to satisfy consumer demand. To complete this process, one must have a thorough awareness of the business environment, including rivals, clients, and market trends (Hitt et al., 2019; Zwerenz, 2020).

On the other hand, blockchain-based business model innovation (BBMI) describes how conventional business models are changed through the usage of blockchain technology. Businesses can perform transactions and store data on a decentralized, secure, and transparent platform made possible by blockchain technology. New business concepts that were previously unattainable or challenging to implement can now be made possible by technology (Marikyan et al., 2022; Purusottama et al., 2022). Organizations digitalize their business models to increase their ability to compete in today's dynamic market, with emerging technologies and shifting consumer demands (Marikyan et al., 2022; Taherdoost & Madanchian, 2023).

The adoption of blockchain-based technology by organizations to improve business profitability, productivity, and efficiency is one of the technical advances (Marikyan et al., 2022). For instance, blockchain-based business model innovation BBMI can be used to improve the efficiency of the supply chain. By tracing products from the manufacturer to the final user (Chang et al., 2019; Zheng et al., n.d.). A business model explains how value is created and delivered, as well as the expenses and revenues related to such activities. The BBMI is concerned with modifications to the company's value creation, value delivery, and value capture processes. Which will encourage innovation to either create

new markets or improve ones that already exist (Marikyan et al., 2022).

Strategic management and BBMI are closely related, as they both are involved in developing innovative strategies to improve business operations. The context for recognizing opportunities and creating new markets or improving ones that already exist (Marikyan et al., 2022). Strategies are provided by strategic management, while the technology for doing so is provided by BBMI. These two strategies can be combined to help organizations build a strong framework that fosters expansion and success (Karpenko et al., 2019; Zheng et al., 2021). For instance, a business might utilise strategic management to find a new market to penetrate and then use BBMI to create a new business model that leverages blockchain technology. This new business model can provide a competitive advantage and drive growth for the company (Zwerenz, 2020).

Furthermore, blockchain can play a role in improving business intelligence, which is a key component of strategic management. By leveraging blockchain-based business intelligence, enterprises can enhance their strategic decision-making capabilities, leading to competitive advantages and long-term success. One of the primary benefits of integrating blockchain technology into business operations is the transparency it can provide. The implementation of blockchain technology can enable the transparency and traceability of key resources within an organization, resulting in a more efficient and trustworthy supply chain network (Gohil & Thakker, 2021; Pancić et al., 2023). Additionally, blockchain technology can be used in product lifecycle management through the integration of other technologies. For instance, the combination of blockchain technology and business intelligence can facilitate strategic management processes, such as performance monitoring and risk analysis (Gohil & Thakker, 2021; Ji & Tia, 2021).

In terms of how strategic management and blockchain-based BMI interact, business intelligence may play a crucial mediating factor (Awamleh & Bustami, 2022). Business intelligence may assist organizations in lowering risks while boosting efficiency through the efficient integration of information resources (Barreto et al., 2017). Business intelligence also describes the procedure of gathering, evaluating, and deciphering data to make smart business decisions. It entails utilizing a variety of tools and approaches to draw conclusions from data and turn it into useful information. Businesses need business intelligence because it enables them to see opportunities, reduce risks, and improve performance (Awamleh & Bustami, 2022; Pancić et al., 2023). For example, organizations may use business intelligence customer data to identify trends and preferences. This analysis can help organizations develop targeted marketing campaigns and improve customer satisfaction (Ain et al., 2019; Pancić et al., 2023). Business Intelligence and Strategic Management have been the backbone of many successful companies, and with blockchain-based BMI, it is no different for pharmaceutical companies. The potential impact of BBMI on pharmaceutical companies can be significant in terms of efficiency, transparency, and security (Zwerenz, 2020).

The advantage of BBMI lies in its ability to generate a secure and transparent supply chain [33]. It enables companies to use smart contracts. Pharmaceutical companies can track their products from the manufacturing stage to the end consumer. Nevertheless, it ensures that the product is authentic and also helps prevent counterfeit drugs from entering the market (Awad et al., 2022; Prokofieva & Miah, 2019). Additionally, BBMI can help reduce the time and cost associated with manual record-keeping processes (Fellah et al., 2023; Marikyan et al., 2022).

Business intelligence plays a notable role in the relationship between strategic management and BBMI (Awawdeh et al., 2022; Fellah et al., 2023). It acts as a tool that enables businesses to collect, analyze, and interpret data that are at the very centre of making informed decisions. It is believed that by using business intelligence, businesses are more likely to optimize their operations and improve their performance (Fitriana & Djatna, 2011; Maulana & Wulandari, 2019).

In the study of BI Systems Implementation in Jordanian Pharmaceutical Companies, the study concludes that the successful implementation of BI is essential for performance success elements

(Alabaddi et al., 2019). For example, a company may use business intelligence to analyze customer data to identify trends and preferences. This analysis can then be used to develop a new business model that leverages blockchain technology. The use of business intelligence ensures that the new business model is based on data-driven insights, leading to improved performance and increased success (Alabaddi et al., 2019). This supposed relationship will explore how the integration of strategic management, BBMI, and business intelligence can lead to transformative changes in how businesses operate. Hence, this study hypothesizes that:

H1: Strategic Management and Business Intelligence positively affect Blockchain-based BMI.

In today's business climate, the connection between entrepreneurship and BBMI is a subject of utmost importance. Entrepreneurs have the opportunity to create advanced business models that offer special value to their clients by combining these two principles and utilising business intelligence tools to construct decentralized platforms, lower expenses, and enhance productivity (Chen, 2017; Larios-Hernández, 2017).

Entrepreneurship is "creating and managing a new business venture to achieve a profit" (Hitt et al., 2019). On the other hand, BBMI is developing new business models using blockchain technology (Marikyan et al., 2022). Combining entrepreneurship and BBMI can result in the development of novel business models that have the potential to upend established markets (Oche, 2021; Zheng et al., 2021). Hence, this study hypothesizes that:

H2: Entrepreneurship and Business Intelligence positively affect Blockchain-based BMI.

The field of business analytics has been paying close attention to BBMI in recent years. Furthermore, Business Intelligence (BI) may be necessary to fully exploit the potential advantages of BMI (Ahmad & Mustafa, 2022; Bany Mohammad et al., 2022; Pancić et al., 2023). Business analytics is the practice of using statistical and quantitative analysis methods to glean insights from corporate data and apply those insights to decision-making. Academics and professionals anticipate that the widespread application of business analytics will have a considerable impact on corporate performance (Yin & Fernandez, 2020).

Business analytics play a crucial role in the development and implementation of BBMI. With the use of blockchain technology and business analytics, organizations can effortlessly store and share data in a very secure and open manner. This enables organizations to access crucial data and evaluate it in real time, enabling them to make wise decisions quickly and effectively (Fellah et al., 2023; Pancić et al., 2023; Yoo & Roh, 2021).

The same is true of the relationship between BI and BBMI, Business Intelligence's importance in Blockchain-Based BMI The entire potential of Blockchain-Based BMI can only be achieved through the usage of Business Intelligence, even though blockchain technology can completely transform the way businesses function. Businesses may make data-driven decisions that can help them stay ahead of the competition thanks to business intelligence, which offers them useful insights into their operations. Businesses may examine the data they get using blockchain technology with the help of business intelligence, and then use this knowledge to create and put into practice successful business strategies (Marikyan et al., 2022; Pancić et al., 2023).

Additionally, BI could serve as a mediator between business analytics and BBMI. Business intelligence is required to fully utilize the potential of blockchain-based BMI. Business intelligence (BI) is used to give organizations crucial insights into how well their operations are running (Pancić et al., 2023; Yin & Fernandez, 2020). It also enables organizations to make defensible decisions based on the data they gather using blockchain technology. Businesses may analyse the data they collect from blockchain platforms using business intelligence, and then use this data to create and put into practice

strategic business plans that will help them grow and succeed. In the very competitive corporate climate of today (Ji & Tia, 2021; Pancić et al., 2023).

Business analytics is used in a variety of industries, including banking, insurance, the medical industry, and others. For instance, utilising business analytics (descriptive and predictive analytics) in the pharmaceutical industry is important for sufficient reasons. First, it enables businesses to examine enormous amounts of data and learn more about consumer trends, market trends, and drug effectiveness. Making informed judgments about which drugs to produce, how to price them, and how to advertise them to customers is then possible using this knowledge. Second, business analytics may assist organizations in finding inefficiencies in their supply chains and operational processes, which can result in cost savings and improved productivity. Finally, businesses can get a competitive edge in the market by using predictive analytics to foresee future trends and adjust their strategy accordingly.

Numerous examples exist of pharmaceutical companies that have effectively increased efficiency and profitability by utilising business analytics. For instance, Pfizer and Novartis optimized their supply chain using predictive and prescriptive analytics to lower inventory costs and boost revenues (Finelli & Narasimhan, 2020; Guo, 2023). Hence, this study hypothesizes that:

H3: Business Analytics and Business Intelligence positively affect Blockchain-based BMI

The study's theoretical framework shows the conceptual framework after a detailed discussion of the literature review.

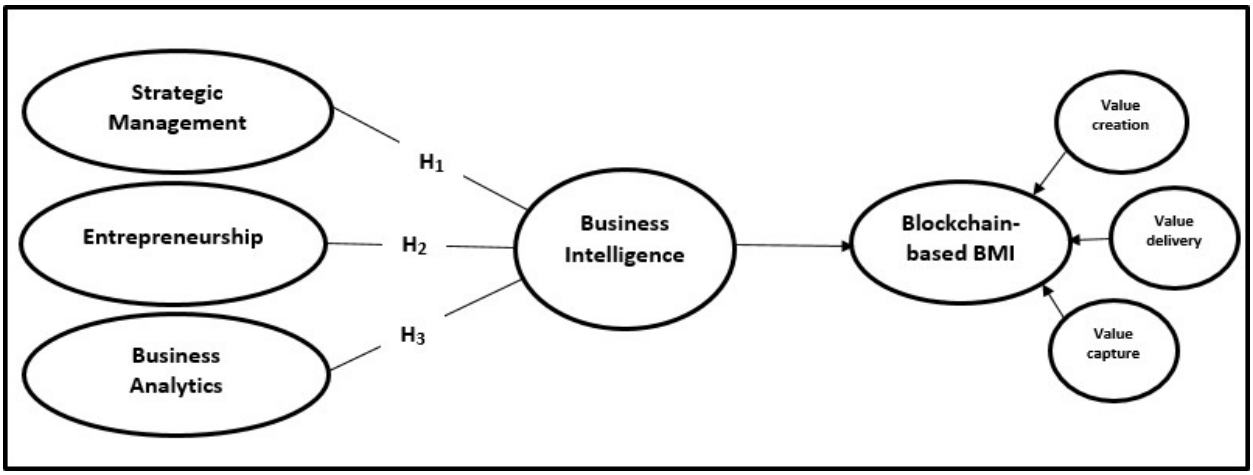

Fig. 1: Research Model

The conceptual research model that demonstrates the factors affecting blockchain-based business model Innovation (BBMI) through business intelligence.

3. Research Methodology

The study adopted an analytical descriptive approach that is based on analysing the latest practical studies related to factors (i.e., entrepreneurship, business analytics, and strategic management) affecting blockchain-based business model innovation through business intelligence. The previous literature analysis provided the required support for backing the hypotheses and the study model. Consequently, the current study tool was developed based on specific references. These references were selected based on their suitability, relatability, and similarity to the current study. To ensure the extent of the study population's understanding of the study's instrument, a pilot study was used on 32 managers in pharmaceutical companies.

The study involved 15 Jordanian pharmaceutical companies that operate blockchain-based solutions and are considered key players in Jordan's pharmaceutical sector. Several factors led to the selection of the pharmaceutical sector as the research context. First is the sector's dependence on supply

chain and blockchain technology. Second, the concept of business intelligence is not new to the industry. There is some evidence of business intelligence research being conducted in the industry. Traditional questionnaires were distributed to the managers of the selected companies as they have extensive experience in running companies.

A probability sampling method was adopted. The use of probability samples increases representativeness, reduces bias, facilitates statistical inference, promotes comparability, makes generalizability, is consistent with ethical considerations, supports accuracy of estimation, and supports random It is justified because it controls errors and allows the application of statistical tests and evaluations of effectiveness. Out of the total questionnaires distributed, 352 valid questionnaires were considered valid for statistical analysis.

The study tool was developed by reverting to the previous studies that presented validated questionnaires in different countries and sectors (Awamleh & Bustami, 2022; Barringer & Bluedorn, 1999; Duan et al., 2019; Marikyan et al., 2022; Rustamadji & Omar, 2019; Tsolakidis et al., 2020). A pilot study was distributed to the research sample to ensure the reliability and validity of the study questions. The study tool was designed based on the following details to cover the study variables.

As an independent variable, entrepreneurship is measured by 9 questions adopted by referring to the following studies (Barringer & Bluedorn, 1999; Tsolakidis et al., 2020). The questions were evaluated using a 7-point Likert scale, where the number "1" represents strongly disagree and "7" strongly agree. Secondly, business analytics is represented by 3 questions based on (Duan et al., 2019). It is based on a 7-point Likert scale, where the number "1" represents strongly disagree and "7" strongly agree. Lastly, 11 questions to measure strategic management; detailed 3 dimensions, which are (understanding of the planning, adequacy to company, and utilisation) based on the following studies (Rustamadji & Omar, 2019; Tsolakidis et al., 2020). It adopted a 5-point Likert scale, where the number "1" represents strong disagreement and "5" represents strong agreement. The selection of the scale came due to the suitability of the context.

The mediator variable, business intelligence, 5 questions were adopted by referring to the following studies (Awamleh & Bustami, 2022; Paulino, 2022) by adopting the 5-point Likert scale, where the number "1" represents strong disagreement and "5" represents strong agreement. The BI measure used in this study has a long trial of validated use in similar contexts. The dependent variable, Blockchain-based Business Model Innovation 12 questions were adopted using 3 dimensions, which are (value creation, value delivery, and value capture) based on the following study (Marikyan et al., 2022) by adopting a 5-point Likert scale, where the number "1" represents strong disagreement and "5" represents strong agreement. The current scale has been selected due to the relativity between the scale's questions and the current study questions. Having a diversified scale that adopts 5 point Likert scale and 7 points Likert scale was found to better serve measuring each variable as it has been verified in previous studies. Furthermore, the analysis procedures weren't affected by this issue, it rather benefited the accuracy of the measurement.

The study relied on the quantitative method of data collection. A questionnaire was adopted to distribute questions to the target community, and then the SPSS program was used to ensure the validity and reliability of the study tool. In the final stage, the PROCESS Micro v3.5 program was applied to answer the study questions. The data was kept confidential and its results were used for research only.

The PROCESS macro is well known within the academic research community. Originally it was introduced by (Andrew F. Hayes). It is used to establish statistical techniques for mediation and moderation analysis. The PROCESS macro permits the analysis of both moderation and mediation effects within a single framework. It provides estimates for direct and indirect effects, allowing researchers to investigate complex relationships in their data.

352 completed questionnaires were found approved and validated for analysis using the SPSS 25 program, and several statistical analyses were applied to test the validity, reliability, and linearity of the

data to make sure that the data were suitable for testing the hypotheses. Then, the hypotheses were tested using PROCESS Micro v3.5 software to answer the direct and indirect effects of the study questions.

Pearson correlation test was used to confirm the internal validity (**R = < 0.01) and (*R = < 0.05) the results were confirmed except for two variables of the dimensions of blockchain-based business model innovation, which are value delivery and value capture. A unified variable (BBMI) achieved the condition of internal validity. In addition, the independence of the data was confirmed since all the numbers are among (20 =< R =< 90) except for two variables from the dimensions of blockchain-based business model innovation, which are value delivery and value capture. On the other hand, a unified variable (BBMI) fulfilled the independence condition (F. Hair Jr et al., 2014; Sekaran & Bougie, 2016).

Cronbach's Alpha was used to confirm the reliability of the study tool. The reliability was found to be significant with overall credibility (α = 0.95) while the lowest item is not less than (α = 0.70). Consequently, the study met the condition of the reliability of the study tool (F. Hair Jr et al., 2014). The linearity was verified because all the numbers are between (2.58 >= Skewness - Kurtosis =< -2.58) (Sekaran & Bougie, 2016).

The respondents' responses to the entrepreneurship questions showed that the mean was (4.9), which is a medium level according to 7-point Likert while the mean for business analytics was (5.3), which is a high level according to 7-point Likert. Additionally, the strategic management mean was between (3.6) and (3.5), which is between medium and high level according to 5-point Likert while business intelligence's mean was (4.1), which is a moderate level according to 7-point Likert.

Table 1: the internal validity through Pearson Correlation test.

Variable	**IV**						**M**	**DV**			
Item	**EP**	**BA**	**SM**	SMUP	SMAC	SMU	**BI**	**BBMI**	VC	VD	VCR
EP	1.0										
BA	.81**	1.0									
SM	.80**	.66**	1.0								
SMUP	.75**	.61**	.88**	1.0							
SMAC	.72**	.59**	.89**	.76**	1.0						
SMU	.64**	.56**	.87**	.57**	.77**	1.0					
BI	.57**	.51**	.62**	.52**	.62**	.51**	1.0				
BBMI	.34**	.29**	.31**	.25**	.29**	.28**	.33**	1.0			
BBMIVC	.66**	.55**	.74**	.67**	.70**	.62**	.82**	.36**	1.0		
BBMIVD	.18**	.17**	.12*	.10	.11*	.11*	.10	.84**	.08	1.0	
BBMIVCR	.01	.00	-.03	-.07	-.02	.01	-.01	.75**	-.06	.42**	1.0

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed), N= 352.

EP= Entrepreneurship; BA= Business Analytics; SM= Strategic Management: UP= Understanding of the Planning, AC= Adequacy to Company, U= Utilisation; BI= Business Intelligence; BBMI= Blockchain-based Business Model Innovation: VC= Value Creation, VD= Value Delivery, VCR= Value Capture. High level according to 5-point Likert; and finally, Blockchain-based Business Model Innovation was between (3.8) and (2.6) which are low and high levels. Interestingly, the "value creation" dimension had the highest level of interest within the study community.

Table 2: Tests of Reliability, Normality, and Descriptive Statistics.

Variable	IV						M	DV				∑
Item	EP	BA	SM	UP	AC	U	BI	BBMI	VC	VD	VCR	Description
N. of item	9	3	11	4	3	4	5	12	4	4	4	40
Alpha (α)	.94	.91	.93	.93	.76	.87	.91	.84	.82	.95	.92	.95
Skewness	-1.0	-1.2	-.7	-.9	-.6	-.7	-1.3	.63	-.9	.5	.5	Er= .13
Kurtosis	1.1	1.6	.9	.9	.7	.6	2.5	-.1	2.1	-.9	-.7	Er= .26
Maximum	7.0	7.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	Likert Scale
Minimum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Likert Scale
Mean	4.9	5.3	3.6	3.6	3.6	3.5	4.1	3.0	3.8	2.6	2.6	HL&ML
SD	1.2	1.2	0.7	0.9	0.8	0.8	0.7	0.7	.7	1.2	1.0	HL&ML

Alpha (α) >= 70; Skewness & Kurtosis = ±2.58; Mean & SD = High level (HL) & Medium level (ML)
EP= Entrepreneurship; BA= Business Analytics; SM= Strategic Management: UP= Understanding of the Planning, AC= Adequacy to Company, U= Utilisation; BI= Business Intelligence; BBMI= Blockchain-based Business Model Innovation: VC= Value Creation, VD= Value Delivery, VCR= Value Capture.

PROCESS Micro v3.5 was used to test the direct and indirect impact and to test periods for LLCI and ULCI values which do not meet zero [55]. According to Table 4, the total effect of strategic management of explained (0.38) from BI & BBMI as shown by R-sq, F test (213.1) which is statistically significant at (P = < 0.01). In addition, LLCI and ULCI between (0.19 and 0.37) did not meet the zero value, which fulfilled the statistically significant distance condition. The direct effect of SM explained 0.10 from BI & BBMI based on R-sq, F test (36.45) which is statistically significant at (P = < 0.01). LLCI and ULCI between (0.04 & 0.27) meet zero value, which the statistically significant distance condition was not met [55]. Partially mediated effect (complementary) where the direct effect is 0.15, the indirect effect is 0.13 and the total effect reaches 0.15 + 0.13 = 0.28, which improves the value of the complementary effect.

Table 3: Direct & Indirect effect summary of BI between SM & BBMI.

The total effect of SM on BBMI: " SM & BI & BBMI"

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.28	0.04	0.38	6.06	213.1	0.19	0.37	0.00

The direct effect of SM on BBMI: SM BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.15	0.06	0.10	2.63	36.45	0.04	0.27	0.00

Indirect effect(s) of SM on BBMI: SM → BI → BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.13	0.04	0.13	3.63	25.60	0.06	0.21	0.00

**Level of confidence for all confidence intervals in output:95.0000
SM= Strategic Management; BI= Business Intelligence; BBMI= Blockchain-based Business Model Innovation.

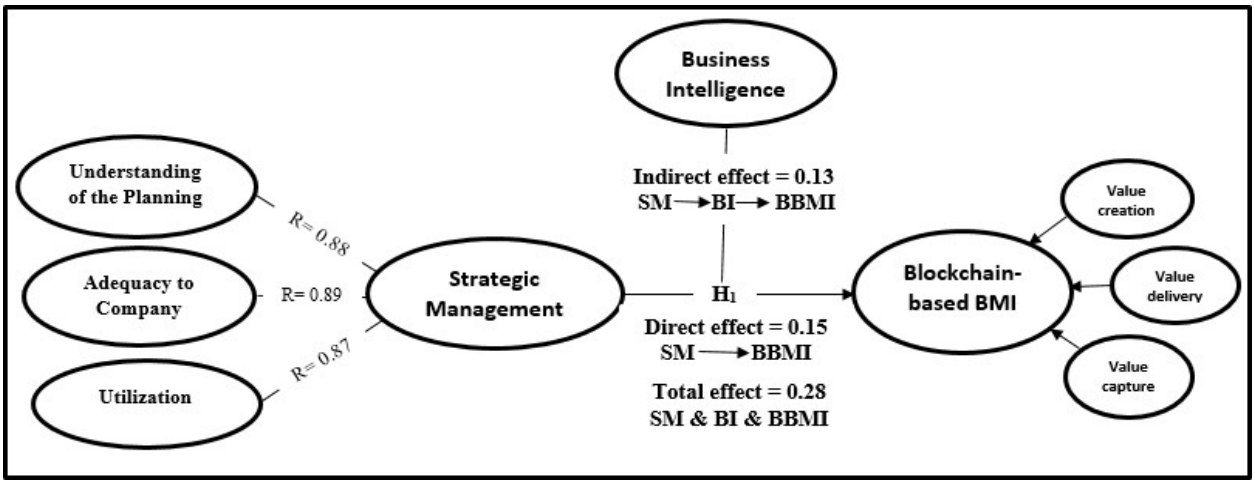

Fig. 2: The Direct and indirect effect of Strategic Management on Blockchain-Based Business Model Innovation (BBMI) Through Business Intelligence

The total effect of entrepreneurship of R-sq of EP explained (0.32) from BI & BBMI, F test (168.5) which is statistically significant at (P = < 0.01). In addition, LLCI and ULCI between (0.13 and 0.24) did not meet the zero value, which fulfilled the statistically significant distance condition. Other than that, the direct effect of EP of R-sq explained 0.11 from BI & BBMI, F test (45.22) which is statistically significant at (P = < 0.01). On the other hand, LLCI and ULCI between (0.06 & 0.19) meet zero value which the statistically significant distance condition was not met (Hayes, 2015).

Partially mediated effect (complementary) where the direct effect is 0.12, the indirect effect is 0.07 and the total effect reaches 0.12 + 0.07 = 0.19 which improves the value of the complementary effect.

Table 5: Direct & Indirect effect summary of BI between EP & BBMI.

The Total Effect of EP on BBMI: EP & BI & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.19	0.03	0.32	6.72	168.5	0.13	0.24	0.00

The Direct Effect of EP on BBMI: EP & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.12	0.03	0.11	3.65	45.22	0.06	0.19	0.00

Indirect effect(s) of EP on BBMI: EP & BI & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.07	0.02	0.14	3.43	29.02	0.03	0.11	0.00

**Level of confidence for all confidence intervals in output:95.0000

EP= Entrepreneurship; BI= Business Intelligence; BBMI= Blockchain-based Business Model Innovation.

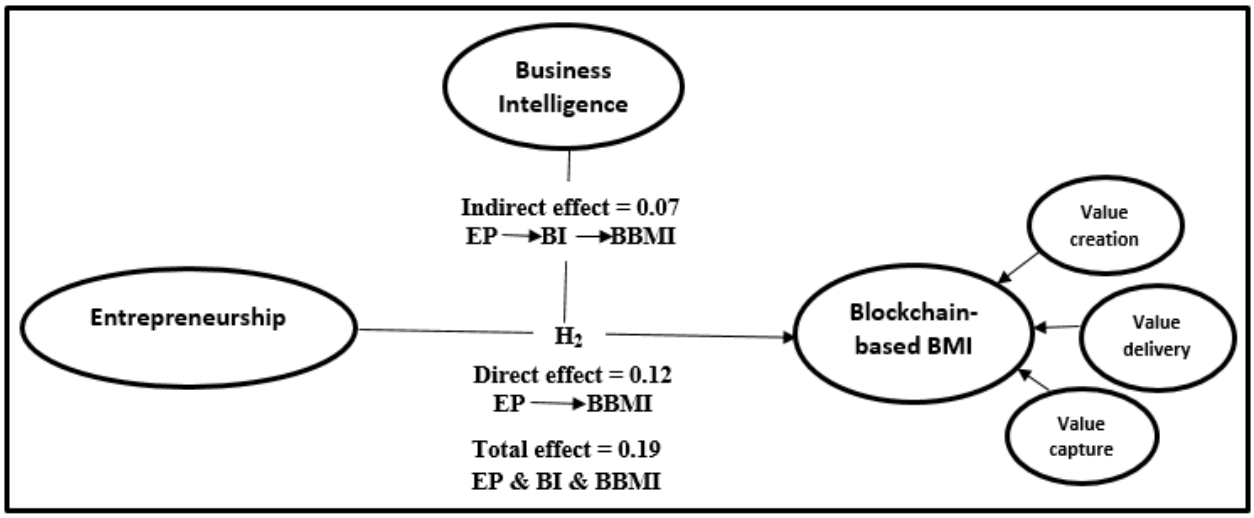

Fig. 3: The Direct and indirect effect of Entrepreneurship on blockchain-based Business Model Innovation (BBMI) Through Business Intelligence

The total effect of BA on BI & BBMI as explained by (R-sq =0.26), F test (123.4) which is statistically significant at (P = < 0.01). Moreover, LLCI and ULCI between (0.10 and 0.21) did not meet the zero value, which fulfilled the statistically significant distance condition. Other than that, the direct effect of BA of R-sq explained 0.13 from BI & BBMI, F test (25.92) which is statistically significant at (P = < 0.01). On the other hand, LLCI and ULCI between (0.04 and 0.11) meet zero value, which the statistically significant distance condition was not met (Hayes, 2015).

Partially mediated effect (complementary) where the direct effect is 0.09, the indirect effect is 0.07 and the total effect reaches 0.09 + 0.07 = 0.,16 which improves the value of the complementary effect.

Table 6: Direct & Indirect effect summary of BI between BA & BBMI.

Total effect of BA on BBMI: BA & BI & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.16	0.03	0.26	5.61	123.4	0.10	0.21	0.00

Direct effect of BA on BBMI: BA & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.09	0.03	0.08	2.74	31.53	0.01	0.02	0.00

Indirect effect(s) of BA on BBMI: BA & BI & BBMI

Effect	SE	R-sq	t	F	LLCI	ULCI	p
0.07	0.02	0.13	4.33	25.92	0.04	0.11	0.00

**Level of confidence for all confidence intervals in output:95.0000

BA= Business Analytics; BI= Business Intelligence; BBMI= Blockchain-based Business Model Innovation.

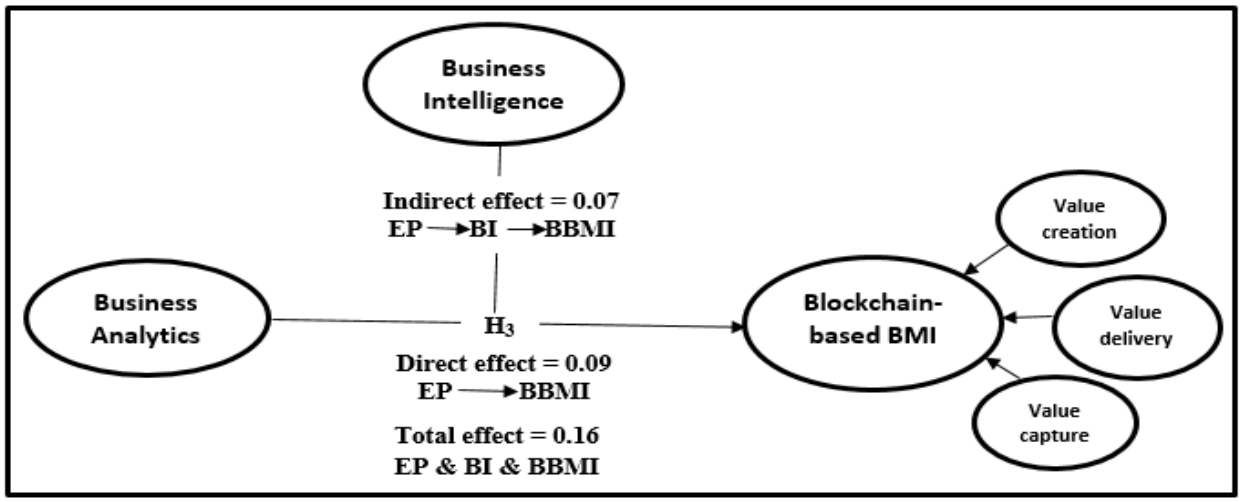

Fig. 4: The direct and indirect effect of business analytics on blockchain-based business model innovation (BBMI) through business intelligence

4. Discussion

The current study focused on three significant factors (strategic management, entrepreneurship, and business analytics) in influencing blockchain-based business model innovation. Furthermore, the study proved that analysing big data through business intelligence and turning it into important insights significantly develops business and administrative decisions. The study focused on pharmaceutical companies; this is to consider the conditions of the project life cycle and to examine the role of factors in the unique and diverse industries in its health field, which are based on blockchain-based business model innovation (Cui et al., 2022).

The strategic management focused on holding meetings of the company's protocols through the blockchain-based business model innovation, which achieved success in adopting the strategy of consensus of the participants in decision-making in various fields, but some obstacles establish a barrier in front of companies through the expected traditional survey of the effectiveness of the meetings, which constitute inaccurate predictions in making accurate decisions (W. Wang et al., 2019). However, the current study improved results by using the mediating engine to analyse data through business intelligence, which forms visualisations with high accuracy that help companies make rational and more accurate decisions.

Previous literature has argued that the blockchain-based business model innovation did not take into account the trend of entrepreneurial firms, arguing that it does not provide any value to customers in using their resources. But it served as an alternative, which is the efficiency of transactions, which could be the basis for creating clients' value (Zott et al., 2011). The current study showed that entrepreneurial companies contribute to the development of unlimited institutional innovations that create value for customers and seek to adopt innovative initiatives that help them progress and innovate.

Technology platforms are invading the current world, which calls for a strategic revolution rather than shouldering the hard burdens. The digital platform has become dependent on blockchain-based business model innovation, which works to enhance business, which works to enhance the dynamism of work (Mishra & Mishra, 2022). These platforms must rely on business analysis, artificial intelligence, and blockchain because digital transformation creates a huge database that cannot be interpreted for value if it is not analysed in the form of insights and graphic forms that facilitate reading and converting them into valuable information that assists making decisions and achieving visions for future business in the right form (Mishra & Mishra, 2022).

From a theoretical lens, the current study tackles crucial gaps in the literature. It has established a direct link between business intelligence and blockchain-based business model innovation. This will

open the door for further efforts to optimise this relationship in different industries. This study also contributed to the literature by emphasising the critical connection between entrepreneurship and blockchain technologies, which also is missing from the literature. Finally, by including the strategic management dimension, this study tested the effect of strategic decision-making on the relationship between business intelligence and blockchain-based business model innovation.

From a practical perspective, Given the complexity of the organisational context and challenges, the study's findings have significant implications, particularly for pharmaceutical companies and researchers: First, improvements in Decision-Making: Organisations may make well-informed strategic decisions by using blockchain technology's business analytics and intelligence solutions. A proactive approach to decision-making is made possible by the analysis of blockchain data, which can reveal insightful information about market trends, consumer behaviour, and operational efficiencies (Kumar, 2012; Marikyan et al., 2022; Taherdoost & Madanchian, 2023). Secondly, efficiency and transparency improvements: due to the decentralised and irreversible ledger it provides, blockchain technology increases efficiency and transparency. Organisations may obtain actionable insights from business analytics and intelligence to find process bottlenecks, streamline processes, and guarantee transparency throughout the value chain (Taherdoost & Madanchian, 2023). Thirdly, innovation and present New Business Models: Blockchain technology combined with strategic management and entrepreneurship enables businesses to experiment with new business models and tech-driven breakthroughs. De-centralised applications and smart contracts can be created thanks to blockchain technology, creating new prospects for innovative business models (Taherdoost & Madanchian, 2023).

Fourthly, risk reduction and security: by combining business analytics and intelligence, blockchain technology offers a safe and impenetrable platform for organising and storing data. Organisations can evaluate and reduce risks related to the deployment of blockchain technology. Potential vulnerabilities can be found via predictive analytics, allowing for the proactive implementation of security measures (Ji & Tia, 2021; Taherdoost & Madanchian, 2023). Fifthly, customer engagement and trust: The openness and immutability of blockchain technology can promote trust and enhance customer engagement. Businesses may better understand client preferences, behaviour, and feedback by integrating business intelligence and analytics. This allows them to customise products and services to meet the demands of their customers, which increases their trust and loyalty (Kumari & Yadav, 2018; Taherdoost & Madanchian, 2023). Sixthly, the collaboration between strategic alliances and ecosystems: Collaboration between ecosystem members is made safe and transparent, thanks to blockchain technology. Organisations may identify potential partners, examine market dynamics, and form strategic alliances by integrating strategic management, entrepreneurship, business analytics, and business intelligence. This fosters community growth and innovation within the blockchain ecosystem (Awad et al., 2022; Fitriana & Djatna, 2011; Suyambu et al., 2020; Taherdoost & Madanchian, 2023; Tarek & Adel, 2016). Overall, the incorporation of business intelligence, business analytics, and strategic management into blockchain technology has sufficient applications that can benefit researchers and organisations by promoting efficiency, transparency, innovation, and strategic decision-making.

The study findings would inspire managers of the application of strategic management in blockchain technology. Managers might try making use of blockchain's ability to foster innovation inside a company and produce competitive benefits. This is to establish successful blockchain strategies that contribute to long-term success. It is helpful to apply strategic management principles to assess market opportunities, comprehend consumer needs, and develop such plans (Dal Mas et al., 2020; Karpenko et al., 2019). Managers could rely on this study's result and incorporate entrepreneurship and data analytics in blockchain technology to encourage innovation, risk-taking, and the creation of new business models. Entrepreneurial managers within the blockchain space would learn how to seek to identify promising opportunities, develop novel applications or solutions, and bring brilliant ideas to the market by integrating entrepreneurship, blockchain technology can foster a dynamic ecosystem that

encourages experimentation, collaboration, and the exploration of uncharted territories (Ratten, 2021; Tarek & Adel, 2016; Trimi & Berbegal-Mirabent, 2012).

Strategic managers may acquire actionable insights from blockchain data and use those insights to make well-informed decisions by using analytical techniques and tools. Logistics and supply chain managers would learn about blockchain technology using business analytics to examine transactional data, track network behaviour, spot abnormalities, and boost productivity. It aids researchers in trend identification, market behaviour forecasting, and process optimisation, all of which improve performance and competitiveness (Cui et al., 2022; Lohmer et al., 2022; Pancić et al., 2023). Finally, Managers could integrate business intelligence amongst business analytics, entrepreneurship, strategic management, and blockchain technology to concentrate on utilising data visualisation, reporting, and data mining tools to derive beneficial business insight from blockchain data (Awamleh & Bustami, 2022; Hitt et al., 2019; Pancić et al., 2023; Wong et al., 2005; Zwerenz, 2020).

This study was limited to one environment and one sector that is pharmaceutical companies in Jordan. Therefore, future research might want to diversify the sample. The study sample also included the management position only, which has better details than the rest of the staff, but the study did not include other job positions. Further studies might consider multiple viewpoints from the different employment levels. In addition, the study used quantitative data and did not take any qualitative data, which confirmed the importance and accuracy of the quantitative aspect of the current study. Another suggestion for future studies is to use mixed method studies and incorporate quantitative and qualitative data sources to recommend a holistic framework which can explain the interrelationship between the constructs in different contexts. In terms of the study setting, further studies would emphasise the cultural factor and how it will manipulate the dynamics of the model.

5. Conclusion

By elucidating the crucial optimisation role of business intelligence and analytics, this study makes important scholarly and practical contributions. It enriches academic literature on blockchain technology management by offering a tested model that bridges data interpretation with entrepreneurial innovation. In addition, it makes it possible to match blockchain initiatives with larger corporate objectives, encourage innovation and the development of new business models, make data-driven decision-making easier, and offer insightful data for increased performance and competitiveness. The findings also equip executives with targeted guidelines to accelerate organisational transformation through blockchain solutions augmented by robust analytics. Future research can enrich insights by assessing variations across sectors and regions and exploring qualitative nuances.

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