





“Effect of network strategic capabilities on digital transformation in Jordanian universities”

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EFFECT OF NETWORK STRATEGIC CAPABILITIES ON DIGITAL TRANSFORMATION IN JORDANIAN UNIVERSITIES

Abstract

The study aims to explore the effect of network strategic capabilities (NSCs) with its dimension of artificial intelligence (AI) and blockchain on digital transformation (DT) in Jordanian universities. The paper used the analytical-descriptive approach to analyze and interpret the results. The study population includes Jordanian universities, and the sample consists of top management. Out of 400, 304 questionnaires were completed and returned. The results show that AI ($\beta = 1.219, t = 1.175, p < 0.00$) and blockchain ($\beta = -0.773, t = 0.437, p < 0.00$) have a significant effect on DT. The first sub-hypothesis results concerning leadership revealed that AI ($\beta = 0.525, t = 0.360, p < 0.03$) and blockchain ($\beta = -0.538, t = 0.186, p < 0.04$) have a significant effect on leadership. The second sub-hypothesis result concerning strategic planning revealed that AI ($\beta = 4.031, t = 3.050, p < 0.002$) and blockchain ($\beta = -5.150, t = 2.334, p < 0.020$) have a significant effect on strategic planning. While for third sub-hypothesis concerning infrastructure, the results of AI were $\beta = 0.818, t = 1.011, p < 0.032$ and for blockchain $\beta = 0.159, t = 0.121, p < 0.904$. This result shows that AI has a significant effect on infrastructure, while blockchain does not have any effect. Therefore, NSCs must be integrated into the business process to enhance and boost DT efficiently and effectively.

Keywords

artificial intelligence, blockchain, digital transformation, strategic capabilities, Jordan

JEL Classification

M10, M20, M31

INTRODUCTION

Utilizing e-technologies to design and use advanced business models, many organizations decide to assess their capabilities and structure to identify necessary and appropriate technologies and ways to introduce them to organizational processes and business offers. Thanh et al. (2021) stated that organizations are forced to adapt to new ways of doing things, mostly related to the DT the world has been experiencing, from AI to blockchain and the internet of things (IoT). Ismail et al. (2017) found that DT is the integration of digital technologies and new business models into all areas resulting in significant changes to how industries function and how to provide value to customers. The concept of DT includes adopting and integrating new information and communication technologies to develop more efficient, flexible, agile, and sustainable solutions for industrial systems. This study examines the contribution of NSCs in DT that leads to many advantages reflected in businesses by creating momentum to drive major industrial transformation, upgrading and revitalizing the process to follow new industry trends, exchanging experiences, and identifying new opportunities. However, the problem in adjusting one's business model(s) and structure to take advantage of new technologies is neither smooth nor direct. It involves moving outside the comfort

zone and perhaps removing procedures that staff and consumers have grown to anticipate. Kraus et al. (2021) asserted that although DT has been widely analyzed and has become a trendy topic for many streams of business research, it still lacks appropriate attention to the various managerial applications.

1. LITERATURE REVIEW AND HYPOTHESES

1.1. Network strategic capabilities (NSCs)

First, it is necessary to clarify the meaning of strategic capabilities (SC), which boosts the company's capability to elevate its skills, abilities, and resources to earn a competitive advantage and constantly raise its value. SC focuses on the organization's assets, resources, and position in the market, predicting its ability to employ strategies in the future. SC is the knowledge and learning process that integrates all capabilities into strategy. It makes an organization's capacity more efficient and helps achieve and sustain a highly competitive business environment. The study explicates different aspects of SC domain.

According to Nayemunnisa and Gomathi (2020), capabilities are context-dependent and transform according to the conditions of the dynamic environment. Related SC is executed in a coherent and integrated manner with several other capabilities to represent network capacity. Networking capabilities are significantly appropriate and productive for companies because they operate in vibrant environments. Advantages are significantly related to network capacity by driving innovation that leads to diverse effects on performance (Parida et al., 2017). The goals and vision of Industry 4.0 associated with intelligent manufacturing have a powerful transformation effect and mobilize great efforts towards reorganization and even revitalization of the industry, leading to a new "industrial revolution." The findings of a comprehensive analysis of Industry 4.0 and its dimensions support this viewpoint, which includes engineering through faster manufacturing, digitization, and new business models. Networking helps people stay on the cutting edge of technology and exceptional business trends and communicate regularly. Externally, networks increase the opportunities that organizations get from their environment.

According to Kirbac and Tektas (2021), while performing DT, businesses use many different information technologies such as AI, augmented reality, internet of things (IoT), and blockchain technology. This study employed two main critical NSCs, AI, and blockchain. Huang et al. (2019) defined AI as the study of how to make computers perform intelligent tasks that, in the past, could only be performed by humans. AI is crucial for business development, introducing innovations and enhancing labor efficiency, lessening labor costs, improving human resources, and creating new job demands (Duan et al., 2019). Companies integrate AI technologies into their business operations to boost efficiency, generate insights, and create new markets. Enterprise applications are powered by AI to improve service clients, elevate sales, improve chain supply, free employees from routine tasks, improve current products, and guide the way toward new products. Therefore, AI is a critical element and simultaneously accelerates the rapid DT (Aly, 2020). In Jordan, the government has issued the Jordanian AI Policy 2020 to enable AI technologies in digital government services and create suitable opportunities for innovation and entrepreneurship. The government is also committed to preparing sectoral plans and strategies for AI that clarify the market analyses required for the growth of AI in Jordan (Ministry of Digital Economy and Entrepreneurship of Jordan, 2020).

Regarding blockchain, Swan (2015) describes it as the comprehensive information technology with tiered technical levels and multiple classes of application from any form of asset registry, inventory, and exchange, including every area of finance, economics, and money. It also includes hard assets such as physical properties; and intangible assets such as health data and other information. Blockchain controls, shares, and processes personal data, minimizes data security issues, and promotes digital technologies (Tandon et al., 2020). Universities introduce this technology to reduce cost, and promote information risk management and validation issues (Huynh et al., 2018). Devi et al. (2015) assert-

ed that blockchain technology is necessary for the educational arena because it is a significant part of the security process, especially in document verification containing academic details, and it provides a reliable solution to avoid any academic fraud. As a result, higher education institutions are increasingly adopting blockchain technologies, particularly regarding information risk management and validation (Sowmiya & Poovammal, 2021). Kirbac and Tektas (2021) conclude that blockchain in DT increases event and document reliability, builds competitive advantage, tracks orders across multiple touchpoints, optimizes applications and processes, improves productivity per file, manages documents digitally, improves system integrations, expands digital collaboration, and transactions integrity and visibility.

1.2. Digital transformation (DT)

Digital transformations influence all sorts of businesses, particularly the ways they conduct their activities. According to Rodríguez-Abitia and Bribiesca-Correa (2021), DT is an evolutionary process through which IT becomes a fundamental element of its daily life, affecting all dimensions that involve both people and the organization itself. In business literature, DT is considered a new and modern term. Micic (2017) defines DT as the integration of digital technology into the business that results in changes in business operation and delivery of value to customers. At the same time, Li et al. (2017) asserted that DT highlights the impact of IT on organizational structure, routines, information flow, and organizational capabilities to accommodate and adapt to IT. Organizations are leveraging modern digital competencies to operate through all processes in the value chain. This creates new streams for revenue, eliminates ineffective and redundant processes, shifting away from repetitive daily tasks to better work strategy.

Furthermore, in this perspective, DT describes the shift from traditional to creative and value creation strategy related to operational procedures to use digital technologies to enhance or replace traditional products or services with digital ones. DT is ongoing innovation and needs a rapid reaction to change, threats, and opportunities in the business environment. Therefore, one should anticipate a shift in all the pillars of DT, includ-

ing the people, process, strategy, and technology. Rossmann (2018) offered a model frame for DT based on capacities development in multiple dimensions, including strategy, leadership, market, operations, people and skills, and technology. Muehlburger et al. (2019) proposed a framework that includes nine permissive factors and later categorized them into four sets associated with organizational values, management capabilities, organizational infrastructure, and workforce capabilities. The nine enablers consist of strategic, tactical, and operational dimensions.

This paper analyzes strategic dimensions, including strategic planning, digital leadership, and digital platform structures. Similar to other industries, higher education institutions must also digitize to remain relevant to changing industry scenarios and trends. DT supports fundamental transformations in organizational structures and strategies (Matt et al., 2015) and power distribution (Wischnevsky & Fariborz, 2006). Therefore, as Schuchmann and Sabine (2015) asserted, organizations must redesign their strategy, organizational structure, and allocation of power and initiate an innovation process related to new leadership methods; it is a challenging learning process for each leader and every organization to adapt to the DT. Leaders need to act to implement digital business transformation, cope with the changes in the organization, and develop its readiness for these changes by proposing and modifying the existing business model.

According to Siti et al. (2021), a leader needs to understand various approaches to leadership skills in order to survive in the Industrial Revolution 4.0, where the business field is changing rapidly. In the era of DT, leaders unlock digital impact by developing not only a new digital platform but create platform-based business models and strategies by bridging the workforce skills gap. This is the vision of the leader who is changing the organization digitally. Leaders need to be definite and observant regarding digital trends, the effects of these trends on business, and how to grab the advantage of unique technologies to uncover new market segments and boost profit margins over their competitors. A leader's role is to ensure the organization's digital maturity match with digital vision and strategy and then set the people, process-

es, technology, structure, and business model to achieve that vision (Sainger, 2018). Consequently, such leaders must use digital transformations to guide their businesses through Industry 4.0, manipulating the troublesome fluctuations and encouraging their staff.

Klein (2020) emphasizes that most companies are still at the beginning of their DT; there is a lack of general understanding and a standard model for digital leadership. One can apply DT at organizational and individual levels; that is why companies should change their procedures, and leaders should adapt actively and effectively. Antonopoulou et al. (2021) stated that a digital leader is characterized by strategic leadership, business knowledge to add value to the organization, and digital comprehension to exploit technology trends.

The second component of DT is strategic planning. According to Kane et al. (2015), strategy, not technology, drives DT. According to Cameron and Green (2009), in DT, there are additional components derived from factors necessary for every successful change process and appropriate strategic planning. Companies need to have a solid and perfect strategy to deal successfully with DT. Due to the fast evolution of digital technologies, various sectors of the economy are forced to introduce radical innovations in their strategies and procedures. Li (2020) sustained that the challenge is not in developing new strategies and business models or new organizational designs enabled by digital technologies, nor in successfully executing them as planned, but in effectively managing the transition from where the organization is toward a desired future state. Thus, DT incorporates digitalization processes necessary for strategic innovations in organizations.

The third component of DT is infrastructure. Digital infrastructure extends from back-office servers to the frontline due to new technology in-

roductions (Saarikko et al., 2020). Sia et al. (2016) maintained that firms transform their culture and leadership styles while building agile and scalable digital infrastructures. Organizations should elaborately assess themselves to achieve DT. According to Albukhitan (2020), the organization should evaluate its infrastructure and investigate how well its system, software application, and tools address current and future needs. For example, Rodríguez-Abitia and Bribiesca-Correa (2021) created an assessment model. It evaluates institutions' digital development, considering whether they can offer adequate IT infrastructure, introduce IT technologies into the educational process, and create different sorts of platforms to unite people and processes.

According to the literature review, Figure 1 shows the relationship between all variables.

Thus, this study aims to explore the effect of NSCs (AI and blockchain) on the DT. The significance of this study comes from the significance of organizations adopting DT and benefiting from using technology in business operations. Primarily the networks that have been able to connect the internal parts of organizations on the one hand and link them with the external environment, other organizations, and stakeholders, on the other hand, in a way that helps them achieve their sustainability and prosperity. As per the pertinent literature, the following hypotheses and sub-hypotheses are proposed:

H1: NSC dimensions blockchain and AI have a statistically significant effect on DT dimensions of leadership, strategic planning, and infrastructure at a significance level of ($\alpha \leq 0.05$).

H1.1: NSC dimensions of blockchain and AI have a statistically significant effect on leadership at a significance level of ($\alpha \leq 0.05$).

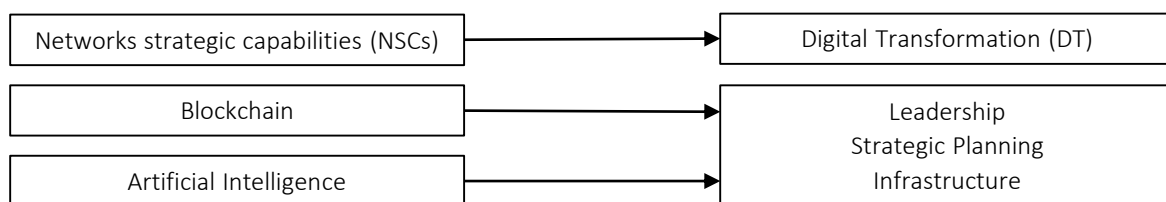


Figure 1. Conceptual framework

H1.2: NSC dimensions of blockchain and AI have a statistically significant effect on strategic planning at a significance level of ($\alpha \leq 0.05$).

H1.3: NSC dimensions of blockchain and AI have a statistically significant effect on infrastructure at a significance level of ($\alpha \leq 0.05$).

2. METHODOLOGY

The study uses a descriptive analytical approach to assess the influence of NSC on DT. This is necessary to explore the data. This paper considers Jordanian universities (public and private), and the study sample and size (10) were taken from these universities using the simple random sampling method, as per the following equation:

$$n = \frac{N}{(N-1)E^2 + 1}, \quad (1)$$

where N – population size, n – sample size, E – allowable error.

The sampling unit consisted of the top management staff in Jordanian universities, and out of 400 distributed questionnaires, 304 questionnaires were returned and analyzed (Table 1). The study has chosen a five-point Likert scale with answer options ranging from 5 = Strongly agree to 1 = Strongly disagree. To test the research hypotheses, a PLS analysis of structural paths and R -square scores of the variables were used, and the explanatory power of the structural model was checked.

Table 1. Summary of the study sample

No.	University Name	Response	Percentage
1	University of Jordan	34	11.2
2	Albayet University	32	10.5
3	Hashimate University	35	11.5
4	Balga Applied University	33	10.8
5	Mutah University	33	10.8
6	Jadara University	26	8.4
7	Israa University	28	9.2
8	Amman Arab University	23	7.5
9	Ahliyyah Amman University	31	10.1
10	Al Zaytoneh university	29	9.5
Total		304	100

3. RESULTS

3.1. Convergent validity

Convergent validity describes how the scales (questions) used to estimate a particular concept (or a variable) are related to each other (Hair et al., 2010). There is more than one way to measure the convergent validity of the variables. These methods include measuring the reliability of questions related to a specific factor called items reliability and calculating the average variance derived from the scale questions or the so-called Average Variance Extracted (AVE). As for the first method, the value of the weight of each question (Item loading) is calculated on its factor, which should not be less than 0.60. In the second method, the AVE value must be greater than 0.5 (Hair et al., 2010). As for the mean of the variance AVE, all the variables have an AVE value greater than 0.5 (Table 2). Thus, the study tool possesses the characteristic of convergent validity.

Table 2. Cronbach's alpha, average variance extracted (AVE), and weight of item loading

Variable	Cronbach's Alpha	CR	AVE
Network Strategic Capabilities	0.856	0.859	0.857
Artificial Intelligence	0.872	0.874	0.872
Blockchain	0.877	0.882	0.880
Digital Transformation	0.883	0.886	0.884
Leadership	0.644	0.684	0.668
Strategic Planning	0.832	0.836	0.833
Infrastructure	0.725	0.763	0.724

Table 3 shows that the overall dependent variable and all its dimensions follow a normal distribution because the Kolmogorov-Smirnov Z values are all less than 1.96. Therefore, the significance for each of them is more than 0.05. Before testing the study hypotheses, it is necessary to secure data appropriateness and relevance. Variance Inflation Factor-VIF test and the tolerance test were performed for each independent variable to ensure there was no multicollinearity between the variables. Table 4 presents the results of testing the variance inflation factor and the allowable variance to NSC. It is shown that values of the variance inflation factor (VIF) for all variables were less than (5) and ranged from (1.53–2.05). The value of the permissible variance (Tolerance) for all variables was

Table 3. Normal distribution of dependent variable dimensions

Items	Infrastructure	Strategic Planning	Leadership	Digital Transformation
Sample Size	304	304	304	304
Mean	4.0143	4.0153	4.2971	4.1751
Std. Deviation	.75885	.77309	.71677	.61688
Value Absolute	.182	.166	.252	.144
value Positive	.097	.101	.163	.091
value Negative	-.182	-.166	-.252	-.144
Kolmogorov-Sminov	.182	.166	.252	.144
Asymp. Sig.	.361	.399	.322	.437

higher than (0.05) and ranged from (0.49–0.65). Based on the decision rule related to (VIF), the values indicate no correlation between the independent variables (Malhotra, 2010).

Table 4. Testing the variance inflation factor and the allowable variance to employ networks strategic capabilities

Variables	VIF	Tolerance
Artificial Intelligence	1.53	.65
Blockchain	1.64	.61

3.2. Hypothesis testing

This sub-section deals with the hypotheses related to the path analysis test, which includes the multipath test, such as direct and indirect effects and the total effect to verify the hypotheses results and interpret the relationships (Hair et al., 2010). First, to test H1, the study used path analysis, namely the effect of the independent factor of NSCs on the dependent variable of DT. Table 5 shows the results of the hypothesis analysis regarding the ef-

fect of networks as strategic capabilities related to their sub-dimensions on the dependent variable DT with its combined dimensions. The results for AI was ($\beta = 1.219, t = 1.175, p < 0.00$) and for blockchain ($\beta = -0.773, t = 0.437, p < 0.00$). Based on the decision rule related to T, the two dimensions of NSCs (AI and blockchain) have a statistically significant effect on DT; therefore, H1 is accepted.

Table 5. Path analysis to employ networks strategic capabilities on DT

Variables	β	S. D	T	P
Network Strategic Capabilities	0.590	0.865	0.682	0.002
Artificial Intelligence	1.219	1.037	1.175	0.000
Blockchain	-0.773	1.768	0.437	0.031

3.3. Results of sub-hypotheses testing

To investigate the effect of NSCs on DT, the study further tested the three sub-hypotheses. The first sub-hypothesis states that there is a statistically significant effect of NSCs with their dimensions (AI and blockchain) on leadership at a significance

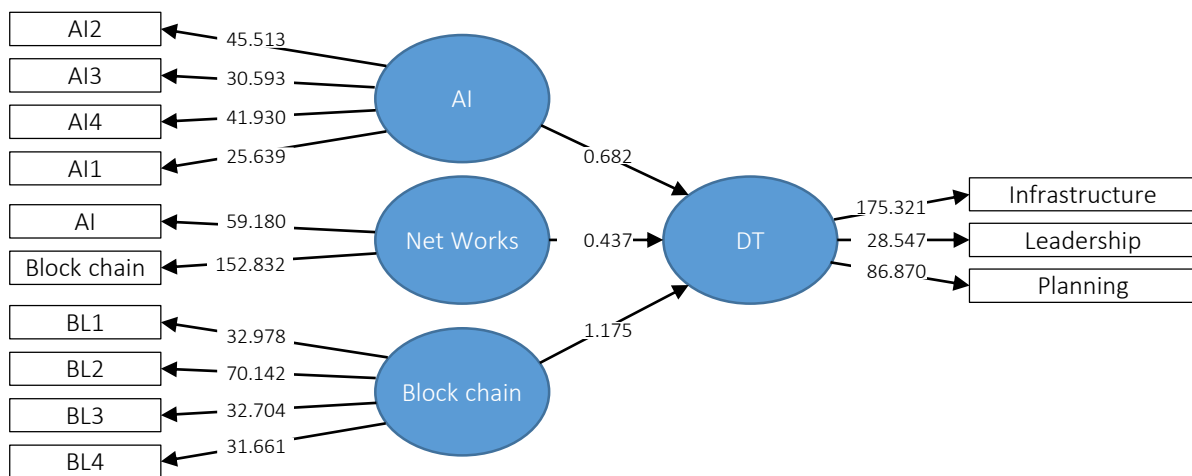


Figure 2. Employing network strategic capabilities on digital transformation

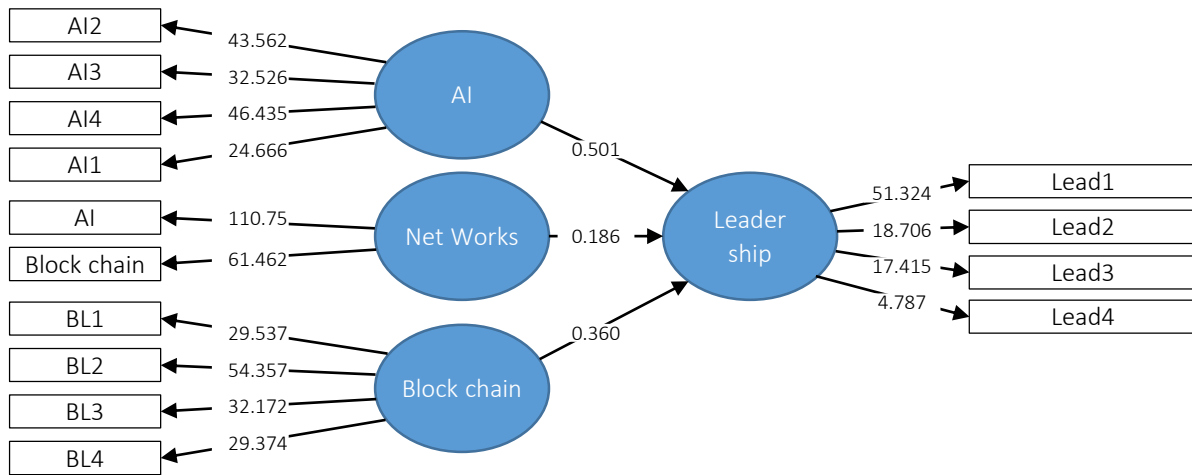


Figure 3. Employing network strategic capabilities on leadership

level of ($\alpha \leq 0.05$). To test this first sub-hypothesis, the study used critical path analysis, namely the effect of the independent factor of NSCs on the first dependent variable dimension of leadership. Table 6 presents the results of the sub-hypothesis analysis, showing the *t*-values for the dimensions (AI and blockchain). The result for AI was ($\beta = 0.525, t = 0.360, p < 0.03$) and for blockchain ($\beta = -0.538, t = 0.186, p < 0.04$). Based on that, the decision is to accept the sub-hypothesis, which means that the two dimensions of NSCs (AI and blockchain) have a statistically significant effect on leadership.

Table 6. Path analysis to employ networks strategic capabilities on leadership

Variables	β	S. D	T	P
Network Strategic Capabilities	0.830	1.655	0.501	0.011
Artificial Intelligence	0.525	1.458	0.360	0.039
Blockchain	-0.538	2.888	0.186	0.044

The second sub-hypothesis states that there is a statistically significant effect of NSCs with their dimensions (AI and blockchain) on strategic planning at a significance level of ($\alpha \leq 0.05$). A critical path analysis was used to test the second sub-hypothesis. Table 7 presents the results and shows the result for the AI dimensions ($\beta = 4.031, t = 3.050, p < 0.002$) and for blockchain ($\beta = -5.150, t = 2.334, p < 0.020$). Based on the results, the second sub-hypothesis is accepted, meaning that AI and blockchain have a statistically significant effect on strategic planning.

Table 7. Path analysis to employ networks strategic capabilities on strategic planning

Variables	β	S. D	T	P
Network Strategic Capabilities	2.453	1.050	2.335	0.020
Artificial Intelligence	4.031	1.322	3.050	0.002
Blockchain	-5.150	2.206	2.334	0.020

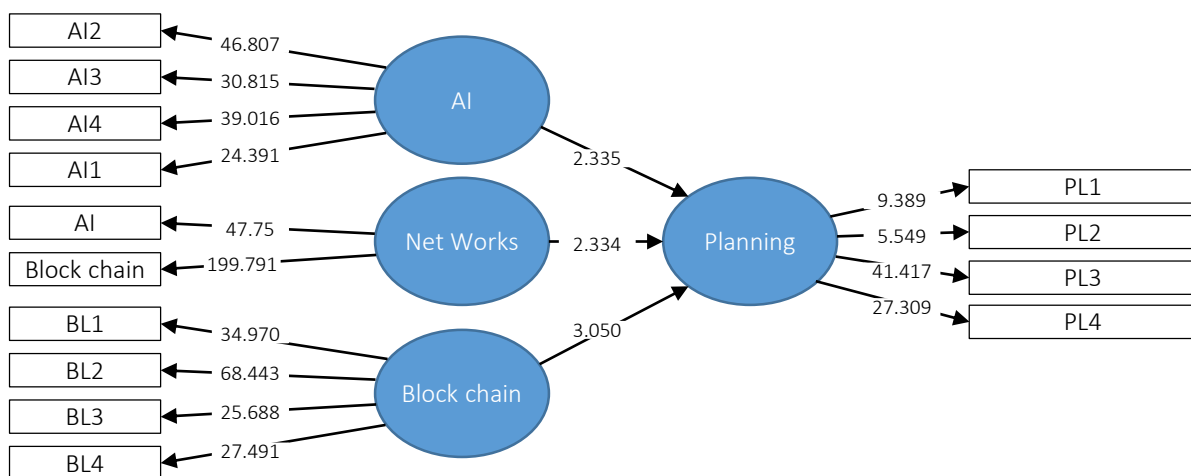


Figure 4. Employing network strategic capabilities on strategic planning

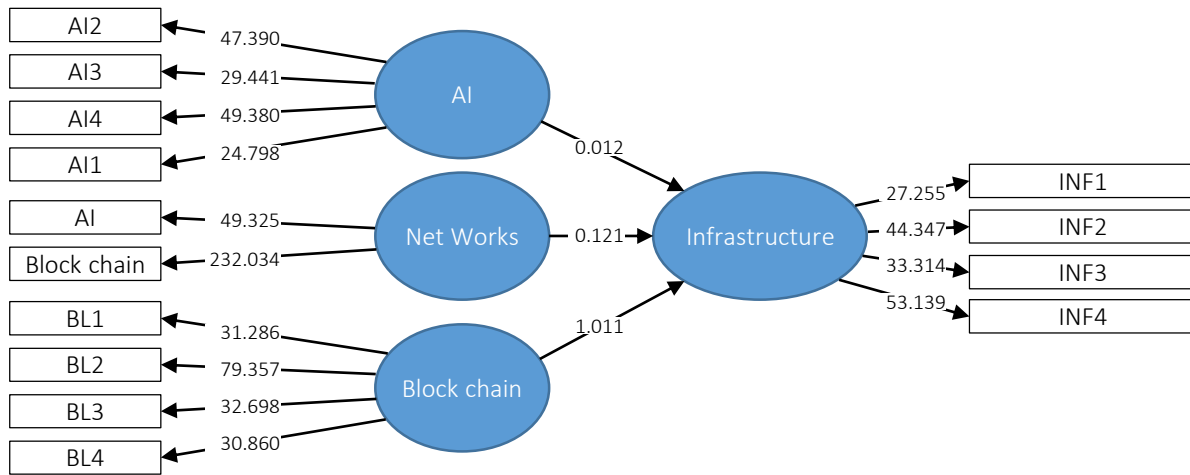


Figure 5. Employing network strategic capabilities on infrastructure

The third sub-hypothesis states that there is a statistically significant effect of NSCs with their dimensions (AI and blockchain) on infrastructure at the significance level of ($\alpha \leq 0.05$). The study used critical path analysis to test the effect of the independent factor of employing networks as strategic capabilities on the dependent variable. Table 8 presents the results of the sub-hypothesis analysis. The results for AI are ($\beta = 0.818$, $t = 1.011$, $p < 0.032$) and for blockchain are ($\beta = 0.159$, $t = 0.121$, $p < 0.904$). Thus, AI has a statistically significant effect on the infrastructure, while blockchain has no statistically significant effect on the infrastructure.

Table 8. Path analysis to employ networks strategic capabilities on infrastructure

Variables	β	S. D	T	P
Network strategic capabilities	0.008	0.609	0.012	0.990
Artificial intelligence	0.818	0.808	1.011	0.032
Blockchain	0.159	1.316	0.121	0.904

4. DISCUSSION

The fast technology expansion and extensive adoption of communications networks have given rise to the concept of DT in recent years. This study intends to explore two essential components of NSCs (blockchain and AI), and how they contribute to the DT in Jordanian universities. DT is critical for business sustainable competitiveness and prosperity since it encompasses all areas of development and creativity inside the company.

AI and blockchain offer a wide range of benefits that support the DT. For example, blockchain facilitates handling, sharing, and processing of individual records and reduces data security issues. Elsaadani et al. (2018) asserted that AI has the potential to drive growth by creating a new workforce with higher productivity and efficiency, and also reducing the cost of business processes and enhancing innovative advances and technological breakthroughs.

To measure and analyze the effect of AI and blockchain on DT, the paper applied the descriptive approach by distributing a questionnaire to the study sample. A critical path analysis was used to test the hypotheses. H1 testing result shows that the two dimensions of NSCs (AI and blockchain) have a statistically significant effect on DT; therefore, this hypothesis is accepted. This result is in line with Aly (2020), AlShamsi et al. (2021), and Malik et al. (2022). The results confirm that AI and blockchain are integral and inherent components of the DT processes. Integrating AI and blockchain into the business model will accelerate the process of DT but will also entail the university to achieve its objectives more efficiently and effectively with the full support of leaders who have a clear digital vision and advanced infrastructure.

Concerning the first sub-hypothesis, the decision is to accept it, which means that the two dimensions of NSCs (AI and blockchain) have a statistically significant effect on leadership. To succeed, the DT leaders ought to transfer leadership skills, talents, and practices to cope with the digital en-

vironment, hence designated as “digital leaders.” The result is in line with Siti et al. (2021) and Klein (2020). The results of the second sub-hypothesis testing show a statistically significant effect of AI and blockchain on strategic planning. Strategic planning for companies adopting the DT is complex since more resources and risks are involved. This is in line with Alam et al. (2018) and Li (2020). Concerning the third sub-hypothesis, AI has a statistically significant effect on the infrastructure, while blockchain has no such effect on the infrastructure. Therefore, it is required to support AI as a pivotal component of network infrastructure by upgrading AI and machine learning models, security, and storage capacity and upgrading the company networks to accommodate the required transitions. The results are in line with Saarikko et al. (2020).

CONCLUSION

The study explored the effect of NSCs (AI and blockchain) on DT and whether universities benefit from adopting DT. Results show that NSCs have a significant effect on DT. Therefore, one needs to prepare universities for the future to act professionally with AI, blockchain, and other types of new technologies by creating a suitable infrastructure. The results also show that universities implementing DT must develop a new business model. That urges a comprehensive transformation in the environment, strategy, and infrastructure to magnify network relationships with many partners such as suppliers, distribution channels, and customers to produce superior customer value. To face this challenge, DT requires support from the university’s top management to cope with new business models to meet the strategic goals of the university and not merely rely on faculty initiatives. According to our model, we can combine AI and blockchain as integral parts of DT to create a new application framework in the education sector that witness relatively a slow adoption of DT compared with other industries.

The results show the importance of leadership in DT. Leaders must possess technical skills to design and implement effective DT strategies and gain effectiveness inside and outside the company. Overall results show that AI and blockchain are vital in DT. However, without suitable infrastructure, qualified leadership, and a professional strategic plan, the firm will not succeed in achieving optimal results in DT.

Finally, due to the new circumstances created by Covid-19, it is evident that universities need to change and cope with new technologies to discern new opportunities and challenges, otherwise, in the long-term, the university will suffer from many dropbacks, such as immutable structure, inability to react, and bureaucratic decision-making.

AUTHOR CONTRIBUTIONS

Conceptualization: Hamza Khraim.

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Formal analysis: Hamza Khraim.

Funding acquisition: Maan Al-Maadhede.

Investigation: Tayseer AL Afaishat.

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Project administration: Tayseer AL Afaishat.

Resources: Tayseer AL Afaishat.

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Writing – original draft: Hamza Khraim.

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