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The role of artificial intelligence and transformational leadership in the digital era: A study in Saudi Arabia

Bandar Fahad Alharbi

Business Administration Department of Business Administration College of Business Administration Majmaah University, Majmaah 11952, Saudi Arabia

(*Email: Bandar.a@mu.edu.sa*)

Abstract

In the ever-changing world where information technology takes center stage, using Artificial Intelligence (AI) and leadership transformation is paramount for achievements. This research, therefore, assesses the impact of transformational leadership on AI implementation in organizations in Saudi Arabia. A quantitative research approach was adopted in this study, and a survey method was used with 71 participants practicing leadership and holding digital positions in different fields. The research establishes a positive correlation between transformational leadership and the adoption of AI, which stresses the leadership's role in promoting change. Furthermore, this research examines the role of technological advancement in moderating the above relationship, whereby technological advancement warrants changes in leadership approaches. This study adds to the available literature by providing insights into the relationship between leadership and AI within Saudi Arabian culture and economy. The results significantly contribute to practitioners and policymakers seeking to increase organizational leadership and AI effectiveness.

Keywords: Artificial intelligence, Digital Era, Saudi Arabia transformational leadership.

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1. Introduction

Technological advancement is a significant difference today, particularly within business-oriented organizations; AI stands for artificial intelligence improvement. Artificial intelligence (AI) is an emerging technology whose functioning is entirely based on human intelligence. AI technology is rapidly becoming the new reality of business activities. However, leadership is also being significantly affected. AI majorly supports the change in leadership within an organization. This transformational leadership model promotes creation and change within the firm or even instills trust.

Since innovation, communication, and collaboration are the rules of transformational leadership, and AI improves innovation capabilities, it is vital to reinforce transformational leadership within an organization [1]. This indicates the increasing need for leadership as more organizations embark on digital change. The responsibility of influencing followers to achieve a specific vision is a crucial feature of transformational leadership, which is relevant in enhancing the adoption and effective use of AI technology [2].

Transformational leaders help promote a change-oriented organizational culture to introduce innovations and new technology. These leaders are vital in dealing with AI integration issues since they foster teamwork, consistent education, and flexibility [3]. The interaction between AI and leadership specifies how AI enables leaders to optimize strategic action plans, make superior decisions, and facilitate organizational development. It examines various AI tools and systems available to leaders and the probability of their applications and benefits. AI may complement teamwork by improving real-time data exchange and the communication process. These capabilities allow transformational leaders to foster a more creative and enthusiastic team to improve processes [4].

Although it has been shown that artificial intelligence (AI) enhances overall organizational performance, more has to be considered about how transformational leadership impacts AI adoption in many contexts, especially in Saudi Arabian businesses. Many executives lack the necessary abilities and tactics to effectively integrate AI into their operations. Businesses may, therefore, find it challenging to use AI technology to foster innovation and improve output. To address these problems, this study focuses on the relationship between transformational leadership and the adoption of AI [5]. While the research now recognizes the importance of artificial intelligence (AI) in transforming organizational dynamics, more must be understood about the ideal processes by which transformational leadership influences AI adoption.

Furthermore, empirical studies on the possibilities and problems of using AI integration within the context of Saudi Arabian businesses need to be more comprehensive. With the aid of investigating the relationship between leadership philosophies and technology trends in a rapidly changing digital environment, this research seeks to close these gaps. Finally, the study offers the following research objectives:

1. To examine how much transformational leadership significantly influences artificial intelligence.
2. To assess how the digital era moderates the relationship between transformational leadership and artificial intelligence.

The introductory section of this study included the problem statement, research objectives, research gaps, and study background. After discussing the literature reviews, the study uses transformational leadership theories and the diffusion of innovations to establish its research hypotheses. Third, this study clarifies and stands by the research methods used in this study. Fourth, the paper offers the research results derived from the survey data. In the fifth section, the study presents the results and shows how they align with advanced studies. The research concludes the findings by outlining their implications.

2. Literature Review and Theoretical Framework

With its roots in the fundamentals of social existence—in which people congregate, interact, and impact each other—leadership has undergone a substantial transformation in recent years. The distinctive characteristic of transformational leadership is when leaders and followers encourage each other to reach higher ethical and motivational standards. This leader frequently connects with their colleagues, promoting trust and cooperative development. Transformational leadership aims to provide new perspectives and creative thoughts to assist the organization in broadening and succeeding [6]. According to Boucher's research, AI is described as systems that exhibit intelligent behavior by assessing their surroundings and making choices on their own to perform predetermined targets [7]. This concept emphasizes how AI may assist leaders with organizational innovation and strategic decision-making, aligning with transformational leadership's transformative objectives.

According to research by Askar, et al. [8], as organizations cope with the possibilities and problems brought about by the rapid development of technology, the relationship between transformational management and the deployment of artificial intelligence (AI) has drawn significant research interest. However, according to Saif, et al. [9], it is identified that transformational leadership plays a crucial role in building the organizational subculture for innovation and change. This is mainly defined by its capacity to motivate and direct followers toward a common goal. This leadership style is particularly effective in cases of AI since leaders often have to guide their subordinates through doubt and resistance to innovative solutions.

Most of the literature supports that organizational AI adoption is boosted by transformational leadership. For instance, transformational leaders facilitate the attempt to influence employees' perceptions toward implementing new technologies, thus minimizing resistance and maximizing participation, as postulated by Hui, et al. [10]. Such leaders enable AI integration and ensure progressive technology utilization by promoting a culture of learning and integration in various organizations. Additionally, research has shown that adopting transformational leadership supports employee insights into the relevance and applicability of AI. According to Khan, et al. [11], it has been found that teams led by transformational leaders are more receptive to the use of AI technology. This culminates in improved operational efficiency and creative solutions, hence the implication that transformational leadership not only accelerates the routinized integration of AI but also optimizes the integration of AI for competitive gain.

However, exemplary opportunities and challenges presented by the digital era shape the effects of transformational leadership in implementing AI. Because organizations need to be sensitive to changing marketplace needs and competitive challenges, the rapid pace of technology development necessitates flexible leadership methods. Transformational leaders also use the accelerated connection and real-time knowledge supplied through digital breakthroughs to cultivate a creative and dynamic company culture [12]. These leaders help people stay updated with technology developments by using digital

platforms for efficient communication, knowledge sharing, and continuous learning. This enables the business to obtain every benefit of integrating AI.

2.1. Theoretical Framework

This study is grounded in two fundamental theories: Transformational Leadership Theory and Diffusion of Innovations Theory. These frameworks provide valuable insights into the dynamics between leadership and AI adoption in organizations.

2.1.1. Transformational Leadership Theory

Bass (1985) proposed the transformational leadership theory, which requires leaders to inspire followers to accomplish organizational objectives and interests rather than mere pastimes. Based on this view, necessary measures to create a supportive and modern work environment are idealized influence, intellectual encouragement, attractive motivation, and individual consideration [13]. Organizational culture, which implies acceptance of change and embracing it, is another aspect that transformational leaders must ensure. Transformational leaders may also act as change agents for technical advancements in AI adoption by managing conditions that require creativity and flexibility. Additionally, transformational leaders can address the arguments and counterarguments regarding the use of AI on behalf of the staff members. By facilitating cooperation, teams can collectively understand and apply AI capabilities [14]. Finally, encouraging consideration within a team ensures that employees are advocated for, especially during AI adoption, thereby reducing resistance and increasing participation.

Hypothesis 1: *Transformational leadership significantly influences the adoption of artificial intelligence within organizations.*

2.1.2. Diffusion of Innovations Theory

According to Rogers [15], diffusion theory analyzes how innovations spread in a social system. Based on the theory, relative advantage, compatibility, complexity, trialability, and observability are the five attributes of an innovation that influence the adoption rate. The pace and effectiveness with which a business can embody and include AI are contained in the aforementioned factors. This research applies the diffusion of innovations theory to demonstrate how the digital era has affected the relationship between transformational leadership and the adoption of AI, as illustrated in Figure 1. Typically, transformational leaders can inform others about the benefits of AI because a significant amount of work is done through digital means. Leaders may also reduce cognitively primed perceptions that AI is harmful by referring to relative advantages such as higher productivity and quality decision-making [16].

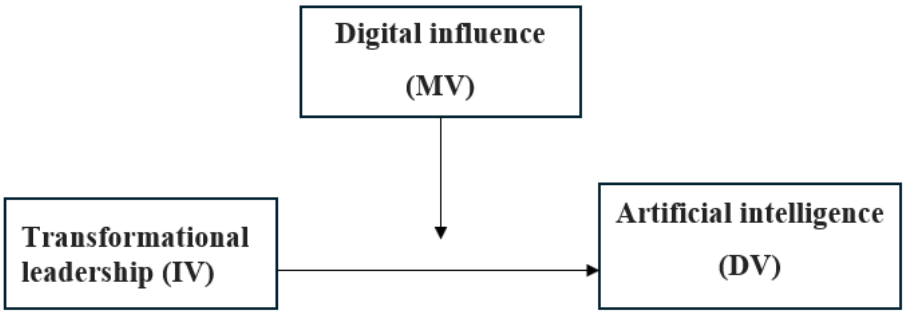

Figure 1.
Theoretical framework.

Moreover, the new digital setting involves reduced operational complexity due to the integration of AI into the current commonplace digital processes of businesses. It also enables concurrent working and data sharing, appearing as support from executives for experimentation with AI [17]. Employees could also use AI innovation on a small scale before full-scale adoption to facilitate change and reduce resistance. This makes the trialability aspect very important. Transformational leaders leverage these digital tools to alleviate any concerns that organizations may have, drive the uptake of AI technology faster, and encourage more organizations to adopt an open-door policy in their workplaces.

Hypothesis 2: The digital era moderates the relationship between transformational leadership and the successful implementation of artificial intelligence technologies, as depicted in Figure 1. This study comprehensively discusses how leadership behaviors impact the attributes regarding the adoption of AI and the features of the digital context through the lens of the literature on transformational leadership theory and the diffusion of innovation theory. In the end, the dual-theoretical approach provides a body of knowledge on successful leadership in the digital age by enhancing the examination of the complex linkages between organizational transformation, technology, and leadership.

3. Research Methods and Data Collection

The research method involves researching and comparing data to scientifically answer the research questions or hypotheses. Limiting the scope and understanding the scientific inquiry system helps keep researchers on track [18]. This chapter explains the method adopted in studying how transformational leadership and artificial intelligence manifest in the Saudi digital age. It addresses the research design, sample size, data collection, and measurement scales, utilizing literature

support and data analysis strategies. This enables the development of an understanding of how the research was conducted and how the data was analyzed.

3.1. Research Design

Research design should be conducted effectively so that conceptual research issues can be linked to rational and implementable empirical studies. It is an inquiry that encompasses research procedures [19]. The study design employed in this examination is cross-sectional. It is suitable for quantitative analysis since it allows for the collection and evaluation of data at a specific time. The primary purpose of this design is to understand transformational leadership and artificial intelligence trends in the era of digitalization in Saudi Arabia. It enables the examination of the relationship between leadership and the variables impacting AI, providing perspective on digital transformation. Because this is a quantitative study, the research design adopted in this study is an online survey method. The questionnaire indicated that transformational leadership, artificial intelligence, and the digital era are the most successful contexts. It performs well for acquiring uniform data from various populations, comparing hypotheses, and identifying trends in the digital era.

3.2. Sample Size and Data Collection

According to Kaur [20], a sample size is the wide variety of participants the researcher selects to participate in the study. The sample size for this research is N=71, and the distribution of participants is male (n=26) and female (n=45). Data were gathered by surveying 71 respondents who had been selected using a non-random convenience sampling method. Professionals operating in leadership and digital positions in various Saudi Arabian sectors have been the most participants, imparting a selection of views crucial to this study. Data collection includes systematically measuring variables to determine research objectives, test hypotheses, and assess results [21]. Utilizing a survey questionnaire method, this study employs a quantitative research approach. An online survey circulated via email between October 2023 and August 2024 was used to accumulate data. The data was collected from Saudi Arabian individuals working in leadership and digital roles in various industries. The data accrued ensures participant privacy and data collection effectiveness. The study's target audience comprises respondents with firsthand experience with transformational leadership and artificial intelligence roles in the digital age.

3.3. Measurement Scales and Literature Support

The survey questionnaire comprised several sections to ensure a thorough understanding of each construct. Section A collected demographic information to examine participant backgrounds, following Morales-García, et al. [22]. Section B assessed attitudes toward artificial intelligence, adapting items from Morales-García, et al. [22]. Section C explored transformational leadership, with items adapted from the Nebraska Hospital Association [23]. Section D examined digitization using items from Pettersson, et al. [24]. At the same time, Section E focused on digitalization, and Section F addressed digital transformation, drawing on items adapted from Pettersson, et al. [24]. All sections employed a Likert scale, a widely used approach in behavioral studies, to enhance consistency and ease of interpretation. Adapting items from established research ensured the validity and reliability of the questionnaire across study constructs.

3.4. Data Analysis

Research on the data was conducted using the Statistical Package for the Social Sciences (SPSS) version 23. This statistical program was chosen because it offers high overall performance in all types of analysis, including moderation analysis, regression analysis, frequency analysis, and descriptive analysis. The participants' objectives, procedures, and rights, including their right to withdraw from the study without repercussions, were shared with them before data collection. This allowed the participants to give their informed consent and to participate in the study, knowing that they were being included.

4. Results

For the present study, the data were analyzed, and the results of frequency analysis, descriptive analysis, regression analysis, and moderation have been presented in this chapter. Analysis was performed using statistical software, SPSS version 23.

Table 1 shows the frequency and percentage distribution of demographic variables for 71 individuals. Female participants were 63.4%, higher than male participants at 36.6%. The majority of the sample is married (57.7%). A significant portion is divorced (16.9%). A smaller number are cohabiting, living together, or widowed. The majority of the sample has a specialized education (54.9%). A significant proportion has a bachelor's degree (31.0%). A smaller number have a postgraduate degree (14.1%). The majority of the sample is employed full-time (74.6%). A smaller number are employed part-time (25.4%).

Table 1.
Frequency analysis of demographic variables (N=71).

Variables		Frequency	Percent
Gender	Male	26	36.6
	Female	45	63.4
Marital status	Married	41	57.7
	Cohabiting	5	7.0
	Living together	8	11.3
	Divorced	12	16.9
	Widowed	5	7.0
Level of education	Specialty	39	54.9
	Bachelor's degree	22	31.0
	Postgraduate	10	14.1
Employment status	Full time	53	74.6
	Part-time	18	25.4

Table 2 presents the descriptive statistics for three study variables: Artificial Intelligence, Transformational Leadership, and the Digital Era. Seventy-one individuals participated in the study. The lowest score for Artificial Intelligence was 4, while the highest score was 40, with an average score of 22.2. The standard deviation for Artificial Intelligence was 11.065, indicating a moderate spread of scores. The lowest score for Transformational Leadership was 17, and the highest score was 68, with an average score of 44.87. The standard deviation for Transformational Leadership was 16.560, also indicating a moderate spread of scores. The lowest score for the Digital Era was 27, while the highest score was 85, with an average score of 61.25. The standard deviation for the Digital Era was 14.662, indicating a moderate spread of scores. This analysis shows that the scores for Artificial Intelligence are generally lower than those for Transformational Leadership and the Digital Era.

Table 2.
Descriptive statistical analysis of study variables (N=71).

	N	Minimum	Maximum	Mean	Std. Deviation
Artificial intelligence	71	4	40	22.27	11.065
Transformational leadership	71	17	68	44.87	16.560
Digital era	71	27	85	61.25	14.662

Table 3.
Effect of transformational leadership on artificial intelligence.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	95.0% confidence interval for B	
		B	Std. Error	Beta			Lower bound	Upper bound
1	(Constant)	12.56	3.637		3.454	0.001	5.3	19.819
	Transformational leadership	0.216	0.076	0.324	2.842	0.006	0.064	0.368
R^2= 105, F=8.075, df= (1,69), p= .006								
a. Dependent Variable: Artificial intelligence								

H_1: Transformational Leadership significantly influences Artificial intelligence.

Table 3 shows the results of a regression analysis examining the effect of Transformational Leadership on Artificial Intelligence. R^2 = .105 indicates that Transformational Leadership can explain 10.5% of the variance in Artificial Intelligence, with F = 8.075, df = (1, 69), p = .006. This indicates that the model is statistically significant and that the overall regression model fits the data well. The coefficient of Artificial Intelligence is positive (0.216), indicating that a higher level of Transformational Leadership is associated with a higher level of Artificial Intelligence. The values t = 2.842 and p = .006 suggest that the coefficient for Transformational Leadership is statistically significant. The confidence interval for the coefficient of Transformational Leadership is (0.064, 0.368). This shows that we are 95% confident that the actual value of the coefficient lies within this range. The results of the regression analysis suggest that there is a statistically significant positive relationship between Transformational Leadership and Artificial Intelligence. Hypothesis 1 is approved.

H_2: The digital era moderates the relationship between transformational leadership and artificial intelligence.

Table 4 presents the results of the moderation analysis examining the effect of transformational leadership on artificial intelligence, with the digital era as a moderator variable. R = .4086 indicates that the model explains 40.86% of the variance in artificial intelligence. R-squared = .1669 shows that the model can explain 16.69% of the variance in artificial intelligence. F = 4.4752, df1 = 3, df2 = 67, p = .0063 indicates that the overall regression model is statistically significant, meaning that the model is a good fit for the data.

Table 4.
Moderation analysis of the digital era between transformational leadership and artificial intelligence.

Model summary						
R	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
0.4086	0.1669	106.5572	4.4752	3.0000	67.0000	0.0063
Model	Coeff	se	t	p	LLCI	ULCI
Constant	23.8322	1.4289	16.6789	0.0000	20.9801	26.6842
TL	0.2290	0.0967	2.3687	0.0207	0.0360	0.4220
DE	0.0429	0.1066	.4028	0.6884	-0.1699	0.2558
Int_1	-0.0108	0.0051	-2.1274	0.0371	-0.0209	-0.0007
Product terms key:						
Int_1: Transformational leadership (TL) x Digital era (DE)						
Test(s) of highest order unconditional interaction(s):						
X*W	R2-chng	F	df1	df2	p	
	.0563	4.5257	1.0000	67.0000	.0371	

Note: Focal predict: Transformational Leadership (TL) (X)
Moderator variable: Digital era (DE) (W)
Outcome Variable: Artificial intelligence (AI).

The coefficient of transformational leadership is positive (0.2290), indicating that a higher level of transformational leadership is associated with a higher level of artificial intelligence. T = 2.3687, p = .0207 suggests that the coefficient for transformational leadership is statistically significant, meaning that the relationship between transformational leadership and artificial intelligence is not likely due to chance.

The coefficient of the digital era is positive (0.0429), indicating that a higher level of the digital era is associated with a higher level of artificial intelligence. T = .4028, p = .6884 suggests that the coefficient for the digital era is not statistically significant, meaning that the relationship between the digital era and artificial intelligence is likely due to chance.

The interaction term between transformational leadership and the digital era represents the combined effect of transformational leadership and the digital era on artificial intelligence. The coefficient is negative (-0.0108), indicating that the positive relationship between transformational leadership and artificial intelligence is more robust at lower levels of the digital era. T = -2.1274, p = .0371 suggests that the interaction term is statistically significant, meaning that the relationship between transformational leadership and artificial intelligence depends on the level of the digital era. The results of the moderation analysis suggest that there is a statistically significant positive relationship between transformational leadership and artificial intelligence. Hypothesis 2 is approved.

5. Discussion

This study analyzes the relationship between transformational leadership, the digital era, and artificial intelligence (AI) adoption. The findings reveal crucial insights into how transformational leadership impacts AI utilization and how digital surroundings moderate this relationship.

The demographic evaluation of the sample population demonstrates a diverse representation of gender, marital status, education level, and employment status, enhancing the generalizability of the findings. The predominance of female participants (63.4%) and a considerable proportion of individuals with specialized education (54.9%) endorse extensive views and experiences about transformational leadership and AI.

The consequences of the regression analysis imply a statistically significant positive relationship between transformational leadership and AI adoption (p = .006). This finding aligns with existing literature that emphasizes the significance of leadership in technology adoption. For example, studies Mengyue, et al. [25] and Estherita and Shanmugam [1] support the perception that transformational leaders who inspire and motivate their teams are more likely to foster environments conducive to technological development. The coefficient of 0.216 shows that for every unit increase in transformational leadership, there is a corresponding increase in AI adoption, highlighting the critical role of leadership style in the digital transformation process.

Moreover, the moderation analysis shows that the digital era significantly influences the relationship between transformational leadership and AI. The finding that the positive impact of transformational leadership on AI adoption is more robust in less digitally advanced environments underscores the critical role of context in leadership effectiveness. This observation is consistent with research by Zhang and Huang [26], which shows that in settings where digital infrastructure and familiarity with technology are constrained, transformational leaders are vital in guiding their teams through the complexities of AI implementation. Such findings are particularly relevant for organizations in emerging markets or those undergoing digital transformation, indicating that effective leadership can bridge technological readiness gaps.

The moderation effect observed—where the interaction term between transformational leadership and the digital era became statistically significant (p = .037)—suggests that the relationship between transformational leadership and AI is not uniform across all digital contexts. The negative coefficient for the interaction term suggests that while transformational leadership fosters AI adoption, its effectiveness may diminish as the digital environment becomes more advanced. The research of Rachman, et al. [27] supports this. Rachman, et al. [27] posits that in highly digitized organizations, other factors,

such as organizational culture, existing technological capabilities, and employee readiness, might play a more significant role than leadership style alone.

In summary, this study contributes to the growing body of literature on the intersection of leadership and technology by emphasizing transformational leadership's pivotal role in promoting AI adoption. Additionally, it highlights the importance of considering the digital environment as a moderating factor that impacts the effectiveness of leadership in fostering innovation. Future research must explore the mechanisms through which transformational leadership affects AI adoption across varying levels of digital advancement and the potential role of other moderating factors, including organizational culture and employee engagement.

5.1. Managerial Implications

The study's conclusions have several managerial implications for Saudi Arabian and comparable organizations. First, managers should adopt transformational leadership styles to create an environment favorable to adopting AI. Transformational leaders may enhance employee engagement with new technology and reduce resistance to change by inspiring and motivating their teams. Second, businesses ought to help management improve initiatives that provide executives with the know-how to cope with the challenges of the digital era. This includes training to collaborate, communicate, and innovate to maximize the benefits of artificial intelligence. Lastly, businesses should utilize digital tools to assist the team's research and continuously adapt to stay current with changing technology trends.

5.2. Conclusion

The study emphasizes the significance of transformational leadership to an organization's ability to use AI successfully within the digital era. The study indicates that good leadership improves organizational overall performance via increased creativity and strategic decision-making, in addition to influencing employees' readiness to adopt AI. The digital era's moderating influences highlight the need for leaders to adjust their strategies in reaction to the fast changes in the era. Building a transformative leadership culture will be essential to overcome obstacles and gain opportunities through digital transformation as organizations continue incorporating AI into their operations. Future research must inspect longitudinal studies to evaluate the long-term consequences of transformational management on AI adoption and organizational performance and the consequences of cultural elements in numerous geographical settings.

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