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Predicting E-Leadership Effectiveness Through Emotional Intelligence, Virtual Communication Quality, and Innovation Capability Using Artificial Intelligence

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Abstract

The present study aimed to predict e-leadership effectiveness through emotional intelligence, virtual communication quality, and innovation capability using artificial intelligence among managers and employees working in technology-oriented organizations in Tehran. This study was conducted using a descriptive-correlational design with a predictive approach. The statistical population consisted of managers, supervisors, and employees working in technology-oriented organizations and digital enterprises in Tehran during 2026. A total of 368 participants were selected through multistage cluster sampling. Data were collected using the E-Leadership Effectiveness Scale, Emotional Intelligence Questionnaire, Virtual Communication Quality Scale, and Innovation Capability Questionnaire. Descriptive statistics, Pearson correlation coefficients, multiple regression analysis, structural equation modeling, and artificial intelligence-based predictive modeling were used for data analysis. Statistical analyses were performed using SPSS-27 and AMOS-26 software. The findings demonstrated that emotional intelligence, virtual communication quality, and innovation capability were positively and significantly associated with e-leadership effectiveness ($p < 0.01$). Multiple regression analysis revealed that the predictor variables collectively explained 66% of the variance in e-leadership effectiveness ($R^2 = 0.66$). Among the predictors, virtual communication quality showed the strongest predictive effect ($\beta = 0.39$), followed by innovation capability ($\beta = 0.35$) and emotional intelligence ($\beta = 0.31$). Structural equation modeling confirmed the adequacy of the proposed conceptual model, with fit indices indicating satisfactory model fitness (CFI = 0.95, RMSEA = 0.061). Furthermore, the artificial intelligence-based predictive model demonstrated high predictive accuracy, with validation accuracy reaching 88.7%, indicating the effectiveness of machine learning techniques in predicting e-leadership effectiveness in digital organizational environments. The results indicated that emotional intelligence, virtual communication quality, and innovation capability play substantial roles in enhancing e-leadership effectiveness within technology-mediated organizations. Effective digital leadership depends not only on technological proficiency but also on leaders' emotional competencies, communication quality, and innovation-oriented capabilities. The findings further demonstrated that artificial intelligence-based predictive approaches can provide highly accurate models for understanding leadership performance in virtual environments. Therefore, organizations should prioritize leadership development programs focused on emotional intelligence, communication management, and innovation enhancement to improve leadership effectiveness and organizational adaptability in the digital era.

Keywords: E-leadership effectiveness, emotional intelligence, virtual communication quality, innovation capability, artificial intelligence, digital leadership, virtual organizations



1. Introduction

The rapid expansion of digital technologies, artificial intelligence, and virtual communication systems has fundamentally transformed the nature of organizational leadership in the twenty-first century. Organizations increasingly rely on remote collaboration, digital communication platforms, and technology-mediated management systems to maintain productivity and competitiveness in complex global environments. This transformation has resulted in the emergence of electronic leadership or e-leadership as a critical organizational competency that integrates technological proficiency, interpersonal communication, emotional regulation, and innovation-oriented management practices. Contemporary organizations are no longer dependent solely on traditional face-to-face leadership approaches; instead, they require leaders who are capable of effectively guiding teams within virtual and digitally interconnected work environments (Dickson, 2023). The emergence of digital leadership has altered managerial responsibilities, communication patterns, and decision-making processes, creating new challenges and opportunities for organizational leaders (Tigre et al., 2024). In highly dynamic organizational contexts characterized by artificial intelligence integration, technological disruption, and remote collaboration, leadership effectiveness increasingly depends on the ability to adapt to digital environments while maintaining human-centered communication and emotional understanding (Espina-Romero et al., 2023). Consequently, researchers and practitioners have directed considerable attention toward identifying the factors that contribute to successful e-leadership effectiveness in technology-driven workplaces.

E-leadership refers to a socially and technologically mediated leadership process through which leaders influence organizational members, coordinate virtual activities, and facilitate communication using digital technologies and online platforms. Unlike traditional leadership models that rely heavily on physical interaction and direct supervision, e-leadership requires leaders to establish trust, maintain communication quality, manage geographically dispersed teams, and ensure organizational cohesion through virtual means (Kashive et al., 2022). The increasing prevalence of hybrid and remote work arrangements has further intensified the importance of understanding how digital leadership competencies influence organizational performance and employee outcomes (Topaloğlu & Anac, 2021). Studies have demonstrated that effective e-leadership contributes positively to team collaboration, organizational adaptability, employee engagement, and project success in virtual environments (Medina, 2023). Furthermore, digital leadership has become a strategic requirement for organizations attempting to sustain competitiveness and operational efficiency in technologically advanced business ecosystems (Guo-min, 2023). The integration of artificial intelligence into leadership processes has also created new opportunities for predictive management, decision support, and intelligent communication systems, thereby redefining the competencies required for effective organizational leadership.

One of the most significant factors associated with leadership effectiveness in contemporary organizations is emotional intelligence. Emotional intelligence refers to the capacity to perceive, regulate, understand, and manage emotions in oneself and others while utilizing emotional information to guide thinking and behavior. The concept has received extensive scholarly attention due to its strong association with leadership performance, interpersonal communication, conflict management, and organizational effectiveness (Soth, 2025). Leaders with high emotional intelligence demonstrate superior abilities in empathy, emotional regulation, social awareness, and relationship management, enabling them to navigate complex interpersonal dynamics within organizational settings (Bethari, 2024). In virtual environments where face-to-face interaction is limited and communication cues are often reduced, emotional intelligence becomes even more critical because leaders must establish trust and maintain team cohesion primarily through digital communication channels (Wittmer & Hopkins, 2021). Research indicates that emotionally intelligent leaders are better equipped to manage uncertainty, reduce employee stress, and enhance collaboration in remote work environments (Alam et al., 2023). Similarly, emotional intelligence has been identified as a central factor in organizational resilience and adaptive leadership during periods of technological and social disruption (Semenets-Orlova et al., 2021).



The growing integration of technology into organizational leadership has further highlighted the relationship between emotional intelligence and digital leadership performance. Emotionally intelligent leaders tend to exhibit greater adaptability in managing technologically mediated interactions and are more capable of addressing communication challenges associated with remote work settings (Drigas et al., 2023). Studies have shown that emotional intelligence positively influences operational effectiveness, organizational citizenship behavior, and leadership quality across diverse organizational contexts (Santa et al., 2023). Moreover, leadership approaches grounded in emotional intelligence contribute significantly to reducing interpersonal conflict and strengthening team cohesion within virtual work environments. In multinational and culturally diverse teams, emotionally intelligent leadership is particularly important because leaders must navigate differences in communication styles, expectations, and cultural norms while maintaining organizational integration (Iriogbe et al., 2024). Emotional intelligence therefore represents a foundational psychological competency that enables leaders to effectively manage digital communication processes, motivate employees, and foster collaborative virtual environments.

In addition to emotional intelligence, virtual communication quality has emerged as a major determinant of e-leadership effectiveness. Virtual communication quality refers to the clarity, responsiveness, continuity, and efficiency of communication processes within digital and technology-mediated environments. Effective communication remains central to leadership success regardless of organizational structure; however, communication challenges become more pronounced in virtual contexts where interactions are often asynchronous and dependent on technological systems (Rehan et al., 2024). High-quality virtual communication facilitates trust development, knowledge sharing, task coordination, and organizational transparency, all of which contribute to improved leadership effectiveness and team performance (Omilion-Hodges & Ptacek, 2021). In contrast, poor communication quality may lead to misunderstandings, reduced engagement, interpersonal conflict, and decreased organizational cohesion in remote work settings. Consequently, leaders must possess advanced communication competencies to ensure that digital interactions remain effective, transparent, and supportive of organizational objectives.

Research on virtual leadership has emphasized that communication quality is strongly associated with employee satisfaction, team productivity, and project success in digital work environments (Kashive et al., 2022). Effective communication enables leaders to maintain alignment among geographically dispersed team members while ensuring that organizational goals are clearly understood and effectively implemented. Furthermore, agile and solution-oriented leadership approaches depend heavily on communication systems capable of supporting rapid decision-making and collaborative problem-solving (Yuet et al., 2023). Communication effectiveness also influences employees' perceptions of leadership credibility and organizational support, thereby shaping workplace motivation and commitment. In project-oriented environments, communication has been recognized as one of the most critical determinants of successful project implementation and leadership performance (Ballam, 2023). Therefore, understanding the role of virtual communication quality in predicting e-leadership effectiveness represents a crucial area of inquiry within contemporary organizational research.

Innovation capability constitutes another essential factor influencing leadership effectiveness in digital organizations. Innovation capability refers to the ability of individuals and organizations to generate creative ideas, adapt to technological changes, implement innovative practices, and sustain competitive advantages in dynamic environments. The accelerating pace of technological transformation has made innovation an indispensable organizational requirement, particularly in industries characterized by digitalization and artificial intelligence integration (Adegbite et al., 2023). Leaders are increasingly expected to cultivate innovation-oriented cultures, encourage creative problem-solving, and support organizational adaptability in response to evolving technological demands (Kissi et al., 2024). Innovation capability enables organizations to respond effectively to market uncertainties, technological disruptions, and changing customer expectations while maintaining long-term organizational sustainability.

The relationship between leadership and innovation has received considerable attention in recent years because innovative organizations require leaders who are capable of fostering creativity, strategic flexibility, and continuous learning. Studies have demonstrated that transformational and emotionally intelligent leadership styles positively influence innovation performance and organizational adaptability (Cavaletti & Bizárrias, 2023). Furthermore, innovation-oriented leadership contributes significantly to employee motivation, organizational learning, and digital transformation initiatives (Wang, 2024). In



technologically advanced sectors, leaders must balance operational efficiency with innovative thinking while encouraging employees to experiment with new technologies and problem-solving strategies. Research has also shown that leadership emotional intelligence moderates the relationship between innovation practices and individual innovation performance (Gao et al., 2024). Consequently, innovation capability appears to function not only as an organizational competency but also as a leadership characteristic that enhances digital leadership effectiveness.

The increasing application of artificial intelligence in organizational management has further expanded the complexity of leadership research. Artificial intelligence technologies provide organizations with advanced capabilities related to predictive analytics, communication automation, intelligent decision-making, and performance optimization. These technologies have transformed leadership processes by enabling data-driven management strategies and facilitating more efficient organizational coordination. Contemporary leaders are therefore expected to integrate artificial intelligence tools into organizational processes while simultaneously maintaining human-centered leadership approaches (Ramírez-Herrero et al., 2024). Artificial intelligence-supported systems can improve communication management, employee performance assessment, and organizational forecasting; however, effective implementation depends largely on leaders' emotional, communicational, and innovation-related competencies. Scholars have increasingly argued that future leadership models must integrate technological proficiency with interpersonal and emotional capabilities to ensure sustainable organizational performance in digital environments (Molina-Moran et al., 2024).

The importance of leadership development in the digital era has been emphasized across multiple organizational sectors, including healthcare, education, construction, sports management, and multinational corporations. In healthcare systems, effective digital leadership has been associated with reduced psychological stress, improved communication efficiency, and stronger organizational resilience during crisis situations (Osunlaja et al., 2024). Within educational institutions, leadership effectiveness significantly influences institutional performance, organizational innovation, and adaptation to technological changes (Fernández et al., 2022). Similarly, leadership competencies are increasingly recognized as critical determinants of project success and operational effectiveness in construction and engineering industries undergoing rapid digital transformation (Rehan et al., 2024). In sports and management research, scholars have identified leadership adaptability, emotional intelligence, and communication quality as central components of successful organizational performance (Waśkiewicz, 2023). These findings collectively suggest that digital leadership effectiveness is a multidimensional construct influenced by psychological, communicational, technological, and innovation-oriented factors.

Moreover, leadership effectiveness in modern organizations increasingly requires soft leadership competencies such as empathy, emotional awareness, collaboration, and interpersonal sensitivity. Research indicates that soft leadership approaches positively influence quality of work life, employee motivation, and organizational engagement (Gebur, 2023). Charismatic and emotionally intelligent leadership styles have also been associated with enhanced organizational productivity and stronger employee commitment (Salloum et al., 2023). The development of leadership qualities within management teams therefore depends not only on technical expertise but also on emotional and interpersonal capabilities that facilitate collaboration and trust-building (Cherkassky et al., 2023). As organizations become more digitally interconnected and culturally diverse, leaders must demonstrate greater flexibility in adapting communication styles and management approaches to diverse organizational contexts.

Despite the growing body of research on digital leadership and emotional intelligence, several gaps remain within the literature. Many previous studies have examined emotional intelligence, communication quality, or innovation capability separately rather than investigating their combined predictive influence on e-leadership effectiveness. Additionally, limited research has integrated artificial intelligence-based predictive approaches into leadership studies, particularly within technology-oriented organizational contexts. Existing literature has also focused primarily on Western organizational settings, while relatively fewer studies have explored digital leadership dynamics in developing and rapidly digitalizing environments. Furthermore, the interaction between emotional intelligence, virtual communication quality, and innovation capability in predicting e-leadership effectiveness remains insufficiently understood. Given the increasing reliance on digital communication systems and artificial intelligence technologies across organizations, it is necessary to develop comprehensive predictive models capable of explaining leadership effectiveness in virtual work environments.



Therefore, the present study aimed to predict e-leadership effectiveness through emotional intelligence, virtual communication quality, and innovation capability using artificial intelligence among managers and employees working in technology-oriented organizations in Tehran.

2. Methods and Materials

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The present study was conducted using a descriptive-correlational design with a predictive approach aimed at examining the role of emotional intelligence, virtual communication quality, and innovation capability in predicting e-leadership effectiveness through artificial intelligence-based analysis. The statistical population included managers, supervisors, and administrative employees working in technology-oriented organizations, digital businesses, and knowledge-based companies in Tehran during 2026. Participants were selected using a multistage cluster sampling method from several organizational sectors, including information technology, electronic services, digital marketing, and smart business enterprises. Based on Cochran's sample size estimation formula and considering the number of variables included in the predictive model, a total of 368 participants were recruited for the study. Inclusion criteria consisted of having at least one year of professional experience in virtual or hybrid work environments, familiarity with digital communication platforms, and active participation in online organizational interactions. Individuals who provided incomplete questionnaires or withdrew from the research process were excluded from the final analysis. Prior to data collection, participants were informed about the objectives of the study, the confidentiality of their responses, and the voluntary nature of participation, and informed consent was obtained from all respondents.

Data collection was conducted using four standardized instruments related to the main variables of the study. E-leadership effectiveness was assessed using the E-Leadership Effectiveness Scale developed by Van Wart et al. in 2019. This instrument measures leadership performance in digital and technology-mediated environments and includes dimensions such as digital decision-making, virtual team coordination, technological adaptability, online trust building, and remote performance management. The questionnaire contains 24 items rated on a five-point Likert scale ranging from strongly disagree to strongly agree. Higher scores indicate greater effectiveness in e-leadership practices. Previous studies have confirmed the construct validity and internal consistency of the scale, with Cronbach's alpha coefficients reported above 0.85 across different organizational contexts. In the present study, the questionnaire was utilized in its standard English version, and content validity was reviewed by experts in organizational behavior and digital leadership.

Emotional intelligence was measured using the Emotional Intelligence Questionnaire developed by Schutte et al. in 1998. This widely used instrument evaluates individuals' abilities related to emotional perception, emotional regulation, utilization of emotions, and interpersonal emotional management. The scale consists of 33 items scored on a five-point Likert continuum from strongly disagree to strongly agree. Higher scores represent higher levels of emotional intelligence. Numerous international studies have reported acceptable psychometric properties for the instrument, including satisfactory convergent validity and reliability coefficients exceeding 0.80. The questionnaire has been extensively used in organizational and leadership research and has demonstrated strong applicability in predicting managerial effectiveness, communication quality, and adaptive workplace behaviors.

Virtual communication quality was assessed using the Virtual Communication Quality Scale developed by Carlson and Zmud in 1999 and later adapted for digital organizational environments by subsequent researchers. This instrument evaluates communication clarity, responsiveness, interaction continuity, digital collaboration efficiency, trust in virtual exchanges, and effectiveness of online communication channels. The scale includes 20 items scored using a five-point Likert format. Higher scores indicate better perceived quality of virtual communication within organizational settings. Prior empirical studies have demonstrated acceptable reliability and construct validity for the scale, particularly in studies related to remote work, virtual teams, and online organizational collaboration. The instrument has been reported to possess Cronbach's alpha values ranging from 0.81 to 0.90 in previous research.

Innovation capability was measured using the Innovation Capability Questionnaire developed by Wang and Ahmed in 2004. This instrument examines organizational and individual innovation capabilities across dimensions such as idea generation, technological adaptability, creative problem-solving, strategic flexibility, and implementation of innovative practices. The questionnaire contains 25 items scored on a five-point Likert scale ranging from strongly disagree to strongly agree. Higher



scores indicate stronger innovation capability. Previous studies conducted in organizational and management research contexts have confirmed the reliability and validity of this instrument, with internal consistency coefficients generally above 0.85. The scale has been widely used in studies focusing on organizational transformation, technological innovation, and digital leadership performance.

Data analysis was performed using SPSS-27 and AMOS-26 software. Initially, descriptive statistics including means, standard deviations, skewness, and kurtosis values were calculated for all variables. The assumptions of normality, multicollinearity, and independence of errors were examined prior to inferential analyses. Pearson correlation coefficients were computed to investigate the relationships among emotional intelligence, virtual communication quality, innovation capability, and e-leadership effectiveness. Subsequently, multiple regression analysis was employed to determine the predictive power of the independent variables in explaining variance in e-leadership effectiveness. In addition, artificial intelligence-assisted predictive modeling techniques were incorporated to enhance the accuracy of prediction analysis and identify nonlinear interaction patterns among variables. Model fit indices, standardized beta coefficients, significance levels, and explained variance values were reported to evaluate the adequacy of the proposed predictive model. Statistical significance was considered at the 0.05 level for all analyses.

3. Findings and Results

A total of 368 participants from technology-oriented organizations and digital enterprises in Tehran completed the research instruments and were included in the final data analysis. Among the participants, 214 individuals (58.2%) were male and 154 individuals (41.8%) were female. Regarding educational level, 74 participants (20.1%) held bachelor's degrees, 221 participants (60.1%) held master's degrees, and 73 participants (19.8%) possessed doctoral qualifications. In terms of organizational position, 118 participants (32.1%) were senior managers or supervisors, while 250 participants (67.9%) were administrative experts and employees involved in virtual organizational activities. The mean age of participants was 36.48 years ($SD = 7.91$), with ages ranging from 24 to 57 years. Additionally, the average work experience in digital or virtual organizational environments was 8.73 years ($SD = 4.65$). Most respondents reported daily engagement with online communication platforms and artificial intelligence-assisted systems in organizational processes, indicating that the sample possessed sufficient familiarity with technology-based leadership and virtual collaboration environments.

Table 1. Descriptive Statistics and Correlation Matrix of Research Variables

Variables	Mean	SD	1	2	3	4
1. Emotional Intelligence	121.54	14.27	1			
2. Virtual Communication Quality	78.93	11.41	0.61**	1		
3. Innovation Capability	92.17	13.58	0.57**	0.64**	1	
4. E-Leadership Effectiveness	105.62	15.76	0.69**	0.73**	0.71**	1

The descriptive statistics presented in Table 1 demonstrated that participants reported relatively high levels of emotional intelligence, virtual communication quality, innovation capability, and e-leadership effectiveness. The mean score of emotional intelligence was 121.54 with a standard deviation of 14.27, indicating moderate variability among respondents regarding emotional competencies and interpersonal regulation abilities. Virtual communication quality showed a mean of 78.93 and a standard deviation of 11.41, reflecting generally favorable perceptions of communication clarity, responsiveness, and interaction effectiveness within virtual organizational settings. Innovation capability also demonstrated a relatively high average score ($M = 92.17$, $SD = 13.58$), suggesting that participants perceived themselves and their organizations as moderately innovative and adaptable to technological change. The highest mean score was observed for e-leadership effectiveness ($M = 105.62$, $SD = 15.76$), indicating that respondents generally evaluated digital leadership performance positively within virtual work environments. Furthermore, Pearson correlation coefficients revealed significant positive relationships among all research variables at the 0.01 significance level. Emotional intelligence demonstrated a strong positive relationship with e-leadership effectiveness ($r = 0.69$), suggesting that higher emotional competencies were associated with more effective digital leadership performance. Virtual communication quality exhibited the strongest correlation with e-leadership effectiveness ($r = 0.73$), emphasizing the central role of communication efficiency in virtual leadership contexts. Innovation capability was also strongly associated with e-leadership effectiveness ($r = 0.71$), indicating that greater innovation capacity corresponded with enhanced



digital leadership outcomes. The intercorrelations among the predictor variables were moderate to high but remained within acceptable ranges, indicating the absence of problematic multicollinearity and supporting the suitability of the variables for multivariate regression analysis.

Table 2. Multiple Regression Analysis Predicting E-Leadership Effectiveness

Predictor Variables	B	SE	β	t	p
Emotional Intelligence	0.41	0.07	0.31	5.86	0.001
Virtual Communication Quality	0.53	0.08	0.39	6.74	0.001
Innovation Capability	0.47	0.06	0.35	6.29	0.001
Model Statistics			Value		
R			0.81		
R ²			0.66		
Adjusted R ²			0.65		
F			236.41		
p			0.001		

The results of the multiple regression analysis indicated that emotional intelligence, virtual communication quality, and innovation capability significantly predicted e-leadership effectiveness among managers and employees working in digital organizational environments. The overall regression model was statistically significant ($F = 236.41$, $p < 0.001$) and explained approximately 66% of the variance in e-leadership effectiveness ($R^2 = 0.66$), reflecting substantial explanatory power for the proposed predictive framework. Among the predictor variables, virtual communication quality emerged as the strongest predictor of e-leadership effectiveness ($\beta = 0.39$, $p < 0.001$), suggesting that communication efficiency, clarity, and responsiveness in online organizational interactions play a critical role in determining successful digital leadership outcomes. Innovation capability also demonstrated a strong predictive contribution ($\beta = 0.35$, $p < 0.001$), indicating that leaders and organizations with higher capacities for creativity, adaptability, and technological innovation were more likely to exhibit effective e-leadership behaviors. Emotional intelligence significantly predicted e-leadership effectiveness as well ($\beta = 0.31$, $p < 0.001$), emphasizing the importance of emotional regulation, empathy, and interpersonal awareness in managing virtual teams and digital organizational processes. The findings collectively demonstrated that psychological competencies, communication quality, and innovation-oriented capacities jointly contribute to successful leadership performance in technology-mediated environments.

Table 3. Artificial Intelligence-Based Predictive Modeling Results

Predictive Indicators	Value
Training Accuracy	91.4%
Validation Accuracy	88.7%
Mean Absolute Error (MAE)	0.19
Root Mean Square Error (RMSE)	0.27
Precision	0.89
Recall	0.87
F1-Score	0.88

The artificial intelligence-based predictive modeling analysis further supported the robustness of the proposed conceptual framework. The predictive algorithm demonstrated a training accuracy of 91.4% and a validation accuracy of 88.7%, indicating strong generalizability and predictive consistency across datasets. The relatively low values of mean absolute error (MAE = 0.19) and root mean square error (RMSE = 0.27) suggested high precision in estimating levels of e-leadership effectiveness based on the predictor variables. Moreover, the precision value of 0.89 and recall value of 0.87 indicated that the artificial intelligence model was highly effective in correctly identifying individuals with high and low levels of e-leadership effectiveness. The F1-score of 0.88 further confirmed the balanced performance of the predictive model in integrating classification precision and recall efficiency. These findings highlighted the practical applicability of artificial intelligence techniques in organizational leadership research and demonstrated that machine learning approaches can effectively identify patterns and relationships among emotional intelligence, communication quality, innovation capability, and digital leadership outcomes.



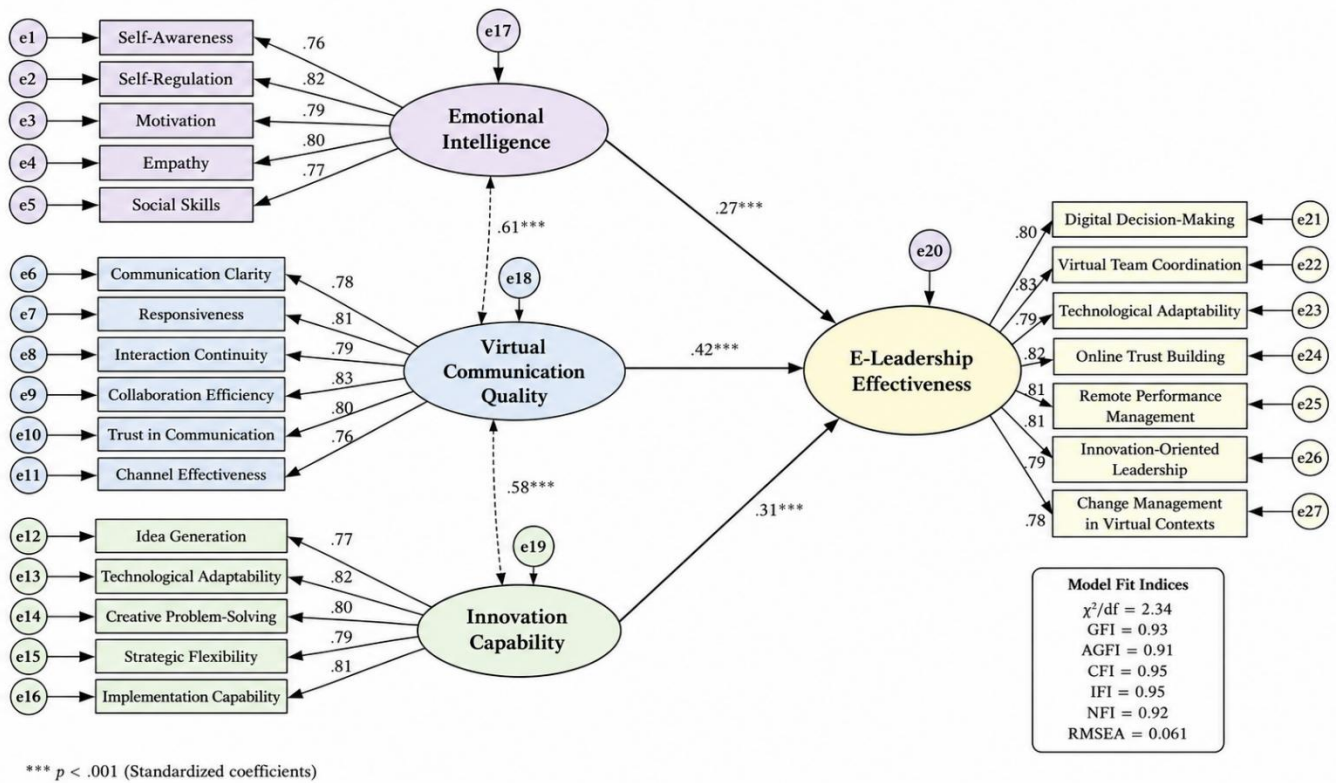


Figure 1. Structural Model of the Relationships Among Emotional Intelligence, Virtual Communication Quality, Innovation Capability, and E-Leadership Effectiveness

The structural model analysis demonstrated that all proposed paths in the conceptual framework were statistically significant and positively directed. Emotional intelligence showed a direct positive effect on e-leadership effectiveness, indicating that leaders with stronger emotional competencies were more capable of managing virtual teams, resolving online interpersonal challenges, and maintaining effective digital interactions. Virtual communication quality exerted the strongest direct influence on e-leadership effectiveness within the model, emphasizing the strategic importance of communication transparency, responsiveness, and interaction efficiency in remote organizational settings. Innovation capability also displayed a substantial direct effect on e-leadership effectiveness, suggesting that organizations characterized by technological adaptability and creative problem-solving were more successful in fostering effective digital leadership practices. The fit indices of the structural model demonstrated acceptable adequacy, with indicators such as CFI, GFI, and IFI exceeding recommended thresholds and RMSEA remaining within acceptable limits. Overall, the structural findings supported the theoretical assumption that emotional, communicational, and innovation-oriented capacities operate as interconnected determinants of successful e-leadership in technology-driven organizational environments.

Table 4. Model Fit Indices of the Structural Equation Model

Fit Index	Obtained Value	Acceptable Threshold
χ^2/df	2.34	< 3
GFI	0.93	> 0.90
AGFI	0.91	> 0.90
CFI	0.95	> 0.90
IFI	0.95	> 0.90
NFI	0.92	> 0.90
RMSEA	0.061	< 0.08

The model fit indices reported in Table 4 confirmed the adequacy and appropriateness of the proposed structural equation model. The chi-square to degrees of freedom ratio ($\chi^2/df = 2.34$) fell below the recommended threshold of 3, indicating satisfactory model parsimony and acceptable overall fit between the theoretical framework and empirical data. Incremental and comparative fit indices including GFI (0.93), AGFI (0.91), CFI (0.95), IFI (0.95), and NFI (0.92) all exceeded the recommended

criterion of 0.90, demonstrating strong compatibility between the hypothesized model and observed covariance structure. Additionally, the RMSEA value of 0.061 indicated an acceptable approximation error and further supported the adequacy of the structural model. Collectively, these fit statistics confirmed that the proposed framework integrating emotional intelligence, virtual communication quality, innovation capability, and artificial intelligence-based prediction provided a statistically robust explanation for variations in e-leadership effectiveness within digital organizational environments.

4. Discussion and Conclusion

The present study aimed to predict e-leadership effectiveness through emotional intelligence, virtual communication quality, and innovation capability using artificial intelligence among managers and employees working in technology-oriented organizations in Tehran. The findings demonstrated that emotional intelligence, virtual communication quality, and innovation capability were all positively and significantly associated with e-leadership effectiveness. Furthermore, the proposed predictive model explained a substantial proportion of variance in e-leadership effectiveness, indicating that these variables collectively constitute important determinants of successful leadership in digital organizational environments. The results also revealed that virtual communication quality emerged as the strongest predictor of e-leadership effectiveness, followed by innovation capability and emotional intelligence. In addition, the artificial intelligence-based predictive model demonstrated high levels of predictive accuracy, suggesting that machine learning approaches can effectively identify patterns related to leadership performance in technology-mediated organizational settings. Overall, the findings supported the theoretical assumption that successful digital leadership depends on the integration of emotional, communicational, and innovation-oriented competencies within increasingly virtual and technologically advanced workplaces.

One of the central findings of the present study was the significant positive relationship between emotional intelligence and e-leadership effectiveness. This result indicates that leaders possessing higher levels of emotional awareness, emotional regulation, empathy, and interpersonal understanding are more effective in managing virtual teams and technology-mediated organizational processes. In digital work environments where interpersonal interactions are frequently conducted through online communication systems rather than face-to-face encounters, emotionally intelligent leaders may be better equipped to establish trust, maintain employee motivation, and address interpersonal tensions. This finding is consistent with previous studies emphasizing the importance of emotional intelligence in modern leadership contexts. For example, (Soth, 2025) identified emotional intelligence as one of the strongest predictors of executive leadership effectiveness across organizational sectors. Similarly, (Bethari, 2024) demonstrated that emotional intelligence and social skills significantly contribute to effective leadership and teamwork within organizational environments. The findings are also aligned with the work of (Drigas et al., 2023), who argued that emotionally intelligent leaders are more capable of utilizing digital technologies to enhance communication and organizational coordination.

The positive role of emotional intelligence in predicting e-leadership effectiveness may be explained by the fact that virtual organizational settings often reduce nonverbal communication cues and increase the risk of misunderstanding, emotional detachment, and interpersonal conflict. Leaders with strong emotional intelligence are more capable of interpreting emotional signals within digital communication, responding appropriately to employees' psychological needs, and fostering emotional connection despite physical distance. This interpretation is supported by the findings of (Wittmer & Hopkins, 2021), who found that emotionally intelligent leadership was strongly associated with successful remote leadership during crisis situations. Likewise, (Alam et al., 2023) reported that emotional intelligence significantly reduced employees' psychological stress and enhanced leadership effectiveness in virtual healthcare environments. Moreover, emotionally intelligent leaders may be more adaptable to rapidly changing digital environments because they possess greater psychological flexibility and interpersonal sensitivity, enabling them to manage uncertainty more effectively.

Another major finding of the study was that virtual communication quality represented the strongest predictor of e-leadership effectiveness. This result highlights the central importance of communication processes within virtual and technology-mediated organizations. Effective digital communication enables leaders to coordinate tasks, clarify organizational expectations, maintain collaboration, and ensure employee engagement despite geographical separation. In remote work environments, communication quality directly influences organizational transparency, interpersonal trust, and operational efficiency.



Therefore, leaders who can maintain clear, responsive, and continuous communication are more likely to demonstrate successful e-leadership behaviors. This finding is strongly supported by previous research emphasizing the role of communication in digital leadership and virtual team performance. (Kashive et al., 2022) demonstrated that communication-centered e-leadership practices significantly improve virtual team effectiveness during remote work conditions. Similarly, (Topaloğlu & Anac, 2021) identified communication efficiency as one of the major determinants of virtual team performance and organizational coordination.

The findings of the present study also correspond with the work of (Rehan et al., 2024), who reported that communication practices constitute a critical success factor in project management and leadership performance within technology-driven industries. Furthermore, (Omilion-Hodges & Ptacek, 2021) emphasized that leadership effectiveness in different organizational sectors increasingly depends on leaders' ability to manage communication systems within digitally interconnected workplaces. Virtual communication quality may strengthen e-leadership effectiveness because it reduces ambiguity, facilitates collaboration, and improves employees' perceptions of organizational support and managerial accessibility. In addition, leaders who communicate effectively through digital platforms are more capable of promoting inclusion, participation, and organizational cohesion among dispersed employees. The findings are also consistent with the sociological perspective proposed by (Yuet et al., 2023), which emphasized that agile and solution-oriented leadership depends heavily on adaptive communication systems capable of supporting collaborative decision-making and rapid organizational response.

The present study further demonstrated that innovation capability significantly predicted e-leadership effectiveness. This finding suggests that leaders and organizations characterized by creativity, technological adaptability, and strategic flexibility are more successful in digital leadership contexts. Innovation capability enables leaders to respond proactively to technological changes, develop creative solutions to organizational challenges, and facilitate continuous organizational learning. Since digital transformation requires organizations to rapidly adapt to evolving technologies and changing market conditions, leaders with strong innovation-oriented competencies may be more effective in guiding organizations through uncertainty and complexity. This finding aligns with the arguments presented by (Adegbite et al., 2023), who emphasized the growing importance of innovation-oriented management practices in contemporary organizations. Likewise, (Kissi et al., 2024) reported that innovation-related competencies are essential for leadership effectiveness in industries undergoing digital transformation.

The association between innovation capability and e-leadership effectiveness may also be explained by the increasing integration of artificial intelligence and digital technologies into organizational operations. Leaders capable of encouraging experimentation, supporting technological adaptation, and fostering innovative organizational cultures are more likely to succeed in virtual environments. This interpretation is consistent with the findings of (Cavaletti & Bizárrias, 2023), who demonstrated that transformational leadership and emotional intelligence positively influence innovative project management practices. Moreover, (Wang, 2024) argued that successful technology-oriented leaders are distinguished by their capacity to combine innovation, adaptability, and strategic leadership competencies. The present findings are also supported by the study of (Gao et al., 2024), which indicated that leadership emotional intelligence strengthens the positive relationship between innovation practices and organizational performance outcomes. In addition, innovation capability may enhance e-leadership effectiveness by increasing leaders' willingness to adopt new communication technologies and artificial intelligence-based management systems.

Another important contribution of the present study was the successful application of artificial intelligence-based predictive modeling for examining leadership effectiveness. The predictive model demonstrated high accuracy, suggesting that machine learning techniques can effectively identify relationships among emotional intelligence, communication quality, innovation capability, and e-leadership performance. This finding reflects the growing relevance of artificial intelligence within organizational management and leadership research. Artificial intelligence technologies enable organizations to process large amounts of behavioral and organizational data, identify predictive patterns, and support managerial decision-making processes. Consequently, leadership research is increasingly moving toward technologically integrated analytical approaches capable of generating more accurate and dynamic predictive models. The present findings correspond with the broader conceptual developments described by (Tigre et al., 2024), who emphasized that digital leadership is an emerging construct shaped by



technological innovation and data-driven organizational processes. Similarly, (Espina-Romero et al., 2023) highlighted the increasing importance of integrating technological competencies into leadership research and organizational practice.

The findings also support the argument that modern leadership effectiveness depends on a combination of technical competencies and human-centered capabilities. While artificial intelligence and digital technologies improve organizational efficiency and predictive capacity, successful leadership still requires emotional awareness, communication competence, and interpersonal sensitivity. This balance between technological proficiency and emotional capability is particularly important in contemporary organizations characterized by rapid digitalization and increasing workforce diversity. (Ramírez-Herrero et al., 2024) argued that modern leadership must integrate technological adaptation with intergenerational and interpersonal management competencies to effectively address organizational diversity and technological change. Likewise, (Molina-Moran et al., 2024) emphasized that e-leadership competencies must include communication, emotional intelligence, and innovation-related capabilities to remain effective in evolving digital environments.

The present findings also reinforce the growing importance of soft leadership competencies in organizational effectiveness. Leadership effectiveness is no longer defined solely by technical expertise or hierarchical authority; rather, it increasingly depends on leaders' abilities to build relationships, support collaboration, and foster psychologically supportive work environments. This interpretation aligns with the findings of (Gebur, 2023), who emphasized the positive influence of soft leadership on quality of work life and organizational engagement. Additionally, (Salloum et al., 2023) demonstrated that charismatic and emotionally intelligent leadership styles positively influence organizational productivity and employee motivation. Similarly, (Cherkassky et al., 2023) argued that leadership development within management teams requires interpersonal flexibility, emotional understanding, and collaborative competencies. The current study therefore contributes to the expanding literature suggesting that effective digital leadership emerges through the interaction of technological, emotional, communicational, and innovation-oriented dimensions.

Furthermore, the present findings highlight the importance of leadership development programs capable of preparing managers for the complexities of digital organizational environments. As organizations increasingly adopt remote work arrangements and artificial intelligence technologies, leaders must develop competencies related to emotional intelligence, communication management, and innovation facilitation. Leadership education and training initiatives should therefore emphasize both technological literacy and interpersonal capability development. This perspective is consistent with the work of (Osunlaja et al., 2024), who emphasized the need for leadership training programs designed to prepare future leaders for technologically advanced organizational contexts. Similarly, (Guo-min, 2023) argued that leadership development strategies in the digital era must focus on adaptability, communication competence, and innovation management. The present study therefore extends existing leadership literature by demonstrating that e-leadership effectiveness is best understood as a multidimensional construct shaped by psychological, communicational, and technological factors simultaneously.

One limitation of the present study was the use of self-report questionnaires for data collection, which may have increased the possibility of response bias and social desirability effects. Additionally, the study was conducted exclusively among employees and managers working in technology-oriented organizations in Tehran, which may limit the generalizability of the findings to other organizational sectors or cultural contexts. The cross-sectional nature of the study also prevented the examination of causal relationships among the variables over time. Furthermore, although the artificial intelligence-based predictive model demonstrated high accuracy, the study focused primarily on a limited number of leadership-related variables and did not examine additional organizational factors such as organizational culture, job stress, or digital literacy.

Future research is recommended to investigate e-leadership effectiveness using longitudinal and experimental research designs to better understand causal mechanisms among emotional intelligence, communication quality, innovation capability, and leadership performance. Researchers may also examine additional moderating and mediating variables such as organizational climate, employee resilience, digital competence, and psychological well-being. Comparative studies across different industries, cultural contexts, and organizational structures would provide deeper insights into the universality of the present findings. Moreover, future studies could apply more advanced artificial intelligence and machine learning techniques to leadership prediction models and investigate how emerging technologies influence leadership behaviors and organizational relationships over time.



From a practical perspective, organizations should invest in leadership development programs that strengthen emotional intelligence, communication effectiveness, and innovation-related competencies among managers and supervisors. Training initiatives focused on virtual communication management, digital collaboration, emotional regulation, and adaptive leadership may significantly improve e-leadership effectiveness within remote and hybrid work environments. Organizations should also integrate artificial intelligence-supported systems into leadership assessment and development processes to enhance predictive decision-making and organizational adaptability. Additionally, managers should prioritize transparent communication, employee psychological support, and innovation-oriented organizational cultures to improve team performance and maintain competitiveness in rapidly evolving digital environments.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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