

The Mediating Role of Digital Innovation on the Relation between Artificial Intelligence Capabilities and E-Governance Excellence within the Saudi Ministry of Health

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Abstract: *This study examines the mediating role of digital innovation in the relationship between artificial intelligence capabilities and e-governance excellence within the Saudi Ministry of Health. The study responds to the growing importance of artificial intelligence in public healthcare governance, where digital transformation has become essential for improving service efficiency, transparency, responsiveness, and institutional performance. A quantitative research design was adopted using a structured, closed-ended questionnaire to collect data from employees involved in digital transformation, information technology, e-health services, healthcare administration, and e-governance practices. A total of 384 valid responses were analyzed using SPSS and Partial Least Squares Structural Equation Modeling. The findings revealed that artificial intelligence capabilities had a positive and significant effect on digital innovation and e-governance excellence. The results also showed that digital innovation had a positive and significant effect on e-governance excellence. Furthermore, the mediation analysis confirmed that digital innovation significantly mediated the relationship between artificial intelligence capabilities and e-governance excellence. These findings indicate that artificial intelligence capabilities enhance governance outcomes not only directly, but also indirectly by strengthening digital innovation practices. The study concludes that achieving e-governance excellence requires more than adopting artificial intelligence technologies; it also requires transforming these capabilities into innovative digital services, integrated processes, and data-driven governance practices. The findings provide useful insights for improving digital healthcare governance and supporting public-sector transformation within the Saudi Ministry of Health.*

Keywords: Artificial Intelligence Capabilities; Digital Innovation; E-Governance Excellence; Saudi Ministry of Health; PLS-SEM.

1. Introduction

Artificial intelligence capabilities have become central to public-sector transformation because they allow government institutions to improve decision-making, automate administrative processes, enhance service responsiveness, and generate value from large-scale data. In healthcare governance, these capabilities are particularly important because ministries and public health institutions are required to manage complex service systems, ensure timely access to care, protect sensitive data, and respond to changing population needs. Within Saudi Arabia, the Ministry of Health has been strongly influenced by the national digital transformation agenda under Vision 2030, which emphasizes the modernization of public services, the expansion of digital health platforms, and the improvement of institutional performance through advanced technologies. Digital healthcare innovation in Saudi Arabia has accelerated during and after the COVID-19 period, as digital platforms, remote services,

electronic health systems, and data-based solutions became essential tools for maintaining healthcare continuity and improving service delivery (Abdulaziz et al., 2023). This shift reflects a broader movement in public administration, where artificial intelligence and digital technologies are increasingly viewed as strategic resources for improving public service efficiency, transparency, and institutional responsiveness (Androniceanu, 2023).

Artificial intelligence capabilities refer to the technological, human, and organizational capacities that enable an institution to adopt, manage, and benefit from AI-based applications. These capabilities include AI infrastructure, data availability, technical skills, workforce readiness, organizational support, and the willingness to use AI in operational and strategic processes. In public-sector organizations, AI capabilities can support predictive decision-making, service automation, resource planning, fraud detection, policy evaluation, and citizen-centered service delivery. Recent studies have shown that AI readiness in public organizations is not limited to the availability of technology; rather, it depends on institutional preparedness, leadership support, employee competence, data governance, and the ability to integrate AI into existing work systems (Ali et al., 2025). In the healthcare context, AI applications have the potential to improve diagnosis, patient flow, administrative efficiency, and health-service planning, while also supporting evidence-based governance and better allocation of healthcare resources (Aljerian et al., 2022). However, the presence of AI capabilities alone does not automatically produce governance excellence unless these capabilities are translated into innovative digital practices and integrated service improvements.

Digital innovation plays a critical mediating role in this transformation process. It refers to the use of digital technologies to create new or improved services, processes, systems, and organizational practices. In public institutions, digital innovation enables the conversion of technological capabilities into practical governance outcomes, such as faster service delivery, improved transparency, better communication, and enhanced user satisfaction. Studies on digital transformation have indicated that digital innovation can act as a mechanism through which digital technologies improve organizational performance, because innovation allows institutions to redesign processes rather than simply digitize existing routines (Al-Ayed et al., 2023). Similarly, research on public-sector digital innovation shows that innovation is shaped by technological capacity, organizational readiness, institutional support, and the ability of government agencies to experiment with new service models (Hong et al., 2022). Therefore, in the Saudi Ministry of Health, digital innovation may explain how AI capabilities contribute to e-governance excellence by enabling more integrated platforms, automated services, data-driven decision-making, and citizen-centered digital healthcare services.

E-governance excellence represents the ability of public institutions to deliver digital services that are efficient, transparent, reliable, accountable, responsive, and oriented toward public value. It extends beyond the basic implementation of e-government systems by focusing on quality, institutional performance, stakeholder satisfaction, and continuous improvement. Prior research has linked e-governance systems with government operational excellence, suggesting that successful digital governance depends on system quality, service integration, leadership commitment, and the ability to align technology with institutional goals (Saleh & Alyaseen, 2021). Other studies also emphasize that e-governance can improve public trust when digital systems are perceived as effective, transparent, and supportive of good governance practices (Hartanto et al., 2021). In this regard, AI-enabled e-governance offers important opportunities for the Saudi Ministry of Health, particularly through improved service accessibility, better health information management, enhanced transparency, and more responsive healthcare administration.

Despite the growing attention given to AI and digital transformation in public administration, the relationship between AI capabilities and e-governance excellence remains insufficiently explained, especially in the Saudi healthcare sector. Existing studies have examined AI adoption in government, digital transformation in public services, and the role of AI in healthcare; however, fewer studies have investigated the mechanism through which AI capabilities influence e-governance excellence. This gap is important because public institutions may invest in AI technologies without achieving excellence if they lack the digital innovation processes needed to convert AI resources into improved services and institutional outcomes. Recent research has highlighted the importance of AI in

enhancing public services and e-government performance (Al-Ansi et al., 2024). Other studies have shown that AI contributes to efficiency and transparency in e-governance, but this contribution depends on how effectively AI is embedded into governance processes and innovation systems (Chopra & Sharma, 2025). Therefore, examining digital innovation as a mediating variable provides a clearer understanding of how AI capabilities generate value within public healthcare governance.

Accordingly, this study examines the mediating role of digital innovation in the relationship between artificial intelligence capabilities and e-governance excellence within the Saudi Ministry of Health. The study contributes to the literature by linking AI capabilities, digital innovation, and e-governance excellence within a single empirical framework. It also responds to the need for context-specific research on digital transformation in Saudi public healthcare, where Vision 2030 has created strong institutional pressure to improve service quality, innovation, and government performance. Practically, the study provides useful insights for policymakers and healthcare administrators by explaining how AI capabilities can be strengthened and transformed into governance excellence through digital innovation. By focusing on the Saudi Ministry of Health, the study offers evidence that can support more effective AI strategies, stronger digital innovation practices, and improved e-governance outcomes in the healthcare sector.

2. Literature Review

2.1 Theoretical Discussion

The relationship between artificial intelligence capabilities, digital innovation, and e-governance excellence can be explained through several complementary theoretical perspectives. The Resource-Based View (RBV) provides an important foundation for understanding artificial intelligence capabilities as strategic organizational resources that can support superior institutional performance when they are valuable, rare, difficult to imitate, and effectively organized. From this perspective, AI capabilities are not limited to the ownership of advanced technologies, but also include the organizational ability to combine AI infrastructure, data resources, technical expertise, and managerial readiness in ways that improve decision-making and service delivery. Chen et al. (2022) applied RBV to explain how artificial intelligence can enhance organizational performance when firms possess the resources and capabilities needed to use AI effectively. Similarly, Moderno et al. (2024) emphasized that robotic process automation and artificial intelligence capabilities can drive digital strategy when organizations are able to align these resources with broader strategic goals. Therefore, in the context of the Saudi Ministry of Health, AI capabilities can be viewed as strategic resources that may improve e-governance excellence when they are transformed into practical digital solutions and governance improvements.

The Dynamic Capabilities perspective also helps explain how AI capabilities contribute to digital innovation and governance outcomes. While RBV focuses on the importance of strategic resources, dynamic capabilities emphasize the ability of organizations to sense opportunities, seize digital possibilities, and reconfigure existing processes in response to environmental change. This is highly relevant to public healthcare governance because ministries operate in complex environments shaped by citizen expectations, technological change, regulatory pressures, and the need for efficient service delivery. Gao et al. (2025) argued that artificial intelligence strengthens innovation capability by enabling organizations to process information, adapt to change, and develop new solutions. Atobishi et al. (2024) also showed that digital capabilities can improve public-sector performance when they are connected to organizational agility. In this study, digital innovation represents a dynamic capability because it allows the Ministry of Health to convert AI resources into improved services, smarter administrative processes, and more responsive e-governance systems.

Diffusion of Innovation Theory offers another useful explanation for the adoption and implementation of AI-based technologies in public-sector organizations. This theory suggests that innovation adoption is influenced by perceived usefulness, compatibility, complexity, trialability, and observability. In the public sector, AI adoption depends not only on technological availability but also on institutional acceptance, employee readiness, leadership support, and the perceived value of

digital solutions. Assaf et al. (2024) highlighted that acceptance of artificial intelligence technologies in government depends on organizational and user-related factors that influence willingness to implement AI systems. Ali et al. (2025) similarly emphasized that AI readiness in public organizations requires institutional preparedness, skilled employees, and clear implementation strategies. Therefore, the Ministry of Health's ability to benefit from AI capabilities depends on whether these capabilities are accepted, integrated, and transformed into digital innovation practices.

Institutional Theory further supports the study by explaining how public organizations adopt digital technologies in response to regulatory, normative, and societal pressures. Public-sector institutions are often influenced by government policies, national strategies, stakeholder expectations, and legitimacy requirements. In Saudi Arabia, Vision 2030 has created strong institutional pressure for government entities to enhance digital transformation, improve service quality, and adopt innovative technologies. Bendary and Rajadurai (2024) noted that emerging technologies and public innovation in the Saudi public sector are strongly shaped by Vision 2030, which encourages government organizations to modernize services and overcome implementation challenges. Schiavi et al. (2024) also explained that institutional theory is useful for understanding digital transformation because technological change is often connected to institutional pressures and organizational adaptation. Accordingly, AI capabilities and digital innovation within the Saudi Ministry of Health can be understood as responses to national transformation priorities and the need to strengthen public-sector legitimacy through improved e-governance excellence.

The EFQM Excellence Model provides an additional theoretical lens for understanding e-governance excellence. EFQM emphasizes leadership, strategy, stakeholder value, innovation, process improvement, and sustainable performance, making it suitable for evaluating excellence in public-sector digital governance. E-governance excellence is not merely the availability of online services; rather, it reflects the ability of public institutions to deliver efficient, transparent, accountable, responsive, and citizen-centered digital services. Rahmati and Jalilvand (2024) highlighted the relevance of organizational excellence models for public-sector performance, while Martusewicz et al. (2024) showed that the EFQM model continues to evolve as a framework for strategic transformation and sustainability. In this study, e-governance excellence is viewed as the outcome of effective AI capability use and digital innovation. This theoretical integration suggests that AI capabilities provide the resource base, digital innovation acts as the transformation mechanism, and e-governance excellence represents the institutional performance outcome.

2.2 Hypotheses Development

Artificial intelligence capabilities are expected to improve e-governance excellence because they enable public institutions to make better decisions, automate routine processes, analyze large amounts of data, and improve the quality of digital public services. In healthcare governance, AI can support predictive analytics, resource allocation, administrative automation, and evidence-based planning, all of which are important for improving efficiency, responsiveness, transparency, and service quality. Within the Saudi healthcare context, AI applications are increasingly linked to the improvement of healthcare services and administrative decision-making, especially as the Ministry of Health continues to expand its digital transformation initiatives under Vision 2030 (Aljerian et al., 2022). Studies on AI in public administration also show that AI can strengthen government performance by improving service delivery, increasing transparency, and supporting more intelligent decision-making processes (Chopra & Sharma, 2025). E-governance excellence depends on the ability of government institutions to provide digital services that are efficient, accessible, reliable, transparent, and citizen-centered. AI capabilities can support these outcomes by improving the speed and accuracy of government operations and by enabling public organizations to respond more effectively to users' needs. Research on AI and IoT in e-government indicates that these technologies can enhance public services by improving integration, responsiveness, and operational effectiveness (Al-Ansi et al., 2024). Similarly, studies on e-governance systems suggest that successful digital governance contributes to government operational excellence when technology is aligned with institutional goals

and service quality requirements (Saleh & Alyaseen, 2021). Therefore, this study proposes the following hypothesis:

H1: Artificial intelligence capabilities have a positive significant effect on e-governance excellence within the Saudi Ministry of Health.

Artificial intelligence capabilities are also expected to enhance digital innovation because AI provides the technological and analytical foundation required for developing new digital services, improving internal processes, and creating data-driven solutions. Digital innovation depends on the ability of institutions to use digital technologies in ways that create new value rather than simply replacing manual procedures with electronic systems. AI capabilities can support this process through automation, machine learning, predictive analytics, intelligent platforms, and improved data processing. Previous research indicates that AI adoption can promote digital innovation by enabling organizations to develop new digital solutions and improve their ability to respond to changing technological and service demands (Zeng et al., 2022). In the public sector, digital innovation is influenced by technological readiness, leadership support, data capacity, and employees' ability to use advanced technologies. Strong AI capabilities can encourage innovation by helping public organizations redesign traditional service models and introduce smarter, faster, and more integrated digital services. Studies on public-sector digital innovation show that innovation is shaped by technological, organizational, and institutional factors, making AI capabilities a key driver of innovative public-service transformation (Hong et al., 2022). In Saudi Arabia, digital healthcare innovation has expanded significantly during and after COVID-19, especially through telehealth, electronic services, and digital health platforms (Abdulaziz et al., 2023). Therefore, this study proposes the following hypothesis:

H2: Artificial intelligence capabilities have a positive significant effect on digital innovation within the Saudi Ministry of Health.

Digital innovation is expected to improve e-governance excellence because it enables public organizations to redesign services, simplify procedures, improve transparency, and enhance user satisfaction. Unlike basic digitization, digital innovation involves the development of new digital processes, integrated platforms, and service models that improve public value. In public administration, the shift from e-government to digital government reflects the growing importance of innovation, integration, and citizen-centered service delivery (Viana, 2021). Digital innovation can therefore strengthen e-governance excellence by improving accessibility, responsiveness, accountability, and the overall quality of digital government services. In healthcare governance, digital innovation is particularly important because public health systems require accurate information, fast service delivery, coordinated platforms, and effective communication between institutions and citizens. Digital health platforms, electronic records, telemedicine, and AI-supported services can improve healthcare accessibility and administrative efficiency. Research shows that digital governance innovation can contribute to public service excellence by enhancing responsiveness and service quality in government initiatives (Harsoyo & Amanatin, 2025). Other studies also indicate that e-government improves transparency and accountability when digital systems are effectively implemented and aligned with public administration goals (Setyarto et al., 2025). Therefore, this study proposes the following hypothesis:

H3: Digital innovation has a positive significant effect on e-governance excellence within the Saudi Ministry of Health.

Digital innovation is expected to mediate the relationship between artificial intelligence capabilities and e-governance excellence because AI capabilities may not automatically lead to excellence unless they are transformed into practical digital improvements. AI capabilities provide the technological resources, data systems, and analytical tools, while digital innovation converts these capabilities into improved services, smarter processes, and better governance outcomes. Previous research shows that digital innovation can mediate the relationship between digital transformation and organizational performance, suggesting that innovation is an important mechanism through which digital technologies create institutional value (Al-Ayed et al., 2023). Similarly, digital capacity can improve

innovation performance when organizations develop the absorptive ability to use technological resources effectively (Kastelli et al., 2024). This mediating role is especially relevant in public healthcare governance because government institutions often face challenges related to system integration, bureaucratic procedures, workforce readiness, and service complexity. Even when AI capabilities are available, their impact depends on whether the organization can use them to create new service models, improve administrative workflows, and strengthen digital platforms. AI has been found to support innovation management in e-government organizations by enabling new ways of delivering public services and improving administrative performance (Alshaer, 2023). In addition, AI capabilities can influence organizational performance through mediating mechanisms such as improved decision-making and innovation processes (Neiroukh et al., 2025). Therefore, this study proposes the following hypothesis:

H4: Digital innovation mediates the relationship between artificial intelligence capabilities and e-governance excellence within the Saudi Ministry of Health.

3. Methodology

This study adopted a quantitative research design to examine the mediating role of digital innovation in the relationship between artificial intelligence capabilities and e-governance excellence within the Saudi Ministry of Health. A quantitative design was appropriate because the study aimed to test predefined hypotheses and assess the statistical relationships among clearly identified constructs. The study was guided by a positivist research philosophy and a deductive approach, where the hypotheses were developed from existing literature and tested using empirical data. This approach is suitable for examining artificial intelligence capabilities as measurable organizational resources that may contribute to institutional and governance outcomes. It is also consistent with studies that examine the influence of artificial intelligence capabilities on organizational performance and digital transformation using structured quantitative models (Chen et al., 2022). In addition, the use of a cross-sectional survey design allowed the study to collect data at one point in time and capture respondents' current perceptions of artificial intelligence capabilities, digital innovation, and e-governance excellence within the Ministry.

The population of the study consisted of employees within the Saudi Ministry of Health who were involved in digital transformation, information technology, e-health services, digital innovation, healthcare administration, and e-governance-related activities. This population was selected because these employees are expected to have relevant knowledge of AI applications, digital platforms, innovation practices, and governance processes within the Ministry. The sample size was determined using Cochran's formula, resulting in 384 respondents. A purposive sampling technique was used to select respondents who had relevant experience or exposure to the study variables. This sampling technique was suitable because the study required informed participants who could evaluate the role of AI capabilities and digital innovation in improving e-governance excellence based on their practical institutional experience. The focus on knowledgeable respondents is consistent with public-sector digital transformation research, where employees' familiarity with digital systems and organizational processes is important for obtaining meaningful data (Atobishi et al., 2024).

Data were collected using a structured, closed-ended questionnaire based on a five-point Likert scale ranging from strongly disagree to strongly agree. The questionnaire consisted of demographic questions and measurement items for the three main constructs: artificial intelligence capabilities, digital innovation, and e-governance excellence. Artificial intelligence capabilities were measured through three dimensions: AI Basic Knowledge, AI Skills, and AI Proclivity, with items adapted mainly from Chen et al. (2022). Digital innovation was measured using items adapted from Zeng et al. (2022), reflecting the organization's ability to adopt, introduce, and apply digital solutions to improve performance and service delivery. E-governance excellence was measured using items adapted from Hartanto et al. (2021) and aligned with excellence-related dimensions such as accessibility, transparency, responsiveness, efficiency, service quality, integration, and overall governance performance. The use of adapted measurement items strengthened the content validity of

the questionnaire because the items were grounded in prior validated studies and refined to suit the Saudi healthcare governance context.

A pilot test was conducted before the main data collection to assess the clarity, reliability, and suitability of the questionnaire. The pilot test involved a small group of respondents from the Saudi Ministry of Health who had relevant knowledge of artificial intelligence, digital technologies, and e-governance practices. The purpose of the pilot test was to identify unclear wording, improve the structure of the questionnaire, and ensure that the items were suitable for the study context. Reliability was assessed using Cronbach's alpha, and the results indicated that all constructs achieved acceptable internal consistency. Validity was supported through the use of adapted items from previous validated studies and through reviewing the questionnaire for clarity, relevance, and alignment with the research objectives. This step was important because digital healthcare innovation in Saudi Arabia has expanded significantly during and beyond COVID-19, requiring measurement items that reflect the current healthcare transformation context (Abdulaziz et al., 2023).

The collected data were analyzed using SPSS and Partial Least Squares Structural Equation Modeling (PLS-SEM). SPSS was used for preliminary statistical analysis, including data screening, missing value assessment, outlier checking, descriptive statistics, normality testing, reliability analysis, and collinearity assessment. After completing the preliminary analysis, PLS-SEM was used to evaluate the measurement and structural models. The measurement model was assessed using indicator loadings, Cronbach's alpha, composite reliability, average variance extracted, and discriminant validity. The structural model was then assessed using path coefficients, coefficient of determination, and bootstrapping to test the proposed hypotheses. Finally, mediation analysis was conducted to examine whether digital innovation mediated the relationship between artificial intelligence capabilities and e-governance excellence. This analytical approach is appropriate for models involving latent constructs and mediating mechanisms, and it is consistent with research showing that AI capabilities can influence organizational outcomes through innovation and decision-making processes (Neiroukh et al., 2025).

4. Findings

This section presents the empirical findings of the study concerning the relationship between artificial intelligence capabilities, digital innovation, and e-governance excellence within the Saudi Ministry of Health. The analysis begins with preliminary statistical results, including normality and descriptive statistics, followed by the assessment of the measurement model to confirm reliability, convergent validity, and discriminant validity. The section then reports the structural model results, including the direct effects among the study variables and the mediating effect of digital innovation. Together, these findings provide the statistical basis for evaluating the proposed hypotheses and determining whether digital innovation explains the relationship between artificial intelligence capabilities and e-governance excellence.

As shown in Table 1, the normality test was conducted using skewness and kurtosis values for the three main constructs. Artificial Intelligence Capabilities recorded a skewness value of -0.212 and a kurtosis value of -0.781. Digital Innovation recorded a skewness value of -0.240 and a kurtosis value of -0.712. E-Governance Excellence recorded a skewness value of -0.157 and a kurtosis value of -0.761. These results indicate that all constructs were within the acceptable normality range, suggesting that the data did not show serious deviation from normal distribution. Therefore, the dataset was suitable for further statistical analysis, including descriptive statistics, measurement model assessment, structural model testing, and mediation analysis.

Table 1: Normality test

	N	Skewness	Kurtosis
AIC	384	-0.212	-0.781
DI	384	-0.240	-0.712
EGE	384	-0.157	-0.761

AIC = Artificial Intelligence Capabilities; DI = Digital Innovation; EGE = E-Governance Excellence

As shown in Table 2, the descriptive analysis summarizes respondents' perceptions of Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence within the Saudi Ministry of Health. Artificial Intelligence Capabilities recorded the highest mean score ($M = 3.257$, $SD = 0.921$), indicating that respondents moderately agreed that the Ministry possesses AI-related resources, skills, and readiness to support digital transformation. Digital Innovation followed closely with a mean score of $M = 3.244$ and a standard deviation of $SD = 0.917$, suggesting that respondents also perceived a moderate level of digital innovation practices, including the adoption and use of digital solutions to improve services and performance. E-Governance Excellence recorded the lowest mean score ($M = 3.197$, $SD = 0.920$), but it still reflected a moderate level of agreement regarding the role of digital governance in improving accessibility, transparency, responsiveness, efficiency, and service quality. Overall, the close mean values indicate that the three constructs were perceived at relatively similar levels, while the standard deviation values suggest a reasonable level of consistency in respondents' answers. These findings provide an initial indication that AI capabilities, digital innovation, and e-governance excellence are present within the Ministry, supporting the need for further analysis of the relationships among these constructs.

Table 2: Summary of Descriptive Analysis

	N	Mean	Std. Deviation
AIC	384	3.257	0.921
DI	384	3.244	0.917
EGE	384	3.197	0.920

AIC = Artificial Intelligence Capabilities; DI = Digital Innovation; EGE = E-Governance Excellence

As shown in Figure 1, the initial measurement model was evaluated to assess the relationship between the study constructs and their measurement items before finalizing the model. The model included Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence. The initial results showed that most indicators had acceptable factor loadings; however, some items recorded weak loadings and therefore required further assessment before retaining them in the final model. Specifically, the initial model indicated that AIBK2, AISK4, DI5, EGE4, and EGE8 had lower loadings compared with the other indicators. These weak items suggested that they did not represent their respective constructs strongly enough in the initial model. Therefore, the measurement model was refined by removing the weak indicators to improve the reliability and validity of the final model. This step was necessary to ensure that the retained items provided a stronger and more accurate measurement of Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence.

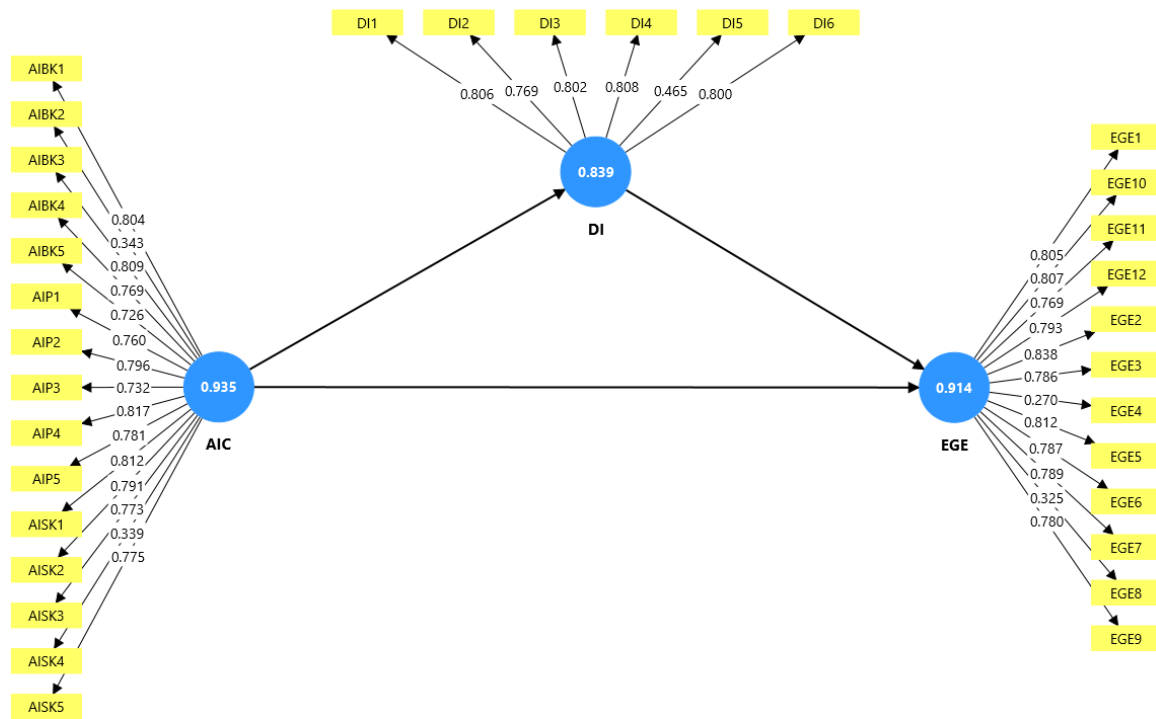


Figure 1: Evaluation of Measurement Model (Initial Model)

As shown in Table 3, the initial measurement model was assessed using indicator loadings, Cronbach's alpha, composite reliability, and average variance extracted. For Artificial Intelligence Capabilities, most items showed acceptable loadings, including AIBK1 = 0.804, AIBK3 = 0.809, AIP4 = 0.817, and AISK1 = 0.812. However, AIBK2 = 0.343 and AISK4 = 0.339 recorded weak loadings, indicating that these items did not adequately represent the construct in the initial model. Despite this, the construct achieved strong reliability, with Cronbach's alpha = 0.935, composite reliability = 0.945, and AVE = 0.544. For Digital Innovation, most items also demonstrated acceptable loadings, including DI1 = 0.806, DI3 = 0.802, DI4 = 0.808, and DI6 = 0.800. However, DI5 = 0.465 showed a weak loading compared with the other indicators. The reliability and convergent validity results for Digital Innovation were acceptable, with Cronbach's alpha = 0.839, composite reliability = 0.884, and AVE = 0.566. For E-Governance Excellence, most indicators showed acceptable loadings, such as EGE1 = 0.805, EGE2 = 0.838, EGE5 = 0.812, and EGE10 = 0.807. However, EGE4 = 0.270 and EGE8 = 0.325 recorded weak loadings. The construct still demonstrated acceptable reliability and convergent validity, with Cronbach's alpha = 0.914, composite reliability = 0.931, and AVE = 0.544. Overall, the initial measurement model showed acceptable reliability and convergent validity for the three constructs. However, several indicators had weak factor loadings and were therefore considered for removal to improve the quality of the measurement model. Based on these results, AIBK2, AISK4, DI5, EGE4, and EGE8 were removed before estimating the final model. This refinement helped strengthen the measurement model and ensured that the retained items represented Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence more accurately.

Table 3: Construct Reliability and Validity – Initial Model measurements

construct	Items	Loading	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
AIC	AIBK1	0.804	0.935	0.945	0.544
	AIBK2	0.343			
	AIBK3	0.809			
	AIBK4	0.769			
	AIBK5	0.726			
	AIP1	0.760			
	AIP2	0.796			
	AIP3	0.732			
	AIP4	0.817			

construct	Items	Loading	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
AIC	AIP4	0.817	0.839	0.884	0.566
	AIP5	0.781			
	AISK1	0.812			
	AISK2	0.791			
	AISK3	0.773			
	AISK4	0.339			
	AISK5	0.775			
DI	DI1	0.806	0.839	0.884	0.566
	DI2	0.769			
	DI3	0.802			
	DI4	0.808			
	DI5	0.465			
	DI6	0.800			
EGE	EGE1	0.805	0.914	0.931	0.544
	EGE10	0.807			
	EGE11	0.769			
	EGE12	0.793			
	EGE2	0.838			
	EGE3	0.786			
	EGE4	0.270			
	EGE5	0.812			
	EGE6	0.787			
	EGE7	0.789			
	EGE8	0.325			
	EGE9	0.780			

As shown in Figure 2, the final measurement model was evaluated after removing the weak indicators identified in the initial model. The refined model retained only the indicators that adequately represented their respective constructs: Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence. Compared with the initial model, the final model shows clearer and stronger relationships between the constructs and their measurement items, indicating an improvement in the overall quality of the measurement model. The retained indicators demonstrated acceptable representation of their constructs, supporting the reliability and validity of the model. Therefore, the final measurement model was considered suitable for further assessment of construct reliability, convergent validity, discriminant validity, and structural relationships among the study variables.

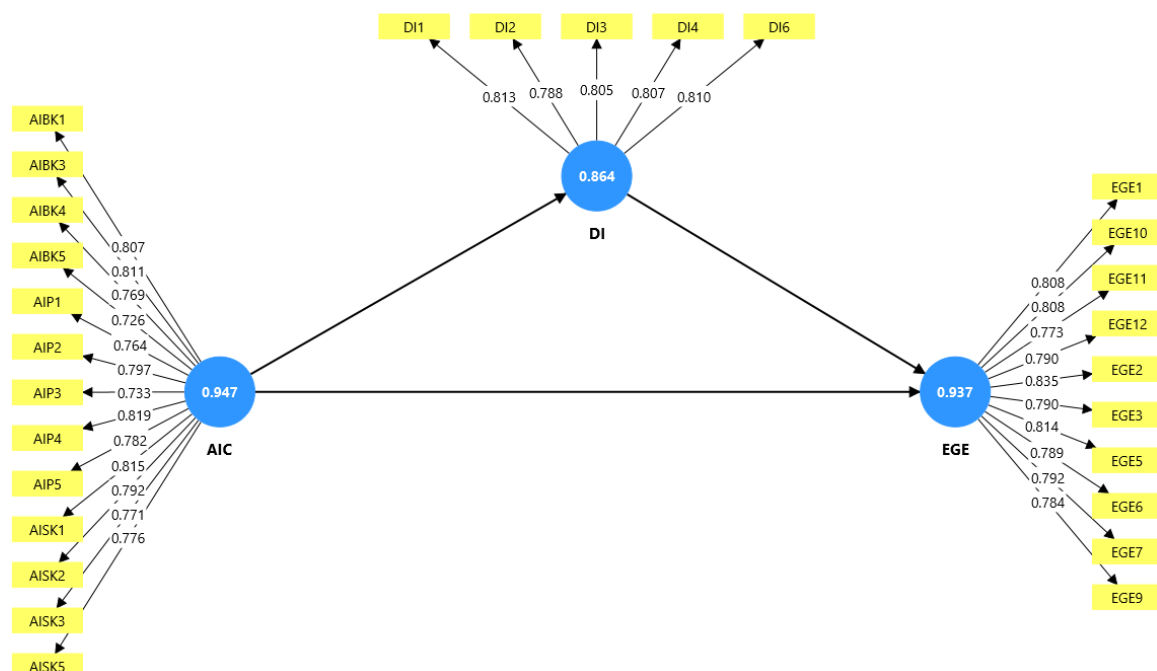


Figure 2: Evaluation of Measurement Model (Final Model)

As shown in Table 4, the final measurement model was assessed after removing the weak indicators identified in the initial model. The results indicate that all retained items achieved acceptable factor loadings, confirming that the remaining indicators adequately represented their respective constructs. For Artificial Intelligence Capabilities, the retained items showed acceptable loadings, and the construct achieved strong reliability and convergent validity, with Cronbach's alpha = 0.947, composite reliability = 0.953, and AVE = 0.612. Digital Innovation also demonstrated acceptable measurement quality, with all retained indicators showing suitable loadings and the construct achieving Cronbach's alpha = 0.864, composite reliability = 0.902, and AVE = 0.648. Similarly, E-Governance Excellence showed strong reliability and convergent validity, with Cronbach's alpha = 0.937, composite reliability = 0.946, and AVE = 0.638. Overall, the final model results confirm that the three constructs met the required standards for internal consistency and convergent validity. Therefore, the final measurement model was considered reliable and valid for proceeding to discriminant validity assessment and structural model testing.

Table 4: Construct Reliability and Validity – Final Model measurements

construct	Items	Loading	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
AI	AIBK1	0.807	0.947	0.953	0.612
	AIBK3	0.811			
	AIBK4	0.769			
	AIBK5	0.726			
	AIP1	0.764			
	AIP2	0.797			
	AIP3	0.733			
	AIP4	0.819			
	AIP5	0.782			
	ASK1	0.815			
	ASK2	0.792			
	ASK3	0.771			
	ASK5	0.776			
DI	DI1	0.813	0.864	0.902	0.648
	DI2	0.788			
	DI3	0.805			
	DI4	0.807			
	DI6	0.810			
EGE	EGE1	0.808	0.937	0.946	0.638
	EGE10	0.808			
	EGE11	0.773			
	EGE12	0.790			
	EGE2	0.835			
	EGE3	0.790			
	EGE5	0.814			
	EGE6	0.789			
	EGE7	0.792			
	EGE9	0.784			

As shown in Table 5, discriminant validity was assessed using the Heterotrait-Monotrait ratio of correlations (HTMT). The results show that the HTMT value between Artificial Intelligence Capabilities and Digital Innovation was 0.683, while the value between Artificial Intelligence Capabilities and E-Governance Excellence was 0.663. In addition, the HTMT value between Digital Innovation and E-Governance Excellence was 0.631. These values indicate that all constructs were sufficiently distinct from each other, as the HTMT results were below the commonly accepted threshold. Therefore, the findings confirm that discriminant validity was achieved in the final measurement model. This means that Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence measured different concepts and could be used confidently in the structural model analysis.

Table 5: The heterotrait-monotrait ratio of correlations (HTMT)

	AIC	DI	EGE
AIC			
DI	0.683		
EGE	0.663	0.631	

AIC = Artificial Intelligence Capabilities; **DI** = Digital Innovation; **EGE** = E-Governance Excellence

As shown in Table 6, discriminant validity was also assessed using the Fornell-Larcker criterion. The diagonal values represent the square root of AVE for each construct, while the off-diagonal values represent the correlations among the constructs. The results show that the square root of AVE for Artificial Intelligence Capabilities was 0.882, which was higher than its correlations with Digital Innovation (0.621) and E-Governance Excellence (0.627). Similarly, the square root of AVE for Digital Innovation was 0.805, which was higher than its correlations with Artificial Intelligence Capabilities (0.621) and E-Governance Excellence (0.570). The square root of AVE for E-Governance Excellence was 0.898, which was higher than its correlations with Artificial Intelligence Capabilities (0.627) and Digital Innovation (0.570). These findings confirm that each construct shared more variance with its own indicators than with other constructs. Therefore, the Fornell-Larcker results support discriminant validity and confirm that Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence are distinct constructs in the final measurement model.

Table 6: Latent Variable Correlations (Fornell-Larcker criteria)

	AIC	DI	EGE
AIC	0.882		
DI	0.621	0.805	
EGE	0.627	0.570	0.898

AIC = Artificial Intelligence Capabilities; **DI** = Digital Innovation; **EGE** = E-Governance Excellence

As shown in Figure 3, the structural model was evaluated to examine the direct relationships among Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence. The path model shows that Artificial Intelligence Capabilities had a positive effect on Digital Innovation and E-Governance Excellence. The model also shows that Digital Innovation had a positive effect on E-Governance Excellence. These results indicate that higher levels of AI capabilities within the Saudi Ministry of Health are associated with stronger digital innovation practices and improved e-governance excellence. In addition, the relationship between Digital Innovation and E-Governance Excellence suggests that digital innovation plays an important role in enhancing governance outcomes. Overall, the path model provides initial support for the proposed structural relationships and confirms the suitability of proceeding with hypothesis testing and mediation analysis.

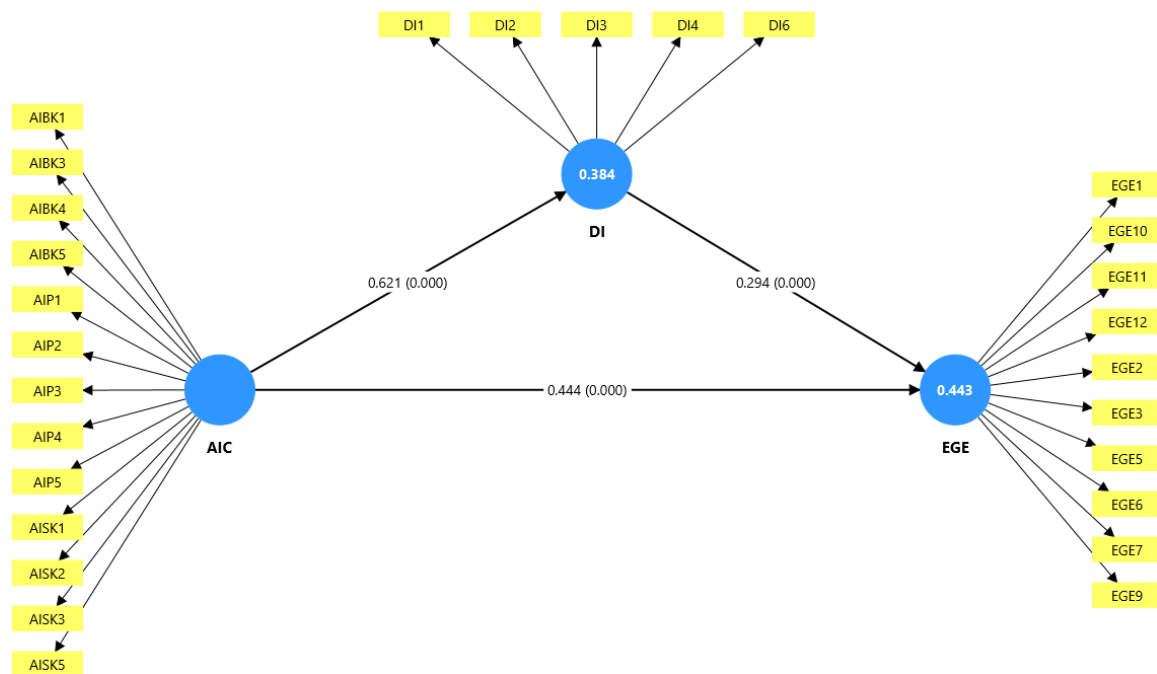


Figure 3: Path Model Significance Results

As shown in Table 7, the coefficient of determination was used to assess the explanatory power of the structural model. The results indicate that Artificial Intelligence Capabilities explained 38.5% of the variance in Digital Innovation, with an adjusted R-square value of 38.4%. This means that AI capabilities contributed meaningfully to explaining changes in digital innovation within the Saudi Ministry of Health. The results also show that Artificial Intelligence Capabilities and Digital Innovation together explained 44.6% of the variance in E-Governance Excellence, with an adjusted R-square value of 44.3%. This indicates that the model had an acceptable level of explanatory power for e-governance excellence. Overall, the R-square results suggest that the proposed model explains a substantial proportion of the variation in the endogenous constructs and supports the relevance of AI capabilities and digital innovation in improving e-governance excellence.

Table 7: Coefficient of Determination (R^2)

	R-square	R-square adjusted
DI	0.385	0.384
EGE	0.446	0.443

4.1 DI = Digital Innovation; EGE = E-Governance Excellence

As shown in Table 8, the direct hypotheses were tested using the structural model path coefficients, standard deviation, t-statistics, and p-values. The results show that Artificial Intelligence Capabilities had a positive and significant effect on Digital Innovation ($\beta = 0.621$, $SD = 0.032$, $t = 19.211$, $p = 0.000$), supporting H1. This indicates that stronger AI capabilities within the Saudi Ministry of Health are associated with higher levels of digital innovation. The results also show that Artificial Intelligence Capabilities had a positive and significant effect on E-Governance Excellence ($\beta = 0.444$, $SD = 0.050$, $t = 8.907$, $p = 0.000$), supporting H2. This means that AI capabilities directly contribute to improving e-governance excellence. Finally, Digital Innovation had a positive and significant effect on E-Governance Excellence ($\beta = 0.294$, $SD = 0.053$, $t = 5.549$, $p = 0.000$), supporting H3. This confirms that digital innovation plays an important role in enhancing e-governance excellence. Overall, all direct hypotheses were statistically supported, showing that AI capabilities and digital innovation are important predictors of e-governance excellence within the Saudi Ministry of Health.

Table 8: Direct Hypotheses

	Beta	SD	T statistics	P values
AIC -> DI	0.621	0.032	19.211	0.000
AIC -> EGE	0.444	0.050	8.907	0.000
DI -> EGE	0.294	0.053	5.549	0.000

AIC = Artificial Intelligence Capabilities; DI = Digital Innovation; EGE = E-Governance Excellence

As shown in Table 9, the mediation analysis was conducted to examine whether Digital Innovation mediates the relationship between Artificial Intelligence Capabilities and E-Governance Excellence. The results show that the indirect effect of Artificial Intelligence Capabilities on E-Governance Excellence through Digital Innovation was positive and statistically significant ($\beta = 0.182$, $SD = 0.035$, $t = 5.234$, $p = 0.000$). This indicates that Digital Innovation plays a significant mediating role in the relationship between Artificial Intelligence Capabilities and E-Governance Excellence. In other words, AI capabilities do not only influence e-governance excellence directly, but also contribute to it indirectly by enhancing digital innovation. Therefore, the indirect hypothesis was supported, confirming that Digital Innovation is an important mechanism through which AI capabilities improve e-governance excellence within the Saudi Ministry of Health.

Table 9: Indirect Hypothesis

	Beta	SD	T statistics	P values
AIC -> DI -> EGE	0.182	0.035	5.234	0.000

AIC = Artificial Intelligence Capabilities; DI = Digital Innovation; EGE = E-Governance Excellence

5. Discussion

The findings of this study provide clear empirical support for the proposed relationships among Artificial Intelligence Capabilities, Digital Innovation, and E-Governance Excellence within the Saudi Ministry of Health. Overall, the results indicate that AI capabilities are an important driver of both digital innovation and e-governance excellence, while digital innovation also plays a significant mediating role in this relationship. This means that the value of AI in public healthcare governance does not depend only on the availability of AI technologies, but also on the Ministry's ability to transform these capabilities into innovative digital services, improved processes, and more responsive governance practices. This finding is consistent with the Resource-Based View, which suggests that AI capabilities can improve organizational outcomes when they are effectively developed and applied as strategic resources (Chen et al., 2022). It also supports recent public-sector research showing that AI readiness and digital capabilities are increasingly important for improving institutional performance and service delivery (Ali et al., 2025).

The positive effect of Artificial Intelligence Capabilities on Digital Innovation suggests that AI-related resources, skills, and organizational readiness help the Saudi Ministry of Health introduce and apply new digital solutions. This finding confirms that digital innovation is not achieved through technology adoption alone, but through the combination of infrastructure, data availability, employee skills, and institutional willingness to innovate. In healthcare governance, AI capabilities can support digital innovation by enabling predictive analytics, automation, integrated platforms, and data-driven decision-making. This result aligns with Zeng et al. (2022), who showed that AI adoption can enhance digital innovation by strengthening an organization's ability to create and apply new digital solutions. It also agrees with Hong et al. (2022), who found that public-sector digital innovation depends on technological, organizational, and institutional conditions. Within the Saudi context, the finding is particularly relevant because digital healthcare innovation has expanded significantly during and beyond COVID-19, making AI capabilities essential for supporting modern healthcare services (Abdulaziz et al., 2023).

The results also showed that Artificial Intelligence Capabilities have a positive and significant effect on E-Governance Excellence. This indicates that AI capabilities directly contribute to improving digital governance outcomes in the Saudi Ministry of Health, including service efficiency,

accessibility, transparency, responsiveness, and overall performance. AI can support these outcomes by improving administrative processes, strengthening evidence-based decision-making, reducing service delays, and enhancing the quality of digital public services. This finding is consistent with Al-Ansi et al. (2024), who emphasized the role of AI and IoT in improving public services and strengthening e-government performance. It also supports Chopra and Sharma (2025), who argued that AI in e-governance can enhance efficiency and transparency. In the healthcare sector, this is also supported by Aljerian et al. (2022), who highlighted the growing role of AI applications in improving healthcare delivery and decision-making in Saudi Arabia.

The positive relationship between Digital Innovation and E-Governance Excellence further confirms that innovation is a key mechanism for improving public-sector governance. Digital innovation allows government institutions to redesign service delivery, improve communication channels, integrate information systems, and provide more citizen-centered digital services. This finding supports the argument that e-governance excellence requires more than the existence of digital platforms; it requires continuous improvement, service integration, responsiveness, and user-oriented digital transformation. Harsoyo and Amanatin (2025) found that digital governance innovation contributes to public service excellence by improving responsiveness and service quality. Similarly, Setyarto et al. (2025) emphasized that e-government can improve transparency and accountability when digital systems are effectively implemented. Therefore, the findings suggest that the Saudi Ministry of Health can improve e-governance excellence by strengthening digital innovation practices, especially those related to service accessibility, process improvement, data integration, and digital healthcare delivery.

The mediation result is one of the most important findings of this study. Digital Innovation significantly mediated the relationship between Artificial Intelligence Capabilities and E-Governance Excellence. This means that AI capabilities influence e-governance excellence not only directly, but also indirectly by improving the Ministry's digital innovation capacity. In other words, AI capabilities become more valuable when they are transformed into innovative digital processes and services. This finding is consistent with Al-Ayed et al. (2023), who showed that digital innovation mediates the relationship between digital transformation and organizational performance. It also aligns with Neiroukh et al. (2025), who found that AI capabilities can influence organizational performance through mediating mechanisms related to decision-making processes. Therefore, the mediation result confirms that digital innovation acts as a bridge between AI resources and governance excellence, helping explain how AI capabilities produce practical improvements in public healthcare governance.

Overall, the findings contribute to the literature by showing that AI capabilities, digital innovation, and e-governance excellence are closely connected in the context of the Saudi Ministry of Health. The study confirms that AI capabilities are not only technical assets, but strategic organizational capabilities that can support innovation and public-sector excellence when properly developed and applied. The results also highlight the importance of aligning AI initiatives with digital innovation strategies to achieve stronger governance outcomes. From a practical perspective, the Ministry should continue investing in AI infrastructure, employee AI skills, digital platforms, data integration, and innovation-oriented practices. Such efforts can help improve service quality, transparency, responsiveness, and public trust in healthcare governance. This is consistent with the broader direction of Saudi public-sector transformation under Vision 2030, where emerging technologies and public innovation are central to improving institutional performance and public value (Bendary & Rajadurai, 2024).

6. Conclusion

This study examined the mediating role of Digital Innovation in the relationship between Artificial Intelligence Capabilities and E-Governance Excellence within the Saudi Ministry of Health. The findings confirmed that Artificial Intelligence Capabilities have a positive effect on both Digital Innovation and E-Governance Excellence. The results also showed that Digital Innovation positively contributes to E-Governance Excellence, indicating that innovative digital practices are important for

improving public healthcare governance. In addition, the mediation results confirmed that Digital Innovation acts as an important mechanism through which AI capabilities are translated into stronger e-governance outcomes. The study concludes that AI capabilities alone are not sufficient to achieve e-governance excellence unless they are supported by effective digital innovation. Therefore, the Saudi Ministry of Health should continue strengthening AI infrastructure, employee digital skills, data-driven decision-making, and innovation-oriented practices. By linking AI capabilities with digital innovation strategies, the Ministry can improve service accessibility, transparency, responsiveness, efficiency, and overall healthcare governance performance. The study also highlights the importance of aligning technological investments with institutional innovation efforts to achieve sustainable excellence in public digital services. Future research may extend this model to other Saudi public-sector institutions or examine additional mediating and moderating factors that may influence the relationship between AI capabilities and governance excellence.

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