The Interplay of Knowledge Management, E-Governance, and Business Performance Efficiency: Insights from Saudi Public Sector Institutions

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Abstract: - This study goes more deeply into the critical aspects of understanding knowledge management, e-governance, and performance efficiency in the Saudi public sector. Simultaneously, the main target is first to grasp how these aspects influence this kind of effectiveness, especially in light of this significant Vision 2030 of the State. By utilizing a technique, the research exploited determined it utilitarian of SMART PLS software to model Structural Equation Modeling (SEM) structure. The study involved 170 people, from the highest-level executives to entry-level employees and cross-section management, administration, and IT specialists. The given article will pursue the complexity of the characters' interactions while revealing some of the book's central lessons. T for this study tool, an elaborate questionnaire went through an extensive pretest phase where the content validity and reliability were verified through interviews with expert methods. In 2023, over a quarter of a year data collection period, the self-administered questionnaire was distributed to the representatives of different public institutions, which was done during the year 2023. We obtained some necessary information through the data found and processed using the SMART PLS and SEM. Outcomes highlighted the complex and multidimensional interrelationship of knowledge management, e-governance, and business performance efficiency, from which we make the knowledge of various factors facilitating the performance of the public sector offices in Saudi Arabia. Indeed, it is worth mentioning that the research endorses essential elements in line with Vision 2030, adding tangible directions to the policymakers, government leaders, and practitioners aiming to increase the productivity and effectiveness of public sector projects in the Kingdom.

Key-Words: - Knowledge Management, E-Governance, Business Performance Efficiency, Public Sector Institutions, Structural Equation Modeling (SEM), Saudi Arabia.

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1 Introduction

E-governance has been and practically is one of the core elements within Kingdome of Saudi Arabia's strategic plan of modernization and digitalization. The country is highly emphasized through this initiative since it reflects the primary strategic goal of enhancing transparency, efficiency, and engagement in public service. Electronic Governance translates into using electronic means to provide government services in such a way that they are easy to access, timely, and quickly purchased, [1], [2], [3]. E-governance plays a prominent role in improving govt. Service delivery in Saudi Arabia by simplifying procedures, diminishing bureaucratic stumbles, and boosting efficiency. While the electronic infrastructure is a necessary component, the

fulfillment of e-governance extends to more than just having an electronic system in place. This decomposition concerns using them, signs of what they improve, and knowledge management. In the frame of e-governance, knowledge management involves the ways of organizing and storing information, access to it, and the usage of that information for the improvement of government services and governance, [4]. The digitalized version of the Saudi economy is one of the most essential elements of the economic reforms announced in Vision 2030. The process affecting the parts of the society, the structure of governance, and the economy as an entity are included. The Ministry of Education and the Universities in Saudi Arabia are also in the digitization part of Vision 2030, [5]. Digitization of the governing process in Saudi Arabia has led to conforming citizens to the use of new technologies, turning towards the citizens-oriented government system, and reducing the public services provision by government agencies cost, [6]. Successful implementation of e-governance requires a focus on key aspects such as effective leadership, a conducive work environment, IT alignment, and organizational performance, [7]. These factors are crucial in driving digital transformation. Additionally, the establishment of a robust cybersecurity framework is identified as a key enabler for the implementation of e-government projects in Saudi Arabia.

Electronic governance, in conjunction with efficient reality management, represents the global trend for lasting improvement of institutional output. While the efficient management of knowledge in the public sector gives institutions an upper hand in exploiting all e-governance tools, e-governance can prioritize resource allocation, accountability, and transparency, which in turn creates the enabling environment that promotes e-governance methodologies, [8]. In this way, the process matters; it provides officials with data quicker to make the right decisions, [9]. Apart from that, once the people can quickly locate the information about the government services, their trust in the government is undoubtedly improved. These are the concrete advantages to be gained from e-governance and knowledge management: sophisticated service delivery, enhanced stakeholder engagement, and better decision-making, [9].

Nonetheless, the challenge of reaching comprehensive integration is a vexing matter. Apart from prominent aspects related to knowledge management in e-governance, government institutions must implement other practices to make their e-governance initiatives more effective, [10]. Staff training should be ongoing so that the workforce should be equipped with the skills to work with these e-government tools and consciously manage knowledge. Establishing feedback mechanisms with stakeholders is another step towards this objective. These processes help in using feedback from stakeholders and thus, in improving the outcomes of e-governance initiatives. Besides, infrastructural innovation should be recognized as necessary for the perfect coordination of business activities and better performance, [10].

Effective integration in public sector institutions should be looked at more as a matter of course than mere knowledge management integration. A peculiar knowledge to be imparted to the staff members is e-governance and knowledge management. Stakeholder feedback is invaluable in relating to e-governance issues; therefore, their input strengthens e-governance efforts. Upgrade the system infrastructure so that it can be widely used without difficulty and superior performance. E-governance is progressing rapidly in KSA despite the hindrances during the digital shift. This research focuses on how knowledge management within the e-governance of the public sector institutions in Saudi Arabia is correlated to the sector's business performance efficiency. Through a comprehensive understanding of knowledge management, e-governance, and organizational efficiency theories, it provides real-life, thought-provoking lessons to policymakers and grassroots professionals.

Moreover, look into the matters such as data availability and efficacy concerns. The study contributes substantially to the e-governance and knowledge management literature. Also, it may affect how the future of e-governance of the public sector institutions in Saudi Arabia will be viewed.

2 Literature Review and Hypothesis

2.1 Business Performance Efficiency
Amid all amount, the crucial role of efficiency of business operations, particularly in public sector IN governmental entities, cannot be understated for the sake of institutional FACE of the enterprise and its advancement. In a rapidly changing environment,

organizations are changing their ways of doing business to meet the requirement of producing goods and services with high efficiency and higher effectiveness. In addition to the broad reform of the public sector, performance contracting, a practical service management strategy, has gradually appeared. A study was performed by [11], after which performance contracting awareness in state corporates came to light. The researcher's findings showed a high degree of information and the organization's competence and ability to realize its objectives improved. Although this study has shown that the success of performance contracts also depends on employees' support and mutual trust, it also provides some directions to improve the implementation of performance contracts.

In the banking sector, a comparative study of financial performance was made by [12], where Public Sector Undertaking Banks (PSUB) were analyzed in terms of Private Sector Banks (PSB). Even during the worst possible scenarios or crises, Studies based on the CAMEL approach found that the public sector banking institutions gained many more advantages than private sector ones by account of such factors response to crisis - CAR, leverage ratio - NPA to NA; efficiency - ROA; liquidity - Liquid assets to total deposits.

Big data analytics technology was introduced during these days, influencing the government's performance. [13], addressed the impact of Big Data analysis potential on governmental efficiency, effectiveness, and fairness. Their results proved that data analytics capability of different degrees plays a primary role in changing the government, enabling it to compete successfully in the private sector.

In a conclusive point, [14], showed the insurance sector's financial performance, a main part of the economy as well as the macro sector. Research of those Indian Public Sector Non-Life Insurance Companies figured out that such factors as commission, claims incurred, investment income, net premium earned, and operating expenses had the greatest influence on financial performance.

2.2 Electronic Interaction and Performance Efficiency

Digital intercourse, where technologies like computers and cell phones constitute the main toolbox in e-government, is a foundation of e-government. It is a medium for efficient communication over the governmental structure and,

thus, turns bureaucratic procedures into more transparent, easy, and convenient services for the people. [15], examined the suitability of an integrated electronic government adoption model (UMEGA). Through their research, the said team concluded that specific factors, such as performance expectancy, effort expectancy, and social influence, do not directly relate to a citizen's attitude towards e-government services. Nevertheless, the facilitating environment of e-government was established as one of the main determinants of both the intention and effort expectancy of e-service usage. In addition, the investigation centered on the critical factor of trusted public service quality and trust in its positive feedback loop the e-government usage, and word of mouth. In e-government services, factors like trust and quality of service play determinant roles in shaping the opinions and actions of the citizens.

In the [16] study, where the UTAUT model was used to assess the citizens' behavior towards e-government services in northern Iraq, the authors sought to explore how the e-government adoption has been playing among citizens in the country. This fundamentally changed the UTAUT model by the insertion of two other concepts: "System trust (TOS)" and "Internet ethics (EOI)". The results clearly show that all constructs are very influential in the intention of people to use e-government services. Safety, ethics, and overall trust were all considered key factors in the intention of people to use e-government services. In addition, [17], also measured the effectiveness of e-government efficiency regarding network facilities. They carried out the analyses to increase ICT network readiness among the countries by implementing the Data Envelope Analysis (DEA) method. This study has confirmed the significant role of ICT network readiness among the other e-government services in their developedness. This research proposes the following hypothesis:

H1: Electronic interaction affects business efficiency in KSA public sector institutions.

2.3 Electronic Services and Performance Efficiency

If e-government services are provided in electronic form, it provides the opportunity for performance and operations efficiency through digital services provision and modernization. Integrating ICT into those services allows us to maximize the provided

services' transparency and informative efficiency level.

According to [18], IoT is included in the growing topic of Information Management (IM), and the new issue is how IoT can be applied in the IM field. Such digital scholars underscored the connections of entities within devices and systems to boost human productivity and system outputs. The research revealed that the Internet of Things (IoT) technologies could significantly assure service delivery optimization as well as the proper handling of workload issues in online governance.

Urban studies are one of the latest research findings, [19], examining the term Smart City, which includes information communications technologies and the Internet of things. The study clearly emphasized the prospects for such technologies to improve the efficacy of services through information sciences and apply them to various problems. The study clarified that the future of bureaucratic or traditional service provision was challenged following the deployment of electronic services due to overcoming deficiencies with data collection from the people and devices and the resulting enhancements in community services.

Moreover, [20], demystified the role of blockchain innovation in supply chain management systems. Although this study considers blockchain within a supply chain, its principles of decentralization, persistence, anonymous-ness, and audit-ability can be used as a base for any e-government service to improve its performance. Using new-generation technologies, such as the IoT and blockchain, governments can evenly enhance operations, increase transparency, and strengthen the relationship between the state and the people through interactive dynamics. This research proposes the following hypothesis: This research proposes the following hypothesis:

H2: electronic services affect business efficiency in KSA public sector institutions.

2.4 Transparency, Accountability, and Performance Efficiency

The pillars of e-government, transparency, and accountability, as the most essential values, lead the way. Blending digital technologies and e-governance platforms has brought systematicity to the administrative system and has done transparency and accountability of governance procedures.

In their study [21], they noticed how the improved technology of a new wave of E-Government can result in improved governance with a higher level of transparency, accountability, efficiency, and effectiveness.

The following is an article by [22], that has focused on the effects of the central bank on the activities of the local leadership, accountability, and financial transparency. According to the findings, such a system enables local government management performance by showing the pivotal role of openness and sincerity. This research proposes the following hypothesis:

H3: Transparency and accountability affect business efficiency in KSA public sector institutions.

2.5 Continuous Improvement and Performance Efficiency

E-government must adapt to citizen needs and technological advances through continuous improvement. Thanks to regular evaluations, feedback, and technology integration, e-government services are efficient and effective.

[23], highlighted Kaizen, a Japanese management philosophy, as a global business philosophy for continuous performance improvement. Effective continuous improvement programs result in cost efficiency, waste reduction, and product quality improvement. The study found that Kaizen has improved performance in many companies, but its implementation outside Japan often fails, emphasizing the need for adaptability.

[24], also stressed the importance of ICT network readiness competency in improving service quality and efficiency in successful e-governments. The study suggested using Data Envelope Analysis (DEA) to improve ICT network readiness between countries. The findings showed that ICT investment and economic performance boost the maturity of e-government demand, supply, and service. This study hypotheses:

H4: Continuous improvement affects business efficiency in KSA public sector institutions.

2.6 Effective use of Information Technology and Performance Efficiency

IT efficiency evolved as the uttermost factor of success in e-government. The advent of e-governance platforms, online services, and data-driven decision-

making has meant improved performance in administration, service delivery, and governance, as well as increased citizen participation.

According to [25], data-driven intelligent technologies also enhance city-data performance and productivity. Instant data and information that make up for how it impacts our ecosystem can also increase productivity, irrespective of whether it is related to the environment, society, or economy. It was learned that in-depth data analysis assists in problem detection and resolution. The study dug into the prevailing pattern of big data use along with a short introduction of the central ideas, such as IoT-enabled data and blockchain-enabled data, to perceive its function in different domains.

[26], designed an E-Government platform. IoT technology generated an intelligent basis here. The contribution of this study to digital transformation and data integration in the various government services is particularly commendable. Departments, levels, and regions were channels for data sharing and exchange. The assessment revealed the primary trend intelligent cities are based on: community engagement and using the crucial factor as a criterion for city planning - the human and social capital.

Furthermore, [27], involves e-government budget risk management. The researchers suggest that modern information and communication technologies - are the driver of e-government. A novel approach to improve e-government performance in complex financial systems was used to study budgetary risk management. This research proposes the following hypothesis: A novel approach to improve e-government performance in complex financial systems was used to study budgetary risk management. This research proposes the following hypothesis:

H5: The effective utilization of Information Technology affects business efficiency in KSA public sector institutions.

2.7 Cyber Security and Performance Efficiency

Cybersecurity has gained a higher degree of significance as government services transit to the digital arena. The performance efficiency of e-government inflation also depends on data privacy and public sector trust.

[28], released their conceptual design of an Intellectual Contract Platform for a blockchain-based intelligent contract platform for patient vital signs monitoring. The study emphasized the data integrity of electronic healthcare systems. Example: How did the classroom environment impact your learning experience and academic performance? The given system is based on blockchain technology, which builds up an immutable database that ensures the ability of all the disputants to access global medical information. The digital market highlights the vital cyber security in the e-health system in terms of efficiency and reliability.

[29], proposed a blockchain-based integrated IoT platform, highlighting the potential risks of current centralized architectures. The research revealed that the majority of IoT sites opted for centralized architectures, exposing themselves to cyber-attacks and single points of failure. The platform, utilizing blockchain technology, generates an immutable ledger, a necessary step to enhance the cybersecurity of IoT systems, which is crucial for system performance.

In another study, [30], proposed a blockchain-based medical platform with a smart contract for EMR protection. The report placed special importance on health data privacy and the openness of healthcare. The research's hypothesis is as follows:

H6: Cybersecurity affects business efficiency in KSA public sector institutions.

2.8 Knowledge Management

Knowledge Management (KM) holds immense potential for the public sector, particularly in the realm of e-government. Embracing KM cannot only enhance performance and streamline processes but also empower decision-making, promising a brighter future for public sector operations.

The research conducted by [31] delved into the characteristics and triggering factors of organizational inertia that impede the effectiveness of knowledge management (KM) in the UAE public sector. The findings underscored the pivotal role of transformational leadership, exterior items, and organizational climate in mitigating resistance and fostering the adoption of personalized management applications. This insight is crucial for understanding how information technologies can catalyze access, adoption, and dissemination of knowledge.
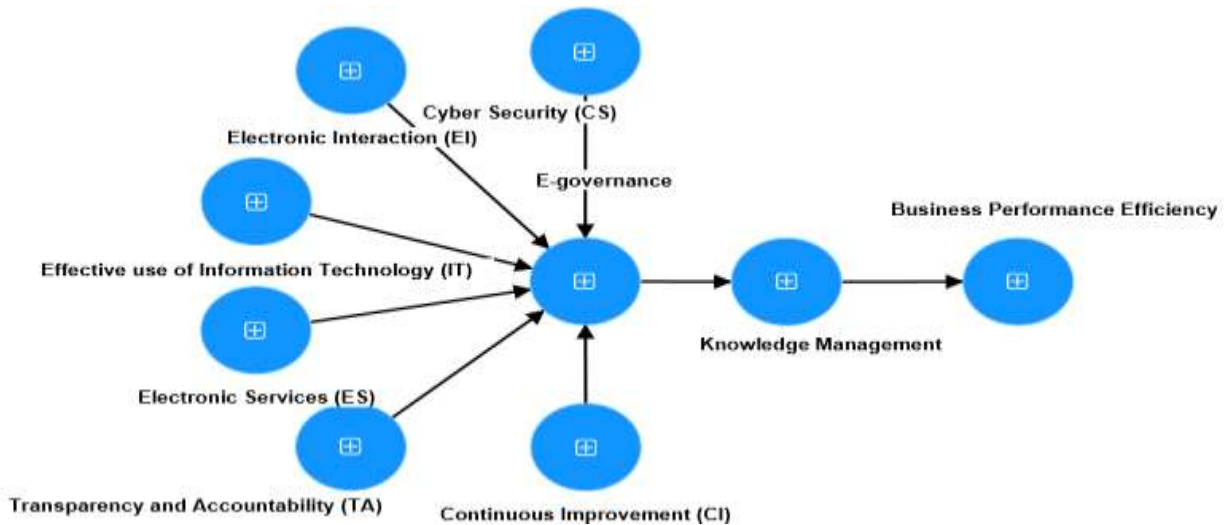
Fig. 1: Study model

[32], takes a comprehensive approach, examining various aspects of the public sector, including performance, management, attitude, and measurement.

While the breadth of their study is extensive, it provides us with a valuable lens through which to examine the potential contributions of knowledge management to enhancing the public sector's performance.

From the existing literature, it is clear that Knowledge Management is a crucial element in the development of more efficient functioning of government agencies. However, it is the integration of this knowledge management with transformational leadership and the cultivation of a suitable work culture that holds the key to unlocking improved efficiency and performance outcomes. This research puts forward the following hypotheses:

H7: Knowledge Management mediates the relationship between electronic interaction and business efficiency in KSA public sector institutions.

H8: Knowledge Management mediates the relationship between electronic services and business efficiency in KSA public sector institutions.

H9: Knowledge Management mediates the relationship between transparency, accountability, and business efficiency in KSA public sector institutions.

H10: Knowledge Management mediates the relationship between continuous improvement

initiatives and business efficiency in KSA public sector institutions.

H11: Knowledge Management mediates the relationship between the effective utilization of Information Technology and business efficiency in KSA public sector institutions.

H12: Knowledge Management mediates the relationship between Cybersecurity and business efficiency in KSA public sector institutions.

3 Method

This study, which specifically includes 170 Saudi public sector managers, administrators, and IT specialists, is designed to provide a nuanced understanding of how knowledge management affects the complex relationship between e-governance and business performance efficiency in Saudi Arabian public sector entities. This targeted selection ensures the findings are directly applicable to your professional context. The authors employed a rigorous process to develop the questionnaire, including extensive interviews with methodology experts and a thorough literature review. This process ensured the questionnaire met the highest content, construction, and validity standards, thereby enhancing the reliability of the data collected.

The self-administered questionnaire, structured on a 5-point Likert scale, was distributed to Saudi public sector representatives for three months in 2023 to collect consistent and accurate responses. Despite

the sample's geographical confinement, the authors ensured that the questionnaire's meticulous design and data collection process maintained the results validity and reliability.

Figure 1 presents the study model, which served as the foundation for the questionnaire. The model was developed based on a comprehensive literature review and aimed to address the research problem of understanding the complex relationship between knowledge management, e-governance, and public sector business performance efficiency. The variables in the questionnaire were carefully chosen to align with this model. Sections of the questionnaire collected demographic data and opinions on the variables. Based on the literature review, the questionnaire focused on knowledge management's core aspects and their effects on e-governance and business performance.

Table 1 shows the items and variables used in questionnaire development. Each item is explicitly linked to academic sources, demonstrating how relevant research and theories shaped the questionnaire. This method gives the survey scholarly roots, boosting its credibility. The questionnaire covers knowledge management, e-governance, and business performance efficiency. The questionnaire examines the complex relationships between these variables by including items related to these critical dimensions and aligning them with the Kingdom's Vision 2030. This method allows the research to fully understand the factors affecting Saudi public sector institution effectiveness and efficiency.

A literature review guided this study's evaluation of three methods to assess the study's model: multiple linear regression (MLR), system dynamics (SD), and structural equation modeling. MLR failed to account for variable interdependence, making it inapplicable. SD was eliminated due to data type. SEM, specifically partial least squares-structural equation modeling (PLS-SEM), was the best method for examining the relationships between observable and unobservable factors.

Table 1. Questionnaire Development

Variable	Source
Business Performance Efficiency	[11] [12] [13] [14]
Electronic Interaction and Performance Efficiency	[15] [16] [17]
Electronic Services and Performance Efficiency	[18] [19]
Transparency, Accountability, and Performance Efficiency	[21] [22]
Continuous Improvement and Performance Efficiency	[23] [17]
Effective Use of IT and Performance Efficiency	[21] [26] [27]
Cyber Security and Performance Efficiency	[28] [29]
Knowledge Management	[31] [32]

4 Results

Study models need high validity and reliability. Smart PLS estimated trajectory models from latent variables using trajectory modeling algorithms to investigate construct correlations. Also estimated were data measurement and structural model, [33]. To assess the study model's reliability and validity, Cronbach's alpha, composite reliability, and average variance were extracted to assess variable stability and saturation with their underlying constructs.
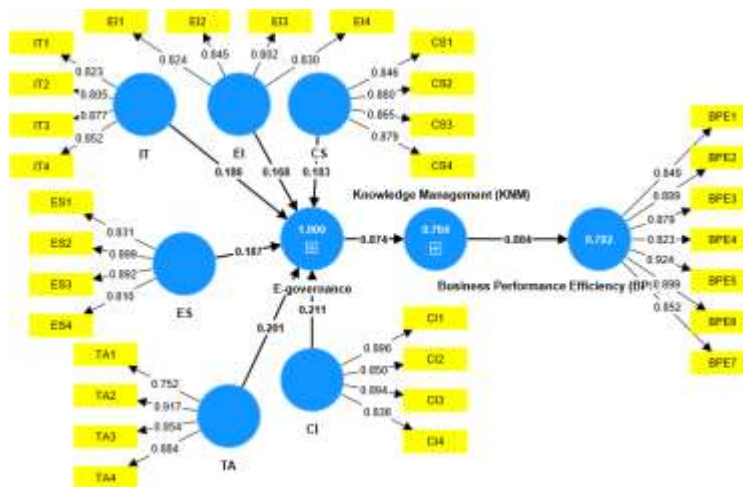

Fig. 2: Output loading of factors

To illustrate the internal reliability and convergent validity of each construct in this study, Table 2 and Figure 2 present all information concisely. Internal reliability identifying factors include necessary measures, among them the composite reliability (CR), Cronbach's alpha, and the average variance extracted (AVE).. While convergent validity is established by the loadings of items on their appropriate constructs, discriminant validity is examined by the correlation matrix values between the constructs.

Table 2. Internal reliability and convergent validity

Variables	Items	Loadings	Alpha CA	Cronbach	Composite reliability CR	Average variance values AVE
Continuous Improvement (CI)	CI1	0.896				
	CI2	0.850				
	CI3	0.894		0.893	0.892	0.756
	CI4	0.836				
Cyber Security (CS)	CS1	0.846				
	CS2	0.880		0.891	0.890	0.753
	CS3	0.865				
	CS4	0.879				
Electronic Interaction (EI)	EI1	0.824				
	EI2	0.845	0.848		0.844	0.681
	EI3	0.803				
	EI4	0.830				
Electronic Services (ES)	ES1	0.831				
	ES2	0.899	0.887		0.881	0.738
	ES3	0.892				
	ES4	0.810				
Effective use of Information Technology (IT)	IT1	0.823				
	IT2	0.805		0.861	0.860	0.705
	IT3	0.877				
	IT4	0.852				
Transparency and Accountability (TA)	TA1	0.752				
	TA2	0.917		0.884	0.875	0.729
	TA3	0.854				
	TA4	0.884				
Knowledge Management (KNM)	KNM1	0.888				
	KNM2	0.888				
	KNM3	0.866				
	KNM4	0.884		0.951	0.951	0.771
	KNM5	0.861				
	KNM6	0.905				
	KNM7	0.855				
Business Performance Efficiency (BPE)	BPE1	0.849				
	BPE2	0.889				
	BPE3	0.879				
	BPE4	0.823		0.951	0.948	0.764
	BPE5	0.924				
	BPE6	0.899				
	BPE7	0.852				

All constructs in the study demonstrate solid psychometric properties, each achieving good convergent validity and internal reliability. Continuous Improvement (CI) captures 75.6% of item variance (AVE = 0.756) and exhibits internal solid consistency (CR = 0.892, α = 0.893). Cyber Security (CS) displays good convergent validity (AVE = 0.753), along with strong internal consistency (CR = 0.890, α = 0.891). Electronic Interaction (EI) demonstrates reasonable convergent validity (AVE = 0.738) and notable internal consistency (CR = 0.844, α = 0.848). Electronic Services (ES) meets convergent validity standards (AVE = 0.705) and shows good inner character (CR = 0.881, α = 0.887). Effective Use of Information Technology (IT) achieves reasonable convergent validity (AVE = 0.729) and strong internal consistency (CR = 0.875, α = 0.884). Transparency and Accountability (TA) exhibits strong convergent validity (AVE = 0.771) and exceptional internal consistency (CR = 0.951, α = 0.951). Knowledge Management (KNM) demonstrates reasonable convergent validity (AVE = 0.764) and robust internal consistency (CR = 0.948, α = 0.951). Business Performance Efficiency (BPE) indicates good convergent validity (AVE = 0.771) and excels in internal consistency (CR = 0.951, α = 0.951), with substantial item loadings supporting convergent validity.

Discriminant validity, crucial in Partial Least Squares Structural Equation Modeling (PLS-SEM), evaluates how distinct measurement constructs are [34]. Common criteria include Fornell-Larcker and Heterotrait-Monotrait (HTMT), [34], [35]. Fornell-Larcker compares construct correlations to their square root of Average Variance Extracted (AVE).

The importance of discriminant validity evaluation in the context of PLS-SEM methods cannot be overstated. It is a crucial step in ensuring the accuracy of results. A construct's AVE square root must exceed its correlation with others to be discriminant, [36]. HTMT validates construct and item correlations when the correlation ratio is below 1. Fornell-Larcker and HTMT are popular PLS-SEM methods, [37].

The Cornell-Larcker discriminant validity, a well-known and trusted method, is demonstrated in Table 3. The off-diagonal parts reveal construct correlations, while the diagonal elements display AVE square roots. The AVE values, a key component, consistently surpass the off-diagonal correlations, thereby proving the construct's discriminant validity.

The findings of the discriminant validity evaluation are as follows: Business Performance Efficiency (BPE) demonstrates strong validity with an AVE square root of 0.874. Continuous Improvement (CI) also shows strong validity with a score of 0.869. Cyber Security stands out with a score of 0.868. Electronic interaction (EI) has an AVE square root of 0.826. Electronic Services (ES) is valid with a score of 0.859. Effective IT use scores 0.840. The KNM score is 0.878. Transparency and Accountability (TA) distinguish themselves with a score of 0.854.

These findings verify each construct's uniqueness, validating measurement models and indicators.

[38], say the two reflective structures are almost identical and have a weak association when the HTMT criterion is less than 0.90. Table 4 shows all values below 0.90, demonstrating reliability and validity. Therefore, the model's discriminant validity (HTMT) is reliable because it meets minimum values and excludes various collinearities.

Table 3. The results of the discriminant validity of the items (Fornell-Larcker criterion)

	BPE	CI	CS	EI	ES	IT	KNM	TA
BPE	**0.874**							
CI	0.807	**0.869**						
CS	0.650	0.688	**0.868**					
EI	0.726	0.736	0.641	**0.826**				
ES	0.742	0.729	0.678	0.766	**0.859**			
IT	0.780	0.778	0.742	0.732	0.714	**0.840**		
KNM	0.745	0.744	0.692	0.698	0.735	0.780	**0.878**	
TA	0.703	0.749	0.698	0.730	0.695	0.750	0.842	**0.854**

Table 4. HTMT Discriminatory Validity Test

	BPE	CI	CS	EI	ES	IT	KNM	TA
BPE								
CI	0.875							
CS	0.708	0.771						
EI	0.807	0.842	0.735					
ES	0.809	0.820	0.763	0.883				
IT	0.862	0.886	0.850	0.855	0.816			
KNM	0.821	0.817	0.751	0.773	0.800	0.861		
TA	0.878	0.855	0.787	0.843	0.788	0.863	0.917	

Table 5. Criteria for the study model structural fit

Variables	R-Square	R-Square Adjusted	Variance Explained
Business Performance Efficiency (BPE)	0.782	0.781	High
Knowledge Management (Knm)	0.764	0.763	High

Table 6. *Results of GOODNESS-OF-FIT*

	Saturated model	Estimated model
SRMR	0.080	0.081
d_ULS	2.799	3.011
d_G	0.953	0.987
Chi-square	2229.145	2269.767
NFI	0.922	0.955

R^2 assesses model fit and predictability, measuring how much variance in endogenous constructs is explained by exogenous constructs and the model's effect size. In this study, it is applied to evaluate the structural model's explanatory power. As shown in Table 5, Business Performance Efficiency (BPE) has an R-Square of 0.782, signifying it explains 78.2% of the variance, with an Adjusted R-Square of 0.781, indicating a high explanatory potential. Knowledge Management (KNM) explains 76.4% of the variance with an R-Square of 0.764 and an Adjusted R-Square of 0.763, showing high explanatory power. These results validate the model's ability to clarify relationships among variables.

Table 6 displays goodness-of-fit analysis for both saturated and estimated models. SRMR, measuring the difference between observed and expected correlations, is slightly higher in the saturated model but still indicates a good fit. D_ULS, assessing model fit, remains acceptable in both models. D_G, comparing fitted to saturated models, shows minor increases in the estimated model, signifying a good fit. Chi-Square values are relatively small, indicating a good model fit. NFI is higher in the estimated model, demonstrating improved fit over a null model.

Examining hypotheses was conducted following the confirmation of the variables' non-overlapping dimensions and the study data's adherence to a normal distribution. The Partial Least Squares (PLS) analysis, employing the bootstrapping technique with 5000 resamples, scrutinized the direct and indirect effects among the study variables, as illustrated in Figure 3. This rigorous analysis approach ensures robust testing of the hypothesized relationships within the model.
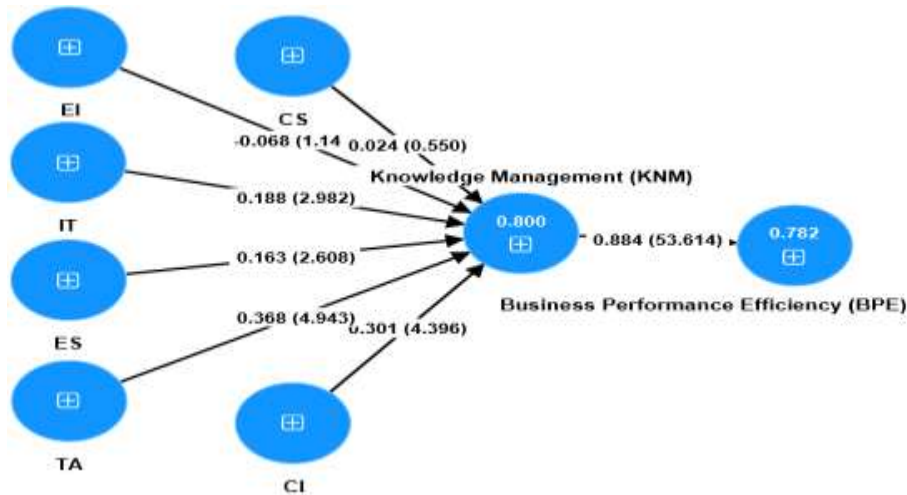
Fig. 3: Structural Model (Bootstrapping @5000)

Table 7. Hypothesis testing

Relationship	β	T statistics (|O/STDEV|)	P values	Decision
H1: EI -> BPE	-0.061	1.146	0.252	Hypothesis Rejected*
H2: ES -> BPE	0.144	2.600	0.009	Hypothesis Accepted**
H3: TA -> BPE	0.325	4.993	0.000	Hypothesis Accepted**
H4: CI -> BPE	0.266	4.356	0.000	Hypothesis Accepted**
H5: IT -> BPE	0.166	2.980	0.003	Hypothesis Accepted**
H6: CS -> BPE	0.021	0.550	0.583	Hypothesis Rejected*
Significant at P** =< 0.01, p*<0.05				

Table 8. Indirect Effects

Relationship	Indirect Effect			Bootstrapped Confidence Interval		Decision
	Path Coeff	t-Value	Significance level P	2.5%	97.5%	
H7: EI -> KNM -> BPE	-0.061	1.146	0.252	-0.162	0.044	No mediation
H8: ES -> KNM -> BPE	0.144	2.600	0.009	0.035	0.250	Partial mediation
H9: TA ->KNM -> BPE	0.325	4.993	0.000	0.193	0.451	Partial mediation
H10: CI -> KNM -> BPE	0.266	4.356	0.000	0.151	0.391	Partial mediation
H11: IT -> KNM -> BPE	0.166	2.980	0.003	0.062	0.282	Partial mediation
H12: CS -> KNM -> BPE	0.021	0.550	0.583	-0.056	0.093	No mediation
Significant at P** =< 0.01, p*<0.05						

Table 7 details the outcomes of hypothesis testing, investigating the associations between various factors and Business Performance Efficiency (BPE). The analysis encompasses the beta coefficient (β), T statistics, P values, and decisions based on the significance level.

Firstly, concerning Electronic Interaction (EI) and its relationship with BPE (H1), the obtained coefficient (β) of -0.061, a T statistic of 1.146, and a P-value of 0.252 led to the rejection of the hypothesis. This suggests that Electronic Interaction does not significantly impact Business Performance Efficiency in the studied scenario.

However, Electronic Services (ES) positively correlated with BPE (H2). Hypothesis acceptance was supported by a coefficient (β) of 0.144, a T

statistic of 2.600, and a P-value of 0.009. This implies that Electronic Services significantly improve Business Performance Efficiency.

Transparency and Accountability (TA) positively correlated with BPE (H3). With a β of 0.325, a T statistic of 4.993, and a P-value of 0.000, the hypothesis was accepted with high significance (P** = < 0.01). This shows how Transparency and Accountability affect business performance efficiency.

Continuous improvement (CI) also positively correlated with BPE (H4). A coefficient (β) of 0.266, a T statistic of 4.356, and a P-value of 0.000 supported the hypothesis at a high significance level (P** = < 0.01). This suggests that Continuous Improvement boosts Business Performance Efficiency.

Effective IT use was positively and statistically significantly associated with BPE (H5). The hypothesis was accepted at a significance level of P* < 0.05, with a coefficient (β) of 0.166, a T statistic of 2.980, and a P-value of 0.003. This means that IT effectively improves business performance efficiency.

However, Cyber Security (CS) and BPE (H6) were not significantly related. The hypothesis was rejected due to a coefficient (β) of 0.021, T statistic of 0.550, and P-value of 0.583, indicating that cybersecurity does not significantly affect Business Performance Efficiency.

Table 8 provides a detailed examination of the indirect effects of the study, focusing on the mediating role of Knowledge Management (KNM) in the relationships between distinct factors and Business Performance Efficiency (BPE). Each pathway is evaluated based on the path coefficient, t-value, significance level, and bootstrapped confidence intervals.

Firstly, concerning the relationship between Electronic Interaction (EI) and BPE (H7), the path coefficient of -0.061 with a t-value of 1.146 and a significance level of 0.252 indicates that Knowledge Management does not act as a mediator in this context. The indirect effect is not statistically significant.

Moving to Electronic Services (ES) influencing BPE through KNM (H8), the path coefficient of 0.144 with a t-value of 2.600 and a significance level of 0.009 signifies a statistically significant indirect effect. Knowledge Management partially mediates, influencing the relationship between ES and BPE.

For Transparency and Accountability (TA) influencing BPE through KNM (H9), the path coefficient of 0.325, a t-value of 4.993, and a significance level of 0.000 highlight a significant indirect effect. Knowledge Management partially mediates the relationship between TA and BPE.

Similarly, in the case of Continuous Improvement (CI) affecting BPE through KNM (H10), the path coefficient of 0.266, a t-value of 4.356, and a significance level of 0.000 indicate a statistically significant indirect effect. Knowledge Management acts as a partial mediator in this relationship.

Regarding the Effective Use of Information Technology (IT) influencing BPE through KNM (H11), the path coefficient of 0.166, a t-value of 2.980, and a significance level of 0.003 suggest a statistically significant indirect effect. Knowledge Management plays a partial mediating role in the relationship between IT and BPE.

Finally, for Cyber Security (CS) influencing BPE through KNM (H12), the path coefficient of 0.021, a t-value of 0.550, and a significance level of 0.583 indicate a non-significant indirect effect. Knowledge Management does not mediate the relationship between CS and BPE.

In summary, Knowledge Management emerges as a partial mediator in the relationships between Electronic Services, Transparency and Accountability, Continuous Improvement, and Effective Use of Information Technology with Business Performance Efficiency. However, it does not mediate the relationships between Electronic Interaction and Cyber Security with Business Performance Efficiency.

5 Discussion

Investigating the relationships between electronic governance dimensions and business performance efficiency in public sector institutions yielded noteworthy results, aligning with and contributing to the existing literature. The study affirmed the pivotal role of business performance efficiency in institutional success, echoing prior research such as [11], focus on mutual support and trust in performance contracting. [15], findings on citizen attitudes support the rejection of H1 regarding electronic interaction and performance efficiency, but literature emphasizing the importance of electronic

services and governance transparency supports H2 and H3.

[23], emphasize the significance of continuous improvement initiatives (H4), and [17] emphasize the importance of ICT network readiness in enhancing e-government services. The accepted hypothesis H5, about effective IT use, aligns with the literature on data-driven intelligent technologies improving city performance and service delivery, [21], [27]. Despite the study's rejection of H6, the literature supports cybersecurity's importance in e-health system trust. Knowledge Management (KM) adoption is hindered by organizational inertia, as [31] found. H7 to H12 propose KM as a mediator, and the literature emphasizes its transformative impact on organizational processes and decision-making, [32]. The study shows how electronic governance dimensions and KM interact, helping us understand how knowledge practices mediate e-government's complex relationships. The study confirms previous findings and deepens our understanding of the complex dynamics affecting public sector efficiency in the digital age.

The study adds knowledge by showing how electronic governance dimensions affect business performance efficiency. The findings illuminate the role of continuous improvement, IT efficiency, and KM in e-governance. Policymakers, practitioners, and researchers seeking to improve public sector efficiency can learn from the findings.

Limitations and Future Research: Future research can benefit from acknowledging the study's temporal constraints and contextual variations. Cross-cultural and longitudinal studies could clarify the relationship between electronic governance dimensions and business performance efficiency. Future research could examine how new technologies and cyber threats affect e-governance.

6 Conclusions

The study examines how electronic governance dimensions affect public sector business performance efficiency. Based on key findings, electronic services, transparency/accountability, continuous improvement, and IT utilization significantly affect performance efficiency. Cybersecurity was not directly related, but its role in ensuring trust and data integrity makes it essential in e-governance. The study's findings match e-governance trends and literature. Electronic services improve business

performance efficiency, aligning with global trends emphasizing digital services' transformative power. Existing research supports the study's focus on transparency, accountability, continuous improvement, and IT efficiency.

Practically, policymakers and practitioners face significant implications. The study emphasizes a holistic approach, including transparent practices, continuous improvement, and IT expertise to complement electronic services. This multifaceted strategy boosts efficiency, citizen satisfaction, and trust.

This research sheds light on the crucial role of Knowledge Management (KM) as a mediator between electronic governance dimensions and business performance efficiency. This aligns with KM's growing significance as a catalyst in organizational processes and decision-making. Understanding KM's mediating role can significantly enhance electronic governance initiatives, providing a new level of insight for policymakers and practitioners.

The study advances the theoretical and empirical foundations of e-governance. The explicit focus on continuous improvement initiatives and KM's mediating role adds to knowledge.

Future research can address limitations and the changing nature of e-governance. Longitudinal studies may reveal electronic governance's long-term effects. Cross-cultural analyses may reveal contextual differences in relationships. The intersection of emerging technologies, cyber threats, and e-governance practices warrants further study.

Outside of academia, the findings of this study hold significant weight, influencing the very fabric of policymaking and practice. They shape the trajectory of e-governance strategies, viewing it as an evolving ecosystem based on transparency, continuous improvement, IT efficiency, and KM. This underscores the importance of your work and the potential impact it can have on the public sector in the digital age.

The research reveals the complex dynamics of electronic governance and its profound impact on public sector efficiency. Empirical findings, literature alignment, and practical implications form an e-governance roadmap. This study illuminates the path to more efficient, transparent, and adaptive governance for public sector institutions in the digital age.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process
During the preparation of this work, the authors used QuillBot and SciSpace in order to improve the readability and language of the manuscript. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Conflict of Interest

The authors have no conflicts of interest to declare.