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INTERNAL AUDITING AND ORGANIZATIONAL CULTURE AS PILLARS OF IT GOVERNANCE: EVIDENCE FROM THE SAUDI ARABIAN HEALTHCARE SECTOR USING PLS-SEM

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ABSTRACT

This study examines the crucial role of internal auditing in strengthening information technology (IT) governance in the healthcare sector of Saudi Arabia, a field undergoing rapid transformation under Vision 2030. The purpose of this study is to develop and assess a conceptual framework that incorporates internal audits and organisational culture as independent variables while evaluating risk management and compliance as mediators that influence the effectiveness of IT governance. A technique known as partial least squares structural modelling (PLS-SEM) was used to analyse responses from 652 healthcare professionals. The results emphasise the value of internal auditing in governing information technology by demonstrating the importance of risk assessment, mitigation, and compliance support. A positive organisational culture, which serves as a key enabler for effective governance practices, also contributes to enhancing these effects and creating a more transparent and accountable environment, ultimately leading to improved patient care and operational efficiency. Policymakers and executives in the healthcare industry can benefit from the study's informative and practical insights to strengthen IT governance through the internal audit function. All indicators of internal auditing demonstrate strong loadings above 0.7, confirming their strong reliability as measures of the construct. Organisational Culture (OC) shows the strongest correlation with other constructions, particularly IT Governance (0.813) and Internal Audit (0.743).

KEYWORDS: Internal Audit; IT Governance; Risk Management; Compliance; Organizational Culture.

1. INTRODUCTION

Information technology (IT) governance is crucial for organizational success, particularly in the healthcare industry, where it involves managing sensitive patient data. Effective IT resource management directly influences operational efficiency and regulatory compliance. The board's corporate governance of IT establishes and implements processes, structures, and relational mechanisms that enable business and IT personnel to carry out their responsibilities, support business/IT alignment, and generate business value from IT-enabled business investments.

Globally recognized frameworks such as (COBIT) and ITIL provide structured approaches to align IT operations with strategic goals, manage risks, and support decision-making processes (Héroux & Fortin, 2013). However, the healthcare sector faces several challenges in applying these frameworks. These include stringent regulatory requirements, increasingly complex IT infrastructures, and heightened data protection demands (Al-Taee & Flayyih, 2023).

The Saudi healthcare industry, currently undergoing rapid transformation as part of Saudi Vision 2030, is particularly affected by these challenges. Saudi Vision aims to leverage innovative technologies to enhance healthcare delivery and operational efficiency. The Kingdom promotes digital health initiatives, IT integration, and strong governance frameworks to advance comprehensive economic and social reforms as part of its national agenda. In line with these objectives, prior research has identified shortcomings. The implementation of IT governance in healthcare institutions, including misalignment with organizational strategy and inadequate risk management practices in digital transformation (Abu-Musa, 2008). Addressing these shortcomings is essential to achieving healthcare objectives.

Internal auditing plays a significant role in mitigating these shortcomings. It mitigates risk, ensures compliance, and strengthens governance effectiveness by analyzing and evaluating IT governance frameworks, verifying their alignment with business objectives, and providing recommendations (Weill & Ross, 2004). However, the role of the internal auditor in evaluating the effectiveness of IT governance remains unrecognized in some sectors, particularly regarding their impact on critical outcomes such as risk management and compliance. Moreover, organizational culture supports the internal audit function by fostering transparency and accountability, thereby ensuring the effectiveness of IT governance.

This study adopts a conceptual framework that considers internal audits and organizational culture as independent variables, emphasizing their role in enhancing IT governance effectiveness through the mediating roles of risk management and compliance. It addresses the gap between theory and practice in the healthcare sector, where limited attention has been paid to the interactions between internal auditing, IT governance, risk management, and organizational culture.

The objectives of this research are to: Investigate how internal audit functions contribute to improving IT governance by providing oversight, transparency, and alignment with strategic IT objectives in the Saudi healthcare sector. Analyze the role of internal audits in identifying, assessing, and mitigating IT-related risks by examining internal audit practices that strengthen risk management. Evaluate the extent to which internal audit functions facilitate compliance with IT governance legislation, policies, and industry standards. Examine the significance of the relationships between organizational culture (OC), risk management (RM), and compliance (C).Evaluate the mediating impact of risk management (RM) and compliance (C) on the relationship between internal audit (IA) and IT governance (ITG).

This study is significant for several reasons.

First, it advances Saudi Vision 2030 by providing insights into factors that reinforce IT governance, thereby supporting the Kingdom's digital transformation objectives in healthcare.

Second, it deepens understanding of how organizational culture influences governance outcomes by incorporating it as an independent variable.

Third, it employs partial least squares structural equation Modeling (PLS-SEM), a robust methodological approach that allows for in-depth analysis of complex interactions between latent variables.

The study contributes to both the theoretical advancement and the practical improvement of healthcare IT governance practices. Based on its findings, healthcare organizations are expected to strengthen their IT governance, compliance mechanisms, and risk mitigation strategies.

The following section provides a comprehensive literature review that discusses the theoretical foundation of this study and highlights gaps in existing research. The section thereafter presents the research methodology, including the data collection process and research model. This is followed by the

results section, and the last section presents the conclusions

2. LITERATURE REVIEW

2.1. The Role Of Internal Auditing In IT Governance Effectiveness

Internal auditing is vital for ensuring the effectiveness of IT governance, as it provides independent assurance that IT processes and controls are aligned with organizational objectives, and that governance mechanisms are appropriate, sufficient, and functional. It achieves this by evaluating the IT governance framework, identifying risks, ensuring compliance with internal and external regulations, and recommending corrective actions.

In regulated industries such as healthcare, internal auditing becomes even more critical. According to Abu-Musa (2008), when investigating IT performance, the internal audit function varies in Saudi organizations depending on industry type, organizational objectives and characteristics, and the number of IT audit specialists. Furthermore, Moorthy et al. (2011) emphasizes that integrating contemporary information technology into internal audit methods enables more accurate and timely assessments of IT systems. Yolanda et al. (2020) also argue that establishing effective audits and implementing adequate internal controls are essential for developing good governance practices within organizations. The Institute of Internal Auditors (IIA) (2012) indicates that internal audit evaluations typically include assessing the alignment of IT governance activities and standards with the organization's risk appetite. Simonsson et al. (2010) link IT governance maturity to the quality of internal auditing, highlighting that organizations with high maturity levels obtain greater value from their auditing functions.

H1: Internal Audit (IA) and IT Governance (ITG) have a significant positive relationship.

2.2. Internal Auditing's Impact on Risk Management and Compliance

Beyond its role in IT governance, internal auditing is critical for strengthening an organization's risk management and compliance mechanisms. Steinbart et al. (2018) describe the confirmatory role of internal auditing in ensuring the efficiency of information security and emphasize that effective IT governance structures mitigate IT risks. They also demonstrated that strong cooperation between internal auditing and information security improves the efficiency of risk management and compliance initiatives. This view is reinforced by the digitalization efforts noted by Al-Mohammedi (2020).

Klinke and Renn (2021) characterize risk management as a cohesive discipline that integrates governance with strategic decision-making. Veerankutty et al. (2018) note that ITG mechanisms assist in risk mitigation and IT business value creation, while also showing that internal audit functions facilitate the early identification of IT-related risks, thereby strengthening risk management systems. Hosban and Hamdan (2015) argue that internal auditors ensure IT infrastructure can withstand increasing digital risks. Rahayu et al. (2020) demonstrate that a proactive audit approach not only enhances regulatory compliance but also fosters continuous improvement in risk management processes.

Similarly, Racz et al. (2010) advocate for integrating IT governance and risk management into a unified framework. Raghupathi et al. (2023) emphasize the essential role of risk management in safeguarding sensitive healthcare data, while Vance et al. (2018) stress the importance of accountability and transparency in governance processes, which in turn enhance regulatory compliance.

The healthcare sector is subject to particularly stringent regulatory oversight. Zasada et al. (2023) assert that compliance mechanisms reduce regulatory violations and improve organizational performance. Debreceny (2013) defines IT governance as a subset of auditing, of broader corporate governance, focusing on the role of information technology within organizations. From this perspective, implementing compliance strategies is necessary to address IT risks. Ghaffari Heshajin et al. (2024) highlight health information governance goals, which include compliance with policies, legal regulations, and privacy protection through alignment of IT governance, risk management, and compliance. The IIA (2018) emphasizes that internal audits of IT governance should focus not only on the implementation of governance practices but also on the effectiveness of governance components, by identifying significant risks, detecting deficiencies in regulatory adherence, and ensuring compliance with both internal and external requirements.

Risk management translates internal audit findings and recommendations into actionable governance practices that enhance IT governance effectiveness. At the same time, compliance ensures that these practices meet regulatory and ethical standards.

H2: Internal audits (IA) and Risk Management (RM) have a significant positive relationship.

H3: Internal Audit (IA) and Compliance (C) have significant positive relationships.

2.3. The Influence Of Organizational Culture On Risk Management And Compliance

Organizational culture represents the shared values, beliefs, and practices that influence organizational behavior. Moorthy et al. (2011) argued that a culture prioritizing accountability, collaboration, transparency, and continuous learning improves governance outcomes by fostering effective risk management and compliance. When ethical behavior and open communication are emphasized, employees are more inclined to adhere to compliance standards and engage in proactive risk mitigation (Sabir & Naveed, 2021). Yornmu and Akushie (2025) emphasize the importance of organizational culture in enhancing stakeholder alignment and satisfaction, particularly in sectors undergoing rapid digital transformation.

Although a direct empirical link between culture and IT governance is still developing, the literature consistently indicates that a positive organizational culture reinforces internal audit efforts and strengthens risk management and compliance processes.

H4: Organizational culture (OC) and Risk Management (RM) have a significant positive relationship.

H5: Organizational Culture (OC) and Compliance (C) have a significant positive relationship.

2.4. IT Governance Frameworks And The Mediating Role Of Risk Management And Compliance

Formal IT governance frameworks, such as COBIT and ITIL, provide a standardized method to make the governance frameworks more practical, customizable, and easier to use, while ensuring alignment with organizational objectives. COBIT is a widely recognized framework for managing and administering IT organizations, developed by the Global Association for Information and Technology (ISACA) to help organizations derive value from IT while ensuring effective governance and risk management. COBIT assists Chief Information Officers (CIOs) and IT managers in aligning IT strategies with business objectives, enables auditors to assess IT processes and ensure compliance with governance standards, supports executives and managers in decision-making and risk management, and aids consultants in implementing and enhancing IT governance frameworks within organizations. ISACA's COBIT framework (2019) is globally recognized for its effectiveness in enhancing governance practices by implementing standardized processes for IT risk management, compliance, and value delivery. De Haes and Van Grembergen (2009) explained how organizations should leverage these frameworks by adapting them to achieve the IT governance goals. Rubino et al. (2017) analyzed how an IT governance framework and its processes enable the establishment of a robust internal control system, providing guidance for managers and auditors to improve risk management and compliance.

The IIA (2018) supports this view by highlighting that internal auditors can utilize IT governance frameworks, such as COBIT, to provide assurance services regarding governance practices and benchmark them against international standards. This benchmarking enables firms to identify deficiencies in their governance procedures and implement changes to enhance the effectiveness of IT governance.

The fundamental principles of IS audit (Cooke, 2018) and the visual modeling methodologies proposed by Almeida et al. (2017) and Powell et al. (2017) reinforce the idea that integrating internal audit functions within these frameworks yields synergistic advantages in monitoring and control. Another well-known framework, ITIL, provides a systematic approach to establishing high-quality IT services and optimizing service management processes (Gërvalla et al., 2018). Additionally, Ernawati and Wang (2023) stated that ITIL provides best practices for IT governance aligned with business requirements.

In health information technology, integrating digital solutions, as discussed by Zayas-Caban and Wald (2020) and Ghaffari Heshajin et al. (2024), has proven critical for supporting both research and clinical operations.

In healthcare, where IT governance ensures the safety of sensitive data and operational reliability, they highlighted the value of using COBIT to improve governance outcomes in hospitals. However, there remains a lack of focused studies on how applying these frameworks affects IT governance effectiveness in healthcare environments, such as Saudi Arabia, which has achieved rapid technological development in recent years.

In this integrated context, risk management and compliance serve as mediators conveying the impact of internal auditing on IT governance outcomes.

H6: Risk Management (RM) mediates the relationship between Internal Audit (IA) and IT Governance (ITG).

H7: Compliance (C) mediates the relationship between Internal Audit (IA) and IT Governance (ITG).

3. METHODOLOGY

3.1. Research Design

This study examines the impact of internal auditing and organizational culture on supporting the internal audit function to operate independently and objectively in identifying, measuring, and addressing risks associated with information technology, as well as ensuring compliance with the principles of international IT governance frameworks in the healthcare sector. Partial least squares modeling (PLS-SEM) was used to examine relationships between path models and latent variables using the Python statistical package.

3.2. Data Gathering

The data collection instrument for this study was a 5-item Likert scale questionnaire administered in Arabic. The tool underwent multiple pretests to assess its usability and ensure accurate interpretation. Questionnaires were distributed as a part of the pilot study to verify that the questions were clearly formulated and easily understood by respondents. Based on the pilot results, necessary modifications were made, and the questionnaire was finalized. The final questionnaire contained 28 statements divided across five variables. This field study was conducted with key personnel in the internal audit and IT departments of Saudi Arabian government hospitals. According to 2024 healthcare statistics, there are 326 government hospitals in Saudi Arabia. The sample comprised 652 individuals.

3.3. Description Of Research Model

Based on the hypotheses outlined in this study, the structural model employs a quantitative methodology using PLS-SEM, an advanced statistical tool for examining complex cause-and-effect relationships involving multiple predictors and outcomes. Partial least squares structural equation modeling was used to evaluate the proposed model. The analysis included assessing measurement models for reliability and validity, as well as evaluating the structural model to examine the hypothesized relationships between constructs (Sarstedt et al., 2022).

This method enables the assessment of both the direct effects of internal audit and organizational culture, as well as the indirect effects mediated by risk management and compliance variables

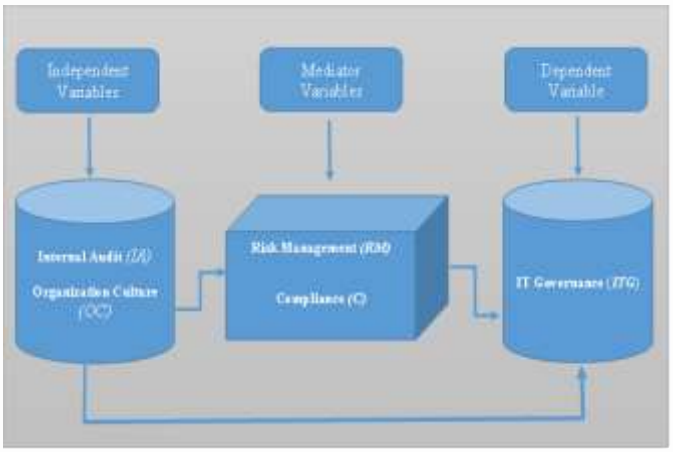

Figure 1: Conceptual Research Model.

4. ANALYSIS OF RESULTS

Partial least squares structural equation modeling (PLS-SEM) is a statistical approach for analyzing complex relationships among multiple variables. By integrating factor analysis with regression, it enables the measurement of latent constructs and the structural connections between them. PLS-SEM is particularly valuable for predictive studies, handling small sample sizes, and accommodating non-normal data (Sarstedt et al., 2019).

4.1. Validation And Reliability Process

The measurement model assessed the reliability and validity of five key constructs: internal audits, organizational culture, IT governance, risk management, and compliance.

Table 1: Reliability And Validity

Construct reliability and validity	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Compliance (C)	0.749	0.767	0.842	0.574
IT Governance (ITG)	0.858	0.868	0.892	0.544
Internal Audit (IA)	0.912	0.914	0.93	0.655
Organization Culture (OC)	0.765	0.799	0.836	0.471
Risk Management (RM)	0.808	0.823	0.875	0.638

Table 1 evaluates construct reliability and validity using Cronbach's alpha, composite reliability (rho_a and rho_c), and average variance extracted (AVE). These indicators assess the internal consistency, reliability, and convergent validity of the measurement model in PLS-SEM. All constructs met the reliability threshold, confirming that the measurement items consistently captured their respective latent variables.

Reliable and valid constructs strengthen the credibility of hypothesis testing in structural models.

Since compliance, IT governance, internal audits, and risk management exhibit strong reliability and validity, the relationships among these constructs are statistically robust and meaningful. These results confirm that the constructs are well measured and suitable for hypothesis testing in PLS-SEM.

4.2. Structural Model Measurement

The evaluation of the structural model focused on the relationships between constructs, with emphasis on collinearity, using Variance Inflation Factor (VIF) statistics. VIF measures the degree of multicollinearity in regression analysis, quantifying the extent to which the variance of a predictor variable is inflated by its correlations with other predictors in the model. Values between 1 and 5 indicate moderate correlation, while values greater than 5 suggest problematic collinearity.

Table 2: Collinearity Statistics (VIF).

Inner model – List	VIF	Conclusions
Compliance (C) -> IT Governance (ITG)	1.946	No multicollinearity
Internal Audit (IA) -> Compliance (C)	2.232	No multicollinearity
Internal Audit (IA) -> Risk Management (RM)	2.232	No multicollinearity
Internal Audit (IA) -> IT Governance (ITG)	2.232	No multicollinearity
Organization Culture (OC) -> Compliance (C)	2.232	No multicollinearity
Organization Culture (OC) -> Risk Management (RM)	2.232	No multicollinearity
Risk Management (RM) -> IT Governance (ITG)	1.946	No multicollinearity

Table 2 shows that all VIF values are below the recommended threshold of 5, indicating no significant multicollinearity among predictor variables. The absence of multicollinearity confirms that the PLS-SEM model is statistically sound, with each predictor contributing uniquely to the model without interference. This strengthens the reliability of hypothesis testing, ensuring that estimated effects accurately represent real relationships within the research framework.

4.3. Path Coefficients and Correlation between Study Variables

Path coefficients represent the strength and direction of relationships between study variables.

Table 3: Paths Coefficients of the Study Variables and the Interpretation Of Each Path.

Paths	Path coefficients	Interpretation
Compliance (C) -> IT Governance (ITG)	0.598	Strong positive effect
Internal Audit (IA) -> Compliance (C)	0.190	Weak positive effect
Internal Audit (IA) -> IT Governance (ITG)	0.180	Weak positive effect
Internal Audit (IA) -> Risk Management (RM)	0.27	Weak-to-moderate positive effect
Organization Culture (OC) -> Compliance (C)	0.580	Strong positive effect
Organization Culture (OC) -> Risk Management (RM)	0.444	Moderate positive effect
Risk Management (RM) -> IT Governance (ITG)	0.245	Weak-to-moderate positive effect

Based on Table 3, organizations with stronger compliance policies are more likely to achieve effective IT governance. Practical internal audit functions contribute to improved compliance, although this effect is weaker compared to other factors. Internal audits also support IT governance and risk management, but again, the effect is moderate. A positive organizational culture has a stronger influence, significantly enhancing compliance and risk management practices. Risk management, in turn, contributes to better IT governance, though its effect is less pronounced than compliance.

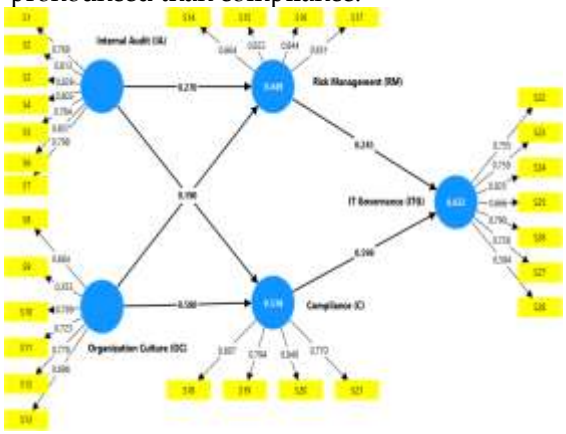

Figure 2: Relationship between the Latent Variables and Their Observed Indicators.

Figure 2 indicate that internal audit (IA) positively influences risk management (RM) and IT governance (ITG), while organizational culture (OC) has a substantial effect on compliance (C) and risk management. Compliance (C) significantly affects IT Governance (ITG). Path coefficients were used to assess the strength of these relationships, with higher values indicating stronger effects. The observed

variables provide empirical evidence supporting the latent constructs.

Table 4: Direct Effects And Indirect Effects For Each Path.

Paths	Total effects
Compliance (C) -> IT Governance (ITG)	0.598
Internal Audit (IA) -> Compliance (C)	0.190
Internal Audit (IA) -> IT Governance (ITG)	0.180
Internal Audit (IA) -> Risk Management (RM)	0.270
Organization Culture (OC) -> Compliance (C)	0.580
Organization Culture (OC) -> IT Governance (ITG)	0.456
Organization Culture (OC) -> Risk Management (RM)	0.444
Risk Management (RM) -> IT Governance (ITG)	0.245

Table 4 shows that strengthening compliance and fostering a positive organizational culture have the most significant overall effects on IT governance. While internal audit and risk management are also important, they function more effectively as complementary mechanisms rather than as stand-alone solutions. A strong organizational culture positively impacts compliance, risk management, and IT governance. In the next section, the researcher will examine composite reliability, AVE, and discriminant validity to further confirm the reliability and validity of the constructs.

4.4. Discriminant Validity Assessment

In the next section, the researcher evaluates composite reliability, AVE, and discriminant validity to ensure the constructs are reliable. Table 5 presents the outer weights of the indicators. The outer weights indicate the relative contribution of each indicator (observed variable) to its corresponding latent construct (unobserved variable). In PLS-SEM, indicators with low weights may be removed if they do not significantly contribute to the construct (Henseler et al., 2015).

Table 5: Outer Weights For Each Indicator.

Indicators	Outer weights	Indicators	Outer weights
S_1 <- Internal Audit (IA)	0.175	S_{15} <- Risk Management (RM)	0.279
S_2 <- Internal Audit (IA)	0.185	S_{16} <- Risk Management (RM)	0.376
S_3 <- Internal Audit (IA)	0.162	S_{17} <- Risk Management (RM)	0.314
S_4 <- Internal Audit (IA)	0.165	S_{18} <- Compliance (C)	0.262
S_5 <- Internal Audit (IA)	0.166	S_{19} <- Compliance (C)	0.317
S_6 <- Internal Audit (IA)	0.192	S_{20} <- Compliance (C)	0.340
S_7 <- Internal Audit (IA)	0.191	S_{21} <- Compliance (C)	0.394
S_8 <- Organization Culture (OC)	0.230	S_{22} <- IT Governance (ITG)	0.226
S_9 <- Organization Culture (OC)	0.123	S_{23} <- IT Governance (ITG)	0.215
S_{10} <- Organization Culture (OC)	0.271	S_{24} <- IT Governance (ITG)	0.219
S_{11} <- Organization Culture (OC)	0.209	S_{25} <- IT Governance (ITG)	0.173
S_{12} <- Organization Culture (OC)	0.293	S_{26} <- IT Governance (ITG)	0.179
S_{13} <- Organization Culture (OC)	0.296	S_{27} <- IT Governance (ITG)	0.187
S_{14} <- Risk Management (RM)	0.280	S_{28} <- IT Governance (ITG)	0.150

As shown in Table 5, all indicators for internal audits have relatively low but meaningful weights, ranging from 0.162 to 0.192. Most indicators of organizational culture also have meaningful weights, except for S9, which contributes very little. All risk management indicators have meaningful weights, with S16 serving as the most important contributor to the construct. All compliance indicators are meaningful, with S21 representing the strongest contributor. Most IT governance indicators are meaningful, except for S28, which has a very low weight. This suggests that S28 contributes little to the construct and may need to be removed or revised. Low-weight indicators may need to be removed or refined to improve reliability and validity.

4.5. Correlation Coefficients Between Study Variables

Table 6 illustrates the strong correlations between compliance and IT governance (0.769), internal audits (0.622), organizational culture (0.722), and risk management (0.697). Thus, organizations with superior compliance processes demonstrate stronger IT governance, indicating that effective internal audit functions, risk management, and a positive organizational culture enhance compliance processes.

IT governance correlates positively with internal audit (0.656) and risk management (0.662), indicating that both contribute to strengthening IT governance. IT governance and organizational culture (0.813), suggesting that an effective organizational culture is a critical enabler of efficient IT governance. Internal audit and organizational culture are strongly correlated (0.743), showing that a positive culture promotes effective internal audit functions. Internal audit (0.600) and organizational culture (0.645) are also strongly correlated with risk management, suggesting that internal audit and organizational culture enhance risk management practices.

These findings highlight the foundational role of organizational culture in driving governance, compliance, and risk management. Internal audit (IA) and RM exhibit moderate to strong correlations with other constructs, suggesting that they play supportive but significant roles in the model. All constructs are positively correlated, indicating that improvements in one area (e.g., organizational culture) positively influence other areas (e.g., compliance, IT governance, and risk management).

Table 6: Correlation Coefficients between each pair of indicators.

Correlations	C	ITG	IA	OC	RM
C	1				
ITG	0.769	1			
IA	0.622	0.656	1		
OC	0.722	0.813	0.743	1	
RM	0.697	0.662	0.600	0.645	1

4.6. Test Of Normality And F-Square Test

Table 7 presents the descriptive statistics and normality test results for the outer model indicators in Partial Least Squares Structural Equation Modeling (PLS-SEM). This analysis helps in understanding data distribution by measuring standard deviation, skewness, and kurtosis, and it also includes the Cramér–von Mises test results, which evaluate the extent to which the actual data distribution deviates from normality. All indicators show a p-value = 0.000, indicating that the data significantly deviate from a normal distribution. The standard deviations reflect moderate variability in the data (Sarstedt et al., 2022).

Table 7: Descriptive Statistics And Normality Test For The Outer Model Indicators In (PLS-SEM).

Outer model descriptive	Standard deviation	Excess kurtosis	Skewness	Cramér-von Mises test statistic	Cramér-von Mises p-value
S_1	0.641	2.71	-0.857	3.856	0
S_2	0.582	1.27	-0.019	4.677	0
S_3	0.545	4.370	-1.414	6.243	0
S_4	0.596	3.392	-0.890	5.991	0
S_5	0.621	3.060	-0.610	6.591	0
S_6	0.515	2.245	0.390	5.533	0
S_7	0.603	3.669	-0.986	5.829	0
S_8	0.729	1.602	-0.814	1.311	0
S_9	0.935	2.756	-1.288	4.225	0
S_{10}	0.614	1.096	-0.418	0.578	0
S_{11}	0.691	10.748	-2.205	1.745	0
S_{12}	0.628	0.978	-0.332	0.443	0
S_{13}	0.718	3.286	-1.468	2.544	0
S_{14}	0.748	1.656	-0.278	2.418	0
S_{15}	0.570	0.607	-0.669	3.133	0
S_{16}	0.537	3.447	-0.774	4.715	0
S_{17}	0.525	1.181	-0.306	4.566	0
S_{18}	0.795	4.592	-1.438	4.597	0
S_{19}	0.608	2.419	-0.388	3.943	0
S_{20}	0.543	0.472	-0.010	3.363	0
S_{21}	0.638	2.533	-0.957	3.137	0
S_{22}	0.656	3.323	-1.247	2.147	0
S_{23}	0.651	0.859	-0.561	1.893	0
S_{24}	0.550	0.227	-0.145	0.581	0
S_{25}	0.746	6.632	-1.34	2.338	0
S_{26}	0.613	-0.087	-0.474	1.544	0
S_{27}	0.677	1.212	-0.178	1.503	0
S_{28}	0.804	3.960	-1.135	1.469	0

Descriptive statistics indicate that most respondents held positive views regarding internal auditing, risk management, compliance, and IT governance, supporting the proposed relationships. However, the presence of significant non-normality suggests that perceptions are not uniformly distributed, implying that organizations may differ substantially in their implementation of internal audit practices.

Table 8: Estimated Values Of F-Square Statistics

Paths	f-square	Effect size
Compliance (C) -> IT Governance (ITG)	0.485	Large
Internal Audit (IA) -> IT Governance (ITG)	0.345	Large
Internal Audit (IA) -> Compliance (C)	0.035	Small
Internal Audit (IA) -> Risk Management (RM)	0.059	Small
Organization Culture (OC) -> Compliance (C)	0.326	Medium to Large
Organization Culture (OC) -> Risk	0.160	Mediu

Management (RM)		m
Risk Management (RM) -> IT Governance (ITG)	0.082	Small

Table 8 examines the effect size (f^2) of relationships within the PLS-SEM model, enabling an assessment of the strength of independent variables in influencing dependent variables (Henseler et al., 2015). The findings suggest that compliance and internal audit exert a strong impact on IT governance, highlighting their critical role in establishing effective governance frameworks. This confirms that adhering to compliance policies and the implementation of robust internal audit practices significantly improve IT governance outcomes. The findings also highlight the contribution of organizational culture to strengthening compliance and risk management.

4.7. PLS-SEM Adjusted Model

Based on the previous analysis, the observed variables (S8, S9, S13, S14, S18, S25, S27, and S28) were removed from the model. After their removal, the path diagram is shown in Figure 3.

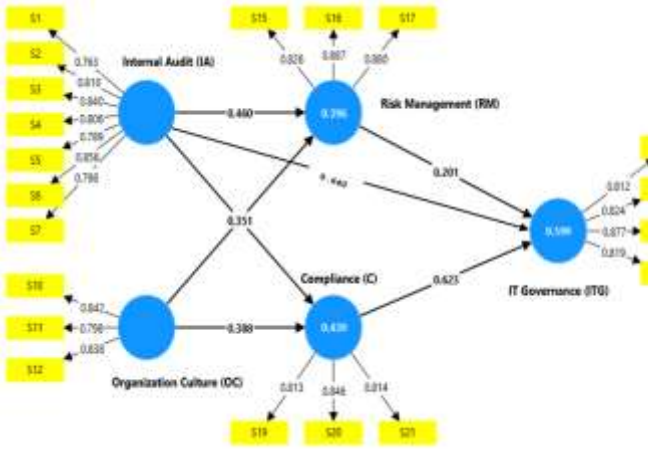

Figure 3: Adjusted Structural Model of the Relationships among Latent Variables and Their Observed Indicators.

Table 9: Comparison between the Estimated Model and Adjusted Estimated Model

Fit summary	Estimated model	Adjusted Estimated model
SUMMER	0.121	0.103
d_ULS	5.984	2.215

Table 9 compares the original estimated model with the adjusted estimated model using two key fit indicators: the Standardized Root Mean Square Residual (SRMR) and Unweighted Least Squares Discrepancy (d_ULS). These indicators evaluate the model's goodness of fit and its accuracy in representing the observed data.

The improvements in SRMR and d_ULS demonstrate that modifications in the adjusted model (e.g., removing weak paths, refining indicators, or improving construct measurements) enhanced model accuracy. A better-fitting model increases confidence in hypothesis testing by ensuring that relationships between constructs are estimated more reliably. The adjusted model thus provides a stronger representation of data, reduces discrepancies, and improves the validity of hypothesis testing.

5. DISCUSSION

The findings of this study significantly enhance our understanding of the influence of internal auditing and organizational culture on IT governance in the Saudi healthcare industry. Results indicate that internal audits have a beneficial but moderate impact on IT governance. This aligns with previous research, such as Abu-Musa (2008) and IIA (2018), which emphasize the role of internal audits in identifying governance deficiencies and ensuring alignment with organizational objectives. While Simonsson et al. (2010) report a strong correlation between high-quality internal audit functions and improved IT governance maturity, our findings suggest that the influence of internal audits is more nuanced within Saudi healthcare institutions. This variation likely due to the complexities of regulatory requirements and the ongoing digital transformation associated with Vision 2023.

This study demonstrates that internal audits affect both risk management and compliance. The correlation between internal audits and risk management is moderately positive, supporting the findings of Yoland et al. (2020) and Steinbart et al. (2018), who highlight the importance of internal audits in early risk identification and mitigation. The impact of internal audits on compliance is relatively low, suggesting that in healthcare, compliance is more strongly influenced by external regulatory requirements than by internal processes alone.

Our results also indicate that organizational culture significantly affects compliance and risk management. Empirical evidence shows that a transparent, accountable, and ethical culture is a key enabler that directly impacts compliance and risk management while indirectly enhancing IT governance, consistent with Moorthy et al. (2011). Moreover, risk management and compliance act as essential mediators in the relationship between internal audit and IT governance.

In summary, this study validates established insights into the roles of internal audit and organizational culture in IT governance while contextualizing them within the regulatory and operational environment of Saudi healthcare. The

application of PLS-SEM allows a detailed examination of both direct and indirect effects (Henseler et al., 2016). The findings indicate that internal audit functions are crucial but require support from a strong organizational culture and integrated risk and compliance frameworks to effectively improve IT governance.

6. CONCLUSION

This study examines the impact of internal audits and organizational culture on IT governance in the Saudi Arabian healthcare sector. PLS-SEM was employed to empirically validate a model in which internal audit and organizational culture are primary predictors, while risk management and compliance serve as mediators in improving IT governance effectiveness. The results indicate that while internal audit positively influence IT governance, their direct effect is moderate, with a greater impact mediated through compliance and risk-management mechanisms. Compliance exhibited the strongest direct effect on IT governance, highlighting its critical role in highly regulated industries such as healthcare. Organizational culture emerged as a fundamental driver that significantly enhances compliance and risk management outcomes.

This study confirms that a strong internal audit function, embedded within a culture of transparency and accountability, strengthens compliance, facilitates effective risk management, and ultimately improves IT governance. These conclusions validate previous research and position IT governance within the broader framework of Saudi Arabia''s healthcare transformation.

Based on the findings, we propose the following recommendations for healthcare policymakers, internal auditors, and IT governance professionals in Saudi Arabia:

- Align internal audit functions with IT governance frameworks such as COBIT and ITIL. Auditors should acquire IT-specific expertise to evaluate risks and compliance in digital transformation environments.
- Encourage cross-departmental collaboration to ensure that governance, compliance, and risk functions are integrated and mutually reinforcing.
- Enhance compliance framework by investing in automated monitoring systems and regulatory mapping to improve responsiveness to external obligations.
- Formalize risk management practices by incorporating risk identification and mitigation techniques into digital health implementation strategies and conducting internal audits to assess risk control measures against organizational risk appetite.
- Adopt internationally recognized frameworks, such as COBIT 2019 and ITIL v4, to improve alignment, governance, and strategic value delivery.
- Integrate modern technologies, including AI and blockchain, in future audits and governance designs to enable real-time monitoring.

6.1. Limitations And Future Research

This study is limited by its geographic and sectoral scope, focusing solely on government hospitals in Saudi Arabia. Consequently, the findings may not be fully generalizable to private healthcare facilities or public-sector organizations in other countries. Although the study encompasses a comprehensive set of constructs—including internal audits, organizational culture, risk management, compliance, and IT governance, other potentially relevant variables, such as technological maturity, leadership support, and staff competencies, were not included.

Future research could explore the role of emerging technologies, such as artificial intelligence, blockchain, and advanced analytics, in enhancing the efficiency and effectiveness of internal audits and IT governance.

To enhance generalizability, future research might incorporate samples from private health sector, or comparative studies across Gulf nations. Furthermore, researchers could analyze the influence of variations in ownership structure, regulatory frameworks, and technological advancements in enhancing of IT governance within the healthcare industry.

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Appendix A

Table A1. Questionnaire Statements.

Symbol	Statements	Variables	Sources
S_1	The internal audit function evaluates IT governance practices in the organization.	Internal Audit (IA)	Abu-Musa (2008); IIA (2012, 2018)
S_2	Internal auditors provide recommendations to improve IT governance frameworks.		
S_3	Internal auditing identifies and mitigates risks associated with IT systems.		
S_4	Internal audit reports are considered during strategic IT governance decisions.		
S_5	The internal audit plan includes evaluating IT governance plans, strategies, and objectives, and their alignment with the organization's strategy.		
S_6	The auditor's report includes an opinion on the extent to which IT governance mechanisms are applied.		
S_7	The internal auditor follows up on the implementation of recommendations regarding IT governance mechanisms.		
S_8	The organization's overall strategy, operational plans, and strategic IT plan are aligned.	Organization Culture (OC)	Ali et al. (2015); De Haes et al. (2017); Weill and Ross (2004)
S_9	IT governance is considered part of the organization's overall governance plan.		
S_{10}	The organization fosters a culture of accountability in IT-related decisions.		
S_{11}	Collaboration among departments is encouraged in IT governance processes.		
S_{12}	Ethical behavior and transparency are emphasized in IT governance practices.		
S_{13}	Innovation is supported to improve IT governance outcomes.		
S_{14}	IT governance mechanisms identify potential IT-related risks.	Risk Management	ISACA (2019); De Haes et al. (2017)
S_{15}	IT-related risks are effectively assessed and prioritized.		
S_{16}	Mitigation strategies for IT risks are implemented and monitored.		
S_{17}	The organization has reduced incidents related to IT failures and breaches.		
S_{18}	IT governance ensures compliance with legal and regulatory requirements.	Compliance (C)	Calder (2009); IIA (2012); ISACA (2019)
S_{19}	Policies and procedures are in place to ensure adherence to industry standards.		
S_{20}	Compliance mechanisms are regularly reviewed and updated.		
S_{21}	The organization has minimized violations of IT governance regulations.		
S_{22}	The organization uses a formal IT governance framework (e.g., COBIT, ITIL).	IT Governance (ITG)	Ali et al. (2015); ISACA (2019); De Haes and Van Grembergen (2009)
S_{23}	The selected framework aligns IT operations with organizational goals.		
S_{24}	The framework helps identify and mitigate IT-related risks.		
S_{25}	IT governance mechanisms reduce risks associated with IT operations.		
S_{26}	IT governance frameworks improve decision-making processes in the organization.		
S_{27}	IT governance improves the overall performance of IT services.		
S_{28}	Information technology systems are continuously improved and developed to adapt to changes in the external environment.		

Table A2. Outer Loadings Of Each Statement On The Questionnaire.

Symbols	Statements	Variables	Outer loadings
S_1	The internal audit function evaluates IT governance practices in the organization.	Internal Audit (IA)	0.768
S_2	Internal auditors provide recommendations to improve IT governance frameworks.		0.813
S_3	Internal auditing identifies and mitigates risks associated with IT systems.		0.839
S_4	Internal audit reports are considered during strategic IT governance decisions.		0.803
S_5	The internal audit plan includes evaluating IT governance plans, strategies, and objectives, and their alignment with the organization's strategy.		0.784
S_6	The auditor's report includes an opinion on the extent to which IT governance mechanisms are applied.		0.857
S_7	The internal auditor follows up on the implementation of recommendations regarding IT governance mechanisms.		0.798
S_8	The organization's overall strategy, operational plans, and strategic IT plan are aligned.	Organization Culture (OC)	0.684
S_9	IT governance is considered part of the organization's overall governance plan.		0.353

S_{10}	The organization fosters a culture of accountability in IT-related decisions.		0.789
S_{11}	Collaboration among departments is encouraged in IT governance processes.		0.723
S_{12}	Ethical behavior and transparency are emphasized in IT governance practices.		0.778
S_{13}	Innovation is supported to improve IT governance outcomes.		0.696
S_{14}	IT governance mechanisms identify potential IT-related risks.	Risk Management (RM)	0.664
S_{15}	IT-related risks are effectively assessed and prioritized.		0.822
S_{16}	Mitigation strategies for IT risks are implemented and monitored.		0.844
S_{17}	The organization has reduced incidents related to IT failures and breaches.		0.851
S_{18}	IT governance ensures compliance with legal and regulatory requirements.	Compliance (C)	0.607
S_{19}	Policies and procedures are in place to ensure adherence to industry standards.		0.794
S_{20}	Compliance mechanisms are regularly reviewed and updated.		0.84
S_{21}	The organization has minimized violations of IT governance regulations.		0.77
S_{22}	The organization uses a formal IT governance framework (e.g., COBIT, ITIL).	IT Governance (ITG)	0.755
S_{23}	The selected framework aligns IT operations with organizational goals.		0.759
S_{24}	The framework helps identify and mitigate IT-related risks.		0.835
S_{25}	IT governance mechanisms reduce risks associated with IT operations.		0.666
S_{26}	IT governance frameworks improve decision-making processes in the organization.		0.790
S_{27}	IT governance improves the overall performance of IT services.		0.536
S_{28}	Information technology systems are continuously improved and developed to adapt to changes in the external environment.		0.594