

The Mediating Effect of Information Technology Usage on the Relationship of Internal Audit Processes and Internal Auditor Competence towards Internal Audit Effectiveness: Evidence from the Chinese Financial Sector

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Abstract

The effectiveness of internal auditing is determined by various factors, such as the independence of the internal audit function, auditors' competence, effective audit planning, efficient audit processes, and support from senior management. The digitalization and informatization of modern enterprises have transformed the way companies are managed and have similarly impacted internal audit practices. Informatization not only alters traditional internal audit processes but also changes auditors' ways of working and thinking. From the perspective of resource-based theory, the effective allocation and full utilization of human, technological and organizational resources can enhance the effectiveness of internal audit. Therefore, the purpose of this study is to examine the impact of internal audit processes (IAP) and internal auditor competence (IAC) on internal audit effectiveness (IAE), as well as the mediating effect of information technology usage (ITU) on the relationship between IAP and IAC and IAE. To test the proposed hypotheses, a questionnaire survey was conducted within Chinese financial enterprises, yielding a total of 133 valid responses. Statistical data analysis was performed using the partial least squares structural equation modelling (SEM-PLS) method. The results indicate that both IAP and IAC have a significant impact on IAE and ITU. Furthermore, ITU serves as a mediating factor, enhancing the positive contributions of IAP and IAC to IAE.

Keywords: Internal audit effectiveness, auditor competence, audit process, information technology usage, resource-based view theory, PLS-SEM

1. Introduction

Effective audit must achieve its intended purpose. Measuring audit effectiveness is a systematic evaluation that involves not only assessing the extent to which the results align with the intended goals but also evaluating the audit process and resources (Beckmerhagen et al, 2004). The audit process generally comprises four steps: planning, execution, reporting, and follow-up. Audit planning involves determining the audit's objectives, scope, timeline, required resources, and methods to be used. Auditors conduct the examination according to the plan, produce a report, and promptly follow up on any identified risks. Audit resources refer to the tools, personnel, and materials necessary for conducting an effective audit. Competent internal auditors are crucial for measuring the effectiveness of internal audits (Yeboah, 2020). Advanced technology platforms and tools, adequate budget, and executive support are essential guarantees for audit effectiveness (Almaqtari, 2024).

The internal audit process is closely related to corporate governance (Cohen et al., 2002). The internal audit process is also connected to the level of informatization and digitization within a company. Digitization has changed internal audit methods and processes, and audit departments are constructing digital audit models to improve the efficiency and effectiveness of internal audits (Zhang & He, 2021). The digital transformation in the audit field impacts audit practices by changing audit regulatory, processes, and auditor's professional profile (Tiberius & Hirth, 2019).

Digitisation has led to the generation of vast and diverse datasets within enterprises, enabling data mining and utilisation, thereby fundamentally transforming internal auditing from theoretical principles to practical

applications. This transformation necessitates corresponding changes for internal auditors in terms of auditing concepts, audit subjects, audit content, and audit methodologies. Additionally, the utilisation of big data allows for analysis and comparison across broader scopes and dimensions, enabling the identification of discrepancies in data, which serves as clues for auditing investigations and facilitates targeted assessment (Zhuang, 2021). Auditors need to actively respond to digital challenges. Digital technology helps improve the reliability and quality of audit reports and enhances stakeholders' trust in the results of audit work (Vuković et al., 2024).

China's financial industry is fully implementing digitalization, not only by building advanced digital hardware facilities but also by strengthening digital thinking and comprehensively improving the digital literacy of all employees, enabling enterprises to adapt to the development of the times. To this end, this paper studies the impact of the internal audit process and auditors' competence in the banking industry on the effectiveness of internal audits in the new information technology environment. Based on the analysis of the effectiveness of internal audit, this study investigated three influencing factors: IAC, IAP, and ITU. The study utilised the partial least squares structural equation modelling (PLS-SEM) method to verify the effects of IAC, IAP, and ITU on the IAE. Additionally, it confirmed the mediating effect of ITU on the relationship between IAC and IAP on IAE.

2. Literature Review and Hypotheses

2.1 Resource-Based View theory

The Resource-Based View (RBV) theory posits that an organization can be seen as a collection of tangible and intangible resources and capabilities (Ahmad, 2015). The competitive advantage of an organization primarily stems from its resources and capabilities (Grant, 1991; Barney, 1991). Human resources are one of the most critical assets of an organization (Barney, 1991), and scarce, highly skilled internal auditors are essential to ensuring effective internal audits (Arena & Azzone, 2009; Turetken et al., 2020; Jaber et al., 2024). The organization's sustained competitive advantage relies on the unique technical resources it possesses (Khalil et al., 2022). In the process of digital transformation, the technical resources of internal audit depend on the organization's information platforms, specialized audit software, and data analytics tools. These technical resources enhance audit efficiency and quality and enable innovative approaches to internal auditing.

Organizational resources encompass the organization's structure, culture, and various management processes (Pan, 2023). Unique and effective internal audit processes are valuable organizational resources. The RBV theory also highlights the importance of capabilities in organizational competitiveness, emphasizing how resources are integrated and utilized. Capabilities are more difficult to replicate than resources because they often involve complex organizational practices and culture (Barney, 1991). A key determinant of internal audit effectiveness is the independence of the internal audit function (Arena & Azzone, 2009), which is guaranteed by providing sufficient resources and access rights. An effective internal audit can add value to the organization, ultimately enhancing its performance and competitiveness.

2.2 Internal Audit Effectiveness

Regarding the definition of Internal Audit Effectiveness (IAE), the existing literature provides many possible answers to this question. Different authors link IAE to different issues, but the focus is on internal audit procedures, outputs, and outcomes. IAE is the degree to which audit results meet the expected goals (Arena & Azzone, 2009). If internal auditing adds value to an organization's internal control, governance, and risk management processes, then it is effective. Internal audit effectiveness is achieving the goal of adding the most value to the organization. The outputs of internal audit activities are related to IAE (Dellai & Slimene, 2021). Studying the factors that determine internal audit effectiveness is very important because it can improve the audit process (Eden & Moriah 1996).

Researchers view IAE from different points of view. Nevertheless, they shared the common view that effectiveness is achieved when the defined internal audit objectives and goals are achieved (Dittenhofer, 2001; Mihret & Yismaw, 2007; Ahmad et al., 2009; Badara & Saidin, 2014). This complicated process includes audit planning, conducting audit engagements, conforming audit results, following up on the results to ensure proper actions are taken, and developing the staff to equip them with sufficient knowledge and skills to conduct audit engagements. Nonetheless, IAE is not limited to evaluating the aspects stated above to ensure that internal audit can achieve its objectives (Dittenhofer, 2001). Overall, IAE refers to the extent to which the internal audit function achieves its objectives and adds value to an organization. Ultimately, IAE is measured by its ability to help the organization achieve its strategic objectives, mitigate risks, improve operational efficiency, ensure compliance with regulations and policies, and enhance stakeholder confidence.

There is a large amount of literature that has previously studied the definition and measurement of internal audit effectiveness (Dittenhofer, 2001; Savčuk, 2007; Arena & Azzone, 2009; Endaya & Hanefah, 2016). There is also a large amount of empirical research that examines the impact of various factors on IAE, including independence, auditors' competence, top management support, internal audit quality, internal audit performance, audit committee characteristics, internal and external auditor relationships, internal audit processes, the use of information technology, organizational status, scope of work, and IA department size (Endaya & Hanefah, 2016; Alzeban & Gwilliam, 2014; George et al., 2015; Azzali & Mazza, 2018; Erasmus & Coetzee, 2018). Turetken et al. (2020) reviewed the influencing variables and measurement factors of IAE and listed 20 influencing variables and 11 measurement indicators of IAE.

Regarding the impact of influencing factors on IAE, some studies only considered the direct impact (Azzali & Mazza, 2018; Arena & Azzone, 2009), while others utilised moderator or mediating variables to study the indirect impact (Endaya & Hanefah, 2016; Muneer et al., 2017; Alqaraleh et al., 2022).

In internal audit work, the role of audit process and auditors competence is very important, which has a direct positive impact on the effectiveness of internal audit (Arena & Azzone, 2009) and also has an indirect impact on the technical support of information platforms and tools (Muneer et al., 2017). This study focuses on verifying the direct effects of IAC and IAP on IAE, meanwhile testing the mediating effect of ITU on the Relationship of IAP and IAC towards IAE.

2.3 Competence of Internal Auditor

The competence of internal auditors is the most important factor affecting the effectiveness of all internal audit activities. Internal auditor competence is a comprehensive reflection of knowledge, skills, personal values and attitudes (IIA, 2021). Internal auditors play a key role in monitoring a company's risk profile and identifying areas to improve risk management (Goodwin-Stewart & Kent, 2006). The essential soft skills required for highly effective internal auditors are summarised into seven aspects: fairness, relationship building, partnership, communication, teamwork, diversity, and continuous learning (Chambers & McDonald, 2013).

Internal auditors with good educational qualifications, professional qualifications, audit work experience and continuous development have a positive impact on internal audit effectiveness (Alzeban & Gwilliam, 2014). In the Malaysian public sector audit, the lack of training, experience and internal audit expertise of auditors has a negative impact on internal audit effectiveness (Ahmed et al., 2009).

The competence of internal auditors consists of three parts: first, internal audit tools, techniques and methods; second, knowledge areas, including business, financial and management accounting, governance, fraud, IT and other knowledge; third, behavioural skills, including operations and communication. Auditors should have corresponding professional competence, follow professional ethics, and maintain independence and objectivity. The effectiveness evaluation of internal auditors should be based on this (CIIA, 2023).

According to Turetken et al. (2020), the competence of internal auditors variable has been the most studied in the literature, appearing in 22 of the 37 studies assessed. By synthesising the above studies and combining them with the research structural model, the following hypotheses are proposed:

H1: IAC has a positive influence on IAE.

H2: IAC has a positive influence on ITU.

2.4 Internal Auditing Process

The auditing process refers to the sequential order and work content of the entire systematic process from the beginning of the preparation to the end of an audit project. For enterprises, the internal auditing process refers to the series of work steps involved in each audit project conducted by the internal audit department from start to finish. Optimising the internal auditing process is vital to enhance IAE. Improving IAE and reducing internal audit risks are the constant focus of internal audit work. Continuously enhancing the quality of IAP is essential for internal audit organisations. High-quality audit services rely on efficient audit processes. Lampe & Sutton (1994) identified 15 factors that contribute to an effective audit and categorised them into three stages of the auditing process: planning, fieldwork, and reporting and review.

The IAP refers to the specific steps and procedures undertaken during the IAP to complete internal audit tasks and achieve internal audit objectives. As the link between audit subjects and audit objects, internal auditors are required to adhere to certain processes. Through established IAP, internal audit objectives can be clarified. At the same time, the focus and essence of internal audit work can be grasped, and internal audit activities can be

carried out systematically. Audit time and resources can be saved, thereby enhancing the effectiveness of audit work (Zhuang, 2021).

The content of internal audit activities directly relates to the design of its process. In a survey conducted from January to November 2010, the Internal Audit Development Research Centre of the Chinese Institute of Internal Auditors found that, among nearly 100 state-owned enterprises in China, the dominant modes of internal audit were system-based audits (68%), risk-oriented audits (23%), and account-based audits (9%) (Zhuang, 2021).

The following hypotheses are proposed based on the role of the IAP.

H3: IAP has a positive influence on IAE.

H4: IAP has a positive influence on ITU.

2.5 Information Technology Usage

Enterprise informatisation and digitisation are the driving forces of the globalisation era. The rapid development of new technologies such as cloud computing, big data, blockchain, and artificial intelligence poses new challenges to the internal management of enterprises. Internal control management of enterprises is also transitioning from manual control to information-based control. Overall, informatisation construction promotes internal control within enterprises effectively, shifting from a single modular internal control and internal audit model to a more systematic and unified direction (Wotschke & Kindermann, 2023). This approach requires internal auditors to keep pace with the informatisation level, as a failure to do so may hinder the improvement of IAE. Continuous updating of internal auditors' information knowledge is necessary to adapt to the new audit technology environment.

A positive relationship exists between ITU and IAE (Mohammed & Khairul, 2017). As expected, technological advances are indispensable for the establishment of an effective digital auditing system. The impact of data protection measures against cyber-attacks and employees' skills and training were found to be significant. Particular attention should be given to the preparation and building of virtual auditing teams (Kim et al., 2009). It is found that the independence of the internal audit department and management support for internal audit are the major determinants of IAE. Moreover, IT has a mediating role in enhancing the positive contribution of the internal audit department and management support towards IAE.

Muneer et al. (2017) studied the impact of three factors—internal audit independence, management support, and information technology—on the performance of banks. The study found that internal auditors should have sufficient knowledge of key IT audit tools. Computer-Assisted Audit Tools and Techniques are specialized software applications used by internal auditors in the public sector to automate and streamline audit processes and perform audit procedures such as data analysis, data extraction, and data transformation, thereby improving the efficiency, effectiveness, and accuracy of internal audits (Alqudah et al., 2023).

The impact of informatisation on internal auditing is significant, providing auditors with more audit information and making the audit process more efficient. Firstly, IT enables auditors to access information more quickly, thus facilitating better completion of audit tasks. Secondly, IT can assist in examining large volumes of audit data, leading to better detection of audit details and issues, thereby reducing the manual workload involved in audit tasks. Finally, informatisation enables auditors to utilise network-related audit tools, such as data recovery, security monitoring, and security assessment, more effectively, allowing for better examination of potential risks.

Various audit activities can be planned and designed on new information platforms, making audit processes highly scientific and efficient. Decision coordination and machine learning coordination can also be utilised to assist audit activities. The following hypotheses are posited based on the role of ITU:

H5: ITU has a positive influence on IAE.

H6: The mediating effect of ITU between IAC and IAE is positive.

H7: The mediating effect of ITU between IAP and IAE is positive.

3. Method

The PLS-SEM is a statistical technique used for modelling complex relationships between latent and observed variables. When the sample size is small, or the data does not meet the assumptions of normality, PLS-SEM is particularly useful. Undeniably, PLS-SEM is a versatile and powerful technique for analysing structural relationships in data, particularly in situations where traditional methods may not be suitable. It is widely used in various fields, including management, marketing, and social sciences (Hair et al., 2014). The study uses SmartPLS 4.0 for statistical analysis.

3.1 Model Specification

The factors influencing IAE comprise internal auditor competence, IAP, and IT. As stated earlier, IT serves as a mediator between internal audit competency and IAE and between IAP and IAE. The proposed hypotheses were tested using a PLS-SEM model. The concept model is depicted in Figure 1.

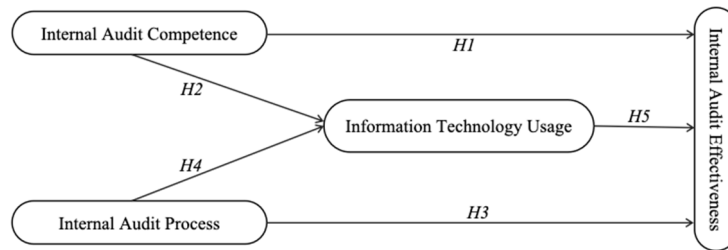


Figure 1. Concept Model

3.2 Measurement of Factors

In the SEM-PLS model, the measurement indicators for latent variables are classified into two types: reflective and formative (Hanafiah, 2020; Coltman & Midgley, 2008). Reflective indicators represent the outward manifestations of latent variables, where changes in the latent variable lead to corresponding changes in all reflective indicators. This study exclusively uses reflective indicators.

For the reflective indicators of IAE, previous research has provided various measurement indicators. Based on the synthesis of earlier studies (Alzeban & Gwilliam, 2014; Shamsuddin et al., 2015; Sulaiman et al., 2022; Onay, 2021), seven indicators were designed. These indicators primarily reflect the achievement of internal audit objectives, audit objectivity, risk management evaluation and improvement, and the enhancement of internal controls within the organization.

The measurement indicators for IAC were derived from the conclusions of studies by Alzeban & Gwilliam (2014), George et al. (2015), and Ta & Doan (2022), resulting in nine indicators (IAC1 to IAC9). These indicators primarily reflect the experience, professional background, continuous development, and overall capabilities of internal auditors.

The measurement indicators for ITU were based on the research findings of Pedrosa et al. (2020), Lutfi & Alqudah (2023), Veerankutty et al. (2018), and Shamsuddin et al. (2015), resulting in five indicators (IT1 to IT5). These indicators mainly assess the extent of IT application and its contribution to internal audit work.

Finally, the measurement indicators for IAP were developed with reference to the research of Zhuang (2021) and Lampe & Sutton (1994), resulting in eight indicators (IAP1 to IAP8). These indicators primarily reflect the standardization, execution rate, and outcomes of the internal audit plan. Table 1 provides a detailed list of the measurement indicators and statistical analysis.

Table 1. Measurement items statistics

Items	Coding	Mean	Standard deviation	Excess kurtosis	Skewness
The organization has a comprehensive internal audit charter.	IAE1	4.534	1.510	0.074	-1.067
The audit results meet the expected goals.	IAE2	4.940	1.168	2.426	-1.570
The internal audit is fully implemented according to the plan.	IAE3	4.504	1.423	0.002	-0.942
The audit report objectively reflects the reality.	IAE4	4.835	1.246	1.705	-1.428
The board or executives promptly discuss the audit report and follow up on the results.	IAE5	4.962	1.160	2.825	-1.594
Internal audit identifies risks within the organization.	IAE6	4.684	1.241	0.557	-1.027
Internal audit improves the organization's internal control.	IAE7	5.083	0.885	3.145	-1.284

Internal auditors have industry work experience.	IAC1	5.105	0.852	3.186	-1.238
Internal auditors hold audit-related certifications.	IAC2	5.135	0.783	0.561	-0.815
Internal auditors have audit-related academic qualifications.	IAC3	5.203	0.723	0.405	-0.693
Internal auditors are familiar with the organization's business processes.	IAC4	5.211	0.683	0.363	-0.583
Internal auditors participate in professional training annually.	IAC5	5.211	0.756	0.452	-0.796
Internal auditors possess communication and coordination skills.	IAC6	5.218	0.729	0.373	-0.719
Internal auditors have extensive knowledge required for the organization's operations.	IAC7	5.158	0.713	-0.540	-0.368
Internal auditors are proficient in using the organization's information platforms and tools.	IAC8	5.188	0.706	0.066	-0.546
Internal auditors frequently attend industry professional exchange activities.	IAC9	5.226	0.700	0.200	-0.613
Standardization of the internal audit plan.	IAP1	5.218	0.653	0.027	-0.422
The importance of audits in organizational development.	IAP2	5.150	0.731	2.123	-0.945
Completion rate of the audit plan.	IAP3	5.316	0.665	0.039	-0.618
Quality of audit working papers and reports.	IAP4	5.414	0.627	-0.575	-0.594
Level of management involvement in the audit plan.	IAP5	5.368	0.643	0.304	-0.698
Extent of application of key audit techniques.	IAP6	5.429	0.579	-0.715	-0.422
Number of days from the end of fieldwork to the report issuance.	IAP7	5.346	0.601	-0.645	-0.329
Audit follow-up execution rate.	IAP8	5.248	0.835	5.515	-1.750
Proficient in using the organization's IT systems to carry out work.	ITU1	5.248	0.740	2.828	-1.225
Level of support provided by the organization's IT engineers for system applications.	ITU2	5.256	0.633	0.235	-0.453
Proficiency in using data analysis tools.	ITU3	5.203	0.743	0.165	-0.683
The application of IT systems has improved work efficiency.	ITU4	5.241	0.727	1.628	-0.883
IT platform application training is conducted frequently.	ITU5	5.256	0.722	0.569	-0.796

3.3 Questionnaire Data

The study collected data through a questionnaire survey targeting 126 listed financial enterprises in China. Surveys were conducted using both online and offline methods. At the end of the data collection phase, a total of 196 questionnaires were returned. After excluding 63 invalid questionnaires, 133 valid questionnaires remained. The specific statistics of the valid questionnaires are presented in Table 2.

Table 2. Respondents' demographic information

Respondent Information		Observation	Percentage
Gender	Male	58	43.61%
	Female	75	56.39%
	Total	133	100.00%
Education Degree	Bachelor	82	61.65%
	Master	51	38.35%
	Total	133	100.00%
Professional Certificate	CPA/CIA	68	51.13%
	Intermediate auditor	37	27.82%
	No	28	21.05%
Working Position	Total	133	100.00%
	Senior internal auditor	36	27.07%
	Department head/deputy head	33	24.81%
	Internal auditor	51	38.35%
	Internal auditor assistance	13	9.77%
	Total	133	100.00%
Working Experience	< 5 years	30	22.56%
	From 5 years - 10 years	72	54.14%
	> 10 years	31	23.31%
	Total	133	100.00%
Department Establishment Time	< 5 years	21	15.79%
	From 5 years - 10 years	71	53.38%
	>10 years	41	30.83%
	Total	136	100.00%

4. Structure Model Analysis

4.1 Measurement Model Assessment

The first step in the structural model analysis is measurement model evaluation based on the following parameters: factor outer loading, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and discriminant validity.

Table 3 reports the results of the factor outer loading, Cronbach's alpha, CR, and AVE. The factor outer loadings of all items range from 0.716 to 0.938. The factor loadings above 0.7 indicate that the construct explains more than 70% of the indicator's variance, demonstrating that the indicator exhibits a satisfactory degree of item reliability. The Cronbach's alpha values are more than 0.8. The CR value above 0.896 exceeds the recommended threshold of 0.7 (Chin, 2009; Hair et al., 2014). These values indicated a good internal consistency of the model and proved that all constructs are reliable. Similarly, convergent validity is considered favourable when the AVE of each construct equals or exceeds 0.5, which is consistent with the study's result. This finding indicates that all items converge in estimating the construct, thereby providing evidence for a good convergent validity of the model (Chin, 2009; Hair et al., 2014).

Table 3. Measurement model assessment

Construct	Items	Outer Loadings	Cronbach's Alpha	CR	AVE	
Internal Process	Audit	IAP1	0.870	0.948	0.951	0.738
		IAP2	0.716			
		IAP3	0.900			
		IAP4	0.914			
		IAP5	0.906			
		IAP6	0.886			
		IAP7	0.898			
		IAP8	0.762			
Internal Competence	Audit	IAC1	0.798	0.972	0.975	0.82
		IAC2	0.885			
		IAC3	0.928			
		IAC4	0.938			
		IAC5	0.920			
		IAC6	0.915			
		IAC7	0.929			
		IAC8	0.923			
Internal Effectiveness	Audit	IAE1	0.749	0.928	0.935	0.698
		IAE2	0.872			
		IAE3	0.834			
		IAE4	0.868			
		IAE5	0.835			
		IAE6	0.829			
		IAE7	0.853			
Information Technology Usage		ITU1	0.807	0.856	0.896	0.635
		ITU2	0.788			
		ITU3	0.769			
		ITU4	0.819			
		ITU5	0.801			

Discriminant validity is evaluated to prove that any construct in the model is truly distinct from other constructs through empirical results (Hair et al., 2014). According to the Heterotrait-Monotrait ratio (HTMT) criterion, Table 4 indicates that no values regarding the HTMT ratio exceeded 0.85. This finding indicates that the discriminant validity is not violated (Henseler et al., 2016).

Table 4. Discriminant Validity HTMT ratio

	IAP	IAC	IAE	ITU
IAP				
IAC	0.666			
IAE	0.716	0.592		
ITU	0.839	0.759	0.778	

4.2 Structure Model Assessment

The second step is inner model evaluation based on the following parameters: R^2 and Q^2 . The inner model is assessed through PLS bootstrapping. In PLS-SEM, R^2 evaluates the explanatory power of the structural model. R^2 values range from 0 to 1, with higher values indicating better explanatory power. Q^2 assesses the predictive capability of the structural model. $Q^2 > 0$ indicates good predictive capability, while $Q^2 \leq 0$ suggests poor predictive capability. Table 5 and Table 6 indicate that R^2 and Q^2 are more than 0.312. Hence, the explanatory power of the variances is at a moderate level or above (Chin, 2009).

Table 5. R^2

	R^2	R^2 adjusted
IAE	0.553	0.543
ITU	0.644	0.639

Table 6. Q^2

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
IAE	931	586.202	0.370
ITU	665	397.431	0.402

5. Hypotheses Testing and Results

According to the PLS bootstrapping algorithm, the factor loadings of all the items are significant ($p = 0.05$). Table 7 reveals the total effect. By assuming a 5% significance level, all relationships in the structural model are found to be significant. The hypotheses $H1$, $H2$, $H3$, $H4$, and $H5$ are supported ($p = 0.05$).

Table 7. Total effect

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Test
IAC -> IAE	0.223	0.224	0.097	2.305	0.000	$H1$ supported
IAC -> ITU	0.357	0.359	0.086	4.171	0.000	$H2$ supported
IAP -> IAE	0.541	0.543	0.097	5.585	0.000	$H3$ supported
IAP -> ITU	0.525	0.526	0.084	6.250	0.000	$H4$ supported
ITU -> IAE	0.397	0.397	0.111	3.560	0.000	$H5$ supported

Notes. $p = 0.05$, two-tailed.

Table 8 reveals the total indirect effect and presents the mediating roles of ITU. The paths IAC -> ITU -> IAE and IAP -> ITU -> IAE were tested significantly. As per the findings, the hypotheses $H6$ and $H7$ are supported ($p = 0.05$).

Three types of mediation exist (Hair, 2017), as listed below:

- (1) Complementary mediation: The indirect and direct effects are both significant and point in the same direction.
- (2) Competitive mediation: The indirect and direct effects are both significant and point in opposite directions.
- (3) Indirect-only mediation: The indirect effect is significant but not for direct .

The direct effect of IAC -> IAE and the indirect effect of IAC -> ITU -> IAE are both significant, implying complementary mediation. The direct effect of IAP -> IAE and the indirect effect of IAP -> ITU -> IAE are both significant, also implying complementary mediation.

Table 8. Indirect effect

Path	Original sample	Sample mean	Standard deviation	T statistics	P values	Test
IAC -> ITU -> IAE	0.142	0.144	0.058	2.447	0.014	<i>H6</i> supported
IAP -> ITU -> IAE	0.208	0.207	0.063	3.306	0.001	<i>H7</i> supported

Notes. $p = 0.05$, two-tailed.

The strength of the mediation can be determined from the value of Variance Accounted For (VAF). The VAF value represents the ratio of the beta coefficient of the indirect effect to the total effect. A VAF value greater than 80% represents full mediation, a VAF value between 20% and 80% indicates partial mediation, while a value below 20% signifies no mediation (Hair et al., 2011). Table 9 indicates two-path partial mediation due to the VAF of IAC -> ITU -> IAE and IAP -> ITU -> IAE are 36.32% and 61.55%, respectively.

Table 9. Mediating result

Independence Variable	Mediator Variable	Dependence Variable	Indirect Effect	Direct Effect	Total Effect	VAF
IAC	ITU	IAE	0.142	0.081	0.223	36.32%
IAP	ITU	IAE	0.208	0.333	0.541	61.55%

6. Conclusion

According to RBV theory, the effectiveness of internal auditing depends on the access, allocation, and utilization of internal resources. An organization with well-structured resource management capabilities, highly skilled auditors, efficient audit processes, and advanced technological tools can create valuable, scarce, and even inimitable audit resources. These resources, in turn, enable the internal audit function to provide valuable recommendations, helping the organization build a sustainable competitive advantage.

This empirical research revealed that the direct impact of IT on IAE is significant, and its mediating effect is also significant, which is sufficient to demonstrate the importance of IT. Undeniably, IT plays a crucial role in enhancing various aspects of internal audit practices. Businesses today are largely shaped by IT and technological advancements. Similarly, internal audits are undergoing transformation due to IT issues. The development of communication and IT has changed how humans work. For instance, IT platforms provide new enterprise management models, leading management towards systematic and intelligent development and making enterprise management more scientific and standardised. Technologies such as big data, cloud computing, mobility, and social media generate high volumes of data. While such data gives enterprises a competitive advantage, it also poses numerous challenges and data governance and management issues to businesses.

This empirical research has discovered that IAC significantly impacts IAE. Simultaneously, the indirect influence of ITU as a mediator variable between IAC and IAE is also significant. The finding indicates that IT, as a platform or tool, aids auditors, thus affecting the effectiveness of internal audits. On the other hand, this finding also demands that auditors must possess relevant knowledge and skills. The internal auditor is the core of internal audit. Thus, they must continuously update their knowledge, master new auditing tools, and undergo continuous professional training to enhance their skills and adapt to new work patterns.

Another empirical finding indicates that the direct impact of IAP on IAE is significant. The indirect influence of ITU as a mediator variable between IAP and IAE is also significant, indicating a close relationship between audit processes and IT. The IAP is the specific steps and procedures undertaken to complete internal audit tasks and achieve internal audit objectives. The audit process is bound to evolve with changes in tasks and objectives and the audit environment. New information platforms and tools allow for the flexible formulation of audit procedures based on different audit tasks and objectives and enable partial or complete automation of auditing processes. In addition, IT tools automate routine audit tasks such as data collection, testing, and reporting. This automation improves audit efficiency by reducing manual effort and allowing auditors to focus on higher-value activities, such as data interpretation and strategic analysis. Additionally, IT tools facilitate remote access to audit systems and data, enabling auditors to conduct audits remotely without the need for physical presence. This

capability has become particularly valuable in situations such as pandemics or travel restrictions.

This study only considers three factors: the competence of the internal auditor, the IAP, and IT usage. Further research is needed to determine whether other factors influencing IAE are effective under the mediation of IT. The data in this study is limited to China's financial industry, and whether the conceptual model is effective in other industries requires further research. In short, the digitalization of enterprises brings new challenges to internal auditing.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal and publisher adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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