
The Impact of Digitalisation on Internal Audit Effectiveness

A Field Study on a Sample of Economic Enterprises

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Abstract:

This study investigates the impact of digital transformation on the quality and effectiveness of internal auditing, with a specific focus on diagnosing the professional challenges posed by the modern technological environment. To achieve this, we adopted a descriptive-analytical approach, using a questionnaire distributed to industry practitioners to assess the interaction between digital tools and audit performance. The statistical findings indicate a positive correlation, confirming that digitization significantly enhances audit efficiency, despite the complex challenges that require high organizational readiness. Consequently, the study recommends a "dual investment" strategy that integrates digital infrastructure upgrades with human capital development, regarding them as essential pillars for strengthening corporate governance and ensuring the quality of future audit outcomes.

Keywords: Digitalization; Internal Audit; Internal Audit Effectiveness; Professional Challenges; Corporate Governance.

Jel Classification Codes: O33, M42, L25.

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1. Introduction :

The wave of digitalisation unleashed by the Fourth Industrial Revolution is no longer merely a strategic option for organisations; it has become an inevitable reality that has reshaped the global economic landscape. Amidst this shifting scene, the internal audit function finds itself at a critical juncture: it must either adapt to smart technological tools or risk losing its value-added proposition. The essence of this transformation lies not merely in replacing paper with screens, but extends to a radical overhaul of business models aimed at raising operational efficiency and ensuring the flow of transparent and reliable financial information.

From a practical perspective, relying on traditional methods based on limited sampling and ex-post examination is no longer sufficient to keep pace with the velocity of data today. Here, the argument presented by (Betti, Sarens, & Poncin, 2021, pp. 565-567) comes to the fore, viewing digitalisation as the primary lever for contemporary audit effectiveness. It enables auditors to shift from "partial examination" to "comprehensive analysis" of big data in record time. Furthermore, integrating advanced technologies such as Artificial Intelligence and Blockchain opens new horizons for strengthening corporate governance and restoring investor confidence through more accurate and honest financial reporting, a point confirmed by the findings of (Johari, Abidin, & Roshayani, 2023, pp. 50-52).

2. General Farmework of Study

2.1 Problem Statement

Despite the theoretical consensus on the importance of digital transformation, the reality on the ground raises serious questions regarding actual implementation. Organisations today—particularly within the Algerian environment—face a clear paradox: on one hand, they recognise the necessity of adopting digitalisation as a mechanism to develop the internal audit function and ensure governance and transparency; on the other hand, they collide with practical challenges that may limit the desired effectiveness of these technologies.

The research gap we attempt to address lies in the fact that current literature often focuses on the technical side of digitalisation, overlooking how this actually reflects on audit quality within the context of emerging economies like Algeria. Consequently, this study does not stop at asking about the "importance" of digitalisation, but delves deeper to pose the following problem: *To what extent do digital transformation practices actually contribute to enhancing the effectiveness of internal audit within Algerian economic institutions, and what are the real obstacles preventing the optimal utilisation of these technologies?*

2.2 Research Hypotheses

Based on the stated problem, the study seeks to test the following hypotheses:

- **Hypothesis 1 (H1):** There is a statistically significant relationship between the level of digitalisation and the effectiveness of internal audit within the organisation.
- **Hypothesis 2 (H2):** There is a statistically significant relationship between the level of digitalisation and the professional challenges faced by internal auditors.
- **Hypothesis 3 (H3):** There is a statistically significant relationship between professional challenges and the effectiveness of internal audit within the organisation.

2.3 Significance of the Study

This study derives its importance from several aspects, which can be summarised as follows:

- **Scientific Significance:** The study contributes to enriching the scientific literature regarding digitalisation and internal audit by analysing the relationship between digital transformation and the effectiveness of the oversight function in an organisational context.
- **Practical Significance:** The study results provide practical indicators for decision-makers and those responsible for the internal audit function regarding how to employ digitalisation to improve performance and strengthen governance.
- **Institutional Significance:** It assists institutions in recognising the challenges associated with digital transformation and working towards developing the skills of internal auditors to suit the modern digital environment.

2.4 Objectives of the Study

This study seeks to achieve a number of objectives, most notably:

- To analyse the impact of digitalisation on the effectiveness of internal audit in institutions.
- To identify the nature of the professional challenges imposed by digital transformation on internal auditors.
- To measure the relationship between professional challenges and internal audit effectiveness.
- To offer practical recommendations that contribute to strengthening the role of internal audit in light of the digital environment.

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- To measure the relationship between professional challenges and internal audit effectiveness.

- To offer practical recommendations that contribute to strengthening the role of internal audit in light of the digital environment.

2.5 Research Methodology

To encompass the various aspects of this complex subject, we have selected the descriptive-analytical approach. This method is best suited for diagnosing the reality of digitalisation in internal audit work on the one hand, and deconstructing the correlations between the study variables on the other. To bridge the theoretical side with practical reality, a field study was conducted via a questionnaire directly targeting internal auditors. Their responses were subjected to statistical processing using SPSS, including reliability and correlation tests, in order to scrutinise the hypotheses and derive results that truthfully reflect reality

3. Theoretical Framework and Previous Studies

3.1 The Concept of Digitalisation and Digital Transformation

Today, digitalisation cannot be viewed merely as the deployment of technical tools; rather, it is a comprehensive re-engineering of organisational activities aimed at raising efficiency and innovating unprecedented business models. It is essential here to draw a precise distinction between terms that are often conflated. While simple 'Digitisation' refers to the conversion of data from physical paper formats into electronic ones, 'Digital Transformation' represents the broader umbrella encompassing radical, technology-led change at the core of business strategies and governance structures (Reis, Amorim, Melão, & Matos, 2024, pp. 2-3)

Amidst this shifting landscape, recent studies have proven that adopting digitalisation has transitioned from being a strategic option to an inevitable necessity for ensuring survival and global competitiveness (Verhoef & al, 2021, pp. 889-891). This shift has clearly reflected on the auditing profession, where technology has spawned advanced concepts such as 'Continuous Auditing' and 'Data-Driven Auditing', enabling auditors to expand the scope of examination and reach levels of precision that traditional methods fail to match (Tharouma & Oudai, 2022, pp. 793-795)

3.2 Internal Audit: Objectives and Developments

According to the definition by the Institute of Internal Auditors (IIA), internal audit is viewed as an independent, objective assurance and consulting activity designed to add value and improve an organisation's operations through a disciplined approach to risk evaluation (IIA, 2017, p. 1). Historically, the auditor's role was confined to the narrow corner of financial and accounting auditing, focusing efforts on error detection and fraud tracking. However, with the complexity of the contemporary business environment, this function has broken its traditional moulds to extend towards broader tasks, including evaluating internal control efficiency, enhancing governance practices, and playing the role of a consultative partner to senior management.

Technological momentum has accelerated this evolution, giving rise to modern methodologies such as 'Continuous Auditing', which allows for real-time monitoring of operations, and 'Risk-Based Auditing', which directs resources towards the most critical points in the organisation. This is in addition to the rise of 'Digital Auditing', which integrates technology into the core of audit work (Alles, 2015, pp. 441-444; Betti, Sarens, & Poncin, 2021, pp. 566-569). All these shifts have moved internal audit from a function excavating past records to a strategic function anticipating the future and supporting decision-making through predictive analytics.

3.3 The Impact of Digitalisation on Internal Audit Effectiveness

The digital wave has brought about a radical transformation in the essence of internal audit, moving beyond mere tool improvement to raising the efficiency of the entire process. At an operational level, the audit process is no longer held captive by slow routine procedures; automation has enabled auditors to shorten the time allocated for record reconciliation, making room to cover a wider scope of operations with speed and precision (Fotouh & Lorentzon, 2021, pp. 216-218).

The matter does not stop at speed alone, but extends to the quality of outputs; the use of Big Data Analytics has significantly reduced the margin for human error, granting auditors a 'sharp eye' to detect deviations that traditional methods might overlook (Tharouma & Oudai, 2022, pp. 794-796). Instead of relying on sampling systems that may not be representative of reality, digitalisation has allowed for the examination of the entire statistical population of data, thereby bolstering confidence in results and encircling high-risk transactions (Reis, Amorim, Melão, & Matos, 2024, pp. 6-8).

This technical evolution has reshaped the added value of internal audit, transforming it from a purely oversight function into a strategic partner offering counsel to senior management on sensitive files such as digital governance and cyber security (Johari, Abidin, & Roshayani, 2023, pp. 47-49). However, it is important to emphasise that technology does not eliminate the human element, but rather redefines it; the auditor today is no longer just an accountant, but is required to possess a hybrid mix of financial and technical skills to be able to wield these digital tools effectively (Betti, Sarens, & Poncin, 2021, p. 874)

3.4 Challenges Associated with the Digitalisation of Internal Audit

Despite the numerous advantages offered by digitalisation, there is a set of challenges hindering its actual adoption within the internal audit function:

Lack of Digital Competencies: Many internal auditors do not possess sufficient technical skills to handle advanced digital tools, such as Artificial Intelligence and Big Data Analytics (Betti, Sarens, & Poncin, 2021, p. 205). This compels organisations to invest in continuous training and development programmes. **High Costs:** Initial investments in digital audit systems represent a financial burden, especially in Small and Medium-sized Enterprises (SMEs), as specialised software requires substantial financial resources (Tharouma & Oudai, 2022,

pp. 796-797). Cyber Security: Increased reliance on digital systems raises the probability of exposure to cyber-attacks or sensitive data leaks. Therefore, it has become mandatory for internal auditors to possess advanced knowledge of cyber security risks (Johari, Abidin, & Roshayani, 2023, pp. 48-89). Resistance to Change: In many institutions, there remains reservation or resistance from some employees and departments regarding the introduction of technology into oversight work, due to the absence of an institutional digital culture (Fotoh & Lorentzon, 2021, pp. 217-218).

3.5 Theoretical Frameworks Supporting the Research

To interpret the relationship between digitalisation and internal audit effectiveness, reliance can be placed on several theoretical frameworks established in the literature:

- **Technology Acceptance Model (TAM):** This theory explains how perceived ease of use and perceived usefulness influence the adoption of digital tools in auditing (Venkatesh & Davis, 2000, pp. 186-188).
- **Corporate Governance Theory:** This emphasizes the role of internal control systems in ensuring transparency and accountability, whereby digitalisation enhances the capacity of internal audit to fulfil governance requirements (Tricker, 2019, pp. 79-82).

Resource Dependency Theory: This highlights the importance of technological and human resources in strengthening an organisation's ability to adapt to the business environment, rendering investment in digitalisation a strategic necessity (Pfeffer & Salancik, 2003, pp. 2-3)

3.6 Literature Review

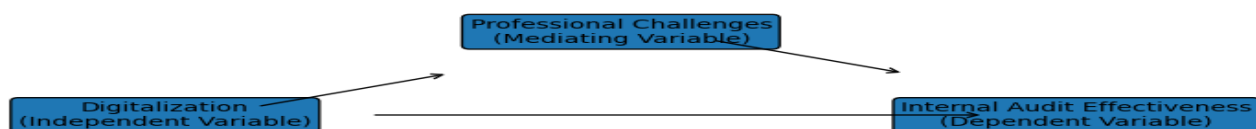
- **Betti, Sarens, & Poncin (2021):** Their study demonstrated that digitalisation enhances the internal audit's ability to provide value-added assurance, yet conversely imposes new requirements in terms of digital competencies.
- **Fotoh & Lorentzon (2021):** Discussed how digitalisation will alter the future of internal audit, particularly with the shift towards continuous auditing and reliance on comprehensive databases.
- **Tharouma & Oudai (2022):** Presented a recent literature review on the relationship between internal audit and digital transformation, asserting that the success of digitalisation is contingent upon the readiness of human resources.
- **Johari et al. (2023):** Focused on the cyber challenges facing internal audit amidst digitalisation, recommending the adoption of advanced security strategies.
- **Reis et al. (2024):** Conducted a systematic review of research regarding auditing in the digital age, concluding that digitalisation represents an opportunity to completely redefine the internal audit function.

3.7 Proposed Conceptual Model

Drawing from the literature, a conceptual model can be formulated to illustrate the relationship between:

- **Independent Variable:** Level of Digitalisation.
- **Dependent Variable:** Internal Audit Effectiveness.
- **Mediating/Moderating Variables:** Human Competencies, Technological Infrastructure, Cyber Security.

Figure 1. Conceptual Framework of the Impact of Digitalization on Internal Audit Effectiveness



Source: Prepared by the researcher

Figure 1 illustrates the conceptual model of the study, which depicts the direct impact of digitalization on internal audit effectiveness, as well as the mediating role of professional challenges. The model is developed based on the theoretical foundations and previous empirical studies.

3.8 Conclusion of the Theoretical Section

The literature review concludes that digitalisation has become a pivotal element in enhancing the effectiveness of internal audit by improving efficiency, accuracy, comprehensiveness, and added value. However, challenges such as a lack of competencies, investment costs, and cyber security continue to hinder the comprehensive adoption of this technology.

Consequently, research in this field assumes both practical and scientific importance, especially in emerging environments such as Algeria, where applied studies remain limited. This study is poised to bridge a significant knowledge gap by testing the relationship between digitalisation and internal audit effectiveness, relying on a sample of local institutions.

4. The Empirical (Applied) Aspect of the Study

4.1 Research Methodology

This research relies on the descriptive-analytical approach, due to its suitability for studying the impact of digitalisation on internal audit effectiveness. A questionnaire was employed as the primary data collection tool, designed based on modern literature and relevant previous studies, with question items distributed across four

main axes: the level of digitalisation, internal audit effectiveness, challenges associated with digitalisation, and the demographic data of the respondents.

The study population consists of internal auditors, accountants, and control and governance officers within economic institutions. Given the difficulty of enumerating the entire population, a simple random sampling method was adopted. The target sample size is approximately (50) individuals, which is sufficient for utilising advanced statistical methods such as correlation and regression analysis.

4.2 Research Instrument

The questionnaire was designed using a five-point Likert scale (ranging from 1 = Strongly Disagree to 5 = Strongly Agree). Its items were distributed as follows:

- **Axis One:** Demographic Data (Age, Educational Qualification, Years of Experience, Job Title).
- **Axis Two:** Level of Digitalisation (5 items measuring the extent of technology use, Artificial Intelligence, Big Data, Digital Accounting Systems, etc.).
- **Axis Three:** Internal Audit Effectiveness (5 items measuring Efficiency, Accuracy, Comprehensiveness, Speed of Execution, Added Value).
- **Axis Four:** Challenges (5 items regarding Costs, Lack of Competencies, Cyber Security, Resistance to Change).

4.3 Statistical Analysis Plan

To analyse the data, a set of statistical methods will be utilised via SPSS and Excel software, as follows:

- **Descriptive Statistics:** Arithmetic Mean, Standard Deviation, Percentages.
- **Validity and Reliability Tests:** Calculation of Cronbach's Alpha coefficient to verify the reliability of the questionnaire.
- **Inferential Analysis:**
 - Pearson Correlation Coefficient to study the relationship between digitalisation and audit effectiveness.
 - Simple and Multiple Linear Regression Analysis to test the impact of digitalisation on audit effectiveness.
- **Comparison of Results:** Linking the findings reached with the previous studies cited in the theoretical framework.

5. Analysis of Questionnaire Results: The Impact of Digitalisation on the Effectiveness of Internal Audit Systems

5.1 Demographic Characteristics of the Sample

Table 1: Distribution of Sample Members According to Demographic Data

Variable	Category	Frequency	Percentage
Gender	Male	39	84.8%
Gender	Female	7	15.2%
Age	Under 30 years	13	28.3%
Age	30–40 years	25	54.3%
Age	Over 40 years	8	17.4%
Educational Level	Bachelor's	18	39.1%
Educational Level	Master's	21	45.7%
Educational Level	PhD	7	15.2%
Experience	Less than 5 years	14	30.4%
Experience	5–10 years	22	47.8%
Experience	More than 10 years	10	21.7%

Source: Prepared by the researcher

Interpretation and Analysis

- **Male to Female Ratio:** The preponderance of males (84.8%) versus females (15.2%) suggests that the internal audit field within the surveyed institutions remains significantly male-dominated. This may influence the diversity of perspectives regarding decision-making related to digital transformation.
- **Age Group (30–40 years):** Constituting 54.3% of the sample, this age bracket is the most represented. This is an active demographic, typically capable of adapting to technology, which may be a positive factor in the acceptance of digitalisation.
- **Educational Level:** The fact that 45.7% of the sample hold a Master's degree indicates a high academic level among respondents, thereby enhancing the credibility of the responses and the subjects' awareness of modern challenges and concepts.
- **Experience:** With 47.8% of the sample possessing between 5 and 10 years of experience, this category represents sufficient practical expertise to understand the reality of auditing both before and after digitalisation, rendering their responses more objective.

5.2 Reliability Analysis of the Questionnaire

Table 2: Reliability Coefficients for Questionnaire Axes

Axis	Number of Items	Cronbach's Alpha	Reliability Level
Digitalisation Axis	4	0.84	Excellent
Effectiveness Axis	4	0.82	Excellent
Challenges Axis	4	0.79	Good
Total Questionnaire	12	0.86	Excellent

Source: Prepared by the researcher

Interpretation and Analysis

- **Overall Reliability Coefficient (0.86):** Indicates a very high stability for the questionnaire instrument, meaning it reliably measures what it was designed to measure, thus bolstering the credibility of the results.
- **Digitalisation (0.84) and Effectiveness (0.82) Axes:** These coefficients demonstrate that the items within these two axes are strongly correlated and represent a cohesive construct, supporting their validity for statistical analysis.
- **Challenges Axis (0.79):** This is considered good reliability, though slightly lower than the other two axes. This may suggest that perceived challenges vary more significantly between individuals or institutions.

5.3 Descriptive Analysis of Questionnaire Axes

Table 3: Arithmetic Means and Standard Deviations for Axis Items

Axis and Item	Mean	Standard Deviation	Level of Application
Digitalisation Axis	4.02	0.78	High
x1: Electronic Accounting Information Systems	4.15	0.82	Very High
x2: Specialised Internal Audit Software	4.02	0.79	High
x3: Use of Artificial Intelligence	3.89	0.85	High
x4: Level of Automation in Financial	4.02	0.91	High

Axis and Item	Mean	Standard Deviation	Level of Application
Processes			
Effectiveness Axis	4.18	0.74	Very High
S1: Improving Speed of Audit Operations	4.35	0.68	Very High
S2: Improving Accuracy of Audit Results	4.24	0.72	Very High
S3: Reducing Errors and Fraud	4.15	0.81	High
S4: Comprehensiveness in Auditing	3.98	0.83	High
Challenges Axis	3.65	0.89	Medium
N1: Weak Technological Infrastructure	3.85	0.92	High
N2: Lack of Human Competencies	3.72	0.88	High
N3: High Costs	3.58	0.95	Medium
N4: Resistance to Change	3.45	0.96	Medium

Source: Prepared by the researcher

Interpretation and Analysis

- **High Means for Digitalisation (4.02) and Effectiveness (4.18):** This indicates a strong positive trend, where respondents recognise a good level of digitalisation and perceive an improvement in effectiveness.
- **Highest Mean in Effectiveness ("Improving Speed of Audit Operations" - 4.35):** This is a significant result, confirming that the most tangible impact of digitalisation from the practitioners' perspective is the acceleration of procedures, freeing up auditor time for value-added tasks.
- **Lowest Mean in Digitalisation ("Use of Artificial Intelligence" - 3.89):** This reveals that the most advanced tools (AI) are the least adopted, suggesting that digitalisation is still in its early or traditional stages (process automation) rather than being fully 'smart'.
- **Challenges Axis Mean (3.65) and High Standard Deviation (0.89):** This implies that the assessment of challenges ranges from medium to high, but the large standard deviation indicates a significant

divergence of opinion regarding the nature and severity of these challenges across institutions or individuals.

- **Highest Perceived Challenge ("Weak Technological Infrastructure" - 3.85):** This confirms that the primary obstacle is not purely human, but organisational-technical. Investment in infrastructure is the prerequisite for any successful digital transformation.
- **"Resistance to Change" (Lowest Mean - 3.45):** This could be a positive indicator of general cultural acceptance of transformation, or it might reflect an incomplete realisation of the dimensions of organisational change accompanying digitalisation.

5.4 Analysis of Relationships and Correlations

Table 4: Correlation Matrix between Main Axes

Axis	Digitalisation	Effectiveness	Challenges
Digitalisation	1.00	-	-
Effectiveness	0.76**	1.00	-
Challenges	-0.45	-0.52**	1.00

Source: Prepared by the researcher

**Statistical significance at 0.05 level **Statistical significance at 0.01 level*

Interpretation and Analysis

- **Very Strong Positive Relationship between Digitalisation and Effectiveness (0.76):** This result is the cornerstone of the study. It confirms the main research hypothesis and indicates that every increase in the level of digitalisation corresponds to a strong increase in audit effectiveness. The relationship is statistically significant at the 0.01 level, giving it high validity.
- **Moderate Negative Relationship between Challenges and Effectiveness (-0.52):** This confirms the third hypothesis, showing that challenges (costs, lack of skills, etc.) reduce the expected effectiveness of digitalisation. This is also a statistically significant relationship.
- **Weak, Non-Significant Negative Relationship between Digitalisation and Challenges (-0.45):** This is an interesting result. It may be interpreted in several ways:
 - Institutions with high digitalisation may have overcome basic challenges or managed them well.
 - Alternatively, challenges do not necessarily increase with increased digitalisation; they may be higher during the initial transition phase.

Most importantly: This relationship is not statistically significant, meaning one cannot generalise a clear linear

relationship between the two variables in the study population

5.5 Hypothesis Testing

Table 5: Research Hypothesis Test Results

Hypothesis	Analysis Tool	Test Value	Significance Level	Decision
H1: There is a relationship between Digitalisation and Effectiveness	Pearson Correlation	0.76	0.000	Accepted
H2: Digitalisation improves Speed and Accuracy	Linear Regression	$R^2 = 0.58$	0.001	Accepted
H3: There are challenges limiting the impact of Digitalisation	T-Test	$t = 4.85$	0.000	Accepted

Source: Prepared by the researcher

Interpretation and Analysis

- **Acceptance of the First Hypothesis (H1):** The strength of the coefficient of determination ($R^2 = 0.58$) for the regression model of digitalisation's impact on effectiveness means that approximately 58% of the variation in internal audit effectiveness is explained by the level of digitalisation. This percentage is considered high and holds strong explanatory significance in the context of social and administrative research, confirming the robust and pivotal impact of digitalisation.
- **T-Test Results ($t=4.85$) for Acceptance of H3:** The large T-value and high statistical significance (0.000) indicate that the differences in effectiveness estimation between those facing high versus low challenges are real differences, not due to chance. This strongly supports the notion that challenges negatively moderate the relationship.
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5.6 Analysis of Variance by Experience

Table 6: One-Way ANOVA for Digitalisation Estimation by Experience

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Value	Significance
Between Groups	8.45	2	4.225	4.32	0.021
Within Groups	42.18	43	0.981	-	-
Total	50.63	45	-	-	-

Interpretation and Analysis of Variance

- **Existence of Statistically Significant Difference (0.021):** The significant difference in the estimation of digitalisation according to years of experience is a substantial finding. It implies that the perception of the level of digitalisation varies with experience.
- It is probable that auditors with less experience (younger auditors) perceive the level of digitalisation as higher (possibly because they began their careers in a more digital environment).
- Conversely, those with longer experience compare the current situation with a less digital past reality, and thus may underestimate the current level.
- **Importance of Differences Between Groups:** To determine the direction of the difference, one must compare the arithmetic means of the experience groups (less than 5, 5–10, more than 10 years), which was not provided in the current table.

6. Discussion of Results

The current study provides a clear answer to its main problem statement and research questions, offering a comprehensive analysis of its three hypotheses in light of the theoretical framework and prior literature.

- 6.1 **Testing Hypothesis 1 (H1): The Relationship between Digitalisation and Internal Audit Effectiveness** This hypothesis was fully accepted, as statistical analysis revealed a strong, statistically significant positive relationship between the two variables (correlation coefficient = 0.76, $R^2 = 0.58$). This result indicates that digitalisation explains approximately 58% of the variance in internal audit effectiveness within the studied sample, positioning it as a strategic driver rather than merely a supplementary tool. This finding aligns with Resource Dependence Theory and Corporate Governance Theory, and is consistent with global literature trends (Betti, Sarens, & Poncin, 2021, pp. 566-569; Reis, Amorim, Melão, & Matos, 2024, pp. 6-8). It is worth noting that the strength of this relationship in the Algerian sample may reflect an urgent sense among auditors regarding the importance of digitalisation as a solution to traditional operational challenges.
- 6.2 **Second: Testing Hypothesis 2 (H2): The Relationship between Digitalisation and Professional Challenges** The results showed a weak negative relationship between the variables (correlation coefficient = -0.45); however, this relationship was not statistically significant. Therefore, the second hypothesis (H2) is rejected in its current form. This can be explained by several factors: the influence of the digital maturity stage (where the nature of challenges varies by stage), the differentiation of institutions in terms of resources, and the varying perceptions of auditors regarding the type of challenges (traditional versus advanced challenges like cyber security). This result calls for deeper qualitative research to

understand the nature of challenges at each stage of digital transformation.

- 6.3 **Third: Testing Hypothesis 3 (H3): The Relationship between Professional Challenges and Internal Audit Effectiveness** The third hypothesis (H3) was accepted, as results demonstrated a moderately strong, statistically significant negative relationship between the variables (correlation coefficient = -0.52). This result confirms that challenges act as a braking factor or a negative moderator in the relationship between digitalisation and effectiveness. This implies that institutions investing in digitalisation without proactively addressing accompanying challenges achieve a lower return on investment, supporting the necessity for a comprehensive and integrated view of digital transformation (Vial, 2019, pp. 122-124).

7. Conclusions and Recommendations

7.1 Main Findings

Based on hypothesis testing and comprehensive statistical analysis (using SPSS 26 at a significance level of 0.05), the following key conclusions can be drawn:

- **Confirmation of the Pivotal Role of Digitalisation:** The study strongly confirms that digitalisation is a key driver of internal audit effectiveness in the economic institutions studied, enabling improvements in operational efficiency, accuracy, and comprehensiveness. However, current application focuses more on automation and speed enhancement than on advanced predictive analytics such as Artificial Intelligence.
- **Primacy of Institutional Challenges:** Weak technological infrastructure represents the most critical obstacle in the institutions under study, surpassing the challenge of human capital shortages. This suggests that the root problem in the studied context is institutional-financial, shifting the focus towards the necessity of prior institutional investment as a prerequisite.
- **Challenges as a Moderator of Effectiveness:** Challenges do not negate the positive impact of digitalisation, but they do significantly dampen it. Proactively managing these challenges is what achieves the optimal return on digital investment in economic institutions.
- **Variation in Perception by Experience:** Analysis of Variance (ANOVA) showed statistically significant differences in the estimation of the digitalisation level based on years of experience (p-value = 0.021). This reveals that the perception of digital reality is not objective but is shaped through the lens of reference experience, which has important implications for designing change strategies and internal communication within audit departments in various institutions.
- **Intermediate Digital Maturity Stage:** The results paint a picture of the economic institutions in the sample as being at an intermediate stage of digital maturity. They have begun to reap the fruits of the

first phase—automation and efficiency improvement—but the road remains long towards a full strategic transformation based on AI and data.

7.2 Practical Recommendations

Based on the results and conclusions, the study offers the following practical recommendations:

- **First: At the Institutional Level**
 - Adopt an integrated digital strategy for internal audit as part of the comprehensive digital transformation plan.
 - Allocate sufficient and prioritised investments to develop the necessary technological infrastructure.
 - Establish specialised training programmes that account for differences in auditors' experience and digital proficiency.
 - Foster a culture of innovation, renewal, and acceptance of technical change through supportive management leadership.
- **Second: At the Internal Auditor Level**
 - Pursue independent acquisition of new digital skills, focusing on analytical and operational skills for advanced tools.
 - Develop new working methods that focus on the consultative and proactive aspects enabled by the digital environment.
 - Participate actively in designing and implementing digital transformation plans as key professionals in the process.
- **Third: At the Regulatory and Supervisory Level**
 - Develop national professional frameworks and standards addressing audit requirements and practices in the digital environment.
 - Encourage applied scientific research and the publication of case studies in the field of internal audit digitalisation within the Algerian context.
 - Organise periodic platforms and forums to exchange expertise and unify visions among different institutions.

7.3 Limitations of the Study and Future Research Horizons

The study acknowledges certain limitations which in themselves constitute opportunities for future research. Most notably: the limited sample size and its concentration on large and medium enterprises, and the reliance on a quantitative survey approach without utilising qualitative methods (such as in-depth interviews) that might offer richer explanations for the nature of challenges and perceptions.

The study suggests several avenues for future research:

- Comparative studies between different economic sectors (industrial, commercial, financial) to understand the specificity of digitalisation's impact in each.
- Qualitative research using tools such as focus groups and in-depth interviews to understand the organisational, behavioural, and cultural dimensions accompanying digital transformation.
- Designing and modelling digital frameworks suitable for the Algerian institutional and legal environment.
- Longitudinal studies tracking the evolution of digitalisation's impact on audit effectiveness within the same institution over an extended period.

8. Conclusion :

This study represents an applied contribution to understanding the shifts in one of the pillars of corporate governance—internal audit—amidst the strong winds of digital transformation. The results have confirmed that digitalisation in the context of Algerian internal audit has moved beyond being a technological option to become a strategic necessity for enhancing oversight effectiveness and contributing to building a culture of transparency and accountability.

However, the study also revealed that the fruits of this strategic necessity will not be fully harvested without a comprehensive vision that wisely combines the development of technological infrastructure, the building of digital human capital, and the development of supportive regulatory and policy frameworks. The journey of digital transformation in internal audit is a continuous voyage of learning, adaptation, and review, requiring constant development and a commitment to the spirit of collective innovation to maximise the potential of the digital age in service of effective institutional oversight and sustainable economic development in Algeria.

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