Internal Auditing Confronting Digital Transformation: Data Security and the Skills Gap as Critical Challenges – An Empirical Study in the Algerian Context

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Abstract: This study measures the extent to which internal auditors in Algeria perceive the challenges posed by digital transformation across two core dimensions: data security and privacy protection, and the development of auditors' technical skills and competencies.

To attain the objectives of this study, a descriptive–analytical methodology was adopted using a five-point Likert-scale questionnaire administered to a stratified random sample of 120 internal auditors representing various Algerian economic sectors. Data were analyzed using the one-sample t-test, one-way ANOVA, and multiple regression, with reliability confirmed through Cronbach's alpha ($\alpha = 0.80$; 0.872).

The findings revealed that both dimensions constitute statistically significant challenges. The data security dimension yielded a mean of 3.535 ($t = 11.418$; $p < 0.001$), while the technical skills dimension recorded a higher mean of 3.603 ($t = 13.356$; Cohen's $d = 1.219$), confirming that the skills gap – particularly in mastering artificial intelligence, blockchain, and big data analytics – represents the most acute challenge. Notably, the two dimensions proved statistically independent (non-significant correlation), and no significant differences emerged across demographic variables ($p > 0.05$), indicating that these challenges constitute a pervasive, profession-wide phenomenon.

Key words: Internal auditing; Digital transformation; Data security; Digital skills gap; Algeria.
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Introduction:

The external auditing profession in Algeria is undergoing fundamental transformations as a result of the digital evolution that has become an urgent necessity across various domains. Digital transformation compels external auditors to adapt to new tools and technologies such as artificial intelligence, big data analytics, and blockchain technologies, thereby contributing to the improvement of audit quality and efficiency. Nevertheless, this transformation poses significant challenges related to technical competence, data security, and the absence of appropriate legislation to regulate digital auditing.

One of the most prominent challenges facing auditors is the lack of the technical skills required to operate within the digital environment. Many auditors lack adequate training in the use of modern tools such as data analytics software and artificial intelligence systems, which affects their ability to deliver accurate and effective audit services. This deficiency necessitates substantial investments in training and human capacity development to ensure that practitioners keep pace with technological advancements.

In addition, data security constitutes a major challenge in the context of digital transformation. With the increasing use of digital systems for storing and processing financial information, such data become vulnerable to cyber breaches and manipulation. Auditors need to develop effective strategies for protecting data and ensuring its integrity during audit engagements, while also complying with laws pertaining to the protection of sensitive information.

Despite these challenges, digital transformation offers opportunities to improve audit quality and enhance its strategic role. Digital technologies can contribute to the automation of routine processes, thereby affording auditors the time to focus on providing analytical insights and valuable advisory services to organizations. To achieve this, professional bodies and organizations must invest in modern technology and develop legislation that effectively supports digital auditing.

Based on the foregoing, the research problem of our study can be formulated as follows:

"**In the context of accelerating digital transformation, what are the most prominent challenges impeding the internal audit profession in Algeria?**"

Study Hypotheses

To address the main research question, two principal hypotheses were formulated:

Hypothesis One (H_1): Data security and privacy protection are among the most prominent challenges facing the internal audit profession in Algeria in the context of digital transformation, as securing data against breaches and manipulation poses a significant difficulty for auditors.

Hypothesis Two (H_2): Digital transformation entails challenges related to developing the skills of internal auditors and updating their technical capabilities, thereby necessitating their qualification to deal effectively with modern digital tools and technologies in audit processes.

Significance of the Study

The significance of the study lies in the following points:

- The study sheds light on the principal challenges facing the internal audit profession in Algeria in the context of digital transformation a contemporary topic with a substantial impact on the quality and reliability of financial reporting.
- The study provides a clear vision of the knowledge and technical gaps confronting auditors, thereby assisting educational and professional institutions in developing advanced professional training programs aligned with the requirements of the digital age.
- It contributes to supporting decision-makers and regulatory bodies in formulating policies and procedures that foster a more secure and effective audit environment, particularly with regard to data protection and technical privacy.

- It represents a scholarly contribution that enriches the research literature on digital transformation and its impact on auditing practices, especially within the Algerian context, which suffers from a scarcity of studies.

Study Objectives

The objectives of the study can be summarized in the following key elements:

- Identifying and exploring the fundamental challenges facing the internal audit profession in Algeria as a result of digital transformation.
- Analyzing the extent to which auditors perceive the technical and organizational challenges associated with data security and privacy.
- Assessing the magnitude of training needs for developing auditors' skills and adapting them to the modern digital work environment.
- Providing recommendations grounded in the study's findings to enhance the effectiveness and quality of the auditing profession in the context of digital transformation.

Study Limitations

This study is confined to a specific spatial, temporal, and human framework, as it addresses the challenges of the auditing profession in the context of digital transformation at the national level, focusing on a sample of internal auditors practicing in Algerian economic enterprises. The study was conducted during the period from March to June 2025. Moreover, the study is concerned with identifying and understanding the technical and organizational challenges related to data security and the development of digital auditing skills, without addressing other dimensions such as potential impacts or proposed solutions. These delimitations are intended to enable the researchers to examine their subject matter with precision and depth within a clear and well-defined scope that reflects the reality of the profession within the framework of digital transformation in Algeria.

Study Methodology

The study adopts a descriptive–analytical approach as its principal methodological framework. The descriptive approach aims to describe and analyze the current state of the challenges facing the internal audit profession in the context of digital transformation, with an in-depth understanding of the dimensions of these challenges and their potential effects on professional practice. The analytical approach is employed to analyze the data collected through research instruments for the purpose of testing the proposed hypotheses and deriving precise scientific conclusions.

On the applied level, a questionnaire was carefully designed based on a review of prior scholarly literature and validated scales, targeting a random sample of internal auditors working in various Algerian economic enterprises, with a sample size of 120 respondents.

The study seeks to achieve integration between the theoretical aspect, extending from the review of scholarly literature, and the practical aspect, represented by the survey study, thereby enabling the construction of a robust knowledge base that facilitates the formulation of practical recommendations grounded in measurable and reliable findings.

Study Variables

The variables of this study consist of two main variables, aligned with the study's objective of exploring the challenges facing the internal audit profession in the context of digital transformation in Algeria:

Independent Variable: Digital transformation in the auditing profession:

This variable encompasses all technical and organizational aspects related to the use of modern digitalization technologies in audit processes, such as the use of artificial intelligence, big data analytics, automation, and blockchain technologies. It also includes the challenges imposed by these technologies on the professional environment, such as privacy and data security.

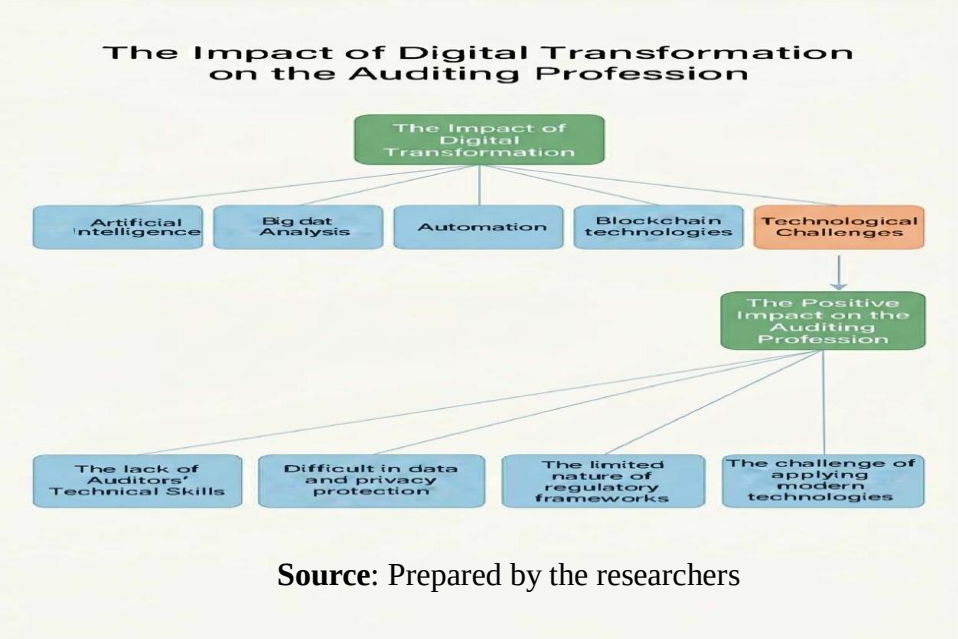
Dependent Variable: Challenges of the auditing profession in the context of digital transformation:

This variable is measured through several sub-dimensions relating to the lack of auditors' technical skills, difficulties in data and privacy protection, the limited nature of regulatory frameworks, and the challenges of applying modern technologies in the daily work environment

The relationship between these two variables is analyzed to understand the nature of the challenges imposed by the independent variable (digital transformation) on the dependent variable (challenges of the auditing profession), thereby contributing to conclusions that support the development of the auditing profession in Algeria in alignment with the requirements of the digital age.

Study Model: Variables of the Challenges of the Auditing Profession in the Context of Digital Transformation

Figure.1 Study Model



Source: Prepared by the researchers

1. Research methodology

This graphical model illustrates the relationship between the independent variable (on the left) ''Digital Transformation in the Auditing Profession'' which encompasses five principal elements: the use of artificial intelligence, big data analytics, robotic process automation, blockchain technologies, and technical challenges.

As for the dependent variable (on the right) 'Challenges of the Auditing Profession in the Context of Digital Transformation'' it comprises four principal elements: the lack of digital auditing skills, difficulties in data and privacy protection, the absence of appropriate legislation, and challenges of practical implementation. The arrows depicted illustrate the causal relationship and the direct impact of digital transformation on the emergence of challenges in the auditing profession.

Previous Studies

The studies that have attempted to address the topic of challenges facing the auditing profession in the context of digital transformation can be presented in chronological order as follows:

-Fadhil, R., Gina, P., Dina, W., Dedi, P., & Eka, P. (2021), entitled: '**Auditing in the Digital Era: Challenges and Opportunities for Audit''**. This study aimed to explore the challenges facing auditors in the digital era, with a particular focus on issues such as data privacy concerns, cybersecurity threats, skills shortages, and regulatory complexities affecting audit practices. The

study also sought to identify opportunities for auditors to enhance audit quality through the adoption of advanced technologies such as data analytics and artificial intelligence, in addition to improving client collaboration and expanding the scope of assurance services in a digital environment. The study employed a grounded theory methodology to analyze the literature related to auditing in the digital environment, thereby enabling a systematic exploration of the challenges and opportunities facing auditors. The research concluded that auditors face significant challenges in the digital era, including dealing with stringent data privacy regulations such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), addressing evolving cybersecurity threats, and dealing with skills shortages in critical areas such as data analytics and cybersecurity, all while complying with dynamic regulatory frameworks such as the International Standards on Auditing (ISAs), Generally Accepted Auditing Standards (GAAS), and the Sarbanes-Oxley Act (SOX) .

-Nabyla, D. (2022), entitled: '**The Digital Transformation of Auditing and the Evolution of Internal Audit''**. This study sought to provide both academics and practitioners with a global vision of the evolution of internal audit in the context of digital transformation, in addition to exploring the impacts of digitalization on audit environments, internal audit practices and methodologies, IT/information systems auditing, and IT governance and risk management. The study concluded by highlighting the impact of digital transformation on internal audit practices and methodologies, including the need for auditors to develop new skills to adapt to a business landscape driven by technologies such as artificial intelligence, blockchain, data analytics, and robotic process automation. It also discussed the implications of the COVID-19 pandemic on internal audit, emphasizing the need for a new vision and new predictive tools in the post-pandemic business world, leading to the evolution of internal audit as a key strategic function.

-Bojana, V., Teodora, T., & Dejan, J. (2023), entitled: **'Challenges of Using Digital Technologies in Audit'**'. This study aimed to present the opportunities and challenges of major digital trends in the field of auditing, such as big data analytics, artificial intelligence, blockchain technology, and robotic process automation, in addition to highlighting the emerging need for auditors to leverage digital technology and address the challenges of digitalization in a systematic and high-quality manner. The study concluded that advances in the use of digital technologies in auditing contribute to increasing reliability and improving the quality of reports, thereby enhancing stakeholders' confidence in audit results. The study also stressed the emerging need for auditors to leverage digital technology systematically and effectively to address the challenges posed by digitalization in the field of auditing.

-Mirwali, A., Musawer, H., Frishta, A., & Amir, K. (2024), entitled: '**The Role of IT (Information Technology) Audit in Digital Transformation: Opportunities and Challenges**. This study aimed to explore the implications of digital transformation on IT audit practices globally, in addition to identifying pivotal insights and providing recommendations for adapting IT audit practices to optimize the advantages of digital transformation while mitigating its associated risks. The study concluded that the significant shift in the role of IT audit is primarily attributable to the adoption of digital technologies, presenting opportunities in data analytics, automation, and strategic advisory roles, while also acknowledging challenges such as cybersecurity risks and resource constraints.

-Arlan, T. (2024), entitled: **'Exploring New Paradigms in Auditing: Challenges and Opportunities in the Digital Era**''. The research problem of this study centered on exploring new perspectives in audit practice with a focus on accounting, employing qualitative research methods and a comprehensive review of recent publications in relevant academic journals and current research reports in the field of auditing and accounting practice. The study reached several findings, most notably that the increasing complexity and volume of data necessitate the use of technology and advanced data analytics to enhance the efficiency, accuracy, and relevance of the audit process in the digital era. Furthermore, despite significant challenges such as adapting to rapid technological developments and data security issues while maintaining audit

quality, there are also opportunities to improve collaboration between auditors and clients, respond swiftly to changes in business, and deliver greater value-added services.

Similarities and Differences Among These Studie

- **Similarities**

The aforementioned studies concur that digital transformation has brought about radical changes in audit practices, making it essential to adopt modern technologies such as artificial intelligence, data analytics, blockchain, and process automation to improve audit quality and efficiency. All the studies focused on the importance of developing new skills for auditors to adapt to the evolving digital environment, particularly given the challenges related to data security and compliance with regulatory frameworks such as GDPR and CCPA. The studies also highlighted the importance of enhancing confidence in audit outcomes through the use of technology to improve reliability and quality. Additionally, they pointed to the need to leverage digital technology to expand the scope of assurance services and enhance collaboration between auditors and clients.

- **Differences**

Despite the similarity in addressing the topic of digital transformation, the studies differ in their focus and objectives. The study by Fadhil et al. (2021) focused on regulatory challenges, cybersecurity, and the impact of stringent regulations on audit practices, whereas the study by Mirwali et al. (2024) addressed the role of IT audit as a strategic function for optimizing the advantages of digital transformation. On the other hand, other studies discussed the impact of the COVID-19 pandemic on internal audit and the necessity of adopting new predictive tools. Furthermore, some studies focused on the strategic advisory roles of auditors, while others focused on improving client collaboration and delivering value-added services in the changing digital business environment.

Research Gaps

The research gaps in the field of digital auditing and digital transformation represent an opportunity to develop innovative solutions addressing current challenges, particularly with regard to data security and privacy, and the development of auditors' technical skills. These gaps constitute key areas through which audit quality can be improved and the rapid pace of digital transformation can be matched.

-Lack of focus on predictive and descriptive analytics: Despite the studies' treatment of the role of artificial intelligence and data analytics in auditing, there is a clear deficiency in research on the deeper use of predictive and descriptive analytics to improve audit quality and future decision-making.

-Absence of a clear regulatory framework for digital auditing technologies: The manner in which regulatory bodies respond to the adoption of digital technologies has not been adequately addressed, leaving a gap in understanding how to achieve a balance between digital innovation and compliance with traditional standards.

-Challenges related to developing the technical skills of auditors: Despite the reference to the lack of technical skills as a major obstacle, there is a need for more detailed studies on effective training strategies to qualify auditors to deal with advanced digital technologies such as blockchain and artificial intelligence.

-High cost of digital transformation: The impact of the high cost of digital transformation on small and medium-sized enterprises has not been adequately researched, leaving a gap in understanding how to support these enterprises in adopting technology

-Social impact of digital transformation on auditing: Most studies focused on technical and organizational aspects, while there is a deficiency in research on the social impact of digital

transformation on the auditing profession, such as changes in the nature of the relationship between auditors and clients or its impact on public trust.
- Environmental challenges and sustainability technologies: How digital auditing technologies can be used to support environmental sustainability goals has not been adequately addressed, opening the field for studying the applications of digital technology in achieving environmental and social objectives.
-Cybersecurity and privacy challenges: Most studies reviewed these challenges without offering practical solutions or integrated methodologies for addressing them.

Bridging the gaps related to data security and privacy, as well as enhancing auditors' technical skills, contributes to achieving sustainable digital transformation in the field of auditing. By focusing on these aspects, organizations can be supported in confronting digital challenges and enhancing confidence in audit outcomes.

Scientific Contribution of the Current Study

Our current study focused on bridging two principal gaps identified within the research gaps, namely: the challenges of data security and privacy, and the development of auditing skills in the context of digital transformation. With regard to data security and privacy, the study addresses innovative methodologies for enhancing data protection against increasing cybersecurity threats, with a focus on developing technical solutions and integrated regulatory frameworks that balance compliance with regulations such as GDPR and CCPA with the use of advanced digital technologies. As for auditing skills, the study highlighted the need for specialized training programs to qualify auditors to use digital analysis tools and artificial intelligence efficiently, while presenting applied models for training strategies that assist auditors in adapting to the evolving digital business environment. This study thus aims to provide practical solutions that contribute to improving audit quality and efficiency while comprehensively addressing security and technical challenges.

Study Structure

In pursuit of achieving the objective of this study, the remainder is organized into two principal sections: The first section examines and analyzes the theoretical and conceptual framework for the challenges imposed by digital transformation on the internal audit profession. The second section is devoted to the survey study, the analysis of results, the testing of the formulated hypotheses, and the presentation of the key findings and recommendations.

1. Challenges of the Internal Audit Profession in the Context of Digital Transformation

Digital transformation is among the most prominent forces reshaping the professional environment of internal auditing at the global level. It is no longer merely a technical update to the tools employed; rather, it has become a structural transformation that redefines the nature of risks, evidence-gathering methods, and the professional competence requirements of the auditor (Manita, Elommal, Baudier, & Hikkerova, 2020). In this regard, the internal audit profession faces a set of intertwined challenges that can be classified into two principal dimensions: the dimension of data security and privacy protection, and the dimension of developing auditors' skills and technical capabilities. A thorough understanding of these challenges requires a critical analysis of the recent literature that has addressed them, with an awareness that most of this literature originated in digitally advanced Western environments, which raises legitimate questions about the extent to which its findings can be generalized to emerging environments such as the Algerian context.

1.1 Challenges of Data Security and Privacy Protection in the Digital Auditing Environment

The expansion in the adoption of digital accounting systems, cloud computing, and data exchange platforms has transformed financial information into highly sensitive digital assets, making them a primary target for cyber-attacks and electronic manipulation. Vasarhelyi et al. noted that the transition of the audit environment toward big data generates unprecedented risks related to data integrity, reliability, and completeness risks that traditional auditing standards were not designed to address (Vasarhelyi, Kogan, & Appelbaum, 2017). This view is consistent with the position of Eka et al., who argued that auditors face fundamental challenges in dealing with stringent data protection regulations such as the European General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), as well as evolving cybersecurity threats that undermine the credibility of digital evidence collected during the audit process (Eka, Dedi, Dina, Gina, & Fadhil, 2021).

However, a critical reading of this literature reveals a clear knowledge gap: most studies that addressed data security in auditing originated from institutional environments equipped with mature digital infrastructures and advanced legislative frameworks. In emerging environments such as Algeria, the challenge extends beyond protecting data from breaches to include the fundamental weakness of the digital infrastructure itself and the fragility of internal digital control systems. The study by Sarens & Betti confirmed that internal auditors in digitally less mature environments face compounded difficulties, as they are required to secure data within systems that inherently lack the minimum digital protection controls, rendering comparison with the experiences of developed countries an unequal one (Sarens & Betti, 2021).

On another front, Vasarhelyi & Dai highlighted that blockchain technology holds great promise for enhancing the security of accounting data through distributed, immutable ledgers, which could bring about a qualitative leap in the reliability of audit evidence (Vasarhelyi & Dai, 2017). In the same vein, Zemánková explained that integrating artificial intelligence and blockchain technology in audit processes can contribute to building audit trails that are more transparent and secure (Zemánková, 2019). However, this technological optimism should be met with critical caution, as the adoption of these technologies requires massive investments and highly specialized human competencies resources not readily available in many organizations, particularly in developing economies. Moreover, Turley et al. warned that big data, despite its enormous analytical potential, raises complex ethical and legal issues related to privacy and data access limits issues that have not yet been adequately addressed in the international standard-setting frameworks for auditing (Turley, Samsonova, & Salijeni, 2019).

In this context, Mirwali et al. argue that cybersecurity risks and the limited resources available to address them represent among the most prominent challenges associated with digital transformation in IT auditing (Mirwali, Musawer, Frishta, & Amir, 2024). It is worth noting here that Arlan confirmed that despite the opportunities afforded by digital transformation for improving collaboration between auditors and clients and delivering value-added services, data security issues and the maintenance of audit quality remain key barriers that must be addressed first (Arlan, 2024).

From a legislative standpoint, the absence of a comprehensive Algerian legal framework regulating data security in the digital environment deepens the severity of this challenge. Unlike European countries, which rely on an integrated legislative system (such as the GDPR), Algeria still lacks detailed legislation that defines the auditor's responsibilities toward digital data and the limits of their authority in accessing and using such data. Munoko et al. pointed out that the legislative vacuum in the area of using artificial intelligence in auditing produces ethical dilemmas related to accountability for algorithmic errors and data biases dilemmas that cannot be resolved by technical tools alone but require clear legislative intervention (Munoko, Brown, Liburd, & Vasarhelyi, 2020). If this is the case in legislatively advanced environments, the matter becomes even more urgent in the Algerian context, which lacks even the basic regulatory frameworks for digital auditing.

It thus becomes evident that the challenge of data security and privacy protection in the digital auditing environment is not a unidimensional challenge, but rather a multi-layered one in which the technical weakness of infrastructure intersects with legislative deficiency and the limited resources allocated to cybersecurity risk management. What distinguishes this challenge in the Algerian context is that it is taking shape at an early stage of digital transformation, meaning that organizations are required to build protection and security systems in parallel with the digitalization process itself, rather than after its completion as occurred in many advanced economies.

1.2 Challenges of Developing Auditors' Skills and Updating Their Technical Capabilities

If data security represents the most prominent technical legislative challenge, then the skills gap represents the deeper and more impactful human formative challenge in the trajectory of the internal audit profession's transformation toward digitalization. The internal auditor in the digital environment is now required to possess competencies that far exceed traditional accounting and financial knowledge, encompassing the ability to deal with artificial intelligence algorithms, analyze large data sets, understand the mechanisms of blockchain technology, and use robotic process automation tools (Kokina & Davenport, 2017). Issa et al. described this transformation as a "reengineering of the professional competency profile of the auditor," noting that artificial intelligence will not replace the auditor but will fundamentally redefine their role in a manner requiring entirely new skills (Issa, Sun, & Vasarhelyi, 2016).

Nabyla confirmed that digital transformation has compelled internal auditors to develop their skills at an accelerated pace to adapt to a business landscape driven by artificial intelligence, data analytics, robotic process automation, and blockchain (Nabyla, 2022). Bojana et al. also stressed the emerging and pressing need for auditors to leverage digital technology and address the challenges of digitalization in a systematic and high-quality manner (Bojana & Dejan, 2023). However, the fundamental critical observation here is that these studies describe the required skills and diagnose the gap but rarely offer practical models for how to bridge this gap in environments already suffering from weak educational and training infrastructure in the digital domain.

In this connection, Kend & Nguyen demonstrated through their study on the impact of big data analytics and emerging technologies on the audit profession in Australia that auditors acknowledge the importance of these technologies but simultaneously admit to not possessing the necessary competencies to deploy them effectively (Nguyen & Kend, 2020). This finding is consistent with what Fadhil et al. (2021) noted regarding the fact that skills shortages in critical areas such as data analytics and cybersecurity represent one of the most prominent obstacles to auditing in the digital era (Fadhil, R., Gina, P., Dina, W., Dedi, P., & Eka, P., 2021). It is noteworthy that this skills deficit is not exclusive to developing countries but is a global phenomenon that varies in severity from one country to another. However, what makes the situation more critical in the Algerian context is the convergence of several compounding factors: the failure to update university curricula in accounting and auditing to include modules on modern digital technologies, the absence of specialized and nationally accredited professional training programs in digital auditing, and the limited opportunities for continuous learning and professional development in this field.

From another theoretical perspective, Vasarhelyi, Rozario, and Moffitt indicated that robotic process automation (RPA) in auditing will free auditors from routine tasks and allow them to focus on tasks of high analytical value (Vasarhelyi, Rozario, & Moffitt, 2018). However, this shift presupposes the existence of auditors capable of performing these advanced analytical tasks an assumption that may not hold true in many professional environments where the auditor is still occupied with manual and procedural tasks. In this regard, Lombardi et al. warned that the future of the auditing profession is contingent upon the ability of professionals to reinvent themselves, asserting that the auditor who does not develop their digital competencies will find

themselves marginalized in a professional environment rapidly moving toward automation and intelligent analysis (Lombardi, D. R., Bloch, R., & Vasarhelyi, M. A., 2015).

At the level of accounting education, Hirth & Tiberius demonstrated through a Delphi study involving experts in Germany that digitalization will bring about fundamental changes in labor market requirements in the field of auditing, necessitating a deep reform of academic curricula to include courses in data science, artificial intelligence, and information security (Hirth & Tiberius, 2019). Alles supported this direction, affirming that the profession needs an educational revolution, not merely a superficial updating of course content, because digital technologies change the very essence of the audit process, not just its tools (Alles, 2015). This vision intersects with what was previously noted regarding the gap between academic curricula and digital auditing requirements as one of the most prominent challenges facing Algerian auditors.

The researchers observe that the prevailing approach in the literature addressing the development of auditors' skills suffers from a methodological shortcoming consisting of a focus on what ought to be, without providing realistic roadmaps that account for the disparity in levels of digital maturity between countries and organizations. For instance, the study by Mirwali et al. (2024) highlights the advisory and strategic opportunities afforded by digital transformation to IT auditors, but it proceeds from an implicit assumption that auditors have already surpassed the stage of acquiring basic skills and have reached the stage of deploying them strategically an assumption that does not hold true in many emerging contexts where auditors are still at the stage of dealing with the fundamentals of digitalization. Moreover, the study by Bojana et al. (2023), which affirmed that digital technologies contribute to increasing reliability and improving the quality of reports, overlooks the reality that this positive effect is contingent upon the availability of qualified human competencies something the Algerian environment reveals to be notably absent.

The comparative critical analysis of the literature also reveals a conceptual issue pertaining to the nature of the required skills themselves. While some studies focus on purely technical skills (such as programming and data analysis), others such as Manita et al. (2020) call for the adoption of a broader approach that integrates technical skills with critical analytical skills and digital governance skills, noting that the digital transformation of auditing requires not only an auditor proficient in using technical tools, but one who understands the strategic, ethical, and organizational implications of these tools. This vision appears more realistic and suitable for the requirements of the current stage, particularly in environments that need to build a comprehensive digital culture rather than merely transferring technologies.

Finally, it becomes clear that the challenge of skills and technical capabilities is no less important than the challenge of data security; indeed, it is arguably deeper and more impactful on the future of the profession. Digital technologies, regardless of their sophistication, remain tools whose effectiveness is contingent upon the competence of those who use them. What makes this challenge more urgent in the Algerian context is that it intersects with deeper structural issues relating to the educational and training system as a whole, meaning that addressing it cannot take place in isolation from structural reforms in accounting education and continuing professional training.

2. Methodological Framework of the Field Study

2.1 Study Population and Sample

The study targeted a population consisting of internal auditors working in Algerian economic enterprises across various sectors. A stratified random sample of 120 internal auditors was selected. The questionnaire was distributed electronically and manually during the period from March to June 2025, and 120 valid questionnaires were retrieved for analysis, yielding a response rate of 100%.

2.2 Study Instrument (Questionnaire)

The questionnaire was designed according to a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) and comprised three parts:

- Part One: Demographic data (gender, age, experience, academic qualification, sector).
- Part Two: Axis One: Challenges of data security and privacy protection (10 items to test H_1).
- Part Three: Axis Two: Challenges of developing auditors' skills and technical capabilities (10 items to test H_2).

Table 1. Demographic Characteristics of the Sample

Variable	Category	Frequency	Percentage (%)
Gender	Male	81	67.5%
	Female	39	32.5%
	Total	120	100%
Age	Under 30 years	18	15%
	30 – 39 years	48	40.0%
	40 – 49 years	34	28.3%
	50 years and above	20	16.7%
	Total	120	100%
Years of Professional Experience	Less than 5 years	23	19.2%
	5 – 10 years	38	31.7%
	10 – 15 years	41	34.2%
	More than 15 years	18	15%
	Total	120	100
Academic Qualification	Bachelor's degree (Licence)	28	23.3%
	Master's degree	48	40%
	Doctorate (PhD)	17	14.2%
	Other	27	22.5%
	Total	120	100%
Sector of Employment	Public sector	27	22.5%
	Private sector	45	37.5%
	Financial institutions	30	25%
	Mixed/Other	18	15%
	Total	120	100

Source: Prepared by the researchers based on SPSS outputs

Based on the preceding table, it can be stated that the sample is predominantly male (67.5%), which reflects the reality of the auditing profession in Algeria, where males are relatively dominant. Furthermore, the largest proportion (40%) falls within the 30–39 age group, indicating that the majority of auditors are in the stage of professional maturity. In terms of

experience, 65.9% of the sample possess between 5 and 15 years of experience, thereby enhancing the credibility of the responses.

2.3 Reliability Testing of the Study Instrument (Cronbach's Alpha Coefficient)

Table 2. Reliability Testing of the Study Instrument (Cronbach's Alpha Coefficient)

Axis	Number of Items	Cronbach's Alpha (α)	Reliability Level
Axis 1: Challenges of Data Security and Privacy Protection	10	0.870	High
Axis 2: Challenges of Developing Skills and Technical Capabilities	10	0.872	High
Overall Instrument	20	0.807	High
Acceptable Threshold: α ≥ 0.70			

Source: Prepared by the researchers based on SPSS outputs

The preceding table shows that all Cronbach's alpha coefficient values exceeded the acceptable threshold (0.70), confirming that the measurement instrument possesses a high degree of internal consistency and reliability. Values of 0.870 and 0.872 for the two axes, respectively, indicate that the items within each axis effectively measure the intended dimension with a high degree of reliability.

Table 3. Normality Test (Shapiro-Wilk)

Axis	Shapiro-Wilk Statistic	Degrees of Freedom (df)	Sig\. (P-value)	Distribution
Axis 1: Data Security and Privacy Protection	0.991	120	0.629	Normal
Axis 2: Skills Development and Technical Capabilities	0.986	120	0.231	Normal
Decision Rule: If P-value > 0.05, the data follow a normal distribution.				

Source: Prepared by the researchers based on SPSS outputs

Since the P-values for both axes are greater than 0.05, the data follow a normal distribution, thereby justifying the use of parametric tests (t-test, ANOVA).

2.4 Descriptive Analysis of the Study Axes

Axis One: Challenges of Data Security and Privacy Protection (H_1)

Table 4. Descriptive Analysis of the Study Axes (Axis One

Item	Mean	Std\. Deviation	Relative Importance	Rank	Direction
S1: Difficulty in securing digital financial data against cyber breaches	3.52	0.76	70.4 %	4	Agree

S2: Limited digital infrastructure for protecting sensitive information	3.16	0.77	63.2 %	10	Neutral
S3: Absence of clear policies for protecting client data privacy	3.56	0.79	71.2 %	3	Agree
S4: Difficulty in complying with international data protection standards (GDPR)	3.63	0.87	72.6 %	2	Agree
S5: Increasing risks of electronic manipulation of financial records	3.33	0.69	66.6 %	8	Neutral
S6: Weakness of internal digital control systems	3.75	0.75	75.0 %	1	Agree
S7: Shortage of personnel specialized in information security	3.58	0.66	71.6 %	5*	Agree
S8: Challenges of data sharing among audit parties	3.64	0.86	72.8 %	3*	Agree
S9: Inadequacy of Algerian legislation for regulating data security	3.48	0.71	69.6 %	6	Agree
S10: Risks of data loss during digital transformation	3.70	0.69	74.0 %	2*	Agree
Overall Axis Mean	3.535	0.513	70.7 %	—	Agree

Source: Prepared by the researchers based on SPSS outputs

The preceding table indicates that the overall mean for the axis reached 3.535 out of 5, with a standard deviation of 0.513, suggesting that the respondents agree that data security and privacy protection constitute a genuine challenge in the auditing profession. The item "Weakness of internal digital control systems" ranked highest with a mean of 3.75, reflecting the reality of Algerian enterprises whose digital systems are still in their early stages. Conversely, the item "Limited infrastructure" received the lowest mean (3.16) within the neutral range, indicating that auditors perceive some relative improvement in infrastructure, though insufficient.

Axis Two: Challenges of Developing Skills and Technical Capabilities (H_2)

Table 5. Descriptive Analysis of the Study Axes (Axis Two)

Item	Mean	Std\. Deviation	Relative Importance	Rank	Direction
S1: Shortage of specialized training programs in digital auditing	3.36	0.67	67.2 %	9	Neutral
S2: Difficulty in mastering artificial intelligence techniques in auditing	3.89	0.75	77.8 %	2	Agree
S3: Limited knowledge of big data analytics techniques	3.48	0.66	69.6 %	7	Agree

S4: Absence of professional standards keeping pace with digital evolution	3.27	0.70	65.4 %	10	Neutral
S5: Challenges of adapting to Robotic Process Automation (RPA) systems	3.83	0.76	76.6 %	3	Agree
S6: Gap between academic curricula and digital auditing requirements	3.83	0.77	76.6 %	3	Agree
S7: Difficulty in understanding and using blockchain technologies	3.89	0.73	77.8 %	1	Agree
S8: High costs of technical qualification and training	3.58	0.69	71.6 %	5	Agree
S9: Auditors' resistance to change toward digital tools	3.57	0.83	71.4 %	6	Agree
S10: Lack of institutional support for digital transformation in auditing	3.32	0.67	66.4 %	8	Neutral
Overall Axis Mean	3.603	0.495	72.1 %	—	Agree

Source: Prepared by the researchers based on SPSS outputs

The overall mean reached 3.603 with a standard deviation of 0.495, which is higher than Axis One, meaning that auditors clearly recognize that developing technical skills constitutes the greater challenge. The items "Difficulty in understanding blockchain technologies" and "Difficulty in mastering artificial intelligence" ranked highest with a mean of 3.89, reflecting the significant technical gap between the level of Algerian auditors and the advanced technologies required by the modern auditing environment.

2.5 Hypothesis Testing

2.5.1 Testing Hypothesis One (H_1)

Hypothesis One (H_1): Data security and privacy protection are among the most prominent challenges facing the auditing profession in Algeria in the context of digital transformation.
A one-sample t-test was used, comparing against the neutral value (3):

Table 6. Results of the One-Sample T-Test for Axis One

Axis	Arithmetic Mean	Standard Deviation	Test Value	t-Value	Degrees of Freedom (df)	Sig\. (P-value)	Mean Difference	Effect Size (Cohen's d)	Decision
Axis 1: Data Security and Privacy Protection	3.535	0.513	3	11.418	119	< 0.001	0.535	1.042	Reject H_0; Accept H_1

Source: Prepared by the researchers based on SPSS outputs

Based on the data in the table, we reject the null hypothesis (H0: $\mu = 3$) and accept the alternative hypothesis (H1), as the computed t-value (11.418) is statistically significant at the 0.01 level, and the arithmetic mean (3.535) is significantly higher than the neutral value.
This result confirms that internal auditors in Algerian enterprises face fundamental challenges related to data security. This can be explained by the fact that most Algerian enterprises are still

in the early stages of digital transformation, lacking robust digital infrastructures and advanced protection systems, in addition to the absence of comprehensive Algerian legislation regulating data security comparable to the European GDPR.

Consistency with Previous Studies

This result is highly consistent with the study by Fadhil et al. (2021), which concluded that auditors face significant challenges in dealing with stringent data privacy regulations such as GDPR and CCPA, and that evolving cybersecurity threats constitute a major obstacle to digital auditing practices. The relatively high mean (3.535) achieved in our study reflects the same reality described by Fadhil and colleagues regarding the difficulty of reconciling cybersecurity requirements with professional practice.

It also aligns with the study by Arlan T. (2024), which confirmed that despite significant challenges such as data security issues and maintaining audit quality, the need to adapt to rapid technological developments remains pressing. Our results intersect with this study particularly in that the item relating to "weakness of internal digital control systems" received the highest mean (3.75), reflecting the same concern expressed by Arlan T. regarding audit quality in digital environments.

It is likewise consistent with the study by Mirwali et al. (2024), which acknowledged that cybersecurity risks represent among the most prominent challenges associated with digital transformation in IT auditing, with reference to the limited resources available to address these risks.

Divergence from Previous Studies

Despite the alignment of our results with some previous studies, there are certain differences with other studies that can be interpreted and presented as follows:

Our results partially diverge from the study by Bojana et al. (2023), which focused more on the fact that the use of digital technologies contributes to increasing reliability and improving report quality, highlighting the positive side of digital transformation more than its security challenges. While the Algerian auditors in our sample expressed clear concern about data security, the study by Bojana and colleagues viewed digital transformation as an opportunity to enhance confidence in audit outcomes. This divergence can be explained by the gap in the level of digital infrastructure between European countries (the setting of Bojana's study) and the Algerian reality, which suffers from a relative lag.

It also diverges from the study by Nabyla D. (2022), which broadened the scope of challenges to include the effects of the COVID-19 pandemic on internal audit and the necessity of adopting new predictive tools, while our study was confined to the security dimension without addressing post-pandemic dimensions. Furthermore, Nabyla D.'s study focused on internal audit as an evolving strategic function, whereas our results showed that Algerian auditors are still at the stage of dealing with the basic challenges of data security and have not yet reached the stage of advanced strategic thinking.

Finally, it can be stated that despite the strong statistical significance ($t = 11.418$, $p < 0.001$), the mean (3.535) falls within the lower range of the "Agree" level (3.40–4.19), suggesting that awareness of data security challenges exists but is not as acute as might be expected. This may be attributable to the fact that many internal auditors have not yet actually dealt with fully integrated digital environments, and therefore their perception of these challenges may be more theoretical than practical. It is noted that this gap between theoretical perception and practical experience has not been adequately addressed in the aforementioned previous studies, granting our study a scientific contribution consisting of revealing that the level of awareness of the security challenge in Algeria is relatively lower than what international studies have indicated, due to limited actual exposure to integrated digital environments.

2.5.2 Testing Hypothesis Two (H_2)

Hypothesis Two (H_2): Digital transformation entails challenges related to developing auditors' skills and updating their technical capabilities.

Table 7. Results of the One-Sample T-Test for Axis Two

Indicator	Value
Arithmetic Mean	3.603
Standard Deviation	0.495
Computed t-value	13.356
Significance Level (p)	0.000 (< 0.05)
Effect Size (Cohen's d)	1.219 (Very large effect)
Degrees of Freedom	119

Source: Prepared by the researchers based on SPSS outputs

We reject the null hypothesis (H_0) and strongly accept the alternative hypothesis (H_2), as the t-value (13.356) is higher than its counterpart in Axis One, and the effect size (1.219) is classified as very large according to Cohen's criteria

This axis highlights the acute gap between the current skills of Algerian auditors and the requirements of digital auditing. In the context of an accelerating digital economy, auditors need competencies in artificial intelligence, blockchain, and big data analytics skills that are not sufficiently taught in Algerian universities and for which specialized professional training programs are not provided.

Consistency with Previous Studies:

This result is closely and directly consistent with the study by Nabyla D. (2022), which explicitly concluded that auditors need to develop new skills to adapt to a business landscape driven by artificial intelligence, blockchain, data analytics, and robotic process automation. Our study's results confirm this proposition quantitatively, as the very large effect size (d = 1.219) strongly supports Nabyla D.'s assertion that the skills challenge represents a paramount priority.

It also aligns with the study by Fadhil et al. (2021), which noted that skills shortages in critical areas such as data analytics and cybersecurity represent one of the most prominent challenges facing auditors in the digital era. The finding that the item ‘Difficulty in mastering artificial intelligence techniques’’ received a high mean (3.89) precisely matches what Fadhil and colleagues described as a critical skills gap.

It is likewise consistent with the study by Bojana et al. (2023), which stressed the emerging need for auditors to leverage digital technology and address digitalization challenges in a systematic and high-quality manner. The high mean (3.83) received by the item ‘Gap between academic curricula and digital auditing requirements’’ in our study embodies the same concern expressed by Bojana regarding the necessity of systematic qualification of auditors.

It further aligns with the study by Arlan T. (2024), which concluded that the increasing complexity and volume of data necessitate the use of technology and advanced data analytics to enhance the efficiency and accuracy of the audit process, noting that adapting to rapid technological developments remains a major challenge.

Divergence from Previous Studies:

Our results diverge from the study by Mirwali et al. (2024), which focused on the strategic and advisory dimension of the role of IT audit, highlighting opportunities in data analytics, automation, and advisory roles. In contrast, our results revealed that Algerian auditors are still at

a pre-benefit stage with regard to these opportunities, as their challenge remains focused on acquiring basic skills rather than developing them toward advanced advisory roles. This reflects a gap in digital maturity stages between the institutions studied in both studies.

They also differ in the severity of the challenge from the study by Nabyla D. (2022), which discussed the impact of the COVID-19 pandemic as a catalyst for digital transformation in internal audit, while this factor did not emerge in our study's results. This can be explained by the fact that the pandemic's impact on digital transformation in Algeria was less severe compared to the countries studied by Nabyla D., as the pandemic did not accelerate the pace of digitalization in Algerian institutions to the same degree.

Additionally, divergence also appears with the study by Bojana et al. (2023), which considered that digital technologies contribute positively to increasing reliability and improving report quality, while the Algerian context in our study shows that auditors have not yet reached the stage of experiencing the positive impact of these technologies due to the persistent skills gap. The positive outlook presented by Bojana and colleagues is contingent upon the availability of qualified human competencies, which our study reveals to be absent in the Algerian framework.

Finally, it can be stated that the fact that the effect size for this axis (d = 1.219) is greater than that of Axis One (d = 1.042) confirms that the greater challenge lies on the human side (skills) and not solely on the technical side (data security), which is consistent with the consensus of most of the five previously cited studies. However, attention should be drawn to several critical observations:

-First: Some respondents may have overestimated the difficulty of technologies (blockchain, artificial intelligence) due to their insufficient familiarity with them, which may have inflated the magnitude of the perceived challenge. The items with the highest means relate to technologies that most auditors have not actually worked with, and therefore the responses may reflect fear of the unknown more than an actual experience of the challenge.

Second: Unlike what studies such as Mirwali et al. (2024) suggested regarding digital transformation opening new advisory and strategic doors, our results reveal that Algerian auditors are still stuck at the level of basic challenges, indicating that discussion of the strategic opportunities of digital transformation in Algerian auditing remains premature without first addressing the skills gap.

-Third: Our study offers an additional contribution in the form of quantitative confirmation with a larger sample (120 versus 31 in the original study) that the consensus indicated by all previous studies regarding the skills challenge also applies to the Algerian internal context and not only to international experiences, with a fundamental difference being that the severity of the challenge in Algeria is deeper due to the absence of nationally accredited specialized professional programs.

2.5.3 Analysis of Differences According to Demographic Variables

Table 8. Differences by Gender (Independent Samples t-Test)

Axis	Males' Mean	Females' Mean	t-Value	Significance Level	Decision
Data Security	3.536	3.533	0.025	0.980	No significant differences
Skills Development	3.677	3.451	2.381	0.019	Significant differences in favor of males

Source: Prepared by the researchers based on SPSS outputs

The results of the table indicate that there are no statistically significant differences in the perception of data security challenges between genders, while there are statistically significant differences in the skills development axis in favor of males (p = 0.019). This can be interpreted by the fact that male auditors are more engaged in technical aspects, making them more aware of the challenges of digital skills.

Table 9. Differences by Years of Experience (One-Way ANOVA)

Axis	F-Value	Significance Level	Decision
Data Security	0.506	0.679	No significant differences
Skills Development	0.944	0.422	No significant differences

Source: Prepared by the researchers based on SPSS outputs

The absence of significant differences by experience is a notable finding, as it was expected that less experienced auditors would perceive skills challenges to a greater extent. However, this result indicates that digital transformation represents a comprehensive challenge affecting all auditors regardless of their experience, as even those with extensive experience have not received adequate digital training.

Table.10 Differences by Sector (ANOVA)

Axis	F-Value	Significance Level	Decision
Data Security	1.668	0.178	No significant differences
Skills Development	0.525	0.666	No significant differences

Source: Prepared by the researchers based on SPSS outputs

The results of the one-way ANOVA presented in the table indicate the absence of statistically significant differences between the responses of sample members toward both the data security and skills development axes, as the computed significance levels were 0.178 and 0.666, respectively, both exceeding the statistically accepted level of 0.05. Accordingly, the null hypothesis positing the absence of substantive differences between respondents' opinions is accepted, indicating that their perceptions of these challenges are characterized by a considerable degree of homogeneity and consistency. This finding reflects the fact that the challenges imposed by digital transformation on the internal audit profession, particularly those related to data protection and the development of technical and professional skills, are not confined to a specific category of auditors but represent a shared professional concern among all members of the sample. Consequently, this result lends the study an important interpretive dimension, namely that digital transformation has created a new professional environment that imposes challenges that are convergent in perception and impact, thereby necessitating the adoption of comprehensive approaches in professional training and qualification, as well as in strengthening data security controls within audit practices.

Table .11 Correlation Analysis Between the Study Axes

Indicator	Value
Pearson Correlation Coefficient (r)	-0.075
Significance Level (p)	0.416

Source: Prepared by the researchers based on SPSS outputs

The Pearson correlation coefficient ($r = -0.075$) indicates a very weak negative relationship between the two study axes (Data Security and Privacy Protection vs. Skills Development and Technical Capabilities). Furthermore, the significance level ($p = 0.416$) far exceeds the accepted threshold of 0.05, confirming that this correlation is not statistically significant .This result carries a critical interpretive implication: the challenges of data security and the challenges of skills development are two independent dimensions rather than two manifestations of a single underlying challenge. In practical terms, this means that:

-An organization may invest heavily in advanced data protection systems without necessarily possessing digitally qualified audit teams.

-Conversely, an organization may train its auditors in sophisticated analytical tools without having a secure and robust digital infrastructure.

This relative independence between the two dimensions confirms that addressing the challenges revealed by this study cannot be accomplished through a single comprehensive solution. Rather, it necessitates two parallel and distinct strategies: the first being technical and legislative, aimed at strengthening data security and updating the legal frameworks governing digital auditing; and the second being formative and educational, aimed at rebuilding auditors' digital skills and qualifying them to use technology with competence and responsibility.

2.5.4 Multiple Regression Model

A multiple regression analysis was conducted to measure the effect of demographic variables on the total perceived challenges:

able.12 Multiple Regression Model

Indicator	Value
R^2 (Coefficient of Determination)	0.064
Adjusted R^2	-0.050
F-Value	0.561
Significance Level	0.879

Source: Prepared by the researchers based on SPSS outputs

-R^2 = 0.064: The coefficient of determination indicates that the demographic variables (gender, age, years of experience, academic qualification, and sector of employment) collectively explain only **6.4%** of the total variance in auditors' perception of digital transformation challenges. This is an **extremely low** explanatory power .

-Adjusted $R^2 = -0.050$: The **negative** adjusted R^2 value further confirms the model's poor fit. A negative value indicates that the demographic predictors perform **worse than a simple mean model** in explaining the variance, suggesting that the inclusion of these variables adds **no meaningful predictive value** whatsoever .

-F-Value = 0.561 with a significance level of **0.879:** The model is **not statistically significant** ($p = 0.879$, far exceeding the 0.05 threshold). This means that the null hypothesis stating that all regression coefficients are equal to zero **cannot be rejected** .

In conclusion, it can be said that these results confirm that the perception of digital transformation challenges in the auditing profession **transcends individual demographic characteristics** and reflects a **general professional reality** that encompasses all categories of auditors, irrespective of their gender, age, experience, qualification, or sector of employment. This finding carries significant implications for policy and practice: any intervention aimed at reforming or developing the auditing profession in the context of digital transformation must be **comprehensive and non-selective** targeting the **professional system as a whole** rather than focusing on specific demographic subgroups. The roots of the challenge are **structural**, linked

to the broader institutional, legislative, and training environment, rather than being attributable to individual-level differences.

3. Results and Discussion

The results of the study show that digital transformation in the Algerian auditing environment has produced two distinct types of challenges: technical and legislative challenges related to data security and privacy protection, and human formative challenges related to auditors' capabilities and digital skills. The elevated overall mean for the data security axis, with clear statistical significance, indicates that auditors have come to recognize that the current digital infrastructure of enterprises does not provide the level of security required for sensitive financial data, and that internal control systems in their traditional form are no longer adequate in confronting emerging cybersecurity risks. However, the level of this awareness, though exceeding the neutral point, does not reach the acute risk perception described in some international studies, reflecting the fact that a proportion of auditors still operates in partial or transitional digital environments that have not yet experienced the full complexities of cybersecurity.

In contrast, the results for the skills and technical capabilities axis were more acute and pronounced, both in terms of the arithmetic mean and the effect size, confirming that the core of the digital transformation problem in Algerian auditing lies in the skills gap more than in the shortage of technical tools themselves. In this regard, auditors expressed genuine difficulty in comprehending artificial intelligence techniques, big data analytics, and blockchain, which is explained by the fact that university education and professional training have not yet kept pace with this transformation. This finding is consistent with what several previous studies have argued regarding human capital being the weakest link in the adoption of digital auditing, though in the Algerian context it takes on a more acute dimension because the technological transformation is occurring amid a relative weakness in the educational and training system pertaining to accounting and auditing.

Moreover, the absence of substantive statistical differences in the perception of challenges by gender, age, experience, and sector reinforces the notion that these challenges are not confined to a particular category of auditors but represent a general phenomenon extending across various generations, professional levels, and institutional sectors. This finding is significant from a public policy perspective, as it means that any intervention to reform or develop the auditing profession in the context of digital transformation must be comprehensive and non-selective—that is, it should not focus solely on young auditors or financial institutions but should target the professional system as a whole. Furthermore, the weak explanatory power of the multiple regression model, which used demographic variables to predict the level of perceived challenges, reveals that the roots of the problem are deeper than individual characteristics and are linked to the structure of the institutional, legislative, and training environment in its entirety.

On the other hand, the weak correlation between the data security dimension and the skills dimension demonstrates that these two dimensions, despite their apparent interconnection in theoretical discourse, move practically in quasi-independent trajectories. An organization may invest in advanced protection systems without possessing digitally qualified audit teams, and it may train its auditors in sophisticated analytical tools without having a secure and robust infrastructure. This relative separation between the two dimensions confirms that addressing the challenges revealed by the study cannot be accomplished through a single comprehensive solution; rather, it requires two parallel strategies: the first, technical and legislative, to strengthen data security and update the legal frameworks governing digital auditing; and the second, formative and educational, to rebuild auditors' digital skills and qualify them to use technology with competence and responsibility. Through this interpretation, the study's results are not confined to describing the reality of challenges but open a broader discussion on how to reengineer the auditing profession in Algeria so that it transitions from a reactive posture toward

the risks of digital transformation to a proactive posture of capitalizing on the opportunities it affords.

Conclusion

This study demonstrates, within its theoretical and applied framework, that digital transformation is no longer a secondary option for the auditing profession in Algeria; rather, it has become a governing factor that reshapes the nature of professional practice and compels both internal and external auditors to adapt to a digital environment characterized by data complexity, technological acceleration, and growing cybersecurity risks. The theoretical treatment revealed that digital transformation carries within it significant opportunities to improve audit quality and effectiveness through artificial intelligence, big data analytics, automation, and blockchain, yet it simultaneously poses profound challenges at the levels of data security, technical skills, and legislation—particularly in the Algerian context, which is still in the process of building its digital infrastructure and qualifying its human resources to keep pace with these transformations .

The field study results also showed that auditors consider data security and privacy protection to be prominent challenges in the context of digital transformation, with strong statistical confirmation that current digital control systems and existing legislation do not yet measure up to the increasing risks in the cybersecurity environment. The findings further demonstrated that the greatest challenge lies in developing auditors' skills and technical capabilities, where difficulty in mastering artificial intelligence, blockchain, and big data analytics techniques emerged as the most significant barriers to deploying technology in auditing. In alignment with these findings, the study recommends the following:

1. Adopting specialized national and professional training programs in digital auditing in collaboration between universities and professional bodies.
2. Developing a comprehensive Algerian legislative and regulatory framework for data security aligned with international standards.
3. Investing in digital infrastructure and protection systems within enterprises.
4. Reviewing and updating academic curricula in accounting and auditing to incorporate modules in artificial intelligence, data analytics, and blockchain technologies, so that the auditing profession in Algeria can transition from a defensive response to challenges toward capitalizing on the opportunities afforded by digital transformation.

Future Research Directions

This study opens broad research horizons that can be leveraged to develop the auditing profession in the context of digital transformation at both the academic and professional levels. From a scholarly standpoint, the results represent a starting point for constructing more complex models that integrate technical dimensions (data security, digital infrastructure, accounting information systems) with human and organizational dimensions (digital culture, resistance to change, leadership supportive of transformation), through expanding the study's variables and employing mixed research methodologies combining quantitative and qualitative approaches. Future studies may be conducted comparing internal and external auditors, or across different sectors (banking, industrial, public), or even across different countries, to assess the degree of digital auditing maturity and derive benchmark models useful for decision-makers and professional bodies.

On the applied level, this study can form the basis for designing training programs and field experiments that assess the effectiveness of interventions in reducing the skills gap and enhancing the efficiency of using digital technologies in auditing. It also opens the door to research aimed at constructing normative frameworks for digital auditing in the Algerian context, including working guides and control procedures adapted to local realities while drawing on international best practices. Future studies may also be directed toward measuring the impact of digital transformation in auditing on financial reporting quality, governance

transparency, and the reduction of financial corruption risks, thereby making this research area a direct contributor to supporting economic and institutional reforms in Algeria.

Bibliography List:

1. Alles, M. G. (2015). Drivers of the use and facilitators and obstacles of the evolution of Big Data by the audit profession. Accounting Horizons, 29(2), 439–449.
2. Appelbaum, D., Kogan, A., & Vasarhelyi, M. A. (2017). Big Data and analytics in the modern audit engagement: Research needs. Auditing: A Journal of Practice & Theory, 36(4), 1–27.
3. Arlan, T. (2024). Exploring new paradigms in auditing: Challenges and opportunities in the digital era.
4. Betti, N., & Sarens, G. (2021). Understanding the internal audit function in a digitalised business environment. Journal of Accounting & Organizational Change, 17(2), 197–216.
5. Bojana, V., Teodora, T., & Jakšić, D. (2023). Challenges of using digital technologies in audit.
6. Dai, J., & Vasarhelyi, M. A. (2017). Toward blockchain-based accounting and assurance. Journal of Information Systems, 31(3), 5–21.
7. Fadhil, R., Gina, P., Dina, W., Dedi, P., & Eka, P. (2021). Auditing in the digital era: Challenges and opportunities for audit.
8. Issa, H., Sun, T., & Vasarhelyi, M. A. (2016). Research ideas for artificial intelligence in auditing: The formalization of audit and workforce supplementation. Journal of Emerging Technologies in Accounting, 13(2), 1–20.
9. Kend, M., & Nguyen, L. A. (2020). Big Data analytics and other emerging technologies: The impact on the Australian audit and assurance profession. Australian Accounting Review, 30(4), 269–282.
10. Kokina, J., & Davenport, T. H. (2017). The emergence of artificial intelligence: How automation is changing auditing. Journal of Emerging Technologies in Accounting, 14(1), 115–122.
11. Lombardi, D. R., Bloch, R., & Vasarhelyi, M. A. (2015). The current state and future of the audit profession. Current Issues in Auditing, 9(1), P10–P16.
12. Manita, R., Elommal, N., Baudier, P., & Hikkerova, L. (2020). The digital transformation of external audit and its impact on corporate governance. Technological Forecasting and Social Change, 150, 119751.
13. Mirwali, A., Musawer, H., Frishta, A., & Amir, K. (2024). The role of IT audit in digital transformation: Opportunities and challenges.
14. Moffitt, K. C., Rozario, A. M., & Vasarhelyi, M. A. (2018). Robotic process automation for auditing. Journal of Emerging Technologies in Accounting, 15(1), 1–10.
15. Munoko, I., Brown-Liburd, H. L., & Vasarhelyi, M. A. (2020). The ethical implications of using artificial intelligence in auditing. Journal of Business Ethics, 167(2), 209–234.
16. Nabyla, D. (2022). The digital transformation of auditing and the evolution of the internal audit.
17. Salijeni, G., Samsonova-Taddei, A., & Turley, S. (2019). Big Data and changes in audit technology: Contemplating a research agenda. Accounting and Business Research, 49(1), 95–119.
18. Tiberius, V., & Hirth, S. (2019). Impacts of digitization on auditing: A Delphi study for Germany. Journal of International Accounting, Auditing and Taxation, 37, 100288.
19. Zemánková, A. (2019). Artificial intelligence and blockchain in audit and accounting: Literature review. WSEAS Transactions on Business and Economics, 16, 568–581.