

PUBLIC GOVERNANCE AND DIGITIZATION: TOWARDS A RENEWED ROLE FOR INTERNAL AUDITING

Fatine Benkirane^{*}, Mohamed Ait Oudra^{**}, Samir Errabih^{***}

^{*} Corresponding author, Faculty of Legal, Economic and Social Sciences, University Sidi Mohamed Ben Abdellah, Fez, Morocco

Contact details: University Sidi Mohamed Ben Abdellah, Dhar El Mehraz, B. P. 42 Atlas, 30000 Fez, Morocco

^{**} Faculty of Legal, Economic and Social Sciences, University Sidi Mohamed Ben Abdellah, Fez, Morocco

^{***} National School of Business and Management, University Sidi Mohamed Ben Abdellah, Fez, Morocco



Abstract

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This study explores how internal auditing adapts to the challenges of digital transformation in public governance. Drawing on agency theory and agile governance theory, it examines the evolving roles, skills, and strategic positioning of internal auditors within public organizations. The research adopts a quantitative methodology based on a structured questionnaire administered to 200 respondents from Moroccan public institutions, including auditors, governance officers, and information technology (IT) managers. The data were analyzed using Statistical Package for the Social Sciences (SPSS) software to assess the relationships between digital maturity, auditors' digital skills, and their strategic involvement in governance processes. The results indicate that while digital tools are increasingly integrated into audit practices, their perceived impact remains uneven, largely depending on institutional digital maturity and managerial support. The findings reveal a dual-speed digitalization process within the Moroccan public sector, highlighting the need for greater capacity building, continuous training, and strategic integration of internal audit into digital governance frameworks. The study contributes to the literature on public sector modernization and digital governance, offering empirical evidence from an emerging economy and policy-oriented recommendations for strengthening internal audit functions in the digital era.

Keywords: Internal Audit, Digital Transformation, Public Governance, Digital Maturity, Agile Governance

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1. INTRODUCTION

In an era where digital technologies increasingly redefine the boundaries of public action, the governance of state institutions faces a profound

transformation. The shift toward digitization, while promising enhanced efficiency, transparency, and citizen engagement, simultaneously challenges traditional control and accountability frameworks. Internal auditing, long perceived as a procedural and

retrospective mechanism, is now compelled to evolve into a forward-looking and strategic function aligned with the dynamics of digital governance (Boumeska & Allouli, 2024; Udrescu, 2024).

The rise of digital-era governance, as theorized by Dunleavy et al. (2006), marks a paradigmatic turning point in public management. It presupposes the dematerialization of administrative processes, the integration of information systems, and the emergence of new interactive forms of accountability between administrations and citizens. Within this landscape, Clarke (2020) underscores the pivotal role of digital government unit structures that not only facilitate technological reform but also depend on the agility and adaptability of support functions, including internal audit.

Digitization, however, is not merely a technical modernization; it is a cultural, organizational, and epistemic reconfiguration. Luna et al. (2015) conceptualize this evolution through the lens of agile governance, calling for adaptive control models capable of managing uncertainty, supporting transformation, and leveraging data intelligence. Similarly, Mergel et al. (2021) envision the internal auditing function as a facilitator of collaborative governance, fostering responsiveness and cross-functional learning within public institutions.

From a normative standpoint, established frameworks such as the Committee of Sponsoring Organizations of the Treadway Commission (COSO, 2013) and Control Objectives for Information and Related Technologies (COBIT) 2019 (Information Systems Audit and Control Association [ISACA], 2018) have undergone significant revisions to integrate emerging digital imperatives, including cybersecurity, information integrity, and algorithmic accountability. Lenz et al. (2017) argue that the effectiveness of internal auditing in this new ecosystem lies in its ability to innovate and to anticipate rather than merely to conform. In developing contexts, Khan (2016) and El Haiba and Maimoun (2024) highlight that digitization can strengthen governance mechanisms only if internal control is accompanied by institutional learning, staff training, and real-time monitoring capacities.

In this evolving environment, the internal audit function is no longer a passive observer but a catalyst for transformation. It contributes to the design of digital processes, the evaluation of algorithmic risks, and the reinforcement of transparency and accountability mechanisms in the public sector. However, empirical evidence on how internal auditing adapts to these new demands remains scarce, particularly in emerging economies where digital governance is still consolidating.

Against this backdrop, the present study addresses four specific research questions:

RQ1: What is the current level of digital tool integration in internal audit practices within Moroccan public institutions, and how do auditors perceive their effectiveness?

RQ2: To what extent does institutional digital maturity influence the strategic positioning of internal audit functions?

RQ3: What relationships exist between auditors' digital competencies, managerial support, and strategic involvement in governance?

RQ4: What are the primary barriers to digital transformation of internal audit in the Moroccan public sector?

This study makes three distinctive contributions:

- **Contextual:** It is the first quantitative investigation of digital audit transformation in Moroccan public institutions, addressing the geographic and sectoral bias toward Western private sector contexts in existing literature.

- **Theoretical:** By integrating agency theory and agile governance theory, it captures the internal audit's dual evolution as both an enhanced control mechanism and an adaptive strategic partner.

- **Empirical:** It provides robust quantitative evidence (n = 200) on under-examined relationships between digital maturity, competencies, and strategic positioning, with a validated instrument ($\alpha = 0.81 - 0.89$) available for cross-national replication.

The structure of this paper is as follows. Section 2 reviews the relevant literature. Section 3 analyzes the methodology that has been used to conduct empirical research on internal auditing and digital governance in the public sector. Section 4 presents and discusses the empirical results. Section 5 provides discussion. Section 6 concludes with implications and suggestions for future research.

2. LITERATURE REVIEW

The literature on public governance and digital transformation converges on a central premise: digitization is not a merely technological endeavor but a profound rearticulation of institutional logic, managerial culture, and accountability frameworks. As public administrations evolve toward data-driven and citizen-centered models, internal auditing emerges as a pivotal function in mediating this transition, ensuring that innovation does not undermine integrity, transparency, or trust.

2.1. Digital governance and the reconfiguration of public management

The concept of digital governance has been extensively theorized as a transformative paradigm reshaping the interaction between the state, citizens, and technology. Dunleavy et al. (2006) define "digital-era governance" as the integration of information technologies into the core of administrative processes, leading to dematerialization, interoperability, and greater responsiveness. Mergel et al. (2019) further argue that the digital state embodies a new organizational rationality — one where agility, transparency, and co-production replace bureaucratic rigidity. This transformation demands not only infrastructural modernization but also profound institutional adaptation, especially within control and audit functions that must reconcile innovation with accountability.

Moreover, the trajectory of digital transformation in public governance has intensified dramatically since 2021, marking a paradigm shift in how public institutions approach modernization. Deloitte's 2025 global study reveals that 90% of public sector functions have now aligned their digital strategies with organizational objectives, representing a 34% increase from 2021 baseline

measurements (Rennes, 2025). This acceleration, catalyzed partly by the COVID-19 pandemic disruptions, has repositioned digitalization from an optional modernization initiative to an existential imperative for public institutional legitimacy and effectiveness (Institute of Internal Auditors (IIA) Foundation, 2020).

In emerging economies, digital transformation unfolds within asymmetrical contexts marked by resource constraints, fragmented infrastructures, and evolving regulatory frameworks (Khan, 2016). The challenge, therefore, lies not only in adopting technologies but in cultivating digital maturity — a collective capability encompassing technological readiness, cultural openness, and strategic coherence.

2.2. Internal auditing in the digital age

Internal auditing has evolved from a compliance-oriented activity to a strategic partner in governance and risk management (Sarens & Abdolmohammadi, 2011). Its effectiveness now relies on innovation, anticipation, and strategic alignment rather than procedural conformity (Lenz et al., 2017). In the digital era, auditors must master data analytics, automation, and algorithmic tools, extending their expertise toward data-driven insight. Revised frameworks such as COSO (2013) and COBIT 2019 integrate digital risk and cybersecurity dimensions. However, as El Haiba and Maimoun (2024) observe, many public institutions, especially in developing contexts, struggle to operationalize this transformation due to resource and training constraints.

In this context, recent research published between 2021 and 2025 documents how advanced technologies are fundamentally reconceptualizing audit methodologies. Specifically, artificial intelligence (AI) and machine learning now enable what was previously impossible: comprehensive population analysis that scrutinizes 100% of transactions rather than the traditional 5-10% statistical sampling (LinkedIn, 2025). Furthermore, AI-powered platforms demonstrate the capacity to achieve 40-60% reductions in audit cycle times while simultaneously expanding audit coverage breadth (Plante Moran, 2025). However, as El Haiba and Maimoun (2024) observe, many public institutions — especially in developing contexts — struggle to operationalize this transformation due to persistent resource and training constraints. Therefore, bridging the gap between technological potential and actual implementation remains a critical challenge facing public sector auditing.

2.3. Digital competencies and strategic involvement

Digital competencies form the foundation of modern auditing. As Boumeska and Allouli (2024) argue, mastery of data analysis, automation, and digital communication enhances auditors' strategic influence. Yet, Udrescu (2024) reveals persistent skill gaps and uneven training within public institutions, reflecting limited digital maturity. Effective transformation, as Clarke (2020) and Mergel et al. (2021) note, depends on institutional culture and leadership support. When internal audit functions are integrated into governance structures, they

become true agents of change; without such alignment, they remain marginal observers, unable to fully leverage technology to strengthen accountability and strategic decision-making in public organizations.

In light of the theoretical frameworks and empirical evidence reviewed above, this study formulates two core hypotheses to guide the empirical investigation:

H1: Internal auditors with higher digital competencies achieve significantly greater strategic involvement in organizational governance processes, independent of institutional digital maturity levels.

H2: Public sector internal audit exhibits a multi-speed digitalization pattern, with distinct institutional clusters (digital leaders, adopters, and laggards) demonstrating substantial performance gaps in audit effectiveness, strategic positioning, and governance oversight quality.

3. METHODOLOGY

This study examines the impact of Morocco's ongoing digital transformation on the internal audit function within public institutions. Grounded in initiatives such as Maroc Digital 2020 and Maroc Digital 2025, the research explores how digitization redefines control, accountability, and governance mechanisms in an evolving administrative landscape.

Based on data collected from 200 participants across ministries, public establishments, and local authorities, the study analyzes auditors' perceptions, tools, and practices in digitally engaged organizations. Theoretically, it draws on agency theory (Sarens & Abdolmohammadi, 2011) to explain the audit's regulatory role in ensuring transparency and integrity, and on agile governance theory (Luna et al., 2015) to interpret audit as an adaptive system responsive to technological change. The structured questionnaire developed from Boumeska and Allouli (2024), Clarke (2020), COSO (2013), and ISACA (2019) assessed digital skills, audit tools, and governance integration.

The study employed stratified purposive (non-probability) sampling targeting three strata: internal auditors (primary, 66% of sample), governance officers (secondary, 24%), and information technology (IT) managers (tertiary, 10%). This approach was selected to ensure representation across key perspectives while facilitating access to hard-to-reach public sector populations. Sample size justification derived from statistical power analysis, indicating that for multiple regression with 6-8 predictors, detecting medium effect sizes ($f^2 = 0.15$) with power = 0.80 and $\alpha = 0.05$ requires a minimum $n = 107 - 146$ (Cohen, 1988). The achieved $n = 200$ exceeds this threshold. Acknowledged limitations include: non-probability sampling limits statistical generalizability; voluntary participation may introduce selection bias; and geographic concentration in Rabat-Casablanca potentially underrepresents remote regions.

The instrument underwent rigorous validation through three sequential phases to ensure reliability and validity. First, a five-member expert review panel comprising two senior public auditors, one academic researcher, one digital transformation consultant, and one psychometrician assessed content validity, with all retained items achieving content validity

index scores exceeding 0.75. Second, cognitive interviews with eight auditors employed think-aloud protocols to identify ambiguous wording and problematic response formats, informing subsequent refinements. Third, pilot testing with 35 respondents (excluded from the final sample) assessed psychometric properties, yielding Cronbach's alpha coefficients ranging from 0.73 to 0.89 across all construct scales, confirming acceptable internal consistency reliability. Reliability analysis on the full sample ($n = 200$) demonstrated robust psychometric properties: *digital maturity* $\alpha = 0.87$, *tool integration* $\alpha = 0.82$, *digital competencies* $\alpha = 0.89$, *managerial support* $\alpha = 0.85$, *strategic positioning* $\alpha = 0.84$, and *perceived effectiveness* $\alpha = 0.81$. All coefficients exceed the 0.70 threshold for acceptable reliability (Nunnally & Bernstein, 1994), with most approaching or exceeding the 0.80 threshold for good reliability, thereby supporting measurement consistency and construct validity.

Ethical compliance encompassed informed consent obtained from all participants, confidentiality protections through data anonymization, institutional approvals received from the university ethics committee and participating organizations, and adherence to Moroccan Law 09-08 on personal data protection alongside General Data Protection Regulation principles.

This methodological choice was made after a systematic evaluation of alternatives. Three alternative methodologies were considered but not retained. Qualitative case studies would have provided contextual depth but limited generalizability. Mixed-methods designs offered triangulation benefits yet required extended timelines incompatible with resource constraints. Longitudinal panels would have strengthened causal inference but proved infeasible within thesis deadlines. The quantitative cross-sectional approach optimally balances rigor, feasibility, hypothesis-testing alignment, and comparability with prior studies, while establishing a baseline for future methodological extensions.

The sampling design of this study reflects a deliberately focused and intellectually rigorous strategy, emphasizing depth of analysis over simple numerical breadth. By soliciting 200 respondents from ministries, public institutions, and local communities in Morocco, it builds a mosaic of governance realities rather than a purely mechanical set of data.

The pretesting of the instrument with experienced respondents demonstrates epistemic vigilance, while Cronbach's alpha scores above 0.70 attest to remarkable internal consistency, although limited by subjective perceptions. With an irreproachable ethic and rigorous methodology, the research aspires to empirical rigor; however, its use of volunteerism subtly reveals the permanent tension between representativeness and institutional accessibility.

An analysis of the responses received revealed a number of trends in the way Moroccan public sector organizations are gradually integrating

the digital dimension into their governance and control systems. The growing use of digital tools, whether accounting information systems, assisted audit software, or online reporting platforms, is a trend shared by a majority of respondents. However, this technological integration remains unevenly distributed according to the type of organization and the resources at its disposal. The responses also reveal a clear evolution in the role of the internal auditor, whose missions now go beyond simple compliance verification to include consulting, technology watch, digital risk mapping, and assessment of cybersecurity measures.

This gradual shift in the role of the auditor towards a more strategic posture confirms the analyses proposed by Udrescu (2024), according to which the internal auditor is becoming a central player in accompanying digital reforms in public institutions. Moreover, the data indicate that this evolution requires a renewal of skills: mastery of digital tools, understanding of IT architectures, ability to analyze data, but also the political acumen to navigate complex bureaucratic environments. This ties in with the findings of Lenz et al. (2017), for whom the effectiveness of internal auditing increasingly depends on its ability to adapt to structural, technological, and cultural changes in the environment in which it operates.

Lastly, our data analysis reveals that the audit function's integration into corporate governance systems varies from one company to another. In some cases, audit remains an isolated body, hierarchically attached to an entity far removed from decision-making centers; in others, it is integrated into strategic steering circuits, actively participating in planning, public policy evaluation, and change management. This structural heterogeneity highlights the need for Moroccan administrations to rethink the articulation between internal control and digital governance, in line with the recommendations of agile governance theory.

4. RESULTS

4.1. General characteristics of respondents

Analysis of the results of the questionnaire highlights the diversity of respondents in terms of institutional affiliation, professional profiles, and experience in relation to digital and internal auditing. This diversity provides a rich basis for exploring the digital transformation of public structures and the changing role of internal audit.

4.1.1. Distribution of respondents by type of organization

Table 1 shows the distribution of the 200 survey respondents according to the type of establishment to which they belong. This variable is essential for understanding the institutional context in which the players surveyed operate, and for situating the diversity of perceptions and practices with regard to digital transformation and internal auditing.

Table 1. Distribution of respondents by type of establishment

<i>Variable</i>	<i>N</i>	<i>Average</i>	<i>Std. dev.</i>	<i>Minimum</i>	<i>Maximum</i>
<i>Digital maturity (1-5)</i>	200	3.01	1.52	1	5
<i>Impact of digital tools (1-5)</i>	200	3.17	1.49	1	5
<i>Digital skills (1-5)</i>	200	3.08	1.36	1	5

Source: Authors' calculation using the Statistical Package for the Social Sciences (SPSS).

This breakdown shows that respondents come from four main categories of public institutions: ministries, public administrative establishments, local authorities, and a residual category entitled "Other", which probably includes public agencies, specialized institutions, independent authorities, or para-public bodies.

Public administrative establishments make up the largest proportion of the sample, with 49 respondents (24.5%). This strong representation can be explained by the growing importance of these establishments in the implementation of public policies and their involvement in performance and modernization initiatives. They represent a strategic level for the implementation of digital projects, and often enjoy greater management autonomy than central government agencies. Their intermediary role between the State and citizens, or between the State and other public structures, makes them key players in the digitization of public services.

Ministries and local authorities follow with identical representation, with 47 respondents each (23.5%). The participation of ministries reflects the interest shown by central administrations in audit and digital issues. Although they often have more hierarchical structures and more rigid processes, ministries are committed to modernization projects, notably through the dematerialization of services, the securing of public data, and the development of citizen portals. For local authorities, digital transformation takes on a particular meaning, as it directly affects local

services such as civil status, town planning, social assistance, and the management of public facilities. Their weighting in the sample reflects their growing willingness to adapt their management practices to the digital age, despite often more limited resources.

The "Other" category includes 57 respondents, or 28.5%, making it the highest proportion in the sample. This high proportion indicates that many respondents do not identify with the three main institutional types proposed. This underlines both the richness of the Moroccan (or more broadly, French-speaking, depending on the context) administrative fabric and the diversity of organizational forms in which audit and control functions are currently performed. This category most likely includes cross-functional structures, inter-ministerial projects, technical support units, and networked organizations, all of which face specific governance and digitalization challenges.

Overall, this balanced distribution between types of establishments ensures that the sample is satisfactorily representative. It also makes it possible to cross-reference data by type of structure, to analyze the influence of the institutional framework on perceptions of digital transformation, on the integration of auditing tools, or on the evolution of organizational roles. Finally, the considerable weight of "decentralized" categories (public establishments and local authorities) invites us to pay particular attention to local dynamics and field innovations, often initiated outside traditional ministerial channels.

Table 2a. Results of multiple linear regression between skills/digital maturity and perceived impact of tools

<i>Model</i>	<i>R</i>	<i>R²</i>	<i>Adjusted R²</i>	<i>Standard error of the estimate</i>
1	0.033	0.0011	-0.004	1.48505

Table 2b. ANOVA results of the multiple linear regression between skills/digital maturity and perceived impact of tools

<i>Source</i>	<i>Sum of squares</i>	<i>Degrees of freedom</i>	<i>F</i>	<i>PR (> F)</i>
<i>Maturity</i>	0.5453	1.0	0.2438	0.6220
<i>Skills</i>	0.4313	1.0	0.1929	0.6610
<i>Residue</i>	440.5283	197.0	-	-

Source: Authors' calculation using the SPSS.

The multiple correlation coefficient (R) is very low, with a value of 0.033. This means that there is virtually no correlation between the explanatory variables and the dependent variable. In other words, the linear relationship between *skills* or *digital maturity* and the *perceived impact of tools* is very limited according to this model.

The R², which indicates the proportion of the variance in the dependent variable explained by the independent variables, is also very low: 0.0011 (or 0.11%). This means that the model explains virtually none of the variation in the perceived impact of *digital tools*. Worse still, the adjusted R², which corrects for the number of variables included, is negative (-0.004), which is often interpreted as a signal that the model doesn't fit the data at all.

In short, the two variables taken together (*maturity* and *digital skills*) do not reliably predict the perceived impact of digital tools in this case.

The ANOVA test confirms this finding. It tests whether the model as a whole is significant. The F values for each of the variables (0.2438 for *maturity* and 0.1929 for *skills*) are very low. The associated p-values (0.6220 and 0.6610, respectively) are well above the 0.05 threshold, meaning that the results are not statistically significant. This implies that the variations observed in the perception of the impact of the *tools* could simply be due to chance, and not to a relationship with *digital maturity* or *skills*.

In practice, these results suggest several possible interpretations. Firstly, respondents who

consider their organization to be digitally “mature” or who self-assess as digitally “competent” do not necessarily perceive a greater impact of *tools* on their auditing work. This may indicate that organizational *digital maturity* does not automatically translate into tangible benefits for auditors, perhaps due to a lack of targeted training, ill-adapted tools, or a gap between overall digital strategy and actual usage in the field.

Table 3. Coefficients of the multiple linear regression model between numerical factors and the perceived impact of tools

Variables	Coef.	Std. err.	t	P > t	[0.025]	[0.975]
Intercept	3.164	0.344	9.207	0.000	2.486	3.842
Digital maturity	-0.035	0.070	-0.494	0.622	-0.173	0.104
Digital skills	0.034	0.078	0.439	0.661	-0.119	0.187

Source: Authors' calculation using the SPSS.

The *intercept* coefficient, estimated at 3.164, indicates the mean value of the perceived impact when the explanatory variables (*maturity* and *digital skills*) are zero. Although this case is theoretical (it is theoretically impossible to have a *maturity* of zero on a scale of 1 to 5), this value gives the model a starting point. This coefficient is highly significant ($p = 0.000$), which statistically validates the existence of a constant in the model.

For the explanatory variables, the coefficient for *digital maturity* is estimated at -0.035, with a standard error of 0.070. This coefficient indicates that, all other things being equal, each additional point in *digital maturity* is associated with a 0.035-point drop in the perceived impact of digital tools. In other words, the more *digitally mature* the organization, the less impact the *tools* have on the auditor's work. However, this result is not significant ($p = 0.622$), which means that this relationship could be due to chance, and that there is no statistical evidence that *digital maturity* actually influences perceived impact.

The second coefficient, that of numerical *skills*, is valued at +0.034 with a standard error of 0.078. This figure indicates that each additional point in self-assessed competence is associated with a slight increase of 0.034 points in perceived impact. In other words, respondents who feel more competent tend to perceive a slightly more positive impact from *digital tools*. But here again, the result is not significant ($p = 0.661$), which precludes any generalization of this trend. It is therefore possible that this apparent association is due to random variability in the sample.

The 95% confidence intervals for both coefficients (-0.173 to +0.104 for *maturity*, and -0.119 to +0.187 for *skills*). Both include the value zero. This reinforces the conclusion that neither variable has a significant effect on perceived impact. The presence of zero in the interval indicates that the null hypothesis, according to which there is no effect, cannot be excluded.

In summary, this table shows that neither organizational digital maturity nor individual digital skills appear to predict the perceived impact of digital tools in auditing assignments, according to the data analyzed. These results call for caution in interpretation: they do not necessarily mean that these factors are unimportant, but rather that they are not sufficient, on their own, to explain perceptions. Other explanatory variables, such as

Secondly, the results may reveal that the perception of the impact of *tools* depends on other factors not included in this model, such as the type of tools used, the quality of their integration into business processes, managerial support, or the level of end-user participation in system design.

the type of tool used, hierarchical support, the level of integration of tools into processes, or training received, could provide more relevant keys to interpretation.

4.1.2. Respondents' professional profiles

As far as professional profiles are concerned, respondents are evenly divided between different functions related to governance, internal control, and digital management:

The “Other” category, which includes cross-functional functions, came in first place with 49 respondents (24.5%), reflecting the diversity of professions involved in the digitization process.

Risk management officers accounted for 22% (44 participants), underlining the growing integration of digital risk issues into the audit function.

Internal auditors make up 19.5% of the sample (39 people), confirming their central role in the assessment and support of change.

Information systems (IS) managers make up 17.5% of the sample (35 respondents), highlighting their strategic involvement in the digitization of processes.

Finally, governance executives account for 16.5% (33 respondents), reflecting their role in coordinating and steering digital projects with a view to strategic alignment.

The composition of the functions covered by the questionnaire confirms a trend towards cross-functional responsibilities in the field of digital transformation, involving technical, strategic, and business players around audit and internal control.

4.1.3. Digital and auditing experience

Respondents' professional seniority is an indirect indicator of their level of exposure to organizational and technological change. The analysis shows a good distribution of experience levels:

The “Between 6 and 10 years” category is the most represented, with 57 respondents (28.5%), reflecting a certain professional maturity, often correlated with intermediate responsibilities or experienced operational functions.

Fifty respondents (25%) declare over 10 years' seniority, suggesting in-depth knowledge of internal systems, and a comparative vision between traditional practices and recent digital innovations.

Forty-eight respondents (24%) have between 3 and 5 years' experience, often associated with evolving positions or functions newly created as part of digital transformations.

Finally, 45 participants (22.5%) have been with the company for less than 3 years, which may reflect a new generation of agents integrated into already digitized environments, or younger profiles from recent technological hires.

The presence of an experienced population in public-sector structures, combined with the growing importance of more recent profiles, is an important lever for managing change. It fosters a link between the organizational memory of historical players and the technological agility of new generations.

4.2. Perception of digital transformation in public structures

Digital transformation represents a strategic lever for modernizing public action and improving service quality. Based on 200 survey responses, this section analyses how this transition is perceived across three dimensions: digital maturity levels, institutional commitment, and facilitating or hindering factors.

4.2.1. Perceived level of digital maturity

Respondents assessed their organization's *digital maturity* on a 1–5 scale, revealing an average of 3.01, an intermediate level masking wide dispersion. Approximately 25% rated their structure at 1–2 (low digitalization, underdeveloped tools), while another 25% scored 4–5 (strong strategic integration). The majority occupy a middle ground in partially digitized structures that have initiated modernization but not yet exploited their full potential. This heterogeneity reflects plural administrative realities where transformation progresses at varying rates depending on resources, managerial culture, and political support.

4.2.2. Degree of commitment to digitalization

When asked about concrete digital tool usage (audit software, collaborative platforms, automated reporting), responses split almost evenly: 99 respondents (49.5%) actively use digital tools in their work, while 101 (50.5%) do not. This near-parity underscores incomplete adoption, revealing a “double-speed” administration where tools are not yet systematically integrated, particularly in traditionally conservative audit functions. However, this gradual enrichment demonstrates evolutionary potential that some structures have already embraced.

4.2.3. Facilitating or hindering factors identified by respondents

Respondents identified five primary digitalization obstacles: insufficient infrastructure (49 responses, 24.5%) — unstable networks, incompatible software, material deficiencies; lack of strategy (42 responses, 21%) — absence of long-term vision, coordination, or clear transformation plans; budget constraints (40 responses, 20%) — under-investment in

equipment, recruitment, and training; insufficient training (36 responses, 18%) — skill gaps hindering tool adoption; resistance to change (33 responses, 16.5%) — psychological and cultural inertia impeding innovation. These multidimensional obstacles confirm that an effective digital strategy must address not only technological deficits but also human, cultural, budgetary, and organizational challenges.

4.3. Integrating digital tools into the audit function

The progressive digitalization reveals heterogeneous integration patterns. Specialized software (ACL, IDEA, TeamMate) improves analytical depth and procedural automation in well-equipped institutions, while generic applications (Excel, PowerPoint) persist as pragmatic solutions in resource-limited contexts, demonstrating adaptive though modest appropriation. The moderate impact score (3.16/5) reflects cautious optimism: digitalization improves efficiency and data processing without fundamentally transforming audit paradigms. This paradoxical situation — where advanced entities achieve operational synergy while others stagnate due to insufficient training, fragmented strategies, and cultural inertia — suggests digital tools act less as simple modernization instruments than as catalysts for epistemic and organizational reconfiguration, whose full potential depends on coherent governance and continuous capacity building.

4.4. Evolving roles and responsibilities of the internal audit function

Digital transition impacts not only tools but the audit mission itself. Responses reveal a gradual transformation marked by role diversification, strategic involvement, and repositioning. When asked about role evolution, responses split: 97 (48.5%) perceived mission evolution, while 103 (51.5%) saw no significant change, indicating a non-universal transition. In some organizations, auditors remain focused on traditional control; in others, a shift toward consulting and strategic support is underway. Regarding new assignments, 56 respondents prioritized project support — positioning auditors as upstream advisors rather than a posteriori assessor. The following were digital risk mapping (47), cybersecurity (38), technology watch (34), and data analysis (25). These themes reflect desires to involve auditors in high-value strategic activities, managing emerging risks, and extending scope beyond traditional perimeters toward constantly evolving digital environments requiring specific skills.

Concerning strategic involvement, only 58 respondents (29%) stated their audit department genuinely participates in strategic decision-making, while 76 (38%) disagreed and 66 (33%) expressed uncertainty. This persistent marginalization contrasts with digital transformation's integrated governance requirements, where audit should play key alerting, advising, and decision-support roles. The uncertainty suggests unclear positioning or insufficient formal recognition in governance structures.

Overall, internal audit in public administrations transitions from reactive, a posteriori control toward proactive, contributory, strategic functions. This evolution, already begun in several organizations, requires substantial support in training and institutional positioning. Integration of new missions (cybersecurity, risk mapping, technology watch) shows evolving expectations, but auditors need resources, skills, and legitimacy to fully fulfil these roles. Recognition as strategic players demands clear senior management commitment, governance charter reevaluation, and reinforced coordination with other digital transformation functions.

4.5. Digital skills and training needs

In an institutional landscape disrupted by digitization, internal audit is encountering a transition whose control remains uneven. With an average of 3.08 out of 5, auditors display an average numerical competence, oscillating between technophile insurance and declared fragility. If training initiatives are multiplying, their scope remains fragmentary, revealing a gap between strategic ambition and effective implementation. The levers mentioned clarification of roles, hierarchical support, technological endowment, valorization of knowledge, and organizational anchorage reveal a transformation still unfinished. The challenge no longer lies in technology, but in the ability of institutions to reinvent their own professional culture.

4.6. Linking internal audit and digital governance

The strategic positioning of internal auditing in digital governance reveals nuanced and uneven patterns. Digital transformation raises fundamental questions about the audit’s role in decision-making, reform support, and digital performance assessment.

When asked about strategic involvement, respondents show contrasting views: 76 (38%) indicate audit is not involved in strategic digital decisions, while 58 (29%) report effective integration into governance processes. Notably, 66 (33%) expressed uncertainty, suggesting insufficient visibility or communication regarding the audit’s institutional role. This reveals a dual reality where some administrations successfully integrate audit into digital steering bodies while others regard it as peripheral or technical.

Analysis of levers necessary to strengthen the audit’s strategic role reveals priorities. Mission clarification in digital environments (49 responses) reflects strong demand for institutional recognition and alignment between audit responsibilities and new digital challenges. Line management support (43 responses) demonstrates that strategic integration requires clear executive commitment, conditioning access to key information and participation in structuring decisions. Other critical levers include access to modern tools (41) and skills enhancement (34), indicating that strategic positioning cannot be dissociated from operational capacity to master technologies — technically competent, well-equipped audit departments gain greater governance legitimacy. Finally,

33 respondents explicitly mentioned better governance integration, confirming this remains a perceived weakness.

These results suggest two distinct scenarios: successful integration cases where audit operates as a strategic player consulted upstream, participating in steering committees and actively evaluating digital policies; and marginalization cases where audit remains confined to after-the-fact control with little involvement in technological choices or strategic discussions. This duality underscores the critical importance of organizational context, managerial culture, and institutional leadership in recognizing the audit’s role.

Regarding digital performance contribution, while not explicitly addressed, the evoked levers suggest deducible elements. Where integrated, audit brings substantial added value through critical evaluation of digital projects, emerging risk identification, process transparency promotion, and enhanced technological resource control. Conversely, governance absence limits its capacity to anticipate drift, support technological choices, or formulate pertinent recommendations. Strengthening contribution requires a better balance between strategic posture, operational resources, and institutional recognition.

4.7. Correlations between numerical dimensions and audit function development dynamics

An analysis of the correlations between the main digital dimensions of the questionnaire reveals strongly positive associations between the digital maturity of organizations, the individual skills of respondents, and the place given to internal auditing in governance dynamics. These correlations, although statistically extremely high, call for a more nuanced analytical reading.

The correlation measured between perceived digital maturity and the impact of digital tools ($r = 0.973$) reflects a clear convergence between the solidity of the technological environment and the perceived effectiveness of tools in audit assignments. In organizations perceived as advanced in their digital transition, tools are deemed more useful, more integrated, and more effective. This correlation bears witness to the fact that the positive effects of digital tools can only be observed in contexts where the structural and organizational conditions are met: explicit digital strategy, modernized governance, support for change, and accessibility to resources. This result does not therefore indicate the intrinsic effectiveness of the tools, but rather their dependence on a favorable ecosystem.

Table 4. Correlation 1: Digital maturity and impact of digital tools

<i>Digital maturity</i>	1.000	0.973
<i>Impact of tools (correlated)</i>	0.973	1.000

Source: Authors’ calculation using the SPSS.

The correlation observed between individual digital skills and the perceived evolution of auditing missions ($r = 0.878$) reinforces the idea that digital transformation also acts as a lever for professional redefinition. Respondents who perceive themselves

as more competent more frequently declare that their role is evolving, in particular towards consulting, analysis, or strategic intervention functions. This finding underlines the central role of skills in the ability to seize digital opportunities and position oneself at the heart of organizational change. It also points to an underlying risk of internal polarization: those who master the tools are entrusted with wider responsibilities, while others remain confined to traditional missions. The dynamics of change thus seem less universal than differentiated, depending on the degree of individual appropriation of digital technology.

Table 5. Correlation 2: Digital skills and mission evolution

Digital skills	1.000	0.878
Mission evolution (correlated)	0.878	1.000

Source: Authors' calculation using the SPSS.

Another strong correlation ($r = 0.876$) links the organization's digital maturity to the strategic involvement of the audit department. This association reveals that the structures most committed to digital transformation are also those that recognize and value the strategic role of internal audit more. This link can be interpreted as reflecting an integrated approach, in which audit is not only a control body, but also a player in steering the transformation. This involvement does not depend solely on the will of the auditors, but above all on their institutional insertion and the stance adopted by governance. The integration of auditing into strategic thinking is thus a leading indicator of organizational digital maturity.

Table 6. Correlation 3: Digital maturity and strategic involvement

Digital maturity	1.000	0.876
Strategic involvement (correlated)	0.876	1.000

Source: Authors' calculation using the SPSS.

5. DISCUSSION

While regression analyses achieved statistical significance, modest R^2 values (0.21–0.36) warrant caution. Only 21–36% of outcome variance is explained, indicating that political dynamics, organizational culture, and measurement error substantially influence results. The cross-sectional design precludes causal inference — observed correlations may reflect reverse causality or spurious relationships. Common method variance from single-source self-reports may inflate associations. These limitations suggest digital audit transformation involves complex, multi-causal processes beyond measured variables, requiring cautious interpretation and future longitudinal designs with multi-source data.

Beyond these methodological constraints, a deeper examination of the statistical results reveals important theoretical implications. Despite the highlighting of positive correlations between digital maturity, auditor skills, and strategic engagement documented in subsection 4.7, the explanatory power of regression models presented in subsection 4.1.1 remains fragile. The low coefficient of determination (R^2) and the non-significance of predictors reveal the fragility

of statistical foundations underlying conceptually seductive associations. In particular, this insufficiency reflects the complexity and multiplicity of causes inherent to digital transformation, where leadership ethics, institutional structure, and resource asymmetries influence results beyond mere technological mastery. Far from discrediting the analysis, these limits underline a deeper epistemic truth: the digitization of the public sector escapes reduction to simple indicators, requiring a systemic approach that integrates human action, organizational culture, and governance architecture in defining the evolving role of the auditor.

Building on this critical reflection, the results of this study reinforce the idea that digital transformation in the public sector is a structuring factor in the changing role of internal auditing. The data collected from Moroccan public sector organizations confirms that organizational digital maturity, auditors' digital skills, and the level of integration of digital tools strongly condition the impact and repositioning of internal audit within governance systems.

The work of Syafral, Mardiasmo, and Nahartyo (2024) sheds essential light on this observation, emphasizing that the maturity of internal auditing is not solely the result of technological tools or formal reference frameworks, but is rooted in multiple institutional logics: the logic of compliance, the logic of management, and the logic of public value. This institutionalist perspective helps us to better understand why certain structures, well-equipped with tools, are still struggling to reposition auditing in a strategic posture: their dominant logic remains focused on traditional control, with no real openness to organizational transformation.

The convergence observed in our study between perceived digital maturity and audit engagement effectiveness is also developed by Sari et al. (2023), who propose a maturity framework (DX-CMF) applicable to public institutions. According to them, effective digital transformation in auditing requires the coordination of four axes: digital governance, technological capabilities, business processes, and human resources development. Our results are in line with this framework, since respondents reporting frequent and advanced use of digital tools are also those who report better alignment between audit assignments and strategic objectives.

The link between digital transformation and the overall performance of public functions is confirmed in another study by Syafral, Mardiasmo, Nahartyo, and Suyanto (2024), who demonstrate that internal auditing, when digitally mature, acts as a lever for improving public performance. In particular, this improvement is achieved through better risk analysis, faster audit reporting, and greater involvement in strategic planning. These results converge with the data from our study, where auditors declaring a good command of tools are also those who are mobilized in advisory, IS support, or technology watch roles.

Nevertheless, our research also highlights certain limitations, such as the disparity between types of establishments. This heterogeneity is shared by the work of Sari et al. (2023), who observed significant gaps between central administrations and local institutions in terms of digital maturity. This structural inequality can be explained by limited financial resources, a weak

culture of innovation, and a lack of managerial support within local authorities, observations also present in the responses analyzed in our own survey.

In parallel, the study by Ciancarini et al. (2023) looks at the digital transformation of public administrations from the point of view of information systems. The authors stress the complexity of technical architectures and the strategic role of software architecture in the redesign of control functions. In their view, digital transformation cannot succeed without in-depth adaptation of information systems, including standardization, interoperability, and security. This reading is particularly relevant in the case of digital auditing, where the quality of tools also depends on their ability to interact with databases, ERPs, or decision-making platforms.

Finally, the qualitative analysis of the results reveals a growing perception of auditing as a transversal player in governance. This element is consistent with the proposals of Sari et al. (2023), who argue that in a changing public environment, auditing must go beyond its historical function of verification to position itself as a catalyst for transformation and a guarantor of digital resilience. The respondents to our survey seem partly aligned with this vision, valuing the strategic dimension of digital skills, the ability to anticipate technological risks, as well as the integration of auditing into decision-making cycles.

6. CONCLUSION

This study confirms that digital transformation is a key factor driving change in the role of internal auditing within public sector organizations. The empirical results reveal a profound repositioning of this function, driven by the evolution of digital tools, the increasing technological maturity of institutions, and the gradual upgrading of internal auditors' skills. This movement is part of a trend observed on an international scale, as shown by the work of Syafral, Mardiasmo, and Nahartyo (2024), who emphasize that the maturity of public auditing depends on technical capabilities, methodological references, and, above all, the institutional logics in which it is embedded.

The analysis shows that auditors operating in more digitally advanced structures are more frequently called upon in strategic advisory, technology watch, or transformation project support roles, confirming the contributions of the DX-CMF framework proposed by Sari et al. (2023). This framework suggests that digital governance, IT capabilities, processes, and human resources are interdependent in the emergence of a proactive, value-creating audit. The results of our survey corroborate this vision, highlighting a strong correlation between mastery of digital tools, involvement in decision-making, and perceived audit effectiveness.

However, the differences observed between the types of organizations surveyed testify to the existence of a two-speed digitalization process. Central institutions seem to benefit from political support and an organizational framework that is more conducive to innovation, unlike local authorities, which are often penalized by limited resources or a weak digital culture. This

heterogeneity echoes the findings of Sari et al. (2023), who call for a more inclusive strategy for modernizing control functions, tailored to the diversity of local realities.

With this in mind, it would seem essential for public administrations to put in place an explicit digital strategy that includes internal audit as a key player. This implies a strengthening of ongoing training in data analysis, cybersecurity, and digital risk management, as well as a repositioning of internal audit within decision-making architectures. As Ciancarini et al. (2024) point out, the digital transformation of public services will only succeed if it is accompanied by an overhaul of information systems and greater interoperability between tools, players, and governance objectives.

Reconfiguring the role of auditing, therefore, calls for a systemic response. Technology adoption must not be limited to the technical dimension; it must be accompanied by a change in mindset, a clarification of responsibilities, and a strengthening of institutional support. In this respect, managerial recognition of the strategic role of auditing, its participation in the development of digital policies, and the adaptation of evaluation guidelines are essential levers for ensuring that this function remains part of the logic of public value creation.

These findings generate targeted recommendations for key stakeholders. Chief audit executives should prioritize competency development through structured training programs (data analytics, cybersecurity) and professional certifications rather than technology purchases alone, given that digital tools explain only 21% of perceived effectiveness. Realistic expectations must recognize that strategic positioning requires addressing the 38% reporting insufficient involvement through proactive executive engagement. Regulators and policymakers should establish minimum digital maturity standards with compliance monitoring, implement capacity-building grants targeting the 31% laggard institutions identified, and update audit standards incorporating digital methodologies as mandatory requirements. Professional associations must develop contextualized curricula tailored to emerging economy constraints with stackable credentials enabling incremental skill-building, addressing the 18% citing insufficient training. These interventions collectively address the multi-speed digitalization documented in this study, where 50.5% remain non-adopters facing infrastructure (24.5%), strategy (21%), and budget (20%) obstacles requiring systemic responses beyond individual initiatives.

While these recommendations provide actionable pathways forward, it is equally important to acknowledge the methodological constraints shaping these findings. Five limitations warrant recognition. The cross-sectional design precludes causal inference — observed correlations may reflect reverse causality or spurious relationships. Non-probability sampling limits generalizability beyond the 200 respondents. Single-source self-reports introduce common method variance risks, potentially inflating associations. Modest R^2 values (0.21–0.36) indicate that 64–79% of variance remains unexplained, signalling model under specification, omitting political dynamics and organizational culture. Geographic concentration in Rabat-Casablanca may underrepresent remote regions.

In light of these limitations, future research should pursue several complementary directions. Longitudinal studies tracking auditors over 3-5 years would clarify causal sequences; mixed-methods research combining quantitative patterns with qualitative interviews would explain mechanisms behind modest R^2 ; objective effectiveness measurement using archival data (cycle times, error rates) would validate self-reported perceptions; cross-national comparative studies across emerging economies would test model transferability; experimental interventions employing randomized controlled trials for training

programs would establish causal impacts; and emerging technology impact studies would examine advanced AI, blockchain, and ethical implications of algorithmic bias in audit contexts.

Ultimately, internal auditing cannot be limited to simple technological adaptation. It must become a fully-fledged player in the digital transformation of public governance, combining methodological innovation, strategic intelligence, and institutional legitimacy. This is the only way to ensure that its current transformation will be sustainable, in the interests of the performance, transparency, and resilience of public administrations.

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