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INTERNAL AUDIT IN THE EUROPEAN ENERGY SECTOR: EVIDENCE AND COMPETENCY IMPLICATIONS

Svetlana MIHAILA
Academy of Economic Studies of Moldova, 61 B. Bodoni Street, Chișinău
svetlana.mihaila@ase.md
ORCID ID: 0000-0001-5289-8885
Cristina Gabriela COSMULESE
Stefan cel Mare University of Suceava, Romania
gabriela.cosmulese@usm.ro
ORCID ID: 0000-0002-8406-7004
Maria-Alessia FELEAGĂ
Bucharest University of Economic Studies, Romania
feleagamaria24@stud.ase.ro
ORCID ID: 0009-0004-4371-6882

Abstract
The European energy sector operates in a context characterized by intensive regulation, large capital investments, accelerated energy transition, and increasing technological risks, including cyber risks specific to critical infrastructure. In this context, internal audit plays the role of providing independent assurance and advisory services regarding governance, risk management, and internal control. The paper proposes a comparative case study between Enel S.p.A. and Iberdrola S.A., based on content analysis of official public documents for the years 2024 and 2025. The theoretical framework integrates literature on internal audit effectiveness, the independence of the internal audit function, professional internal audit standards, and specific characteristics of the energy sector regarding cybersecurity and critical infrastructure. The results highlight convergences in governance architecture (board/committee-level oversight), risk-based planning, and quality assurance and improvement programs (QAIP). At the same time, differences are identified in the way digital transformation is reflected in public reporting. The paper proposes a matrix linking internal audit dimensions and competencies, anchored in documentary evidence, and formulates practical implications for the development of internal auditor competencies in the energy sector.

Keywords: *Internal audit; energy sector; corporate governance; risk management; competencies; cybersecurity.*

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INTRODUCTION

The European energy sector stands at the intersection of requirements for continuity of essential services, decarbonization pressures, digital transformation, and compliance constraints. The complexity of the value chain (generation, transmission/distribution, supply, trading) and its nature as critical infrastructure increase the importance of governance and risk management. In this context, internal audit becomes a key assurance and advisory function, defined by The Institute of Internal Auditors as an independent and objective activity that adds value and improves operations by evaluating and enhancing risk management, control, and governance (IIA, 2024).

Recent studies shows that the effectiveness of internal audit is determined by organizational factors and professional capabilities: the positioning of the function within the governance architecture, independence and objectivity, support from management and the audit committee, resources and quality of audit processes, as well as auditors' competencies (Nguyen et al., 2025; Geapcă, 2025; Kawtar & Khadija, 2025). Moreover, Christopher et al. (2009) highlights the inherent tensions between reporting to management and maintaining independence, suggesting that board/committee-level oversight mechanisms are critical for credibility.

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In the context of the European energy sector, where internal audit functions must navigate complex regulatory pressures, technological risks, and sustainability-driven performance expectations, the need for robust competency frameworks becomes increasingly evident, especially as contemporary research highlights that the effectiveness of internal audit is inseparable from the systematic evaluation of its performance through multidimensional tools, which enable a more rigorous assessment of audit quality, strategic alignment, and value creation (Boghean & Boghean, 2020).

Against the backdrop of digitalization and the interconnection of information technology with operational technology (IT/OT), the energy sector is exposed to sector-specific cyber risks with potentially systemic impact (Grosu et al., 2022). The Energy Community report on cybersecurity in energy highlights typical vulnerabilities (legacy systems, integration with new technologies, smart metering, IoT) and the need for a dedicated sectoral approach (Energy Community, 2019). Likewise, the EPRS analysis on the cybersecurity of critical energy infrastructure notes the importance of a dedicated approach for electricity grids and energy systems (European Parliament/ EPRS, 2019). Therefore, it is relevant to understand how the internal audit function is organized in large energy groups and what competencies such organization entails.

The objective of this paper is to describe and compare, based on official public documents, the governance and functioning of internal audit in two European energy groups – Enel S.p.A. and Iberdrola S.A. – and to derive implications for internal auditor competencies. The research questions are:

RQ1: How is the internal audit function positioned and governed at group level in Enel and Iberdrola?
RQ2: What risk-based planning, reporting, and follow-up mechanisms are described in official documents?
RQ3: To what extent are the specific characteristics of the energy sector (critical infrastructure, cyber/IT-OT, regulation) reflected in the architecture and declared priorities of the internal audit function?
RQ4: What competencies (skills) emerge, explicitly or implicitly, as necessary for internal auditors within a European energy group?

I.INTEGRATED THEORETICAL FRAMEWORK: EFFECTIVENESS, INDEPENDENCE, IIA STANDARDS AND SECTOR-SPECIFIC CHARACTERISTICS

Research on internal audit (IA) has evolved from a predominantly compliance- and control-testing-oriented focus toward a value-added orientation centered on governance and risk management. Arena and Azzone (2009), based on a sample of Italian companies, show that internal audit effectiveness is influenced by: (i) team characteristics (competencies, experience), (ii) audit processes and activities (methodology, planning), and (iii) organizational links (reporting lines, relationship with management). Cohen and Sayag (2010) confirm, in a study of Israeli companies, the importance of management support and organizational independence as determinants of effectiveness. Previous studies (Cosmulese, 2020; Lenz & Hahn, 2015) synthesize the empirical literature and highlight the convergence between determinants (independence, resources, quality) and the outcomes pursued (value, decision relevance). Independence and objectivity are central elements yet often challenged in practice. Christopher et al. (2009) show that when internal audit is overly dependent on management, credibility and the ability to influence governance may be affected. For this reason, functional reporting to board committees and direct access to the board are considered best practices for maintaining objectivity and protecting the function from interference.

Professional standards provide a common language and a set of requirements for designing and evaluating the function. The Global Internal Audit Standards, published by the IIA (2024), represent the mandatory component of the professional framework and cover: the purpose of internal audit, ethics and professionalism, governance of the function, management of the function, and the performance of audit services. From the perspective of this paper, particularly relevant are the requirements concerning: (i) governance of the function and reporting to oversight structures, (ii) risk-based planning and plan adaptability, (iii) communication of results and follow-up of recommendations, and (iv) the Quality Assurance and Improvement Program (QAIP) (IIA, 2024).

In the energy sector, these principles are applied in an environment characterized by heightened technological risks and specific operational constraints: interdependent IT/OT systems, critical processes with availability and safety requirements, and regulatory pressures. The Energy Community study (2019) highlights vulnerabilities associated with energy digitalization and the need for sector-specific cybersecurity capabilities, while the EPRS analysis emphasizes that cybersecurity of energy networks requires dedicated approaches (European Parliament/EPRS, 2019). Within this framework, the role of internal audit expands: beyond financial controls and compliance, internal audit must assess resilience, the maturity of technological controls, and the alignment of governance with the organization's risk profile (Boghean, 2022).

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II.RESEARCH METHODOLOGY

The research is qualitative and uses comparative case study method, based on content analysis of official public documents. The approach follows a logic of transparency in the selection and reporting of sources, inspired by the PRISMA 2020 recommendations regarding the documentation of the identification and selection process (Page et al., 2021), adapted to a corpus of organizational documents.

The units of analysis are two listed and integrated European energy groups – Enel S.p.A. and Iberdrola S.A. – selected based on comparability criteria: size, geographical diversification, activities in networks and renewable energy, and the availability of relevant public documents regarding governance and internal audit. The analysis is conducted at group level, in order to avoid the lack of comparability generated by local institutional differences.

The document selection followed explicit criteria, presented in *Figure 1:* (1) official documents published on corporate websites; (2) direct relevance to the governance and functioning of internal audit; (3) timeliness – financial years 2024 and 2025; and (4) full public access (PDF/HTML). Following the application of these criteria, four core documents were selected (Table 1). Additional supporting pages (for example, "Internal Controls/Internal Audit" pages on corporate websites) were used only for contextual confirmation, without extending the main corpus.

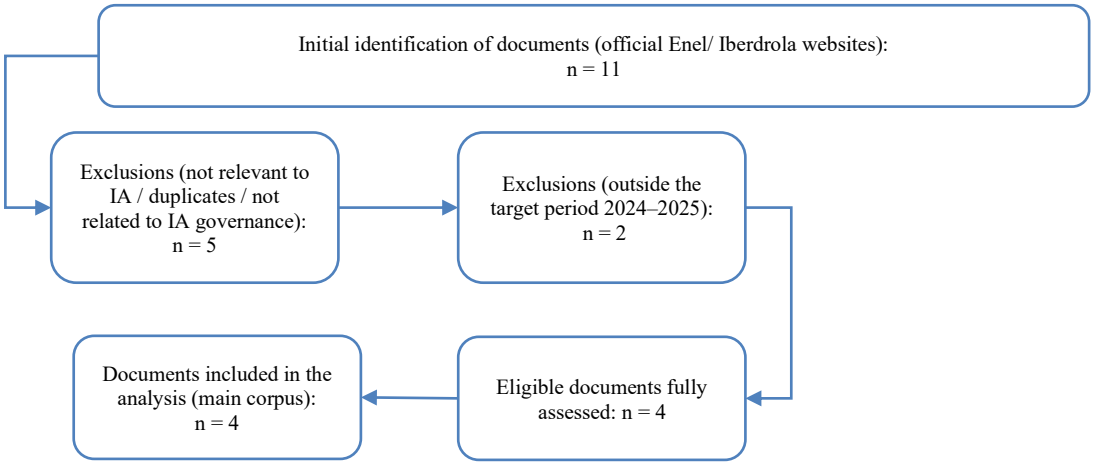

Figure 1. Document Selection Scheme
Source: Authors' own projection based on official Enel/ Iberdrola websites

Figure 1 illustrates the process of selecting the documents that make up the main corpus of the study, reflecting the application of a rigorous and transparent methodological approach. Of the total of 11 documents identified on the official websites of Enel S.p.A. and Iberdrola S.A., five sources were excluded because they were not directly relevant to the governance and functioning of internal audit or because they were informational duplicates. In a subsequent stage, two additional documents were eliminated because they did not fall within the analyzed time frame, namely the 2024–2025 fiscal years. Following the application of these criteria, four eligible documents were retained, forming the main corpus used in the comparative analysis. This selection scheme enhances the transparency of the research process and supports the methodological robustness of the comparative case study.

Table 1. Documents Analyzed (Main Corpus)

Company	Document	Year	Type	Role in Analysis
Enel S.p.A.	Report on Corporate Governance and Ownership Structure	2024	Governance Report (PDF)	Evidence on committees, oversight, IA role in governance
Enel S.p.A.	Audit Function Charter	2025	IA normative document (PDF)	Mission, independence, planning, reporting, QAIP, standards compliance
Iberdrola S.A.	Annual Corporate Governance Report	2024	Governance Report (PDF)	Evidence on IA & Risk Division, ICFRS, analytics/AI initiatives
Iberdrola S.A.	Basic Internal Audit Regulations	2025	IA normative document (PDF/HTML)	Organization, reporting, responsibilities, QAIP, group-level coordination

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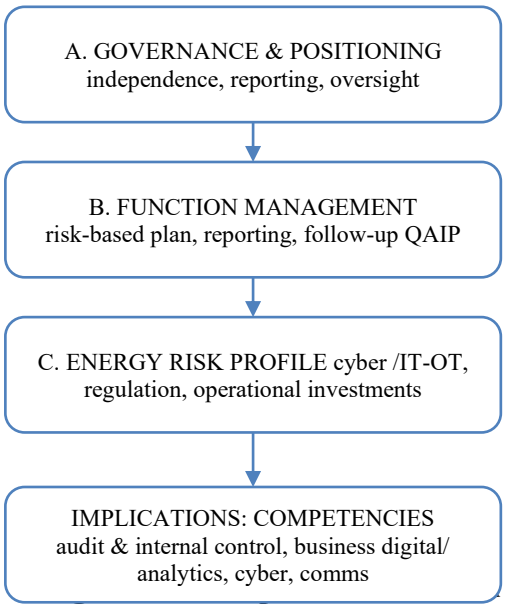
Source: Authors' own projection based on official Enel/ Iberdrola websites

Table 1 presents the structure of the final corpus and the analytical relevance of each selected document. For each group analyzed, both corporate governance reports and regulatory documents specific to the internal audit function were included, allowing for an integrated examination of the institutional and operational framework. This structure facilitates comparability between the two entities regarding governance architecture, oversight mechanisms, reporting lines, the independence of the internal audit function, and quality assurance practices.

Conceptual Model of Analysis

The conceptual model used is presented in Figure 2 and links: (A) governance and positioning of the internal audit function (reporting lines, access to board/committee, independence), (B) function management processes (risk-based planning, reporting, follow-up, QAIP, resources), and (C) the risk profile specific to the energy sector (cyber/IT-OT, regulation, operational/infrastructure, investments). The intersection of these dimensions generates implications for internal auditor competencies (RQ4).



Source: Authors' own projection

Analysis and Coding Procedure

The documents were analyzed through thematic coding, using a grid derived from the IIA Standards (2024) and from the literature on internal audit effectiveness (Table 2). The codes addressed: (1) IA governance and independence; (2) risk-based planning; (3) reporting, follow-up and communication; (4) QAIP and evaluations; (5) references to energy sector-specific risks (cyber/IT-OT, critical infrastructure); (6) signals regarding competencies (for example, mentions of analytics/AI, internal control over financial reporting).

Table 2. Coding Grid Used in the Analysis

Dimensions	Analytical Question	Indicators in Documents	Theoretical Anchoring
(1) IA Governance & Independence	To whom does IA report? What mechanisms ensure independence?	mentions of board/committee; unrestricted access; protection from interference	Christopher (2009); IIA (2024)
(2) Planning and Resource Management	How is the annual plan constructed? How are resources allocated?	risk assessment; plan approval; budget; reported deviations	Arena & Azzone (2009); IIA (2024)
(3) Reporting, Follow-up and Communication	How are results communicated and recommendations monitored?	periodic reports; implementation deadlines; monitoring until closure	Lenz & Hahn (2015); IIA (2024)
(4) QAIP and Evaluations	Is there a Quality Assurance and Improvement Program?	QAIP; internal evaluations; external evaluations; standards compliance	IIA (2024)

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(5) References to Energy Sector-Specific Risks (cyber/IT-OT, critical infrastructure)	Are technological or sectoral risks mentioned?	cybersecurity; IT/OT; systemic internal control; operational resilience	Energy Community (2019); IIA (2024)
(6) Signals Regarding Competencies (analytics/AI, ICFR, etc.)	What indications of competencies emerge from priorities or initiatives?	Data Analytics; AI; ICFR; ERM; group-level coordination	Cohen & Sayag (2010); Rikhardsson et al. (2019)

Source: Authors' own projection

Table 2 summarizes the thematic coding framework used in the document analysis, which is based on the IIA Standards (2024) and the specialized literature on the effectiveness of internal audit. The structure, organized into six analytical dimensions, ensures a systematic evaluation of the internal audit function from the perspective of the governance framework, operational processes, and the ability to adapt to risks specific to the energy sector.

III.ANALYSIS OF RESULTS

Results of the Analysis – Enel S.p.A.

This section addresses RQ1–RQ3 for the Enel case, using Enel documents (2024; 2025). The analysis examines: (i) positioning and governance of the function, (ii) function management processes (plan, reporting, QAIP), and (iii) the link with sector-specific risks.

Positioning, Reporting and Independence

The *Audit Function Charter* (2025) states that the audit function evaluates "systematically and independently" the effectiveness and adequacy of the Group's Internal Control and Risk Management System (ICRMS) (Enel, 2025). The document emphasizes its applicability at group level and the coordination of audit units through reporting to the head of the function (Enel, 2025). In terms of authority, the Charter stipulates full and unrestricted access to relevant information and personnel, as well as protection against interference in the selection and performance of audit engagements (Enel, 2025). These clauses are consistent with IIA requirements regarding independence and objectivity (IIA, 2024) and with Christopher et al.'s (2009) arguments concerning the need for institutional protection of the function.

The 2024 Corporate Governance Report describes oversight mechanisms at committee level: the relevant committee evaluates and monitors the work plan of the function and oversees its autonomy, adequacy, and effectiveness (Enel, 2024). From a literature perspective, such board/committee-level oversight is associated with internal audit effectiveness and its capacity to influence governance (Cohen & Sayag, 2010; Lenz & Hahn, 2015).

Risk-Based Planning, Reporting and Follow-up

The Charter specifies the existence of an annual audit plan constructed based on risk assessment and prioritization, incorporating input from management and governance structures, and including mechanisms for communicating significant deviations from the plan (Enel, 2025). The plan also includes resource and budget components, suggesting a structured function management approach aligned with professional standards (IIA, 2024). Regarding reporting, the document indicates periodic reporting to governance structures and monitoring of recommendation implementation until closure (Enel, 2025).

Interpretatively, these elements suggest a mature "risk-based internal audit" model, in which annual planning constitutes a governance process in itself, rather than merely an operational list of engagements. According to the literature, such maturity depends on competencies in risk assessment, understanding business processes, and the ability to transform findings into implementable recommendations (Arena & Azzone, 2009; Lenz & Hahn, 2015).

QAIP and Alignment with Standards. The Audit Function Charter explicitly references the Global Internal Audit Standards and the existence of a Quality Assurance and Improvement Program (QAIP), aligned with the professional framework (Enel, 2025; IIA, 2024). In practice, QAIP requires competencies in methodology, quality management, and the capacity for self-assessment and continuous improvement of the function.

Reflected Sector-Specific Characteristics (Energy, Cyber, Infrastructure). The analyzed Enel documents do not provide an exhaustive list of audit topics; however, the integration of internal audit within the ICRMS and the orientation toward evaluating the Group's internal control system indicate a framework capable of including operational and technological risks relevant to the sector. In a sector characterized by critical infrastructure and IT/OT interdependencies, such integration may support coverage of cybersecurity and operational resilience risks, consistent with recommendations for a sector-specific cybersecurity approach (Energy Community, 2019). Therefore, competency implications include: understanding technological controls, collaboration with risk/compliance/IT functions, and the ability to audit critical processes with availability requirements.

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Results of the Analysis – Iberdrola S.A.

This section addresses RQ1–RQ3 for the Iberdrola case, using Iberdrola documents (2024; 2025). The focus is placed on function organization (Internal Audit and Risk Division), planning/QAIP processes, and explicit signals regarding digitalization.

Positioning, Reporting and Group-Level Organization. The Basic Internal Audit Regulations (29 May 2025) describe the responsibilities, powers, and organization of the function, specifying that the regulations govern the nature, powers, and duties of members of the internal audit function within the Internal Audit and Risk Division (Iberdrola, 2025). The document details reporting lines and the relationship with the Audit and Risk Supervision Committee, as well as group-level coordination, including interaction with "country subholding companies" (Iberdrola, 2025). This governance architecture suggests a model capable of supporting methodological consistency and standardization of practices at international level, a relevant aspect in multinational organizations (Lenz & Hahn, 2015).

Risk-Based Planning, ICFRS and Reporting to Governance. The 2024 Governance Report includes descriptions of committee activities and interactions with the audit and risk function. In the *Annual Corporate Governance Report* (2024), actions and briefings to the committee are mentioned, including elements related to the review of the internal control system over financial reporting (ICFRS) and periodic updates regarding activity plans (Iberdrola, 2024). From a professional perspective, the focus on ICFRS indicates a robust component of financial controls auditing, requiring strong competencies in control testing and documentation.

QAIP and Explicit Competency Requirements. An important element is the explicit mention of QAIP in the *Basic Internal Audit Regulations*: the Chief Internal Audit and Risk Officer is responsible for developing and maintaining a Quality Assurance and Improvement Program, including internal and external assessments of compliance with the Global Internal Audit Standards and mandatory professional standards approved by the IIA (Iberdrola, 2025; IIA, 2024). The Regulations also specify that the leader must possess adequate knowledge, skills, and experience in internal audit, risk management, internal control, and governance (Iberdrola, 2025). This explicit reference provides a direct anchor for RQ4.

Explicit Signal of Digital Transformation: Data Analytics and AI. The Annual Corporate Governance Report 2024 explicitly mentions a "Data Analytics and Artificial Intelligence line of work" carried out by the Internal Audit and Risk Division and presented to the committee (Iberdrola, 2024). This mention is relevant in two respects: (i) it confirms that the function invests in analytical capabilities; and (ii) it suggests that progress in this area is treated as a governance topic, communicated to the committee. In terms of competencies, this implies data analytics skills, understanding the limitations and risks of AI use, the ability to integrate analytical outputs into audit conclusions. The literature on continuous auditing solutions suggests that adopting analytical tools requires both technical competencies and interpretative professional judgment (Rikhardsson et al., 2019).

Comparative Analysis – Enel vs. Iberdrola

This section addresses RQ1–RQ3 through a systematic comparison of the key dimensions for the two groups. The results indicate significant convergence in the design of the function at governance level, but also differences in how digital transformation is reflected in public reporting (Table 3).

The most important convergences are: (1) board/committee-level oversight, which strengthens independence (Enel, 2024; Iberdrola, 2025); (2) annual risk-based planning and mechanisms for reporting and follow-up (Enel, 2025; Iberdrola, 2025); and (3) the existence of QAIP and explicit references to compliance with IIA standards (Enel, 2025; Iberdrola, 2025; IIA, 2024). These elements correspond to the determinants of effectiveness identified in empirical literature (Arena & Azzone, 2009; Cohen & Sayag, 2010; Lenz & Hahn, 2015).

The main difference identified is that Iberdrola explicitly reports a Data Analytics and AI line of work within the function (Iberdrola, 2024), while Enel provides a more detailed description of the integration of internal audit into the internal control and risk management system, as well as the governance of the annual plan (Enel, 2025). This difference may reflect both internal priorities and different reporting styles; however, from a competency perspective, both cases indicate the need for digital capabilities: either through explicitly communicated initiatives (Iberdrola), or through integration of internal audit within the control and risk architecture (Enel).

Table 3. Comparative Matrix (Key Dimensions)

Dimension	Enel – Evidence (documents)	Iberdrola – Evidence (documents)	Interpretation (implications)
Reporting & Oversight	Committee monitors the plan and the autonomy/effectiveness of the function (Enel, 2024).	Reporting to committee; responsibilities detailed in regulations (Iberdrola, 2025).	Board/committee oversight supports independence (Christopher et al., 2009).

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Risk-Based Planning	Annual plan based on risk prioritization; reporting of deviations (Enel, 2025).	Annual activity plan; group-level coordination (Iberdrola, 2025).	Requires competencies in risk assessment and business understanding (Arena & Azzone, 2009).
QAIP	QAIP + references to Global Internal Audit Standards (Enel, 2025).	QAIP with internal/external compliance assessments (Iberdrola, 2025).	Requires competencies in methodology and quality management (IIA, 2024).
Digital/Analytics	Integration within ICRMS and systemic evaluation of internal control (Enel, 2025).	Explicit mention: Data Analytics & AI line of work (Iberdrola, 2024).	Requires data analytics and AI governance competencies; supports continuous auditing (Rikhardsson et al., 2019).

Source: Authors' own projection

IV.COMPETENCIES OF INTERNAL AUDITORS IN THE ENERGY SECTOR

This section addresses RQ4 by deriving competencies based on: (i) the implicit requirements of the governance models and processes described in the Enel and Iberdrola documents; and (ii) the literature on internal audit effectiveness and the adoption of analytical solutions. In both cases, risk-based planning and reporting to boards/committees imply a competency profile that goes beyond strict financial auditing: auditors must understand operational processes, assess emerging risks, and communicate results in a language oriented toward risk and strategy (Lenz & Hahn, 2015; IIA, 2024).

The link with the analyzed documents is direct: (1) QAIP and compliance with IIA standards are explicitly mentioned by both groups (Enel, 2025; Iberdrola, 2025), implying methodological and quality management competencies; (2) Iberdrola reports data analytics and AI initiatives (Iberdrola, 2024), implying digital and advanced analytical competencies; (3) the integration of internal audit within the internal control and risk management system at Enel (Enel, 2025) indicates the need for ERM competencies, understanding of group-level controls, and collaboration with other assurance functions; and (4) the sectoral context, documented in the Energy Community and EPRS sources, emphasizes cybersecurity competencies and understanding of IT/OT environments (Energy Community, 2019; European Parliament/EPRS, 2019). The resulting competency profile, detailed in Table 4, is an "integrated" one: a core of audit competencies (methodology, internal control, testing and documentation), complemented by business and governance competencies (communication, influence, ethics), and expanded through digital/technological competencies (data analytics, cybersecurity, IT/OT).

This profile is consistent with the literature on internal audit effectiveness, which shows that internal audit value depends on the ability to connect findings to risks and decision-making (Lenz & Hahn, 2015), and with the orientation of IIA standards toward quality and continuous improvement (IIA, 2024).

Table 4. Matrix Linking Internal Audit Dimensions and Competency Implications (Enel vs. Iberdrola)

Dimensions	**Enel – Evidence**	**Iberdrola – Evidence**	**Analytical Interpretation**	**Competency Implications**
(1) Governance and Independence	Committee-level oversight; unrestricted access; protection against interference (Enel, 2024; 2025).	Explicit regulations regarding reporting to the Audit and Risk Supervision Committee (Iberdrola, 2025).	Both groups strengthen independence through board/committee oversight mechanisms.	Professional ethics, skepticism, ability to communicate with the board, stakeholder management.
(2) Planning and Resource Management	Annual plan based on risk assessment and prioritization; reporting deviations (Enel, 2025).	Annual plan coordinated at group level; integration with risk structures (Iberdrola, 2025).	Mature risk-based audit model integrated within ERM architecture.	Risk assessment, understanding of operational processes, strategic planning, efficient resource allocation.
(3) Reporting, Follow-up and Communication	Periodic reporting; monitoring recommendation implementation until closure (Enel, 2025).	Regular briefings to committee; review of ICFRS controls (Iberdrola, 2024).	Emphasis on accountability and traceability of recommendations.	Clear drafting of findings, negotiation and influence skills, follow-up and monitoring capabilities.
(4) QAIP and Evaluations	Explicit references to Global Internal Audit Standards; existence of QAIP (Enel, 2025).	Formalized QAIP; internal and external compliance	Orientation toward quality and continuous improvement of the function.	Internal audit methodological competencies, quality management, self-

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		assessments (Iberdrola, 2025).		assessment and professional benchmarking.
(5) References to Energy Sector-Specific Risks (cyber/IT-OT, critical infrastructure)	Integration of audit within ICRMS; systemic evaluation of internal control (Enel, 2025).	Coordination with risk function; reporting on controls and resilience (Iberdrola, 2024; 2025).	Necessity to address technological and operational risks specific to critical infrastructure.	IT audit, understanding IT/OT architecture, evaluation of cybersecurity controls, operational resilience analysis.
(6) Signals Regarding Competencies (analytics/AI, ICFR, etc.)	Integrated evaluation of internal control and risks at group level (Enel, 2025).	Explicit mention of Data Analytics & AI line of work; focus on ICFRS (Iberdrola, 2024).	Progressive digital transformation of the internal audit function.	Data analytics, use of digital tools, understanding AI governance, advanced financial audit and ERM competencies.

V.CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The paper comparatively analyzed the internal audit function at group level in Enel S.p.A. and Iberdrola S.A., based on official public documents published in 2024 and 2025. In relation to the research questions, the results can be synthesized as follows:

For *RQ1*, both groups describe an internal audit function positioned strategically and supervised at board/committee level, with mechanisms supporting independence and objectivity (Enel, 2024; Iberdrola, 2025). This architecture is consistent with the literature's arguments regarding functional independence (Christopher et al., 2009) and with determinants of effectiveness (Cohen & Sayag, 2010).

For *RQ2*, the documents indicate annual risk-based planning, reporting to governance structures, and follow-up of recommendation implementation, as well as the existence of QAIP and explicit references to the Global Internal Audit Standards (Enel, 2025; Iberdrola, 2025; IIA, 2024). These elements suggest procedural maturity and quality orientation, compatible with the literature on internal audit effectiveness (Arena & Azzone, 2009; Lenz & Hahn, 2015).

For *RQ3*, the specific characteristics of the energy sector are reflected mainly through the orientation toward risk management and signals of digitalization. In a critical infrastructure sector, cybersecurity and IT/OT represent material risks that must be integrated into planning and control evaluation (Energy Community, 2019; European Parliament/EPRS, 2019). Iberdrola provides explicit evidence of digital transformation through the Data Analytics and AI line of work (Iberdrola, 2024), while Enel emphasizes the integration of internal audit within the internal control and risk management system (Enel, 2025).

For *RQ4*, from the combination of standards, literature, and case evidence emerges a set of priority competencies: (i) "core" audit and internal control competencies (including ICFR); (ii) risk assessment and understanding of operational and regulatory processes; (iii) digital competencies – data analytics, IT audit, and understanding of cyber/IT-OT risks; and (iv) communication and influence competencies at governance level. Table 4 provides a matrix that can be used in the design of training programs and in the assessment of competency gaps.

The practical implications are relevant for internal audit functions in the energy sector: organizations can use a competency matrix anchored in sectoral risks, prioritize the development of analytical capabilities, and strengthen QAIP mechanisms to maintain quality under technological complexity conditions. At the same time, committee/board-level oversight remains critical for independence and for the internal audit function's ability to add value.

The limitations of the study are inherent to documentary analysis: (1) publicly available information may be selective and influenced by reporting style; (2) the performance of the function (KPIs) and the effects of recommendations are not empirically assessed; (3) the corpus includes four core documents for comparability and timeliness but does not capture all operational details of audit plans. Therefore, the conclusions should be interpreted as evidence regarding the "design" and "declarations" of the function, rather than its full execution.

Future research directions may include: (i) interviews and/or surveys among Chief Audit Executives and auditors in the energy sector to validate the competency matrix and measure the impact of digital competencies on effectiveness; (ii) extension of the sample to other European energy groups to test the robustness of observed differences; (iii) studies focused on governance of AI use in internal audit (policies, controls, ethics) and on audit/assurance over non-financial information relevant to the energy transition; and (iv) development of comparable indicators for internal audit maturity in the energy sector (for example, IT/OT risk coverage, recommendation closure time, level of data analytics utilization).

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