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IDENTIFYING GREEN SKILLS OF GOVERNMENT AUDITORS FOR GREEN INDUSTRY OVERSIGHT

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A B S T R A C T

This study aims to identify the green skills required by government auditors when conducting examinations of green industries in Batam. Employing a phenomenological qualitative approach, the research involves auditors from the Supreme Audit Agency (BPK) as key informants and reviews relevant regulations and audit guidelines. Data were collected through in-depth interviews and analyzed thematically using NVivo. The findings indicate that government auditors are expected to possess four essential competencies: financial skills, management skills, leadership skills, and procurement skills. However, green-related competencies—such as waste management, energy efficiency, green communication, city planning, design, and landscaping skills—are not yet fully developed and require further strengthening. Moreover, future government auditors are expected to obtain certification and enhanced capabilities in forestry auditing to support more sustainable audit practices.
Keywords: *Green Skills, Government Auditors, Green Industry*

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Penelitian ini bertujuan mengidentifikasi *green skills* yang dimiliki auditor pemerintah dalam melakukan pemeriksaan pada *green industry* di Batam. Menggunakan pendekatan kualitatif fenomenologis, penelitian ini melibatkan auditor Badan Pemeriksa Keuangan (BPK) sebagai informan kunci serta menelaah regulasi dan pedoman audit yang relevan. Data dihimpun melalui wawancara mendalam dan dianalisis secara tematik dengan bantuan NVivo. Temuan penelitian mengungkap bahwa auditor pemerintah harus memiliki empat keterampilan utama, yaitu *financial skills, management skills, leadership skills,* dan *procurement skills*. Namun, *green skills* seperti *waste management, energy efficiency, green communication, city planning, design,* dan *landscaping* belum sepenuhnya dimiliki dan masih memerlukan penguatan. Selain itu, ke depan auditor pemerintah harus memiliki sertifikasi dan kemampuan di bidang *forestry audit*.
Kata kunci: *Green Skills, Auditor Pemerintah, Green Industry*

INTRODUCTION

Sustainable development goals have become a topic of discussion by countries around the world, especially in the United Nations forum. This discussion gave birth to at least 17 Sustainable Development Goals (SDGs) which were first compiled at the Earth Summit in 1992 and were set to become the global development agenda in 2015. The development agenda towards sustainability is creating new skills that require the future workforce to master green skills. The transition to these skills is critical to the development agenda of every country, as by 2030, 60% of the workforce will still not have mastered the green skills essential to sustainable development goals. The National Long-Term Development Plan (RPJPN) of Indonesia in 2025-2045 is the embodiment of sustainable development launched by the government of Indonesia. A sustainable economy is one of the pillars of development that focuses on managing renewable resources for Indonesia's competitiveness.

The implementation of this RPJPN is expected to increase Indonesia's economic growth to 6-7% per year. In realizing a

sustainable economy, there is an economic transformation development agenda which includes the application of the green economy as the center of national economic growth. The transformation of the national green economy will involve an increase in green skills in various sectors. Green skills are needed for both structural and industrial jobs that require ongoing training (Kowalska, et al., 2022). It is estimated that 4.4 million new jobs will open in sectors that require green skills mastery for workers in Indonesia. The jobs sector in operations management including business analysts, administrative personnel, accounting personnel, audit personnel, and everything related to the management structure of the organization is not spared from the demands of sustainable development that transforms into green job.

Green jobs in Indonesia continue to increase. In the period 2016-2021, there was an increase of around 8%. However, it is not accompanied by an increase in human resources who have green skills, which is around 6%. In supporting the growth of the green economy, the government needs to equip the apparatus with green skills. In the realization of economic transformation, Indonesia implements a special economic zone policy. By 2023, Indonesia already has 20 special economic zones plus 3 new areas that will operate in 2024, so Indonesia will have 23 special economic zones. Batam is one of these areas, especially on the island of Rempang which is designed to become an eco-city in which there are various integrated sectors including the industrial sector. Green industry is the latest focus of city development, which is oriented towards green cities, which started with the inauguration of Free the Sea Company in 2023. The focus of development towards green industry encourages the creation of clean energy industrial areas. This need is answered through the development of a green industry area by Tunas Industrial in Batam city starting in 2023 with a potential investment of up to 15 trillion rupiah. Among these regions, Batam provides a particularly relevant research setting because it is one of Indonesia's largest industrial centers and is currently undergoing a transition toward green industrial development. As industrial activities become increasingly aligned with sustainability objectives, government auditors in Batam face new challenges in overseeing environmental accountability and green industry practices. Therefore, Batam offers an appropriate context for identifying the green skills required by government auditors in supporting sustainable industrial development.

Previous research on the need for green skills for the industrial sector found that there is a great need for a workforce equipped with green skills so that it is required in every institution to train the workforce to support sustainable economic development (Sern, Zaime, & Foong, 2018). The United Nations Industrial Development Organization also stated in its report that the green economy will change the demands of workforce capabilities in various fields along with a sustainable transition in both the private and public or government sectors (Auktor, 2020). The increasing need for green skills was identified as one of the guidelines for the national development plan as a standard qualification for the Indonesian workforce (ILO, 2018). Based on the results of previous research and several reports on green skills, researchers can conclude that improving green skills for economic actors is a must in realizing national economic transformation. In supporting the new economic orientation, the government must prepare all aspects including equipping the apparatus with green skills. One of them is government auditors. The future economy and business will be centered on sustainability and environmentally oriented activities and innovations to gain trust and competitive development (Nezhyva & Mysiuk, 2022).

Government auditors must possess green skills to effectively oversee the rapidly developing green industries in Batam, which increasingly adopt environmentally sustainable technologies and practices. As audit objectives expand beyond financial compliance to include

environmental responsibility, auditors need competencies that enable them to assess waste management, energy efficiency, emission controls, and other sustainability-related practices. Without adequate green skills, auditors may overlook critical environmental risks or fail to evaluate compliance with green regulations, potentially undermining the integrity and accountability of public-sector oversight. Strengthening these skills ensures that audits remain relevant, comprehensive, and aligned with the evolving landscape of sustainable industrial development. Despite the rapid growth of green industry initiatives, government auditors in Indonesia generally rely on conventional auditing competencies that focus on financial, compliance, and performance aspects. Environmental risks, climate-related issues, resource efficiency, and sustainability governance require additional competencies that are not yet systematically integrated into auditor development programs. This situation creates a competency gap between the increasing complexity of sustainability-related oversight and the existing capabilities of public-sector auditors. Therefore, identifying the green skills required by government auditors becomes essential to ensure effective oversight of green industry development.

Research on identifying the green skills required by government auditors is essential to address existing competency gaps and ensure audit institutions remain adaptive to emerging environmental challenges. As sustainability regulations become more complex, auditors need a well-defined set of skills to evaluate green policies and industry practices effectively. This research provides evidence-based insights into the specific capabilities auditors currently possess and those they still lack, offering a foundation for targeted training, curriculum development, and certification programs. Moreover, such research supports policymakers in designing strategic capacity-building initiatives that enhance the quality, credibility, and relevance of public-sector audits in the era of green transformation.

Previous studies have extensively discussed green skills in the context of industrial workers, engineers, and private-sector employees. Sern, Zaime, & Foong, (2018) identified green skills such as leadership, management, communication, waste management, and energy management as critical competencies for supporting sustainable industrial development. Similarly, Vona et al. (2018) emphasized that environmental regulations increase demand for technical and managerial green competencies across various occupations. Recent studies have expanded the discussion of sustainability-related competencies beyond technical occupations. Sheta, Osman, & Elamer, (2025) highlighted the growing role of internal auditors in ESG assurance and sustainability governance, suggesting that auditors are increasingly expected to evaluate environmental and social performance. Likewise, Alander & Caicedo, (2026) found that public-sector auditors face challenges in maintaining independence and adapting audit practices to evolving governance requirements.

Collectively, recent studies suggest that the auditing profession is undergoing a substantial transformation driven by sustainability and technological developments. Scarpellini, et al, (2026) emphasize the importance of environmental proactivity and waste-accounting competencies in supporting circular economy initiatives. Wahyuni, Fernando, & Krisnanmoorthy, (2026) demonstrate that green human capital and green accounting capability are critical for sustainability-related accountability processes. Meanwhile, Sofyani, et al, (2026) highlight the growing need for new competencies to support technology-enabled public sector auditing. Consistent with these studies, the present research suggests that government auditors can no longer rely solely on traditional financial auditing competencies. Instead, effective oversight of green industries requires a broader set of green skills encompassing environmental knowledge, sustainability assessment, leadership, communication, and strategic management capabilities.

Although previous studies have examined green skills and sustainability auditing separately, limited research investigates the intersection between these two domains, particularly within the public sector. Existing green skills studies focus primarily on industrial workforces, while sustainability auditing research largely examines corporate auditors and ESG assurance practices. Consequently, little is known about the specific green competencies required by government auditors responsible for overseeing green industry development. This gap provides the basis for the present study. This study develops the findings of Sern, Zaime, & Foong, (2018) on green skills for green industry bay contextualizing and analyzing the green skills needed by government auditors in Batam. In this study, researchers chose government auditors in Batam because Batam is a special economic zone that focuses on industrial zones and in the future will be developed towards green industrial zones as a realization of Indonesia's sustainable development goals. Research on green skills in government auditors, especially in industrial areas, is still rarely done. This research raises a problem formulation, namely what are the green skills that must be possessed to face the green industry for government auditors in Batam city. And this research will identify the green skills that government auditors must have in facing the green industry in Batam. This research has the scope of discussion of green skills on the ability of government auditors to face the green industry in Batam.

The novelty of this study lies in its pioneering exploration of green skills within the context of government auditing, specifically targeted at oversight of green industries-an area that remains under-researched in the auditing and sustainability literature. Unlike previous studies that focus primarily on corporate environmental competencies or general sustainability reporting, this research uniquely integrates phenomenological insights from government auditors with an analysis of regulatory frameworks to map the precise skills required for effective green industry oversight. By highlighting gaps between existing auditor competencies and emerging sustainability demands, the study offers a new conceptual framework for developing auditor readiness in environmental governance, contributing both theoretically and practically to the field of public-sector auditing.

LITERATURE REVIEW

Green Theory

Green theory explains that there is an understanding from a political economy perspective that shows environmental change because of production, distribution and consumption to meet human needs. This cycle is not designed to achieve environmental sustainability. According to Goodin, (1992) in Dyer, (2017) there is a need for boundaries that precede environmental sustainability based on green theory values. This theory does not exclude the needs of human life but involves the environment in broader planning. Green theory demands changes in human values and behavior to deal with transformations centered on the sustainability of the natural environment. Green theory holds that environmental change is a direct consequence of collective human behavior. Sheta, Osman, & Elamer, (2025) describes internal auditors as “sustainability champions” who increasingly contribute to ESG assurance, environmental risk assessment, and sustainability governance processes. This transformation aligns with the assumptions of Green Theory, which emphasizes environmental responsibility and accountability within organizational decision-making.

Green skills according to Kowalska, et al., (2022) are the abilities, knowledge, values and attitudes needed by the workforce in various sectors to adapt, build and support sustainability in resources in accordance with environmental provisions or regulations. Mastery of green skills is an important demand in the implementation of a circular economy and is needed in every industry that focuses on sustainable technology. This demand has resulted in

green skills as identified by (Sern, Zaime, & Foong, 2018). Design skills, planning must integrate sustainability elements in every sector to support the idea of environmental preservation. Leadership skills and management skills, these skills are needed to respond to changes in structure, function and operations in an organization to support sustainable activities. In addition, city planning skills and landscaping skills are needed to plan the evolution of the city into a smart future city that is liveable and sustainable. Energy skills, workforce training is required to reduce dependence on non-renewable resources and transition to renewable resources. Furthermore, financial skills and procurement skills are essential for a sustainable and balanced economy and development in line with the responsibility of maintaining and sustaining the living environment. Waste management skills, these skills are essential for industries to have the ability to reduce, reuse and recycle through planned planning, implementation and coordination. Finally, communication skills are not limited to verbal and non-verbal communication but also the use of technology to communicate in an environmentally friendly manner.

The report on green industrial skills by Auktor, (2020), published by United National Industrial Development Organization, explains that most countries have transitioned towards sustainability between production and consumption activities along with environmental awareness. This transition provides opportunities for the creation of new jobs that require mastery of green skills. The current global trend will evolve and strengthen towards a green economy and cooperation in every employment sector supported by green skills will create important effects for the workforce and address the lack of unmet best practices. A report on green skills deals in Australia by McDonald, (2012), states the country's transition to a low-carbon industry requires training across a range of sectors. This need creates challenges and opportunities in realizing sustainable practices. With this agreement, the country will reach out to the current workforce for training in green skills that will create effectiveness in economic productivity.

A scholarly article by Vona, et al., (2018), using a novel data-driven methodology, provides evidence of relevant employability skills towards a sustainable economic transition. The article identifies two key green skills: technical skills and management skills. Environmental regulations issued by the United States government create significant demand on the mastery of green skills by every workforce. The report on green skills innovation for inclusive growth by Cedefop, (2015), states that a trained and skilled workforce is essential for environmental economic growth. Special attention to training in green skills must continue to close the skills shortage or gap. Measures that can be taken include forecasting future skills and their demands, motivating the young workforce, customizing training, exchanging management personnel, and involving employees in the company's green transformation process.

A technical report by Esco, (2022) under the European Union identifies 571 skills and knowledge concepts as green. This concept helps Europe in the labor market with the mastery of green skills. The green skills needed include information, communication, assistance, management, logistics, equipment operation, and construction. Research conducted by Vona, et al., (2015) defines green skills as the ability of high-level technical analysis to know matters related to design, production, management, and supervision based on environmental regulations. Environmental regulations are creating demand for green skills mastery in various job sectors. Environmental policies for economic sustainability increase the demand by 9.5% for scientists and 4.5% for technical personnel with green skills.

In the global green skills report in LinkedIn, (2023), show that in 2022 and 2023 there is an increase in demand for green skills of 22.4%, while the available green talent is only growing by about 12.3%. The energy, transportation and

finance sectors are in the spotlight to meet sustainability targets. Around the world, only 1 and 8 workers have mastered green skills, so there is still a gap in meeting the needs of a workforce skilled in green skills. The project report on green skills in the socio-economic field by Kowalska, et al., (2022) found that the green transition process will involve the government, private sector and non-governmental organizations to play an active role. The green transition demands environmental regulation, green products, awareness, and responsibility to influence policy makers' decisions. The interest in circular economy increases the demand for skills adjustment needed based on the ecological environment.

A publication report on Indonesia's green skills published by ILO, (2018) found a gap between the national green economy strategy and the mastery of green skills needed by industry. Indonesia does not yet have a roadmap in answering the gap that occurs. So that the right response is through KKNI must include mastery of skills for each workforce including green jobs. In addition, the active role of industry in internal training is very important to close the gap in the national green economy strategy. A report published on green skills globally by the (ILO, 2019) found that skill gaps are worsening, posing a challenge to the green transition. Countries with weak policies in the green jobs sector are at great risk in the green transition process. This challenge can be overcome by increasing awareness of environmental-based jobs through education and training programs.

RESEARCH METHODS

This research involves the Supreme Audit Agency (BPK) of the Riau Islands region as the object of research. BPK Riau Islands was chosen on the grounds that it is an official state agency that manages the examination and responsibility of state finances in accordance with the research objectives through a phenomenological approach to obtain research results based on experience (Hadi, Asrori, & Rusman, 2020). The research will be conducted in Batam City. Batam is a city designed to be an industrial city, making it an appropriate location for researchers in accordance with the scope of research.

This study involved representatives of government auditors of the Riau Islands Supreme Audit Agency as informants or subjects in this study. The subjects of this research were selected through purposive non-probability sampling. Researchers determine informants, namely individuals who have direct experience with the object of research to understand deeply and intensively related to the information under study Gentles, Charles, & Ploeg, (2015) and regulations that become the legal basis, in accordance with the criteria of phenomenological research which requires informants to be individuals who experience the phenomenon under study (Creswell, 2014). The government auditors of BPK Riau Islands region were selected based on their duties and responsibilities in carrying out financial supervision tasks in the Batam City government environment and can represent informants to identify green skills for government auditors to face the green industry in Batam City. The informants in this study are senior government auditors who have experience auditing companies and governments that apply sustainable principles in their operations.

The selection of five informants was based on the principle of information richness commonly adopted in phenomenological research. All informants

Table 1.
Research Informants

Code	Description
A1	Government Auditor
A2	Government Auditor
A3	Government Auditor
A4	Government Auditor
A5	Government Auditor

Table 2.
Documents/Literature Review

Code	Description
P1	Presidential Regulation Number 111 of 2021
P2	State Financial Audit Standards

occupied strategic positions within the Supreme Audit Agency and possessed substantial experience in conducting government audits, including audits related to sustainability-oriented programs. The data collection techniques used in this study were in-depth interviews with one informant, namely A1, and open-ended questions for other informants, namely A2, A3, A4, and A5. Data was also explored based on documentation owned by government auditors to identify green skills that exist in the government auditor guidelines in carrying out their duties, including the following.

If necessary, researchers will also triangulate the data obtained by method triangulation or theoretical triangulation. The list of questions in the interviews that will be conducted by researchers refers to the green skills indicators by (Sern, Zaime, & Foong, 2018) which will then be developed into questions by researchers. The questions asked are structured questions. Interviews were conducted directly through face-to-face meetings using an interview recorder and interview notes. The interview was conducted in the April period at the Riau Islands Supreme Audit Agency office. The list of questions is attached to this research. The data analysis technique used in this research is thematic analysis. This analysis will process any information that will classify the most frequently appearing themes based on the green skills category in the theoretical study. Researchers use the help of the NVivo version 12 Plus application in the data analysis that will be carried out. The steps taken in analyzing data (Priyatni, et al., 2020) are as follows: 1) Import data sources Data sources in this study are presented in the form of transcripts of interview results, open questions, and documentation recorded in the form of Microsoft Word documents or portable document format (pdf). This documentation and transcripts will then go through the coding process. 2)Data coding. The results of interview transcripts, open questions and documentation in pdf form will then be coded with the help of the NVivo application. Data coding is done inductively through intense reading of data and data classification. Researchers set coding criteria based on green skills indicators discussed in the theoretical study to interpret the meaning of interview transcripts, open-ended questions and documentation. 3) Hierarchy chart. The data that has been processed will be visualized with a hierarchy chart. This chart is used to observe the tendency of the analysis of results. 4) Presentation of results and drawing conclusions The data that has been processed and visualized will then be presented in a descriptive discussion by the researcher. After that, the researcher will draw the right conclusions based on the results of data analysis conducted through the use of NVivo.

The coding process was conducted in several stages using NVivo 12 Plus. First, open coding was performed by carefully reviewing interview transcripts, open-ended responses, and supporting documents to identify meaningful statements related to green skills. Second, similar codes were grouped into categories corresponding to the green skill dimensions identified in the literature, including financial skills, management skills, leadership skills, procurement skills, energy skills, waste management skills, communication skills, design skills, landscaping skills, and city planning skills. Subsequently, axial coding was conducted to identify relationships among categories and generate broader themes regarding competency ownership and competency requirements. Finally, selective coding was applied to develop an integrated

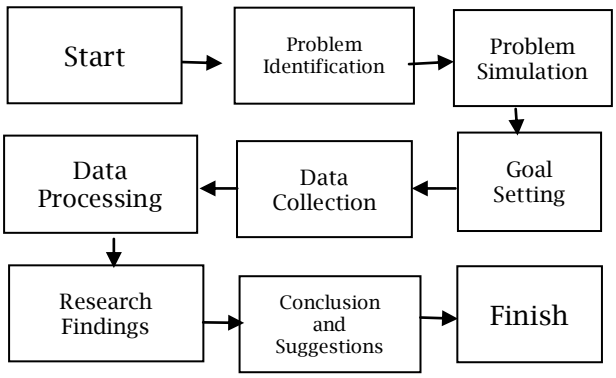


Figure 1.
Research Flow

interpretation of the green skills needed by government auditors.

ANALYSIS AND DISCUSSION

Research data comes from informants and regulations/regulations that guide informants in carrying out their duties. A1 is a government auditor who has sustainable audit experience and has held functional positions at the BPK Representative of Riau Islands Province. A2 is a government auditor who acts as the head of the examination field of BPK Representative of Riau Islands Province. A3 is a government auditor who acts as an expert examiner of the BPK Representative of Riau Islands Province. A4 is a government auditor who acts as the head of the audit inspection team of the BPK Representative of Riau Islands Province. Then, A5 is a government auditor who acts as the leader of the BPK audit team of Riau Islands Province Representative. P1 represents data sourced from presidential regulations and P2 represents data sourced from SPKN. In-depth interviews were conducted on A1 and open questions on A2, A3, A4 and A5.

Green skills are made into codes for the identification of skill mastery. Other skills and certifications became additional codes for the identification of other skills in addition to those already identified and special certifications for green skills. Further research identifies the ability of green skills as follows. That means, green skills were translated into specific coding categories to facilitate the identification and assessment of auditors' competency levels. Additional skills and professional certifications were also coded to capture a broader range of expertise beyond the core competencies already recognized, particularly those related to specialized environmental auditing. These supplementary codes highlight the need for auditors to acquire more advanced and sector-specific green qualifications, such as certifications in forestry or environmental management.

The results of the study identify the ability of green skills in government auditors which shows that all green skills identified based on research theory are owned or required by government auditors. Financial skills, management skills and leadership skills are the most abilities based on reference codes identified as owned or required by government auditors. Procurement skills have the same reference

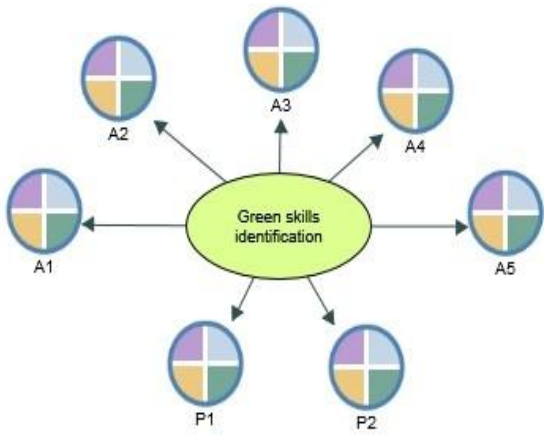


Figure 2.
Source Map Data



Figure 2.
Codes Map

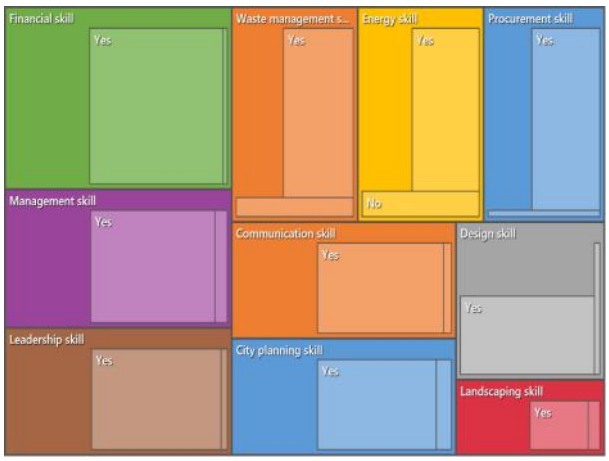


Figure 3.
Green Skills Hierarchy Chart

codes as waste management skills, energy skills, communication skills, and city planning skills. However, procurement skill is also included as a skill owned or required by government auditors, which is supported by the results of in-depth interviews identified as another ability that is also owned or required by government auditors. Design skills and city planning skills are green skills that have fewer references than other green skills.

Triangulation of research data through a project map that identifies green skills obtained from each source. The sources above include research informants and rules or regulations that are guidelines set for government auditors. The research obtained 113 total references from all research sources. References are coding on specific abilities that represent/state the mastery/understanding of government auditors on green skills. The references obtained by each green skill are as follows.

The results of in-depth interviews, open-ended questions, and regulatory analysis identified four green skills that are mainly possessed by government auditors, namely financial skills, management skills, and leadership skills. Supported by the number of reference trends from each green skill based on the data that has been processed. The abilities that are already owned get more references than other green skills. Other green skills that are also important for government auditors to understand in the audit process within the scope of the green industry are waste management skills, energy skills, communication skills, city planning skills, design skills and landscaping skills. Thus, to identify the factors that support the possession or need for the four main green skills, including financial skills, management skills, leadership skills and procurement skills, the researchers conducted mapping for detailed exploration of the mastery of these green skills.

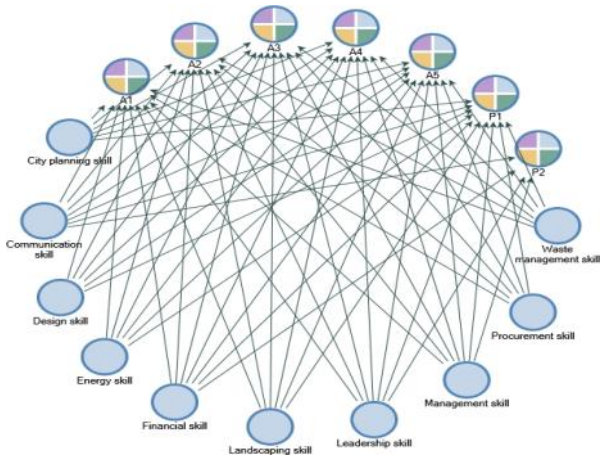


Figure 4.
Triangulation of Green Skills Project Map

Financial Skills

Mapping financial skills is identified as an ability that is owned or needed to be mastered based on an understanding or agreement between A1, A2, A4 and A5. However, A3 believes that financial skills are not needed by government auditors. P1 and P2 provide a basis for financial skills based on several factors such as budget allocation and effectiveness, governance, budget oversight, internal control, and economic growth. Although financial skills emerged as the dominant competency, effective sustainability oversight requires auditors to evaluate complex environmental and social information that

Table 3.
Green Skills Reference

	A1	A2	A3	A4	A5	P1	P2	Total
Waste Management Skills	3	1	1	1	1	4	0	11
Procurement Skills	1	1	1	1	1	6	0	11
Management Skills	4	1	1	1	1	3	2	13
Leaderships Skills	3	1	1	1	1	4	1	12
Landscaping Skills	1	1	1	1	1	1	0	6
Financial Skills	1	1	1	1	1	2	10	17
Energy Skills	2	1	1	1	1	5	0	11
Design Skills	2	1	1	1	1	4	0	10
Communication Skills	2	1	1	1	1	3	2	11
City Planning Skills	1	1	1	1	1	6	0	11
Total	20	10	10	10	10	38	15	113

often extends beyond conventional financial evidence. Consistent with Noegroho, et al, (2025), professional judgment in such contexts depends on broader cognitive capabilities and skepticism, suggesting that future auditor development should integrate both financial expertise and sustainability-oriented analytical skills.

Management Skills

Mapping management skills identify this ability based on factors for assessing efficiency, quality control, and the existence of standard guidelines. As agreed, and supported by A1, A2, A4, P1, and P2. However, A3 and A5 disagree that management skills are not needed by government auditors in dealing with the green industry. The importance of management skills identified in this study is consistent with Wehrhahn, (2026), who emphasizes that sustainability assurance depends on effective collaboration among audit committees, internal auditors, and external auditors. Sustainability oversight requires extensive coordination, information sharing, and stakeholder engagement. Therefore, government auditors overseeing green industries must possess not only technical auditing competencies but also interpersonal and managerial capabilities that facilitate cross-functional cooperation.

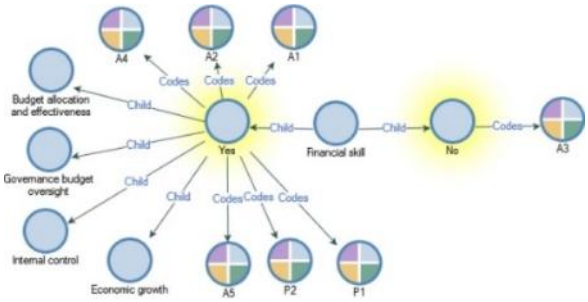


Figure 5.
Financial Skills Map

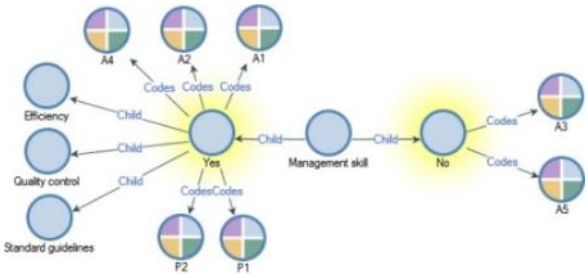


Figure 6.
Management Skills Map

Leadership Skills

Mapping on leadership skills identifies agreements A1, A2, A4, and A5 supported by P1 and P2 which state the need for mastery of these green skills. The factors that assess the need for mastery of these green skills include policy, reformation and responsiveness. On the other hand, A3 does not agree that mastery of green skills in the form of leadership skills is needed by government auditors. Alander & Caicedo, (2026) highlight the importance of leadership, communication, and professional credibility in maintaining auditor independence within public sector organizations. In other hands, Kócziás & Demirel, (2025) who emphasize that green capabilities are not limited to technical environmental knowledge but also include managerial and leadership competencies that facilitate organizational transformation toward sustainability.

Procurement Skills

Mapping on procurement skills shows that there is agreement and understanding between A1, A2, A4, A5 supported by P1 that this ability is owned and absolutely must be mastered by government auditors. Supported by several factors that intersect with the procurement process and are related to renewable technology adoption, procurement criteria and procurement tools applied to the green industry. Consistent with Luo & Marrone, (2026) green hiring and environmental commitments can only produce meaningful outcomes when supported by governance practices, including sustainable

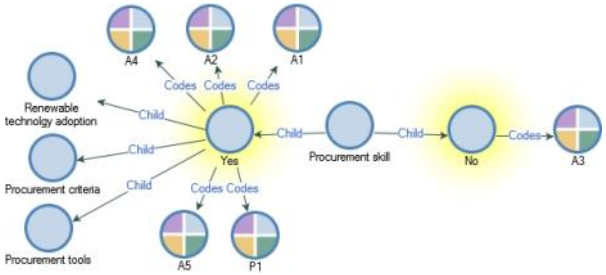


Figure 8.
Procurement Skills Map

procurement systems. Therefore, procurement skills enable government auditors to assess whether environmental objectives are integrated into procurement decisions and implemented effectively throughout the supply chain. However, A3 also expressed disagreement with the need for procurement skills to be mastered or possessed by government auditors.

The results of in-depth interviews and analysis of other data sources identified green skills other than those owned or required to be mastered by government auditors including waste management skills, communication skills, energy skills, city planning skills, design skills and landscaping skills must also be understood by government auditors. As identified below. In waste management skills, A1, A4 and P1 agreed that government auditors must understand the 3R principles (reduce, reuse and recycle). However, A2, A3 and A5 stated that government auditors do not need to understand this skill. Energy skills have several parts that auditors must understand based on what A1 and P1 stated, such as universal access, energy efficiency, energy proportion, and circulation. However, A2, A3, A4, A5 think energy skills are not needed by government auditors. Hayes & Killey, (2025) argues that professional competencies are strengthened when individuals engage in activities that directly utilize and expand their expertise. In the context of green auditing, auditors who have limited involvement in sustainability-related assignments may have fewer opportunities to develop practical knowledge of waste management systems and environmental performance evaluation.

In communication skills, A1, A2, A4, A5, P1, and P2 argue that this ability needs to be understood by government auditors. This ability is related to public access and information presentation. Likewise, A3 believes that communication skills do not need to be understood by government auditors. Alander & Caicedo, (2026) argue that internal auditors increasingly rely on communication, negotiation, and professional credibility to maintain their independence and effectiveness as the third line of defense. In the context of green industry oversight, auditors must interact with multiple stakeholders while preserving their objectivity. Consequently, leadership and communication competencies become essential for ensuring both audit independence and sustainability accountability. Hayes & Killey, (2025) demonstrates that auditors who participate in skill-based community service activities develop stronger professional judgment, stakeholder awareness, and ethical sensitivity than those involved in non-skilled activities. This suggests that green skills may not be effectively developed solely through formal training programs.

In city planning skills, A1, A4, A5 and P1 think this skill needs to be understood in relation to understanding planning that is directly related to climate change anticipation and industry diversification and proportion. A2 and A3 do not think it is necessary to understand or master the city planning skill. In design skills, A1, A2, A4, A5, and P1 agreed that understanding this skill is needed to understand sustainability and sustainable inclusive launched by the government. The research identified A3 as disagreeing with the need to understand this skill. On landscaping skills, A1, A2, A4, A5 and P1 agreed that an understanding of landscaping skills is needed to understand the planning of supporting infrastructure (city layout) for the green industry. Likewise, A3 believes this ability does not need to be understood by government auditors. The research identified no other capabilities included in green skills that need to be mastered or understood by government auditors. A special certification that is also available related to government auditors' ability in green skills is forestry auditing. This special certification is not yet needed, but training with experts and sharing knowledge needs to be done to improve mastery and understanding of green skills. The study identified the green skills of government auditors into two categories, namely green skills owned/mastered by government auditors and green skills

understood by government auditors. The following are the green skills owned/ mastered by government auditors.

The research identified four green skills abilities that government auditors have, although not all research informants agreed on them. Mastery of this ability shows that government auditors already have a high level of technical analysis ability (Vona, et al., 2015) to be able to master green skills. The results also support the need for government auditors to master green skills in dealing with the green industry based on the green skills (Sern, Zaime, & Foong, 2018) identified in this study. The following are the green skills that government auditors understand.

The research identified green skills such as waste management skills, communication skills, energy skills, city planning skills, design skills and landscaping skills require understanding by government auditors. Although not all informants agreed on this. The results of this study support green theory which requires changes in human values and behavior to face transformations centered on the sustainability of the natural environment (Kowalska, et al., 2022)

Table 4.
Green Skills Owned-Mastered by Government Auditors

Green Skills Identification	Factors and Criteria	Description
Financial Skills	Budget allocation and effectiveness Government budget oversight Internal control Economic growth	This capability has been developed and is necessary to evaluate the allocation and effectiveness of budget use that takes into account economic growth, as reflected in per capita income and gross domestic product as a result of green financial skill economic growth industry. Government auditors also involve information technology systems in internal controls to oversee budget management that takes into account materiality, potential errors, irregularities, fraud, and losses in green industries, which may differ from those in general industries.
Management Skills	Efficiency Quality control Standard guidelines	Government auditors have the management skills to establish and develop quality control systems in green industry assessments, including supervision, tiered reviews, monitoring, and inspection consultations. Government auditors also evaluate efficiency to improve productivity, which will result in higher economic productivity and be implemented in a series of green industry development guidelines as a basis for audits.
Leadership Skills	Policy Reformation Responsive	Government auditors possess leadership skills that require responsive decision-making in accordance with the independence, integrity, and professionalism of auditors. This is also based on green industry policies that serve as guidelines for conducting audits in the implementation of sustainable practices as reforms for sustainable national resource management.
Procurement Skills	Renewable technology adoption Procurement criteria Procurement tools	Government auditors have procurement skills to oversee the procurement process for goods and services involving the adoption or acquisition of renewable technologies, taking into account environmentally friendly procurement criteria and adequate and sustainable procurement facilities.

reflected in green industry policies that require auditors to have green skills (Sern, Zaime, & Foong, 2018), namely skills that must be possessed by human resources in the form of high-level technical analysis skills (Vona, et al, 2015) identified in this study. The research found a certification that auditors also need to have to assess the green industry, namely forestry auditing followed by knowledge sharing along with the transition to a sustainable development plan (McDonald, 2012).

Recent auditing literature indicates that the profession is undergoing a substantial transformation in response to sustainability challenges. Alander & Caicedo, (2026) highlight the importance of leadership, communication, and professional credibility in maintaining auditor independence within public sector organizations. Sheta, Osman, & Elamer, (2025) further argues that auditors are increasingly acting as sustainability champions who contribute to ESG assurance and environmental governance, whereas Wegenberger & Ponocny, (2025) explain what competencies are required to perform this role effectively. Noegroho, et al, (2025) demonstrates that effective audit judgment depends not only on technical expertise but also on cognitive capabilities and professional skepticism. Meanwhile, Wehrhahn, (2026) emphasizes that sustainability assurance relies heavily on collaboration among governance actors. Malik, et al, (2026) argue that future professionals must integrate sustainability competencies with leadership, collaboration, and systems-thinking capabilities. Collectively, these studies support the present findings that green industry oversight requires government auditors to develop a comprehensive portfolio of competencies encompassing financial expertise, leadership, communication, management capability, critical thinking, and sustainability-related knowledge.

CONCLUSION

Green skills are an important part of dealing with the development orientation of the green industry. Government auditors have a role in overseeing this development

Table 5.
Green Skills Understood by Government Auditors

Green Skills Identification	Factors and Criteria	Description
Waste Management Skills	Reduce, Reuse, Recycle (3R) Integrated waste management	Government auditors generally agree on the need for an understanding of the integrated waste management principles — reduce, reuse, and recycle — applied to green industry development planning.
Communication Skills	Public access Information and presentation	Government auditors understand that public access to information must be open for everything related to the development of green industry.
Energy Skills	Universal access Energy efficiency Energy proportion Circulation	Government auditors understand that energy use in green industries must be universally accessible, with efficient energy use and proper consideration of energy circulation in planning.
City Planning and Design Skills	Climate change anticipation Industry diversification and proportion Sustainable inclusivity Sustainability	Government auditors understand green industry as the government's effort to anticipate climate change and diversify industries. Government auditors understand that development planning must align with sustainability plans that are inclusive and equitable.
Landscaping Skill	City layout	Government auditors understand that green industries must have development plans based on well-organized regional layouts.

policy. This study identified four skills that have been mastered by government auditors in the form of financial skills, management skills, leadership skills and procurement skills. It is important for government auditors to have green skills to be able to deal with the development of the green industry. Government auditors must also understand other green skills as identified in this study. Understanding individually or with the help of experts is needed to go hand in hand with the development of national development policies that refer to the SDGs. Looking ahead, government auditors are also expected to obtain relevant certifications and strengthen their expertise in forestry auditing to better support sustainable audit practices.

The results of this study have several important implications. First, the gap between auditors' existing competencies and the green skills required for green industry oversight indicates the need for targeted capacity-building programs. Government institutions should integrate green-related competencies-such as waste management, energy efficiency, and sustainable urban planning-into auditor training and professional development frameworks. Second, the evolving policy landscape aligned with the SDGs underscores the urgency for auditors to acquire specialized expertise, including certifications in areas such as forestry auditing. Strengthening these competencies will enhance the quality and relevance of audit practices in supporting sustainable development. Finally, collaboration with subject-matter experts may be necessary to ensure auditors can effectively evaluate increasingly complex environmental aspects, thereby improving the overall accountability and governance of green industry initiatives.

LIMITATIONS AND SUGGESTIONS

This research is based on the limited sources or understanding of green skills, both in terms of understanding or mastery in each individual government auditor. This study conducted in-depth interviews with one individual government auditor and four individual government auditors for open-ended questions, as well as two documentations. Future research should focus on developing a comprehensive Green Auditor Competency Framework that can serve as a reference for professional development, training programs, and certification standards. Quantitative studies may also be conducted to validate the competency dimensions identified in this research and measure government auditors' readiness to perform ESG and sustainability audits. Comparative studies involving auditors from different regions, government institutions, or countries may provide broader insights into green auditing competency development. Furthermore, future research may explore the relationship between green skills and audit quality to better understand how environmental competencies contribute to effective sustainability oversight.

References

Auktor, G. V. (2020). Green industrial skills for a sustainable future. *United Nations Industrial Development Organization, Vienna.*

Alander, G. E., & Caicedo, M. H. (2026). Internal auditors' independence tactics: defending the third line in Swedish public sector agencies. *Accounting, Auditing & Accountability Journal*, 215–240. https://doi.org/10.1108/AAAJ-01-2024-6866.

Cedefop. (2015). *Green skills and innovation for inclusive growth. In Green skills and innovation for inclusive growth. https:// doi.org/10.1787/9789264239296-en*.

Creswell, J. W. (2014). *Research design : qualitative, quantitative, and mixed methods approaches*. Nebraska: SAGE Publications.

Dyer, H. C. (2017). *Green theory.* Bristol, England: E-International Relations, ISBN 978-1-910814-19-2. https:// eprints.whiterose.ac.uk/120472/.

Esco. (2022). *Green Skills and Knowledge Concepts: Labelling the ESCO classification.* https:// esco.ec.europa.eu/en/about-esco/ publications/publication/green-skills-and-knowledge-concepts-labelling-esco: European Commission.

Gentles, S., C, C. C., & Ploeg, J. (2015). *Sampling in qualitative research:*

Insights from an overview of the methods literature. Hamilton: The qualitative report, 20(11), 1772-1789.

Hadi, A., Asrori, & Rusman. (2020). *Penelitian Kualitatif Studi Fenomenologi, Case Study, Grounded Theory, Etnografi, Biografi.* Banyumas: CV Pena Persada. http://repository.uinsa.ac.id/167/1/Abd Hadi_QualitativeResearch.pdf.

Hayes, M. J., & Killey, M. (2025). The effect of skilled versus nonskilled community service on auditor behavior. *Journal of Accounting Literature* , 1-13. https://doi.org/10.1108/JAL-10-2024-0309.

ILO, I. L. (2018). *Skills for Green Jobs in Indonesia.* Geneva, Switzerland. www.ilo.org/publns: ILO publications.

ILO, I. L. (2019). *Skills for a greener future: A global view based on 32 country studies*. Geneva. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_emp/documents/publication/wcms_732214.pdf: Publications Production Unit (PRODOC) of the ILO.

Kócziás, C., & Demirel, P. (2025). The impact of green skills and green capabilities on firms' financial performance: A systematic literature review. *Journal of Innovation & Knowledge*, Volume 10, Issue 6. https://doi.org/10.1016/j.jik.2025.100846.

Kowalska, K., Szczygieł, E., Szyja, P., & Śliwa, R. (2022). *Green skills in the field of Social Economy.* Krakow, Poland. DOI: https://doi.org/10.24917/9788380848924: ISBN 978-83-8084-892-4.

LinkedIn. (2023). *Global Green Skills Report 2023*. https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/global-green-skills-report/green-skills-report-2023.pdf: LinkedIn Economic Graph.

Luo, L., & Marrone, M. (2026). Green Talent, Greener Outcomes? The Role of Governance in Translating Green Hiring into Substantive Environmental Action. *J Bus Ethics*, https://doi.org/10.1007/s10551-026-06326-4.

Malik, S., Malik, M., Khadija, B., & Saqib, M. A. (2026). Identifying industry 5.0 workforce skills for sustainable and human centric transformation: A multi-stakeholder expert panel study in a developing country. *Journal of Environmental Management*, Volume 410, 15 June 2026, 130044. https://doi.org/10.1016/j.jenvman.2026.130044.

McDonald, G. C. (2012). The Australian Green Skills Agreement: Policy and Industry Context. *In Institutional Response and Green Skills Delivery TAFE Directors Australia (TDA).*

Nezhyva, M., & Mysiuk, V. (2022). Sustainable development goals: a business opportunity. *Journal of Environmental Science and Sustainable Development*, 5(1), 48-68. https://doi.org/10.7454/jessd.v5i1.1125.

Noegroho, Y. A., Tinungki, G. M., Hartono, P. G., & Matitaputty, J. S. (2025). Personality, cognitive style and auditors' professional skepticism. *Review of Behavioral Finance* , 938–959. https://doi.org/10.1108/RBF-04-2025-0131.

Priyatni, E. T., Suryani, A. W., Fachrunnisa, R., Supriyanto, A., & Zakaria, I. (2020). *Pemanfaatan Nvivo dalam Penelitian Kualitatif: NVivo untuk Kajian Pustaka, Analisis Data, dan Triangulasi.* Malang: Lembaga Penelitian dan Pengabdian Kepada Masyarakat, Universitas Negeri Malang.

Scarpellini, S., Rodríguez-Hernández, R., Aranda-Usón, A., & Valero-Gil, J. (2026). Auditors' environmental proactivity as a driver for waste measurement, accounting, and reporting in a circular economy. *Revista de Contabilidad – Spanish Accounting Review*, 1–22. https://doi.org/10.1108/SAR-03-2026-0020.

Sern, L. C., Zaime, A. F., & Foong, L. M. (2018). Green Skills for Green Industry: A Review of Literature. *Journal of Physics: Conference Series (Vol. 1019, No. 1)*, https://doi.org/10.1088/1742-6596/1019/1/012030.

Sheta, M., Osman, M. N., & Elamer, A. A. (2025). Sustainability champions: the transformative role of internal auditors in ESG assurance – a systematic review and future directions. *Journal of Accounting Literature*, 1-41. https://doi.org/10.1108/JAL-09-2024-0255.

Sofyani, H., Amalia, R., Hasan, H. A., & Saleh, Z. (2026). Big data analytics in enhancing public sector auditing:

drivers, benefits and the moderating role of auditor certification. *Journal of Accounting in Emerging Economies* , 31–50. https://doi.org/10.1108/JAEE-12-2024-0538.

Vona, F., Marin, G., Consoli, D., & Popp, D. (2015). *Green Skills.* https://doi.org/10.3386/w21116.: NBER Working Paper.

Vona, F., Marin, G., Consoli, D., & Popp, D. (2018). Environmental regulation and green skills: an empirical exploration. *Journal of the Association of Environmental and Resource Economists*, 713-753. https://doi.org/10.1086/698859.

Wahyuni, I. S., Fernando, Y., & Krisnanmoorthy, J. (2026). Green intellectual capital and accounting capability: the game-changer for sustainability reporting. *Journal of Intellectual Capital*, 1-29. https://doi.org/10.1108/JIC-09-2025-0387.

Wegenberger, O., & Ponocny, I. (2025). Green Skills Are Not Enough: Three Levels of Competences from an Applied Perspective. *Sustainability*, 17(1), 327. https://doi.org/10.3390/su17010327.

Wehrhahn, C. (2026). Sustainability-related co-operation among audit committees, internal auditors and external auditors: a survey-based study. *Meditari Accountancy Research*, 166–195. https://doi.org/10.1108/MEDAR-02-2025-2852.