Providing an Environmental Audit Model for Improving Sustainable Development

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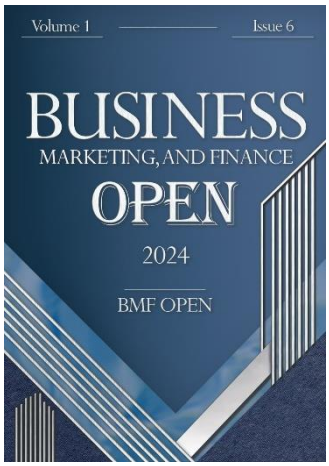

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Abstract: The purpose of environmental auditing is to evaluate the environmental impacts of organizational and corporate activities with an emphasis on compliance with environmental laws, regulations, and standards. Environmental auditing can help organizations assess their performance in environmental protection and propose recommendations for improving sustainable environmental performance. Therefore, the aim of the present study is to review the literature and develop a framework in the field of environmental auditing and present a model for monitoring executive organizations. In this research, a qualitative approach using grounded theory was employed. A purposive sampling method was used, and semi-structured interviews were conducted with 14 experts. Identifying the pattern and ranking the main components of environmental auditing for monitoring executive organizations from the perspective of audit type was the main objective of this study. The results of the research led to the development of an environmental audit model, consisting of causal factors including appropriate environmental policymaking, the development of environmental auditing standards, and intervening factors such as the high cost of environmental destruction, the international importance of environmental issues, and contextual factors involving environmental crises, environmental culture, environmental technology. The interactive dimension includes issues such as environmental disclosure, efficiency in resource usage, and the preservation of environmental sustainability, while the consequential dimension includes improvement in achieving sustainable development through environmental auditing.

Keywords: environmental auditing, sustainable development, appropriate environmental policymaking.

1. Introduction

Environmental accounting is a new approach in accounting that is used to manage and report the economic and environmental consequences of the actions of companies and organizations. This field aims to incorporate environmental factors and the impacts that economic activities have on these aspects into accounting practices. In environmental accounting, the costs and benefits associated with environmental protection are identified and made clear in the reports and financial statements of companies. Environmental auditing is an independent and impartial evaluation process designed to confirm whether an organization's activities and performance align with the protection of the environment and the sustainability of natural resources [1]. The primary objective of environmental auditing is to assess the environmental impacts of an organization's activities with a focus on compliance with environmental laws, regulations, and standards. Environmental auditing is

conducted by independent auditors who possess the necessary expertise and experience in environmental matters. They evaluate whether the policies, procedures, and processes used by the organization or company to protect the environment and mitigate harmful impacts are being properly implemented. Additionally, environmental auditors seek to identify and assess environmental risks within the organization and provide recommendations for improving environmental performance [2, 3].

Environmental auditing is a critical aspect of organizational auditing, especially given the increasing global concerns and public awareness about environmental issues. Many countries have implemented strict environmental laws and regulations, and environmental auditing helps organizations ensure compliance, minimizing legal and financial penalties [4]. It aids in identifying, assessing, and managing environmental risks, enabling organizations to implement appropriate policies and strategies to mitigate these risks and reduce associated damages [5]. Moreover, environmental auditing fosters transparency and public trust by providing independent evaluations of organizations' environmental performance, demonstrating their accountability and adherence to legal obligations [6]. It also identifies new business opportunities in the growing green industry and facilitates the exploration of sustainable products and services to gain competitive advantages. Several theoretical frameworks underpin environmental auditing. The Corporate Social Responsibility Theory emphasizes organizations' responsibilities toward society and the environment beyond profit generation [7]. The Environmental Sensitivity Theory highlights the need for organizations to minimize their environmental impact by bridging the gap between current and ideal practices [8]. The Balance of Interests Theory advocates for aligning organizational, societal, and environmental interests, ensuring sustainable practices [9]. The Sustainability Commitment Theory focuses on organizational dedication to sustainable policies and balancing economic, social, and environmental factors [10]. The Environmental Governance Theory stresses the importance of robust management systems for addressing environmental challenges [1]. Finally, the Social and Environmental Impact Theory examines the direct and indirect effects of organizations on local and global communities and ecosystems [6]. Collectively, these theories provide a robust foundation for evaluating and enhancing organizations' environmental performance, ensuring alignment with sustainability goals and stakeholder expectations.

Despite the significant role of environmental auditing, there is a pressing need for comprehensive research in this area, highlighting the importance of studies like the present one that aims to identify causal, intervening, and contextual factors, as well as interactive dimensions and outcomes of environmental auditing to propose a practical model. Previous studies have emphasized the theoretical and practical aspects of environmental accounting and auditing. For instance, Mohammadi Nafchi and Alikhani (2023) introduced "green auditing" as a key tool for enhancing sustainable development through improved processes and risk reduction [11], and Tazike Leski et al. (2022) investigated the influence of environmental management accounting on human resources and green technology adoption, finding significant positive impacts [12]. Similarly, Heirani et al. (2022) identified and ranked critical components of environmental auditing for monitoring public organizations, emphasizing compliance, financial, and performance auditing as key types [13]. Bebbington and Larrinaga (2024) discussed the evolution of environmental accounting and its alignment with sustainability in the Anthropocene era [14], while Lawal et al. (2024) demonstrated how comprehensive energy audits in Nigeria could promote sustainable development [2]. Shamseddin et al. (2022) identified and analyzed causal relationships among 17 factors influencing the implementation of environmental auditing, proposing focus areas for governments and environmental organizations [1]. Meanwhile, Khalmurzayevna et al. (2023) evaluated internal control risks and audit methods for environmental costs, offering recommendations for enhanced practices. Liu et al. (2018) connected corporate social

responsibility disclosures to improved environmental performance and sustainability accounting outcomes, underlining the role of transparency [3]. Collectively, these studies underscore the importance of environmental auditing in fostering sustainability, improving organizational accountability, and promoting innovative practices to address contemporary environmental challenges.

Environmental auditing can assist organizations in assessing their performance in environmental protection and provide recommendations for improving sustainable environmental practices. These include optimal use of natural resources, pollution reduction, waste management, and biodiversity conservation. By conducting environmental audits and implementing the auditors' recommendations, organizations can achieve environmental sustainability and ensure that their operations meet current societal needs without compromising the future or environmental capabilities [2]. Currently, no organization can deny the impact of environmental factors; thus, companies must be accountable for their environmental activities, transparently disclose the environmental effects of their actions, and accept the liabilities and costs associated with these activities. On the other hand, company managers have gradually realized that when environmental costs are correctly identified, measured, and allocated, they can lead to long-term savings and profit creation. Therefore, managers can establish an environmental auditing system within companies. This system is an integral part of an overall management system that includes the organizational structure, planning, objectives, activities, responsibilities, procedures, processes, and resources necessary to develop, implement, achieve, and maintain environmental policies. The system operates through the inputs and outputs of each system [7]. The benefits of the environmental auditing system include self-monitoring compliance with legal and regulatory requirements, reducing audit costs, improved market outlook, increased resource efficiency, and greater adaptability to changing conditions. On the other hand, the environmental accounting system is used to fully evaluate the environmental costs associated with activities or products [15]. Given the above points and the importance of the topic, this research aims to develop an environmental auditing model to improve sustainable development using grounded theory. Therefore, the main research question is: What model can be proposed for environmental auditing to improve sustainable development?

2. Methodology

The present research aims to develop an environmental auditing model for improving sustainable development, which has been derived through grounded theory. This research is classified as qualitative and fundamental. The research strategy, in terms of its qualitative dimension, is grounded theory. In terms of its paradigm, the study follows a constructivist (interpretive) approach. Furthermore, the present study is exploratory in nature concerning the identification of influential factors. Regarding the type of data, this is a qualitative research study. The statistical population for the qualitative part of the study includes university professors specializing in auditing and auditors from the Court of Audit of Iran, all with over 20 years of experience and holding at least a master's degree, given the specialized nature of the topic. Sample size in qualitative research using interviews is generally recommended to be between 5 and 25 participants (Shafiee & Tat, 2020). In this study, purposive sampling and theoretical sampling methods were employed (Mohammadpour, 2013), and the interview process continued in qualitative analysis until theoretical saturation was reached. Thus, 14 individuals participated in the qualitative section of the research. Semi-structured interviews were used to collect data, as they are more appropriate for exploratory studies aimed at model design. In this study, semi-structured interviews were conducted with experts. Grounded theory was used for data analysis, and MAXQDA software was employed for the analysis.

3. Findings

The demographic characteristics of the study participants are summarized as follows: Out of a total of 14 participants, 11 (78.5%) were male, and 3 (21.5%) were female. Regarding age, 1 participant (7%) was under 40 years old, 6 participants (43%) were aged between 41 and 45 years, and 7 participants (50%) were aged 45 years and older. In terms of education, 4 participants (29%) held a master's degree, while the majority, 10 participants (71%), had a doctoral degree. Concerning work experience, 4 participants (29%) had between 10 to 20 years of experience, and 10 participants (71%) had over 20 years of work experience. These characteristics collectively represent the demographic profile of the study's participants.

To develop an environmental auditing model for improving sustainable development, semi-structured expert interviews were conducted. Before starting the interviews, nine open-ended questions were considered, which are presented below. During the interview process, it was ensured that new questions could also be raised. To familiarize the researcher with the depth and breadth of the data content, repeated readings of the data and active reading (searching for meanings and patterns) were performed. The interview results were analyzed using grounded theory. For this purpose, the interview transcripts were reviewed multiple times. The systematic approach to grounded theory proposed by Strauss and Corbin (1998) was applied for the research.

The interview questions posed were as follows:

- What are the prerequisites for environmental auditing in improving sustainable development?
- What impact does environmental auditing have on the country's sustainable development?
- What specific conditions make attention to environmental auditing important for improving sustainable development?
- What general conditions make environmental auditing important for improving sustainable development?
- What factors make attention to environmental auditing necessary for improving sustainable development?
- What processes lead to environmental auditing for improving sustainable development?
- What processes follow the establishment of the necessary infrastructure for environmental auditing for improving sustainable development?
- What are the outcomes of environmental auditing for improving sustainable development?
- What dimensions does environmental auditing have in improving sustainable development?

Following the interviews and through theoretical sampling, after initial coding of the interview texts, the concepts and categories were extracted. The interview transcripts contained 36,159 words, with 6,214 words containing at least three characters. After performing initial open coding, a total of 1,208 codes were identified, which were later filtered and condensed into 96 concepts. In qualitative research, the criterion for stopping the interview process and analysis is theoretical saturation, meaning that the extension of research does not lead to changes in the concepts or categories emerging during the study. From the late 17th interview until the end of the 14th interview, no changes were made to the concepts or categories (such as new or revised concepts), which signifies the achievement of "theoretical saturation." The open codes were grouped together, and the focused codes were then developed.

Table 1. Main Concepts and Components of the Environmental Audit Model to Improve Sustainable Development

Factors	Concept	Category
Causal Conditions	Reform of laws and regulations, prevention of politicization, proper policymaking, appropriate environmental strategy, increase in environmental budget, coordination between	Environmental Policy Making

	executive and supervisory factors, serious commitment of officials, obligation for listed companies, strict enforcement, establishment of an integrated environmental system, waste budget, allocation of funds to environmental issues, precise definition of responsibilities of relevant organizations	
	Development of appropriate environmental auditing indicators, establishment of environmental auditing criteria, formulation of specific environmental standards, quantification of environmental factors, creation of an environmental cost calculation system, role of universities and research centers in formulating environmental auditing standards, valuation of environmental resources	Development of Environmental Auditing Standards
Intervening Conditions	Intergenerational nature of the environment, irreversibility of environmental costs, high cost of environmental degradation, resource limitations, fundamental role of the environment, importance of environmental indicators and their hidden costs	High Cost of Environmental Degradation
	Stringent standards for agricultural products, carbon standards, international pressures, international environmental standards, environmental standards for imported products, international laws and conventions, increasing demand for environmental products	International Importance of Environmental Issues
Contextual Conditions	Climate crisis in large cities, land subsidence crisis, drought and water scarcity crisis, desiccation of Lake Urmia, dried wetlands crisis, vehicle emissions, factory pollution, environmental pollution, pollution in seas and rivers, improper use of resources, climate change	Environmental Crises
	Public acceptance of environmental protection, public cooperation, the role of people, environmental issues lacking priority, neglect of environmental capital, public awareness campaigns, acceptance of environmental issues, social responsibility of the people	Environmental Culture
	Outdated technology, inability to introduce up-to-date environmental technologies, online environmental monitoring systems, use of advanced environmental technologies	Environmental Technology
Central Phenomenon	Capacity building for human resources in environmental auditing, understanding of laws, familiarity with the environmental responsibilities of various industries, environmental cost-benefit auditing, determining environmental profits and losses, evaluation of environmental auditing indicators, assessment of specific environmental standards, evaluation of environmental factors, training auditors	Environmental Auditing
Interactive Dimension	Reliability of financial statements, transparency of financial statements, disclosure of environmental issues, disclosure of environmental costs, public disclosure of environmental issues, assurance of financial reports	Disclosure of Environmental Issues
	Optimal use of resources, efficiency in resource utilization, reduction of resource wastage, effectiveness of projects, technical and economic justification of projects, optimal allocation of resources, proper project implementation	Efficiency in Resource Use
	Land use planning, proper location selection, reduction of pollution, protection of national resources, prevention of environmental degradation, preservation of resources, prevention of rural migration, reduction of environmental migration, biosafety, reduction of environmental risk	Preservation of Environmental Sustainability
Outcome Dimension	Public welfare, community health, balanced economic and environmental development, consideration of economic, social, and environmental aspects, security aspect of sustainable development, responsible production, poverty reduction	Improvement towards Achieving Sustainable Development

In this research, the following contexts, processes, and outcomes were identified:

Contexts included the categories of *environmental policy making*, *development of environmental auditing standards*, *high cost of environmental degradation*, *international importance of environmental issues*, *environmental crises*, *environmental culture*, and *environmental technology*.

Processes identified included *disclosure of environmental issues*, *efficiency in resource use*, and *preservation of environmental sustainability*.

The outcome of the proposed model was identified as *sustainable development*.

After examining the categories from various perspectives and determining the relationships between categories at different levels, as well as mapping the conditional paths, the phase of axial coding concluded, paving the way for the final step of analysis, selective coding, theory generation, and model finalization. In selective coding, the central phenomenon of the research, *environmental auditing*, was identified.

Figure 1 shows the resulting paradigm model derived from the qualitative findings of the research.

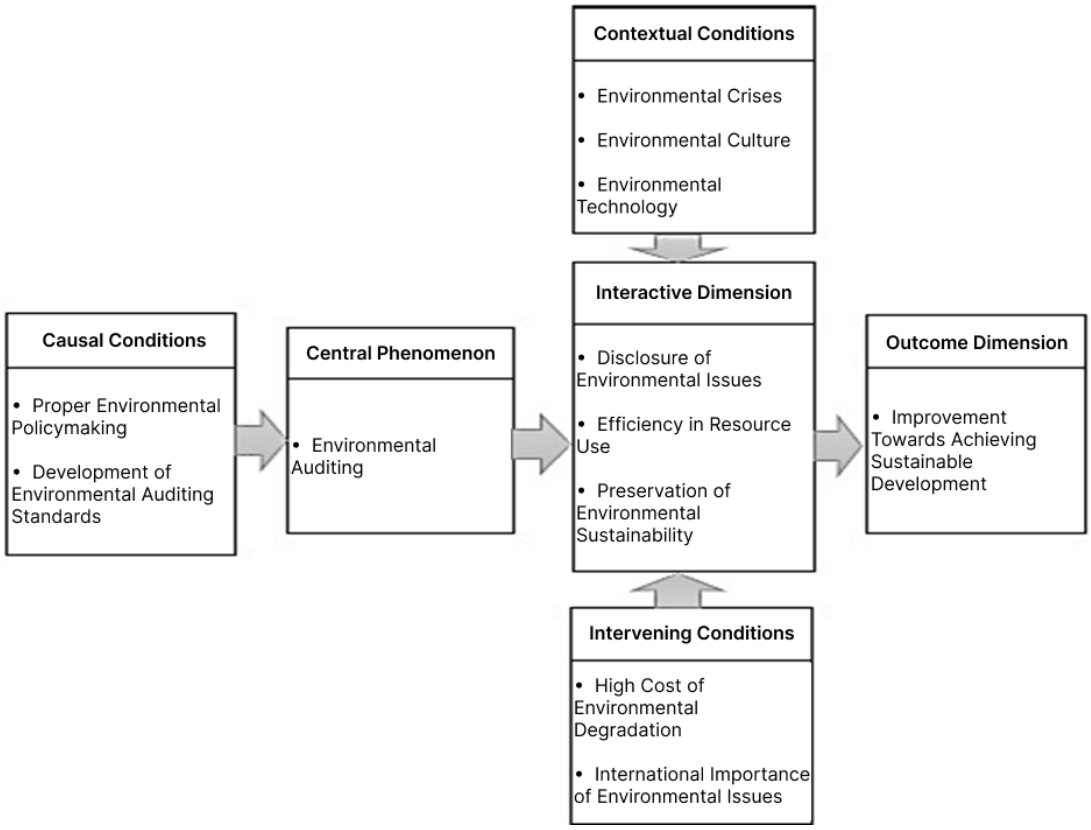

Figure 1. Final Model of The Study

4. Discussion and Conclusion

The present study aimed to develop an environmental auditing model for improving sustainable development using the qualitative grounded theory approach. The primary goal of this research was to propose an environmental auditing model to enhance sustainable development. The secondary objectives included identifying factors influencing the environmental auditing model for improving sustainable development, identifying the required context (causal conditions, intervening conditions, and contextual conditions) for environmental auditing, identifying the interactive dimension related to environmental auditing, and recognizing the outcomes of environmental auditing.

In the qualitative section, 12 main categories were identified based on the paradigm model and structured into six dimensions: proper environmental policymaking and development of environmental auditing standards were identified as causal conditions. Environmental policymaking refers to the establishment and implementation of regulations aimed at protecting and improving the environment. These policies can include measures for pollution control, conservation of natural resources, and sustainable waste management.

The high cost of environmental degradation and the international importance of environmental issues were identified as intervening conditions. Environmental degradation caused by industrial, agricultural, and other human activities imposes significant costs on the economy and society, such as the depletion of natural resources, loss of biodiversity, and increased pollution. These factors highlight the need for environmental auditing, which can help mitigate such costs through penalties and structural reforms. Lawal et al. (2024) emphasized the high costs of environmental degradation and the need to address them [2]. Environmental issues are of significant global

concern as their effects often transcend national borders, requiring international cooperation. The international importance of environmental issues places additional pressure on governments and companies to comply with environmental standards, thereby reinforcing environmental auditing. Shamseddin et al. (2022) emphasized the global significance of environmental issues [1].

Environmental crises, environmental culture, and environmental technology were identified as contextual conditions. Environmental crises such as climate change, severe air and water pollution, and biodiversity loss pose serious challenges to the long-term sustainability of the planet. These crises are the result of years of overexploitation and mismanagement of natural resources and underscore the need for rigorous and ongoing environmental auditing.

Environmental culture refers to the collective attitudes, values, and behaviors within a society that support the protection and improvement of the environment. Promoting environmental culture can be achieved through public education and awareness campaigns, facilitating the acceptance and implementation of environmental policies and standards.

Environmental technology refers to technologies designed to minimize the negative impacts of human activities on the environment. Environmental technologies play a crucial role in improving resource efficiency and reducing harmful environmental effects, thereby enabling more precise environmental auditing.

Disclosure of environmental issues, efficiency in resource use, and preservation of environmental sustainability were identified as the interactive dimension. Transparent disclosure of environmental information plays a critical role in enhancing organizational accountability and supports environmental auditing. Studies emphasized the importance of environmental issue disclosure [3, 11, 14].

Efficiency in resource use refers to the optimal utilization of natural resources in a way that preserves the environment while sustainably meeting societal needs. This variable facilitates improved environmental performance within organizations through environmental auditing.

Preservation of environmental sustainability ensures that today's economic and social activities do not endanger the resources and living conditions of future generations. This goal requires innovative management and technological approaches. As part of the interactive dimension, this variable has a direct relationship with the goals of environmental auditing, which primarily aim to improve environmental sustainability.

Sustainable development was identified as the outcome dimension in the paradigm model. It represents the ultimate result of implementing environmental auditing and other related environmental management activities, leading to improved quality of life and resource preservation for the future. The results indicated that the variables of proper environmental policymaking, development of environmental auditing standards, and environmental crises had the highest frequency, highlighting their greater importance in the research model.

To improve sustainable development through environmental auditing, the following practical recommendations are provided for the variables identified in the research. Regarding proper environmental policymaking, it is suggested to enact stricter laws to prevent environmental degradation and encourage eco-friendly activities, provide tax incentives for companies adopting sustainable technologies, and establish independent supervisory bodies to ensure compliance with environmental laws. For developing environmental auditing standards, it is recommended to design localized auditing standards tailored to national conditions, conduct training programs for environmental auditors to familiarize them with updated standards, and regularly update these standards in line with scientific and technological advancements. Addressing the high cost of environmental degradation involves increasing penalties for companies that harm the environment, implementing carbon taxes for heavy fossil

fuel users, and allocating more funds for restoring degraded areas and environmental protection. Considering the international importance of environmental issues, fostering international collaborations to tackle global environmental challenges, adhering to international environmental agreements such as the Paris Agreement, and securing financial and technical support from global institutions for environmental projects are critical. To tackle environmental crises, it is necessary to develop rapid response programs for addressing these crises, provide public education to raise awareness of environmental issues and response methods, and invest in research to predict and manage environmental crises. Regarding environmental culture, integrating environmental topics into the education system to prepare future generations, launching awareness campaigns about the importance of environmental protection, and encouraging sustainable behaviors through economic incentives are essential. For environmental technology, supporting innovation in eco-friendly technologies through financial and legal incentives, promoting the use of clean and low-carbon technologies in industries, and facilitating the transfer of environmental technologies from developed countries to the domestic market are recommended. In terms of disclosure of environmental issues, companies should be required to transparently disclose their environmental performance, adopt standardized templates for reporting environmental information to enhance comparability, and receive rewards or recognition for voluntarily disclosing environmental data. To enhance efficiency in resource use, financial incentives should be offered to companies with high resource efficiency, manufacturing processes should be optimized to reduce waste and increase productivity, and reuse of materials should be encouraged to reduce reliance on new natural resources. Preserving environmental sustainability requires the development and implementation of sustainable business strategies prioritizing environmental protection, encouraging companies to obtain reputable environmental certifications such as ISO 14001, and investing in projects aimed at preserving habitats and biodiversity as part of corporate social responsibility. Regarding environmental auditing, expanding expertise in this field, creating related professional certifications, legally mandating environmental audits for large companies and high-risk industries, and requiring public reporting of environmental audit results to enhance transparency and accountability are critical. Finally, to achieve sustainable development, it is vital to build sustainable economic and social infrastructures, develop and implement performance indicators to measure and monitor progress toward sustainable development, and strengthen international collaborations to share knowledge and experiences in pursuing sustainable development goals.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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