

Lean Green Audit and Its Importance in Achieving Sustainable Development

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Abstract

This research aims to demonstrate the importance of lean green auditing and its role in achieving sustainable development, through an analytical study of the impact of applying modern auditing methods that combine flexibility (agility) with environmental responsibility (green). The research relied on a descriptive analytical approach, and the study population included a group of administrative competencies and employees in regulatory and accounting bodies in government institutions. (150) questionnaires were distributed, and (130) valid questionnaires were retrieved for statistical analysis. The results showed a strong significant impact and positive correlation between lean green auditing and achieving sustainable development goals. This indicates that implementing this type of audit effectively contributes to raising the efficiency of regulatory performance and improving the quality of reports, as well as reducing waste of time and resources and enhancing adherence to environmental, social, and institutional standards. The research emphasized a set of fundamental recommendations, most notably: The necessity of adopting lean and green methods in auditing work, given their impact on improving efficiency and effectiveness and reducing red tape. Organizing specialized training courses for those working in the regulatory field to enhance their skills in using modern technologies and environmentally friendly practices. Encouraging institutions to integrate environmental and social performance indicators into their periodic audit plans to ensure their alignment with sustainable development goals. Emphasizing rapid response to environmental and economic changes and adopting a culture of continuous improvement in audit work. Thus, the

research demonstrates that agile green auditing is an effective strategic tool for improving institutional performance and achieving a balance between economic, environmental, and social objectives within the framework of sustainable development.

Keywords: Green audit, lean audit, green lean audit, sustainable development

1- Research Methodology and Literature Review

1-1- Introduction

Auditing is one of the key oversight tools that contribute to ensuring the accuracy and efficiency of performance within organizations. It represents an objective and independent activity aimed at assessing the integrity of financial and administrative operations and their compliance with established policies and standards. With the rapid developments in the economic, social, and environmental environment, traditional auditing is no longer able to meet the demands of the current era, characterized by complex risks and intertwined corporate objectives. This has necessitated the search for more flexible and sustainable methods of auditing.

From this perspective, the concept of "lean green auditing" emerged, combining the principles of "lean" work, based on reducing waste and increasing efficiency, with the principles of "green auditing," which focuses on preserving the environment and promoting social responsibility. The relationship between these two dimensions indicates that adopting lean green auditing contributes to achieving sustainable development goals by increasing resource efficiency, improving decision quality, and promoting compliance with environmentally friendly practices.

To determine the nature of the relationship between the research variables (lean green auditing as the independent variable and sustainable development as the dependent variable), the researcher adopted the descriptive-analytical approach, as the most appropriate methodological framework for studying applied administrative phenomena. The practical procedures for the research consisted of designing a robust questionnaire covering the dimensions of both lean green auditing and sustainable development (economic, social, environmental, and institutional). (150) questionnaires were distributed to a sample of employees in government oversight and accounting bodies, from which (130) valid questionnaires were retrieved for statistical analysis.

The researcher used a set of statistical methods, including arithmetic means, standard deviation, correlation coefficient, and simple linear regression, to estimate the extent of the impact of lean green auditing on achieving sustainable development goals. These procedures enabled the analysis of the causal relationship between the two variables and the extraction of precise quantitative indications that demonstrate the nature and strength of this impact, leading to results and recommendations that support the development of audit work towards a more efficient and sustainable direction.

1-2- Research problem

Regulatory and governmental institutions face increasing challenges in a complex operating environment characterized by rapid changes in legislative, economic, social, and environmental requirements. The traditional audit approach has become incapable of keeping pace with these transformations due to its routine nature and limited flexibility in addressing emerging risks or responding quickly to changes.

In contrast, lean green auditing is a modern approach that aims to combine the efficiency of lean methods with the sustainability of environmentally friendly practices. However, its implementation in the Iraqi context still faces numerous obstacles, most notably:

Lack of organizational awareness of its importance, weak technical qualifications of auditors, lack of training in modern methods, and limited administrative and policy support for adopting green practices in audit work.

Accordingly, the main research question can be formulated as follows:

- What is the impact of lean green auditing on sustainable development?

1-3- Importance of research

The importance of this research stems from the conceptual and practical shift in the field of modern auditing, which is no longer limited to verifying financial and accounting aspects. Rather, it has become a strategic tool that contributes to achieving the Sustainable Development Goals by establishing rational and environmentally friendly practices within organizations.

The importance of the research is evident in the following points:

1. Scientific Importance:

The research adds a new cognitive dimension to the accounting and auditing literature by integrating the concepts of green auditing and lean auditing into a single framework aimed at improving institutional performance and enhancing resource sustainability. It also enriches the academic aspect by clarifying the relationship between lean green auditing and the dimensions of sustainable development, as recognized by the United Nations in its 2030 Agenda.

2. Practical and Applied Importance:

The research presents an applied model that government and regulatory institutions can rely on to implement lean green auditing practices, contributing to improving the quality of audit reports and reducing waste of time, effort, and resources.

3. Developmental Importance:

The research aligns with global trends toward sustainable development by employing auditing as a supportive tool to achieve a balance between economic, social, environmental, and institutional dimensions, enhancing institutions' ability to achieve their goals efficiently and sustainably.

4. Local Importance:

The research gains its importance in the Iraqi context due to the challenges facing auditing agencies in adopting modern methods, given limited resources and poor training. This makes the implementation of agile green auditing a necessary step to improve performance and achieve sustainable development.

Thus, the research contributes to bridging a knowledge and application gap in the field of modern auditing and establishes a reliable scientific foundation for developing auditing policies and procedures in line with sustainability requirements for the coming years.

1-4- Research objective

This research aims to demonstrate the role of agile green auditing in achieving sustainable development goals by analyzing the relationship between the application of environmentally friendly agile methods in audit work and the extent to which they impact the efficiency of institutional performance and the sustainability of its resources.

To achieve this primary objective, the research seeks to achieve the following goals:

1- Identify the extent to which the lean green approach impacts achieving sustainable development goals.

2- Measure the impact of lean green auditing in achieving sustainable development goals.

1-5- Research hypotheses

The research includes the following hypothesis:

There is no statistically significant impact of lean green auditing on achieving the Sustainable Development Goals.

1-6- Literature Review

- Study by Yusoff (2016, pp. 99): “Sustainable Development: What Is the Role of Auditing?”

The study aims to identify the role of environmental auditing as a tool for achieving sustainable development in the public sector. It uses a descriptive and analytical approach to test the research hypothesis based on the lack of a relationship between environmental auditing and sustainable development. The study concluded that environmental auditing plays a significant role in contributing to achieving sustainable development goals in government sectors. The results were compared with those of developing countries, and it was found that environmental auditing plays a limited role in developing countries, such as Malaysia, where it is used as a measure to ensure that the planning, development, and activities undertaken by these sectors do not significantly conflict with the environment.

- Study by Sharaq & Brahim (2017, pp.107): “The role of environmental auditing in achieving sustainable development goals”.

The study aimed to identify the nature of environmental auditing and sustainable development, identify the various concepts and contents related to sustainable development, and define the concept of environmental auditing as one of the modern types of auditing. It focused on the developmental role of environmental auditing as one of the most important mechanisms that seek to achieve sustainable development. The study reached several results, the most important of which is that environmental auditing is one of the most important preventive mechanisms to ensure the implementation of development in a sound manner for the benefit of the environment and humanity and to sensitize decision-makers in

economic units to the importance and developmental role that environmental auditing can achieve for economic units and the necessity of mandatory environmental auditing in all economic units. In addition to the importance of holding training courses for auditors to develop their skills in the field of the environment because environmental auditing procedures do not differ from other types of auditing, but require some training in some environmental aspects and the necessity of having it in units, especially industrial ones, a specific environmental policy with clear goals and a time plan to follow up on implementation.

- Study by Sakhr & Hamad (2019, pp.33): “The role of environmental auditing in achieving the sustainable development goals-a suggested model”.

The study aimed to identify the role of environmental auditing in assessing the environmental situation during the audit process and how to develop a special mechanism for implementing environmental auditing procedures. And to identify the justifications that called for interest in environmental auditing, to know the relationship between environmental auditing and sustainable development, and to develop a mechanism for environmental auditing and how to use environmental auditing to achieve sustainable development.

The study concluded that there is a relationship of integration and mutual connection between environmental auditing and sustainable development, and that environmental auditing is not limited to assessing the environmental situation during the audit process only, but rather extends to identifying the environmental impacts resulting from the various activities carried out by the economic unit, and trying to manage the natural resources that represent the backbone of sustainable development.

- Study by Joshi (2021, pp.15): “A Review of Agile Internal Auditing: Retrospective and Prospective”

The study aimed to conduct a review of agile auditing retrospectively and prospectively. Fast information is a guarantee for the audit process, compliance, advisory practices, risk prediction, effective controls for decision-making, and monitoring clients with minimal effort. The study focused on the agile methodology as applied by the auditor to provide fast information, in addition to the fact that auditing according to this approach is particularly suitable for complex operations that require a focused team alongside an experienced

auditor to follow shorter audit cycles and deliver faster services to clients. The flexibility of the agile audit function will vary widely from one economic unit to another according to the size of the economic unit and its organizational culture. The study concluded that the transition to agile auditing has changed the way auditing works and made the completion of audit work more transparent and more efficient. In addition, it can be a more organized and enjoyable process and encourages open communication and personal interaction, and the philosophy of examination and adaptation inherent in the Scrum framework enables the audit team to work effectively in constantly changing conditions, leading to a high level of sustainable productivity for the team.

- Study by Amin & Al-Shammari (2023, pp. 66): “The role of Scrum and Kanban framework in achieving sustainable development as applied to a sample of economic units listed in the Iraqi Stock Exchange”

The study aimed to present a comprehensive concept of lean auditing in two widely used methods in its framework, namely Scrum and Kanban, and to present this concept to workers and professionals, enabling them to integrate the concept of lean auditing into their workplace to increase efficiency. The study concluded that economic units and auditors must adapt to environmental changes and make progress in a new concept of lean auditing, as it helps improve their ability to provide activities and advice in a timely manner to meet the requirements of the current world. Most economic units will actually rely on agility in the coming days and will work in different ways and proactively to analyze any emerging risks, and management must support the implementation of such an approach and empower its audit teams. Auditors working in large economic units, banking, financial and audit units also take into account the need to implement lean auditing in their work.

The above studies addressed lean auditing alone and its relationship to sustainable development, as well as the relationship of green auditing alone to the Sustainable Development Goals. This research examines lean and green auditing and their impact on the Sustainable Development Goals.

2- Green Lean Auditing

Traditional auditing is an independent evaluation function within organizations that examines and evaluates their activities in order to serve them. Therefore, auditors are interested not only in the financial and accounting aspects, but also extend to include

operational aspects, directly or indirectly. Accounting records reflect operational activities and must be dealt with in a balanced and independent manner, with both financial and operational aspects. The auditor must achieve benefits and advantages from linking and creating relationships between both financial and operational aspects (IIA Areas Operational) (Antlova, 2014, pp. 929).

The change in the concept of auditing in recent years has come to be in line with modern developments to keep pace with the era of progress. It is one of the main reasons that prompted the American Institute of Internal Auditors to adopt modern concepts that meet the requirements of the era and confirm its importance to organizations. It provides independent, objective and advisory assurances that aim to add value to organizations and improve their operations by creating a regular and disciplined approach to assessing and improving the effectiveness of risk management, control and government operations. It makes it work to provide reasonable assurance about the extent to which organizations achieve their goals regarding the efficiency and effectiveness of operations, the extent of reliance on financial reports and the extent of compliance with applicable laws and regulations, and achieve a degree of productive efficiency and accuracy in implementing policies. Also, through its advisory and objective role in improving and increasing the chances of achieving goals, improving procedures and operations, and reducing risks to acceptable levels, it works to raise the quality of information and add value to the institution (Antlova, 2014, pp. 929)

Based on the above, auditing is an important tool for organizations because it enables organizations to reform and develop themselves through evaluation, analysis, advice, studies and suggestions. Therefore, changing the auditing mechanism in a way that is compatible with economic and industrial developments and expanding its scope to include all aspects and all activities carried out by organizations necessarily means paying attention to the costs of those activities and their efficiency. Therefore, it has become necessary to use auditing procedures and methods that have been tried in other fields and that work to add value to performance in a way that ensures that organizations achieve their sustainable goals (Wang, et al., 2023).

2-1- Green Audit

Most of the sustainable development goals are implemented at the government level, but organizations of all sizes play a significant role in achieving these goals. This requires

implementing the simplest management principles, which include encouraging efficient use of available resources and innovation in work to find cost-reducing solutions and explore initiatives for business sustainability. While these goals are not binding on organizations, they can be indicative and open the door for them to consider the importance of protecting and preserving the environment. These goals are translated through the implementation of laws and guidelines that are binding on organizations to protect the environment and maintain sustainable development (Wang et al., 2023).

Auditing should be a tool to help activate corporate practices related to sustainability and social responsibility. It is an opportunity for auditing to add value by maintaining the reputation of the organization and taking a step away from traditional auditing, and informing senior management of the importance of maintaining the reputation of the organization and the sustainability of its business at the same time. Auditing begins by including risks related to the environment and sustainable development among the risks that are evaluated to build audit plans. These plans must be included in its annual plan, as audit programs include, within their scope, covering some of the different sustainable development axes, each separately, in addition to their role in evaluating the efficiency of organizations' operations. This requires developing the auditor's expertise to achieve the set goals and add greater value to the organization. The advisory role of auditing is also the largest, so it must evaluate the extent of the effort made by the institution in this field and its impact on it. The advisory role lies in providing advice regarding the importance of both having a clear strategy and policy in this regard and that the institution's goals include a goal concerned with supporting the environment and sustainable development, provided that its three axes include the environment, society and economy. It can also highlight the importance of providing initiatives, indicators and performance measures related to this (Wang, et al., 2023).

The trend towards adopting new practices helps achieve the organization's goals, such as imposing additional clauses when contracting with other parties (suppliers, contractors and service providers) to ensure compliance with sustainable development goals. It also requires providing comprehensive periodic reports on the extent of compliance with relevant standards and legislation, and implementing benchmark comparisons on environmental practices, such as practices related to reducing environmental impact, reducing energy consumption and resulting pollution, the percentage of packaging waste, maximizing recyclable products, maximizing the use of technical systems and reducing the use of paper.

That is, focusing on achieving the full development of human resources directed towards their motivations and creativity to be part of a green organization.

2-1-1- Definition of green audit:

According to the Oxford Dictionary, the term "green" emphasizes environmental protection as a fundamental principle of sustainability and survival, and reduces environmental damage. This, in turn, points to the fact that green auditing is an acronym for environmental auditing

Green auditing is an opportunity for each auditor to prove his/her efficiency in managing auditing operations by knocking on the doors of non-traditional auditing, adding value and achieving audit goals. It is necessary to ensure the extent to which audit principles are achieved, as the auditor has a clear future vision. The Sustainable Development Goals call for a better future for humanity (Sun et al., 2025).

Green auditing ensures that the audit environment is a potential source of possible improvements in organizations. Management expects the audit conducted to provide both diagnostic data on the effectiveness of the processes implemented and, at the same time, the information needed to take improvement actions. The developed audit tool also meets the possibility of generating clear and effective reports. It also reduces the risk of failure in organizations' search for effective procedures that lead to meeting their specific requirements by ensuring a suitable working environment (Lenning & Gremyr, 2016, pp. 22).

Green auditing is an opportunity for every auditor to demonstrate their competence in managing audit operations by tapping into unconventional auditing approaches, adding value, and achieving audit objectives. It is imperative to ensure that audit principles are being met, with the auditor having a clear vision for the future. The Sustainable Development Goals call for a better future for humanity (Sun et al., 2025).

The Institute of Internal Auditors (IIA) defines green internal auditing as an integrated part of the internal management system, through which it determines the adequacy of internal control systems and the extent of compliance with internal regulations and policies. It provides assurance regarding the effectiveness of practices adopted by organizations to support the environment, with the aim of adding value and improving the organization's performance (Onechojon et al., 2013, pp. 101). This demonstrates that green internal

auditing will not deviate from the traditional scope of internal auditing, as internal auditors play a role in promoting the green character of the economic entity in which they work. Meanwhile, green auditing is considered a comprehensive, systematic process for assessing the environmental impact of organizations' activities with the aim of verifying the effectiveness of environmentally friendly practices that improve the organization's operational efficiency in a way that adds value and enhances its reputation (Lenning & Gremyr, 2016). Thus, a formal examination of the extent of an organization's impact on the environment. Organizations of all kinds play a significant role in achieving goals that support environmental progress (sustainable development). Achieving these goals requires implementing the simplest management principles, which include encouraging efficient use of available resources and innovation in work to find quick solutions to reduce costs and explore initiatives for business continuity and sustainability. Although these goals are not binding on organizations, they may serve as guidelines and open the door for them to consider the importance of protecting and preserving the environment. These goals are translated through the imposition of laws and guidelines that are binding on organizations with the aim of protecting the environment and maintaining sustainable development (Lenning & Gremyr, 2016, pp. 25). Hence, auditing must be a helpful tool in activating the organization's practices related to sustainability and social responsibility. It is an opportunity to audit and add value to the economic unit and improve its sustainable environmental performance. This is achieved by improving the effectiveness of environmental risk management and the effectiveness of the internal control system, in addition to enhancing the effectiveness of environmental governance. This is more evident in developed countries than in developing countries, as its role remains unclear in these countries due to the potential conflict of interest between the need for economic development and environmental conservation (Onechojon et al., 2013). Auditing begins by incorporating risks related to the environment and sustainable development among the risks assessed to build audit plans. These plans must be included in the organization's annual plan, as audit programs include, within their scope, coverage of various sustainable development axes, in addition to their role in assessing the efficiency of organizations' operations. This requires developing the auditor's expertise to achieve the set objectives and add greater value to the organization (Sun et al., 2025).

The researcher believes that green auditing is an affirmation of the efficiency of organizations in their use of available resources and an assurance of the efficiency of the

practices adopted by organizations to support the environment, with the aim of adding value and improving the organization's performance.

Improving sustainable environmental performance is achieved by enhancing the effectiveness of environmental risk management. Green auditing ensures that the audit environment is a potential source of improvements within organizations. Management expects the audit conducted to provide both diagnostic data regarding the effectiveness of implemented processes and the information necessary to take improvement actions. Modern auditing tools also enable the creation of clear and effective reports that reduce risks and failures in organizations' search for effective measures to meet their specific requirements by ensuring a suitable working environment. Through the advisory role of auditing, the organization's efforts are evaluated and advice is provided regarding the importance of having a clear strategy and policy, and for the organization's objectives to include a goal related to supporting the environment and sustainable development, with its three axes encompassing the environment, society, and the economy. It can also highlight the importance of providing related initiatives, indicators, and performance measures (Onechojon et al., 2013).

The researcher believes that adopting new practices helps achieve the organization's objectives, such as imposing additional clauses when contracting with other parties (suppliers, contractors, and service providers) to ensure compliance with sustainable development goals. This requires providing comprehensive periodic reports on compliance with relevant standards and legislation, and implementing benchmarks on environmental practices, such as those related to reducing environmental impact, reducing energy consumption and resulting pollution, reducing packaging waste, maximizing recyclable products, maximizing the use of technical systems, and reducing paper use. In other words, focusing on achieving the full development of human resources, directed towards their motivation and creativity, to be part of a green organization. Green auditing is an opportunity for every auditor to demonstrate their competence in managing audit operations by tapping into unconventional auditing approaches, adding value, and achieving audit objectives. It is essential to ensure that audit principles are being met, so that the auditor has a clear vision for the future. The Sustainable Development Goals call for a better future for humanity.

2-1-2- The Importance of Green Internal Auditing

Green auditing is of great importance, including the following:

1. Protecting the environment and reducing environmental damage to ensure sustainability and continuity.
2. A tool to help activate organization governance practices related to sustainability and social responsibility.
3. Rationalizing environmental decisions made by institutions and economic units.
4. Encouraging organizations and economic units to avoid the negative impacts of their operations on the environment.
5. Preventing environmental violations by organizations, which result in violations of laws and regulations.
6. Increasing environmental awareness in society, which reduces environmental risks and promotes the adoption of environmentally friendly green products.
7. Green auditing focuses on sustainable development goals in the internal sphere, starting with including risks related to the environment and sustainable development among the risks assessed when developing audit plans.

2-1-3- The Role of Green Auditing and Sustainable Development

The concept of auditing has evolved, and its objectives and scope have expanded. It is no longer limited to the traditional financial field, but has expanded to encompass all the functions and activities of the economic unit it operates. This is a result of the integration of sustainable development dimensions into audit management. This has led to the emergence of new areas for audit performance. The economic unit is now required to reconcile its economic, social, environmental, and even institutional objectives, as well as improve its relationships with various stakeholders, both directly and indirectly, as a prerequisite for its continuity and survival. This requires focusing on audit elements such as effectiveness and efficiency in managing activities and the optimal use of available resources. Environmental (green) management is the primary tool for achieving sustainable development within the economic unit by emphasizing the optimal use and conservation of resources. In other words, the environmental management system represents the fundamental basis for the

proper implementation of sound audit programs to ensure sustainable development and continuous improvement (Lenning & Gremyr, 2016).

2-2- Lean Auditing

Due to the criticism of traditional methods of performing work for their lack of flexibility and lack of response to external changes, the trend has been towards using modern methods that keep pace with the developments taking place in a competitive environment. Among these methods are the lean methods, which emerged in the mid-nineties of the last century and have been used in many fields and have proven their worth, as these methods work to reduce costs, time and effort (Beerbaum, 2021).

Among the criticisms in most organizations and economic units is their lack of a new approach that works to meet the needs of the audit sector, as it has become difficult to work in a traditional way, due to the lack of flexibility and speed in responding to changes in the digital environment, thus inefficiency in performing their operations, which leads to distrust in the auditor's opinion and dissatisfaction with auditing operations. Traditional auditing work has become a challenge, and therefore, organizations and economic units must adapt to environmental changes and make progress in a new concept, which is lean auditing, which helps the auditor improve his ability to provide the required reports promptly. Lean auditing represents an advanced method that uses the framework to focus on the speed of performing operations and preparing accurate and quick reports in a timely manner without wasting resources and in a way that adds value to the auditing process and the auditor himself (Lenning & Gremyr, 2016, pp. 24).

The transition from traditional auditing to lean auditing implements audit work more transparently and efficiently, focusing on providing important assurances by starting with what is important and implementing audits at a high level and moving from the level of hindsight to high speed of response to expected risks (Daidj, 2022). The most important thing that lean auditing focuses on is adding value, as it is a recognized audit approach that allows real-time provision instead of retrospective assurance, as assurances can be provided regarding the design of new processes and systems and their prioritization based on risks and the needs of the economic unit (Wilhelm, 2021).

Lean auditing is defined as a set of practices that help audit functions achieve their goals in a more useful way, as well as creating fewer documents and reducing waste and effort

(Daidj, 2022). It is characterized by high flexibility among audit team members when exposed to work pressure such as delivering reports and making recommendations within a specific time, in addition to adding value to the team and increasing its self-confidence through daily interactive sessions that improve the team's independence, and immediate feedback allows for early resolution of problems (Roussy & Perron, 2018, pp. 345). Lean auditing also aims to add value to the economic unit by addressing concerns about business and the development of current technology, as units operate in a changing environment, thus risks will change throughout the year. Adapting to external developments in the market, technology, and regulatory requirements of the economic unit leads to a shift in risk management. Audit departments must have the flexibility to address risks and changes within a short period of time and simplify delivery, as the process of including requests from management and making recommendations in a timely manner prevents negative impact on the unit. The process of submitting reports and recommendations in short periods of time, assessing and dealing with problems immediately, and following up on management procedures enables auditors to determine the time of completion of activities and elements in agreement with stakeholders, analyze all aspects, reach final results, discuss them, and move on to the next topic once the specific problem is resolved and the result is reached (Daidj, 2022).

Lean auditing is more transparent in managing operations and achieving customer satisfaction. It is not limited to improving the quality of the audit process only, but it enables the economic unit to apply organizational knowledge and vision and identify gaps, controls and opportunities for continuous improvement, which greatly enhances the ability of internal auditors to understand the systems and operations of the economic unit subject to auditing and creates a broader level of cooperation and knowledge exchange between managers, responsible management and individuals who implement plans to complete operations, thus directly involving stakeholders in the audit process (Beerbaum, 2021).

The use of lean auditing makes the implementation of audit work more transparent and more efficient than it could be traditionally. It is a more organized and enjoyable process that encourages open communication and personal interaction. There has been a shift in the way audit managers work, as their role has become advisory and emphasizes the common goal of adding value and increasing confidence for auditors to self-regulate and achieve the desired results (Lenning & Gremyr, 2016, pp. 23).

The most important distinguishing features of lean auditing are its focus on providing important assurances by starting with what is important and executing audits with a high level of intelligence and insight, i.e. moving from the level of hindsight of the problem to anticipating it. The important thing that is focused on is adding value, and achieving it occurs when the audit outputs are consistent with the goals and strategies of the economic unit, in addition to considering clients as an integral part of the audit team and defining work cycles with a fixed period. This leads to discipline in completing audits on time. During this period, the lean audit team receives simultaneous feedback throughout the audit process, as it is an opportunity to discuss the results that can be reached and examine them mutually and agree on them simultaneously, which requires rationalizing documentation of processes and maximizing the amount of work (Lenning & Gremyr, 2016, pp. 23). There are some features of lean auditing, including (Amin & Al-Shammari, 2023):

- Continuous planning and adaptation become more evident promptly with progress and development, especially in the case of compliance with regulations.
- Relative estimation of the process time, as it is considered a very important factor in implementing regulatory requirements and financial operations of the economic unit because delay leads to the imposition of severe penalties.
- Accurately documenting requirements and providing appropriate documents to implement any process, and thus flexibility for the team in analyzing and conducting continuous updates, because changing any requirement leads to a change in the scope and significant delays in implementation, re-analysis and updating.

Lean auditing is also based on a set of basic points in its work performance, including the following (Lenning & Gremyr, 2016, pp. 21):

- The highest priority in meeting the needs of stakeholders represented by the audit committee and executive management, as well as adding value to the process through early and continuous identification of risks, and thus improving the value of audit reports.
- Flexibility and responsiveness to changes in the requirements of the audit process at any time, as lean methods contribute to creating a competitive advantage to achieve sustainable and valuable reports for management and stakeholders.

- Emphasis on delivering work programs frequently, usually from two weeks to two months, with a preference for a shorter time frame, as well as constantly modifying the audit plan to obtain the highest value.
- Communication throughout the audit process in the economic unit.
- Face-to-face conversation because it is the most efficient and effective way to transfer information to the development team and within the team itself, as it is necessary to think about the amount of time the team spends waiting for a specific response from any party, as this method is effective in obtaining results within a few minutes.
- Teamwork is necessary to work together (auditors and stakeholders) during the audit process to discuss problems periodically and to collect information during interviews.
- Audit reports that address the main risks, opportunities and results consistent with the strategic objectives of economic units are the main measure of development and progress.
- Lean processes enhance sustainable development through which (auditors and stakeholders) are able to maintain a steady pace.
- Continuous development with technical excellence and good design, as it contributes to providing influential results as well as enhancing agility in achievement (Joshi, 2021).
- Simplicity, as it is considered essential in maximizing the art of actual work and identifying unfinished work.
- Compliance with self-organizing teams, from which the best structures and requirements emerge.
- Effectiveness, as auditing must become more effective and its behavior must be controlled at regular intervals.

The Role of Agile Auditing in Achieving Sustainable Development

The evolution of auditing, the expansion of its objectives and scope, and its expansion to include all functions and activities of the economic unit undertaking to achieve the Sustainable Development Goals (SDGs), involves planning for increased and continuous stakeholder engagement in the audit process. This represents a new way of organizing work in agile auditing. This means defining the scope and key areas that can be concluded in

advance, and planning smaller pieces of work during engagement, rather than creating a complete work plan in advance. This leads to faster delivery of valuable reports and reduced effort on plans that are constantly changing as new information or perspectives emerge. Waiting time for these plans is minimized, and work programs are developed and implemented in several concise sprints. Approval of work programs and changes is delegated to work leaders (Amin & Al-Shammari, 2023).

Audit management should consider agile audit methods to complete audits simultaneously, strengthen close relationships with stakeholders, and provide accurate, more relevant, and more impactful reports with less documentation. The auditor's responsiveness and efficiency help achieve the SDGs and address their dimensions, as well as develop strategies and priorities and focus on their most significant risks. The transition from traditional internal auditing to lean auditing is a philosophy for sustainable performance in audit programs. While this philosophy does not encompass all the issues that make an economic unit successful in the long term, it helps the unit understand and observe the relationships that govern various issues related to sustainable development. This enables it to form a comprehensive picture to more accurately predict the future, enabling it to overcome its future economic, social, environmental, and institutional challenges and seize available opportunities before others. In other words, if it adopts the philosophy of continuous performance of lean auditing methods, it will become a pioneering unit, far ahead of its competitors (Beerbaum, 2021).

Economic units need to use new agile methods to achieve sustainability. Auditing must shift from the traditional method to continuous auditing based on agile methods due to the increasing pressure on the auditor to meet the high expectations of stakeholders and the continuous and increasing change in a competitive business environment to provide assurance about expectations for the present and the future (Roussy & Perron, 2018, pp. 346).

2-3- Lean Green Audit

The main objective of the audit is to assess the extent to which the management system complies with the established standards. Audits go through several stages that extend over a long period of data collection, ongoing meetings with employees and management, process audits, and meetings with managers to review the final reports that are submitted to the competent authorities. Therefore, audits take a long time and are equivalent to bureaucratic

procedures. Merely controlling compliance with standards is not the right direction to create added value for the organization (Lenning & Gremyr, 2016, pp. 25).

The audit process is carried out according to a program that is consistent with the organization's objectives and strategic plans, i.e. the audit plan must include all issues related to the audited entity and its strategic objectives. Lean green auditing has become a new approach to developing the audit program in three areas, the first of which is supporting the data collection program and evaluating institutions from a comprehensive perspective, covering all areas of sustainable development. Through it, economic institutions seek to improve efficiency in three areas in providing services by eliminating waste in managing their operations and impacting the natural environment and workplace quality, so that the audit gives the institution added value (Wilhelm, 2021).

Lean green auditing can reduce operating costs by reducing the negative impact on the environment and reducing resource consumption by increasing the efficiency of operations by eliminating time waste and improving the work environment, where the correct organization of work by providing a suitable work environment and achieving occupational safety. Therefore, it allows it to conduct a reliable review of the current status of institutions in three specific points of view. Reviewing acquired competencies, knowledge, motivation, determination and readiness to carry out improvement activities. The development of green auditing responds to making auditing lean with greater added value and goal-oriented (Sun et al., 2025).

The audit of the senior working group, which is based on the consensus assessment together with the action plan, which is created as a final step of the audit in the form of a report, can serve as evidence of changes and new directions to achieve the status of an effective and socially responsible organization that applies the principles of sustainable development. The best practices referred to in the report are based on the best international standards and should be seen as target benchmarks. The green lean audit report conducted for the organization also provides a comprehensive picture of the current situation, recommendations for tools and solutions aimed at supporting the organization and which are necessary to achieve the expected results. The report also includes suggestions for best practices that are essential for the sustainable development of the organization. As a set of key points related to eliminating waste in operations and enhancing efficiency, proposed actions to reduce the negative impact on the natural environment, as well as activities

supporting the work environment, occupational health and safety and disposal of surplus (Sun, et al., 2025).

The emergence of hybrid concepts such as lean green auditing is to emphasize the need to implement the various goals of the organization and take the necessary measures of methods, tools and practices. The main goal of agility is not in the form of effective processes but in focusing on social responsibility, which is the natural environment and the human work environment (human and work, human and machine, human and software (Lenning & Gremyr, 2016, pp.23). Many studies have proven the importance of integrating such tools (Galeazzo et al., 2014, pp.191) to improve operational and environmental performance (Starzyńska & Bryke, 2020, pp. 833), as the lean approach is an incentive to apply the green approach in organizations, and that green may in turn help to maintain the best lean practices. Improving operations according to the lean concept also indirectly prevents the excessive exploitation of the natural environment, i.e. green (Hallam & Contreras, 2016, pp. 2157).

3- Sustainable Development and the Role of Lean Green Auditing in Achieving Its Goals

3-1- The Concept of Sustainable Development

Sustainability is the ability of a system or process to continue to operate or exist for a long period of time, without deterioration or decline in its performance or efficiency. It also means ensuring that individuals currently have development opportunities without neglecting the rights of future generations, i.e. the necessity of adopting the principle of solidarity between successive generations when drawing up development policies, and this paves the way for its comprehensive concept through governmental and non-governmental units, which makes it contribute to the sustainability of development, as it aims at development that takes into account well-being and providing opportunities and capabilities for future generations (Starzyńska & Bryke, 2020, pp. 835).

Sustainable development is a concept that focuses on achieving economic and social development while preserving the environment and utilizing natural resources in a sustainable manner. The term "sustainable development" was first mentioned by the Danish Minister of the Environment Brundtland in 1987, when he presented his report as Chairman of the Commission on Environment and Development, which was established by the international organization since 1984 to follow up and implement what was stated in the

Stockholm Declaration issued by the International Conference on Human Development in 1971, which emphasized the comprehensive concept of development. The concept of sustainable development is considered one of the new concepts on the global level. This term has been used to include efforts and programs directed at the problems that humanity suffers from, related to the depletion of natural resources, human misuse of them, and natural changes resulting from drought and desertification, and the diseases, malnutrition, immunodeficiency, poverty, and unemployment they cause. It also included the rights of minorities and the most affected groups in societies, with the issues of women, children, old age, and stakeholders at the forefront (Abd, 2020, pp.367). Sustainable development is not one of the development patterns that development thinkers have been accustomed to highlighting, such as economic, social, environmental, and institutional development, but rather includes all of them. It develops the earth and its natural and human resources and takes into account the right of future generations to enjoy natural resources (Halonen et al., 2017). Sustainable development requires thinking holistically about the processes related to economic, social, environmental, and even institutional change in relation to the future. Where the standard of living of the community is raised in a civilized manner that guarantees a good life for humanity, continuous progress of economic conditions, exploitation of local capabilities, and optimal use of natural resources (Joshi, 2021).

3-2- The importance of sustainable development

Sustainable development is a link between the current and next generations, ensuring the continuity of human life, decent living, and fair distribution of resources within the country and even between countries. It is a means of bridging the gap between developed and developing countries and plays a major role in reducing economic dependence on the outside, distributing production, protecting the environment, achieving social justice, improving the standard of living, raising the level of education, reducing the illiteracy rate, and providing capital. To reduce this gap and achieve priorities, a well-studied and clear strategic vision is necessary to leave a legacy for future generations (Halonen, et al., 2017).

3-3- Sustainable Development Goals and their Economic Benefits

Sustainable development has a set of goals that have been identified in accordance with the United Nations 2030 Agenda, including eradicating poverty in all its forms everywhere, eliminating hunger, achieving food security and improved nutrition, promoting sustainable agriculture, ensuring healthy lives and well-being for all at all ages, ensuring inclusive and

equitable quality education for all, promoting lifelong learning opportunities for all, achieving gender equality, empowering all women and girls, ensuring the provision and sustainable management of water and sanitation services for all, ensuring affordable access to reliable and sustainable modern energy services for all, promoting increased, inclusive and sustainable economic growth, full and productive employment, providing decent work for all, building resilient infrastructure, stimulating inclusive and sustainable industrialization, encouraging innovation, and reducing inequality within and among countries. Also, make cities and human settlements inclusive, safe, resilient and sustainable, ensure sustainable consumption and production patterns, take urgent action to address climate change and its impacts, conserve and sustainably use the oceans, seas and marine resources to achieve sustainable development, protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss (Halonen, et al., 2017).



Source: (Halonen, et al., 2017)

Sustainable development has many benefits for economic units, including the following (Starzyńska & Bryke, 2020, pp. 844):

- Improving the productivity of natural resources exploited in the industrial aspect, such as agricultural lands and forests.
- Achieving a competitive budget as a result of saving on the use of raw materials.
- Opening the doors to large markets for products and services that meet the basic needs of individuals in an environmentally sound manner and achieving efficiency in the use of these resources.

3-4- Characteristics of sustainable development

Sustainable development has characteristics that distinguish it (Abd, 2020, pp.369), which are as follows:

- Dynamic because it is a continuous and renewable process, meaning that whenever a certain level of development is achieved, it is necessary to move to another level higher than the current level, and so on, for the sustainability and continuity of development.
- Comprehensiveness because sustainable development does not mean only raising the level of income, but rather achieving progress and development in all areas of life, from education and health services, and achieving a relative balance of income, in addition to the level of public and community services.
- The ability to overcome obstacles and narrow the gap between developed and developing countries by achieving growth, accumulating knowledge, and continuing development in the material and moral fields.
- Coordination and integration in the use of resources, taking into account the right of future generations to these resources, meeting the basic needs of individuals, organizing the relationship between rich and poor countries, and preserving the diversity of societies and their cultural, religious, and civilizational specificity.

3-5- Dimensions of sustainable development

The goals of sustainable development are achieved in the following dimensions (economic dimension, social dimension, environmental dimension and institutional dimension)

3-5-1- Economic dimension: It means producing goods and providing services on an ongoing basis to maximize income and improve living standards in the future.

3-5-2- Social dimension: Sustainable development is concerned with social issues and achieving equality in society, as equality is linked to justice and inclusiveness in the distribution of resources and providing appropriate opportunities to obtain work, public services, health and education because it is a major requirement that enables individuals to achieve success (Starzyńska & Bryke, 2020, pp. 834).

3-5-3- Environmental dimension: Sustainable development is concerned with managing natural resources, as it focuses on the quantity and quality of natural resources and the

environmental depletion factor. It needs scientific knowledge to manage natural resource sources to obtain encouraging and interconnected methodological methods with environmental management to reduce pressures on them.

3-5-4- Technological dimension: Public institutions are executive bodies through which the state draws up and implements its economic, social and environmental development policies (Abd, 2020, pp. 370).

3-6- The role of lean green auditing in achieving sustainable development

The concept of auditing has evolved, and its goals and areas have expanded. It is not limited to the traditional financial field only, but has expanded to include all the functions and activities of the economic unit that it performs as a result of integrating the dimensions of sustainable development into audit management. This has led to the emergence of new areas for its performance, so the economic unit has become required to reconcile its economic, social, environmental and even institutional goals, in addition to improving its relations with various parties, whether directly or indirectly, as a basic condition for its continuity and survival, as it is necessary to focus on the elements of auditing represented by effectiveness and efficiency in managing activities and the optimal use of available resources (Sakhr & Hamad, 2019).

Environmental (green) management is the main tool for achieving a sustainable development approach in the economic unit by controlling the optimal exploitation of resources and preserving them, i.e. the environmental management system represents the basic basis for the proper application of lean audit programs to ensure the achievement of sustainable development and continuous improvement (Halonen, et al., 2017). And planning the increasing and continuous participation of stakeholders in the audit process, which is a new way to organize work in lean auditing, i.e. it defines the scope and main areas that can be concluded in advance and plans smaller parts of the work during participation instead of creating a complete work plan in advance, which leads to accelerating the delivery of valuable reports and reducing the effort expended on plans that are constantly changing when new information or points of view appear, reducing the waiting time for these plans to a minimum and developing work programs and implementing them in several quick and concise races. Approval of work programs and changes is delegated to work leaders (Sakhr & Hamad, 2019):

The audit department should look at lean audit methods to complete audits at the same time, enhance close relationships with stakeholders, and provide more relevant and impactful accurate reports with less documentation, as the auditor's speed of response and efficiency helps in achieving the sustainable development goals and addressing their dimensions, in addition to developing strategies and priorities and focusing on their most important risks (Amin & Al-Shammari, 2023).

The transition from traditional internal auditing to lean auditing is the philosophy of sustainable performance of audit programs, as this philosophy does not contain all the issues that make the economic unit successful in the long term, but it helps the unit to realize and observe the relationships that govern the various issues related to sustainable development, and thus it becomes able to form a comprehensive picture to predict the future more accurately, which enables it to overcome its future economic, social, environmental and institutional problems and seize available opportunities before others. That is, if the philosophy of continuous performance of lean methods in auditing is adopted, it will become a pioneering unit that is a step ahead of its competing units (Thanki et al., 2016, pp. 284).

Economic units need to use new lean methods to achieve sustainability, and auditing must shift from the traditional method to continuous auditing based on lean methods due to the increasing pressure on the auditor to meet the high expectations of stakeholders and the continuous and increasing change in a competitive business environment to provide assurance about expectations for the present and the future (Kahyaoğlu, et al., 2020, pp. 208).

3-7- Lean Auditing and Its Role in Achieving the Foundations of Sustainable Development

The right culture for continuous performance development is of utmost importance to make audit teams work together to focus on integrating the comprehensive activities necessary to transform their auditing for several years to months, weeks or minutes while maintaining control and consistency in all these activities by applying a high degree of automation. This was helped by digital transformation processes and the development in a modern technological environment (Starzyńska & Bryke, 2020, pp.833) in reducing the time period in all steps of delivering audit programs and reports. This is consistent with the work of lean auditing (Amin & Al-Shammari, 2023, pp.273), as it helped the auditor improve his

functions and provide measurable value in determining what is necessary and valuable and moving towards it, and what does not add value and moving away from it to reduce the loss of time wasted on performing operations that do not add value to the economic unit (Kahyaoğlu, et al., 2020, pp.209), which leads to reducing costs, in addition to training auditors and knowing whether operations and activities are performed at a high level of efficiency and effectiveness, which achieves the foundations of sustainable development that take into account the preservation of environmental characteristics and the level of performance of current and future natural resources as a basis for the participation of future generations in the available resources, in addition to the sustainability, continuity and continuity of production systems to prevent the possibility of the collapse of the development components of developing countries that rely on traditional systems linked to the components of the natural environment (Thanki et al., 2016, pp.288).

The lean green approach plays a major role in corporate management, which represents the essence of the organization's ambitions to work in the spirit of sustainable development and social responsibility and addresses social and work-related issues (Starzyńska & Bryke, 2020, pp.835). When performing any activity, its efficiency must be measured. That is, when introducing best practices in the organization, individuals (auditors) need to identify relevant key performance indicators (KPIs), the measurement of which will indicate whether a particular procedure has the desired impact on the area in which it was applied. That is, it must reflect the company's strategy and goals, as well as identify and meet the needs of stakeholders (Thanki et al., 2016, pp.289).

The assessment of sustainable development is carried out by measuring the indicators obtained from the analysis of the answers to a set of questions related to the use of good practices in the audited entity (Starzyńska & Bryke, 2020, pp. 838). In this way, the answers regarding the application of good practices obtained during the survey become the basis for a qualitative method for assessing the sustainable development of industrial and service enterprises, which is implemented precisely. The set of audit questions is a reference for the best green lean practices, which represent practical concepts of sustainable development that assume the simultaneous implementation of all economic, social and environmental objectives.

It is concluded that there is a set of important aspects of the lean green audit in the economic unit, which are as follows (Acharya, 2021):

- Improving performance: The development of lean green audit has become more data-enabled, providing stakeholders with valuable and timely results, in addition to its impact on the effectiveness of risk management and controls.
- Increasing efficiency and effectiveness: The current development of lean green audit leads to audits that support the optimal use of available resources, namely data and technology, which provides more efficiency and ensures the identification of risks and increases effectiveness in achieving the designated goals of the units.
- Adding value: The lean green audit helps economic units quickly make decisions appropriate to the current situation, not only by addressing and managing current risks, but also by shedding light on the risks and unexpected consequences associated with the transformation of sustainable development strategies in economic units and in the long term.
- Continuous self-improvement: By increasing the awareness of institutions to work sustainably and restoring work with modern good practices that will save time and effort.

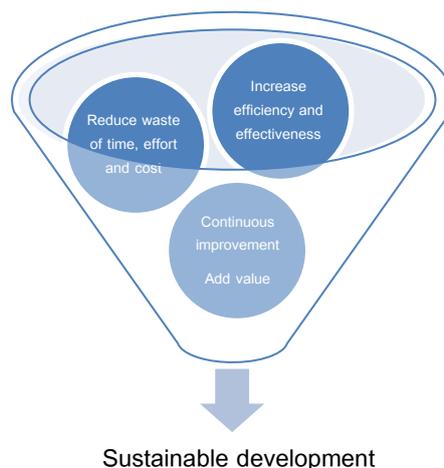


Figure 1. The work of the lean green audit in achieving sustainable development

Source prepared by the researcher

4- The Applied Part

In this Section, the results of the statistical analysis are presented according to the response of individuals by displaying the initial statistical indicators of their answers through the arithmetic mean, standard deviation, and coefficient of variation for all research variables and their relative importance. The Section also deals with testing the research hypotheses and statistical significance.

Research Methodology

The descriptive analytical approach was used to identify the basic contents of the impact of lean green auditing in achieving sustainable development goals. The research community was represented by auditors working in government service departments, and a comprehensive survey of the research community was conducted. To achieve the research objectives and to verify the validity of the hypotheses, a research sample consisting of 150 individuals working in the supervisory aspect in service departments was selected. 150 questionnaires were distributed to the research sample, consisting of two axes, each axis includes a set of paragraphs, where the five-point Likert scale was used to determine the answers to the paragraphs and to determine the level of the answer to reach the results. After sorting the answers, 130 valid questionnaires were obtained for analysis, which were tabulated, classified and analyzed using statistical methods.

(150) questionnaires were distributed to the selected sample, of which (130) questionnaires were retrieved, with a retrieval rate of (86%). (20) questionnaires were excluded for not being suitable for analysis, which was 14%.

1. Description of the characteristics of the research sample

The following table includes the demographic variables of the research sample, including gender, academic qualification, age, years of experience, and job title.

Table 1. Description of the characteristics of the research sample

| Variable | Variable Categories | Number | Percentage |
|------------------------|---------------------------|--------|------------|
| Gender | Male | 85 | 65% |
| | Female | 45 | 35% |
| | Total | 130 | 100% |
| Academic qualification | Diploma | 32 | 24% |
| | Bachelor's | 65 | 50% |
| | Postgraduate Certificates | 33 | 26% |

| | | | |
|---------------------|--|-----|------|
| | Total | 130 | 100% |
| Age | 20-30 | 31 | 24% |
| | 30-40 | 37 | 28% |
| | 40-50 | 32 | 25% |
| | 50+ | 30 | 23% |
| | Total | 130 | |
| Years of experience | Less than 10 years | 19 | 15% |
| | 10-20 | 52 | 40% |
| | 20-30 | 32 | 25% |
| | 30 + | 27 | 20% |
| | Total | 130 | |
| job title | Writer | 20 | 15% |
| | Assistant Auditor, Assistant Accountant | 22 | 17% |
| | Auditor, Accountant | 30 | 23% |
| | Audit Manager | 32 | 25% |

From the analysis of the table results, it was found that the majority of the sample were males, amounting to 65%, while the percentage of females was 35%. This may be due to some customs and traditions that govern the research community, in addition to the main reason, which is the prevailing security situation that may expose females to danger. Therefore, most of the research community was male, especially the young group, as its percentage ranged from 28% for the age group from 30-40. Where they are more active and more daring in facing risks.

It is also noted that the educational qualification variable had the highest percentage, amounting to 50% of those holding a bachelor's degree, followed by 26%, which included higher degrees, and the lowest percentage was 24%, which included a higher diploma. This means that it cares about the educational qualification of its employees, as their ability to create competitive opportunities is very great, and that it puts the right person in the right place.

The experience variable also showed that 40% were for individuals with more than 10-20 years of experience, and 25% had 20-30 years of experience, which is a good percentage. This is evidence that these institutions care about experienced individuals for their ability to face the risks they may be exposed to during their work and their ability to make appropriate decisions at the appropriate times, in addition to their greater administrative and leadership capabilities. The job title variable also included 25% of those with the title of Audit Manager, followed by 23% for individuals with the title of Auditor or Accountant, followed by 20% for department heads or their assistants. This means that most of the job positions in the institutions were for audit managers and department heads, as they are the link between upper and lower management, which helps management make healthy, appropriate decisions at the right time.

2. *Displaying the research results*

The arithmetic means and standard deviation of the questions directed to the study sample for the first axis of the research hypothesis, “The effect of the lean green method on audit efficiency”, were extracted as follows:

Table 2. Arithmetic means and standard deviation of the axis of the impact of the green lean approach on audit efficiency

| Paragraph sequence | Mean | Standard Deviation | Paragraph sequence according to its standard deviation from least to most dispersed |
|--------------------|------|--------------------|---|
| 1 | 4.6 | 0.83 | 5 |
| 2 | 4.56 | 0.87 | 7 |
| 3 | 4.77 | 0.50 | 3 |

| | | | |
|---|------|------|---|
| 4 | 4.92 | 0.26 | 2 |
| 5 | 4.58 | 0.63 | 6 |
| 6 | 4.75 | 0.56 | 4 |
| 7 | 4.96 | 0.19 | 1 |

From the table above, it is noted that the answers of the research sample are generally positive regarding all research questions because most of the arithmetic averages are greater than the average of the axis measurement tool, which is (4.73), and the highest percentage (4.96) was “Using environmentally friendly methods and streamlining procedures for auditing operations and preparing reports increases the efficiency and effectiveness of performance and continuous improvement”, while the lowest percentage (4.56) was for the paragraph that states “The application of lean green auditing is considered one of the efficient methods and its use in supervisory work leads to adding value to the work of the auditor and the auditor himself”, while the rest of the circles were graded according to their importance, and this indicates the stability of the first axis of the hypothesis that includes the effect of the lean green method on audit efficiency. The arithmetic averages and standard deviations were also extracted for the questions directed to the research sample regarding the second axis of the research hypothesis, which includes “The effect of lean green auditing in achieving sustainable development goals” as follows:

Table 3. Arithmetic means and standard deviation of the green and lean audit axis in achieving sustainable development goals

| Paragraph sequence | Mean | Standard Deviation | Paragraph sequence according to its standard deviation from least to most dispersed |
|--------------------|------|--------------------|---|
| 1 | 4.60 | 0.63 | 7 |
| 2 | 4.70 | 0.615 | 6 |
| 3 | 4.33 | 0.78 | 8 |

| | | | |
|---|------|------|---|
| 4 | 4.72 | 0.52 | 5 |
| 5 | 4.83 | 0.45 | 4 |
| 6 | 4.99 | 0.08 | 2 |
| 7 | 4.99 | 0.08 | 1 |
| 8 | 4.84 | 0.40 | 3 |

It is noted from the table above that the answers of the research sample are generally positive regarding all research questions because most of the arithmetic averages are greater than the average of the axis measurement tool, which is (4.75), and the highest percentage was (4.99), which states: “Efficiency, effectiveness, continuous improvement, and optimal use of available resources are important elements in auditing, through which sustainable development goals are achieved.” While the lowest percentage (4.33) was for the paragraph that refers to the question: Efficiency, effectiveness, and continuous improvement processes depend mainly on the effort exerted by the auditor. The rest of the averages were graded according to their importance, and this indicates the stability of the second axis of the hypothesis.

3. *Interpretation of the results of the statistical analysis of the axes*

First axis: The impact of the lean green approach on audit efficiency

Table 4 shows that the axis of the impact of the green lean method on audit efficiency obtained the highest arithmetic mean, which amounted to 4.73 with a standard deviation of 0.61, with a relative importance of 85.1 and a high trend, and in contrast, the coefficient of variation amounted to 12.8.

Table 4. The impact of the green lean method on audit efficiency

| Axis | Arithm etic mean | Standard deviatio n | Relativ e importa nce | Direction of response level | Coefficie nt of variation |
|---|------------------------|---------------------------|--------------------------------|--------------------------------------|---------------------------------|
| The impact of the lean green approach on audit efficiency | 4.73 | 0.61 | 85.1 | High | 12.8 |

Second Axis: The impact of the lean green audit in achieving the Sustainable Development Goals

Table 5 indicates that the results of the axis of the impact of the lean green audit in achieving the sustainable development goals obtained an arithmetic mean of 4.75 with a standard deviation of 0.54 and a relative importance of 84.4 with a high trend and a coefficient of variation of 11.3.

Table 5. The impact of the lean green audit in achieving the Sustainable Development Goals

| Axis | Arithmetic mean | Standard deviation | Relative importance | Direction of response level | Coefficient of variation |
|---|-----------------|--------------------|---------------------|-----------------------------|--------------------------|
| The impact of the lean green approach on audit efficiency | 4.75 | 0.54 | 84.4 | High | 11.3 |

By comparing the results of the axes in Table 4 and Table 5, it is clear that the sample members who are most homogeneous in their answers are the ones with the lowest coefficient of variation, as 11.3 came in first place in terms of homogeneity in the axis of the impact of green lean auditing in achieving the sustainable development goals. The standard deviation value also supported the coefficient of variation, as the lowest value in the standard deviation was met by the lowest value of the coefficient of variation, which greatly supports the homogeneity of the data. This is followed by the other axis, which is the impact of the green lean method on audit efficiency, as it obtained a higher coefficient of variation of 12.8 and a standard deviation of 0.61.

4. Testing the research hypothesis

The research hypothesis, which states that “there is no effect of green lean auditing in achieving sustainable development goals,” was tested by using analytical statistical methods represented by the simple Spearman correlation coefficient, then testing the significance of the relationships using the t-test to determine the strength of the correlation between the research variables.

Table 6. Correlation coefficient and t-test for the correlation coefficient between lean auditing and sustainable development goals

| correlation coefficient value r | t- calculated | df | t-tabular significance at 5% | Significance |
|------------------------------------|------------------|-----|---------------------------------|--------------|
| 0.95 | 1.99 | 129 | 1.64 | Correlation |

It is noted from Table 6 that the calculated t value reached (1.99) which is greater than the tabular t value of (1.64) at a significance level of (0.05), and this indicates the presence of an impact of the lean green audit in achieving the sustainable development goals, which means rejecting the null hypothesis and accepting the alternative hypothesis with a correlation coefficient of (0.95), which indicates the presence of a strong correlation between the research variables. The regression model is one of the best models for estimating the impact of the relationship between the independent variables and the dependent variable. Among these models is the simple regression described above. Where the relationship of the impact of the independent variable (lean green audit) on the dependent variable (sustainable development) can be studied, as the null hypothesis states that "there is no impact of the lean green audit on achieving the sustainable development goals." The alternative hypothesis stated that "there is an impact of the lean green audit in achieving the sustainable development goals." As shown in Table 7.

Table 7. Results of simple linear regression on the impact of green lean auditing and sustainable development

| Dependent variable | Lean Green Audit | | | F | Sig |
|-------------------------|------------------|------|-------|------|-------|
| | β | T | Sig | | |
| Independent variable | | | | 3.86 | 0.000 |
| Fixed limit | 3.64 | | | | |
| Sustainable development | 0.22 | 1.99 | 0.005 | | |

| | | |
|---|--|--|
| Coefficient of determination $R^2 = 0.98$ | | |
|---|--|--|

Table 7 shows that by comparing the F value that was calculated at a significance level of 0.05, which amounted to 3.86, with the tabular F value (2.90), it is clear that the calculated F value is greater, which means rejecting the null hypothesis and accepting the alternative hypothesis.

The table above also indicates that 0.98% of the changes that occur in the values of the dependent variable (Sustainable Development Goals) are due to the independent variable (Lean Green Audit).

The independent variable (Lean Green Audit) also has a significant direct effect. This means that when the independent variable increases by one unit, the dependent variable will increase by 0.22.

Through the t-test of the Beta value coefficient (B1), which amounted to 3.64 and its probability value of (Sig = 0.005), this is evidence of the significance of the Beta coefficient under a significance level of 0.05. Through these results, the null hypothesis will be rejected and the alternative hypothesis will be accepted.

5- Conclusions and Recommendations

5-1- Conclusions

1. There is a strong, statistically significant relationship between lean green auditing and the sustainable development goals of the research sample.
2. Lean green auditing is a tool for a new work method in traditional auditing, as it leads to adding more value to the auditor's reports, the team itself, or to auditing operations.
3. Lean green auditing is an efficient tool, and its use in oversight work leads to adding value to the work of the auditor and the auditor himself.
4. Lean green audit helps organizations quickly make appropriate decisions not only to address and manage current risks, but also shed light on unexpected risks and consequences, which leads to adding value..
5. Lean green audit helps organizations to continuously improve themselves and increase awareness to work sustainably and restore work with modern good practices that will save time and effort.
6. 10. Agile green auditing leads to audits that support the optimal use of available resources, which increases efficiency and effectiveness and ensures the identification of risks and thus the achievement of the designated objectives.

7. Streamlining the procedures for preparing sustainable development reports increases the efficiency and effectiveness of these procedures, in addition to the fact that these reports are considered one of the necessary tools that enable governmental and non-governmental units to identify their economic, social, environmental and even organizational impacts, evaluate their indicators and make improvements that are consistent with the goals of sustainable development.
8. Submitting the necessary and important reports enables organizations to identify economic, social, environmental and even institutional impacts, evaluate indicators and make improvements that are consistent and in line with achieving the goals of sustainable development.

5-2- Recommendations

- 1) The necessity of using agile methods in auditing work that affects the efficiency of the auditing process, where the focus is on work priorities that are determined cooperatively by the work team.
- 2) Developing the auditor's skills in the field of the environment and improving operations for modern and agile auditing procedures, and choosing appropriate programs and methods for auditing and flexibility in work and responding quickly to the changing and renewable business environment.
- 3) Focusing on achieving the full development of human resources, directed towards their motivations and creativity to be part of a green and agile institution.
- 4) It is necessary to introduce agile methods to auditing and control work because of their role and great importance in increasing the efficiency of the auditing process by focusing on important elements and choosing modern auditing programs that work to respond quickly to the changing and renewable business environment.
- 5) Paying attention to the lean green auditing method in all service institutions because of its great importance to the auditor and management, as continuous improvement, attention to available time and resources, avoiding waste, and facing expected risks, which leads to adding value to work in a sustainable environment.

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