# Explanation of Ecosystem Accounting Criteria in Iraqi Industries

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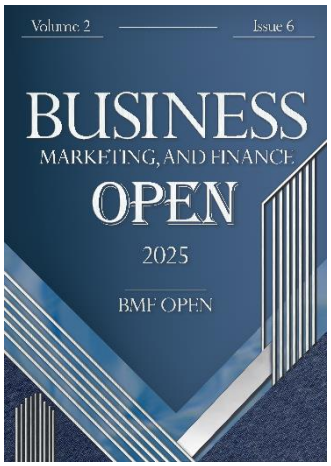


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**Abstract:** The purpose of environmental accounting is to develop information that assists managers in evaluating performance, control, decision-making, accountability, and reporting for an organization or company. The aim of this study is to explain the criteria of ecosystem accounting in Iraqi industries. The collection and analysis of data in this research were conducted through interviews with professional accounting experts in Iraq in 2025. The statistical population consisted of managers of leading companies and university faculty members with activities related to the research topic. Since the present study emphasizes the formation of a conceptual framework or the development of theory and requires the elicitation of experts' tacit knowledge in this domain, the "thematic analysis" strategy was employed. Furthermore, a type of purposive sampling was used for data collection, and the interviewed experts served as the primary research sources. Accordingly, to identify the ecosystem accounting criteria in Iraqi industries under current conditions, the required qualitative data were collected through in-depth and exploratory individual interviews with purposefully selected academic experts. Using content analysis as a research technique, the main and subsidiary themes and factors were identified and analyzed. These themes served as the basis for developing and explaining the criteria of ecosystem accounting in Iraqi industries. The overall findings highlight a positive trajectory in Iraqi industries, in which environmental accounting—including environmental cost accounting, carbon accounting, and sustainability reporting—explicitly contributes to the improvement of ecosystem accounting criteria.

**Keywords:** Environmental cost accounting, carbon accounting, sustainability reporting

## 1. Introduction

The accelerating global transition toward environmentally responsible business practices has significantly expanded the role of environmental and ecosystem-based accounting across industrial sectors. Organizations today operate in an era where ecological degradation, climate change, and resource scarcity have forced governments, corporations, and civil society to reconsider the foundations of economic decision-making. Environmental accounting, in its contemporary form, provides organizations with systematic tools to measure environmental costs, internalize ecological externalities, promote compliance with environmental regulations, and support transparent sustainability reporting. This transformation in accounting thought aligns with global expectations that firms integrate environmental performance into financial and managerial decision

systems, thereby ensuring both ecological stewardship and long-term organizational viability [1]. As businesses face increasingly complex sustainability challenges, research on environmental, green, and ecosystem accounting frameworks has intensified, reflecting the need for approaches that link ecological responsibility with corporate competitiveness and societal well-being [2].

Environmental accounting systems aim not only to quantify environmental costs but also to improve resource efficiency, reduce pollution, and enhance environmental governance within industrial settings [3]. The advancement of management accounting techniques has broadened the capacity of organizations to integrate environmental costs into operational and strategic decisions. For example, environmental management accounting practices have been recognized for their potential to strengthen corporate social responsibility and stakeholder engagement, particularly in environmentally sensitive industries [4]. The narrative dimensions of environmental reporting also provide opportunities for marginalized communities to articulate ecological concerns, thereby shaping more inclusive environmental accountability frameworks within sectors such as mining and heavy industry [4].

A major thread within contemporary literature emphasizes the growing importance of environmental management accounting in strengthening corporate sustainability. Studies indicate that when organizations adopt comprehensive environmental management accounting practices, they experience improvements in both environmental and financial performance, revealing a strong business case for sustainable operations [5]. In many developing economies, these systems contribute to improved waste management, enhanced monitoring of resource flows, and greater cost awareness among decision-makers [6]. Moreover, environmental management accounting is increasingly viewed as a strategic resource for achieving operational excellence, particularly in industrial sectors characterized by high levels of material consumption and pollution [7]. Despite these advantages, firms continue to face structural, cultural, and regulatory barriers that impede the effective adoption of environmental accounting systems [8].

A parallel field that has gained global traction is carbon accounting, which provides organizations with analytical tools to quantify greenhouse gas emissions and integrate carbon management into corporate strategies. As climate concerns intensify, carbon accounting has become an essential element of sustainability reporting frameworks. Bibliometric evidence suggests that carbon accounting has experienced rapid growth in the social sciences, evolving from basic emission-tracking models to more sophisticated mechanisms embedded in corporate environmental, social, and governance (ESG) systems [9]. The expansion of carbon accounting reinforces organizational accountability by requiring firms to disclose carbon footprints, implement emission-reduction strategies, and engage in sustainable energy transitions. Such systems help industries anticipate regulatory changes, prepare for carbon taxation schemes, and optimize production processes in a manner consistent with low-carbon economic principles [10].

In addition to carbon accounting, green accounting practices contribute to ecological sustainability through the integration of environmental considerations into budgeting, investment appraisals, and performance evaluation systems. Empirical evidence shows that green taxes and green financing mechanisms stimulate corporate environmental innovation, reduce environmental degradation, and ultimately enhance corporate social responsibility [11]. Green accounting also supports national sustainability strategies by encouraging industries to adopt cleaner technologies, improve resource efficiency, and internalize environmental externalities. This is particularly important in rapidly industrializing regions where regulatory enforcement may be inconsistent, and environmental degradation poses significant long-term risks to economic stability [12].

The integration of environmental technologies into accounting systems has similarly gained international attention. The use of advanced environmental monitoring tools supports real-time assessment of pollution levels, resource utilization, and environmental impacts, enabling organizations to make informed decisions that enhance sustainability performance [13]. Environmental technologies strengthen green accounting systems by improving the accuracy, completeness, and reliability of environmental data, which in turn enhances transparency in sustainability reporting. These technologies also promote sustainable development by helping organizations align operational practices with international environmental standards, particularly in sectors such as manufacturing, mining, and petrochemicals where waste generation and environmental hazards are significant concerns [13].

Another critical component of environmental governance is environmental auditing. Environmental audits function as systematic assessments of a firm's environmental performance, regulatory compliance, and internal environmental controls [14]. These audits serve as essential tools for identifying inefficiencies, detecting environmental risks, ensuring compliance with environmental regulations, and promoting continuous improvement. As organizations expand globally, the demand for transparent environmental auditing processes has increased, resulting in new frameworks that emphasize accountability, ethical responsibility, and sustainability integration across operational units. Environmental auditing also reinforces stakeholder trust by providing verifiable evidence of an organization's environmental performance, thereby supporting responsible investment and governance practices [14].

From a strategic perspective, leadership plays an indispensable role in shaping organizational environmental performance. Strategic leadership that prioritizes environmental management fosters innovation, enhances competitive advantage, and promotes sustainable operational models [15]. In industries such as mining, where environmental concerns are particularly prominent, strategic leadership drives the adoption of sustainable extraction practices, eco-efficient technologies, and comprehensive environmental reporting systems. Effective leaders are more likely to integrate environmental concerns into long-term planning, align organizational objectives with sustainability goals, and cultivate organizational cultures that value environmental accountability [15].

As cities and industries expand, environmental management accounting practices have become increasingly vital for ensuring sustainable service delivery. In growing urban economies, the effective management of natural resources, waste streams, energy consumption, and environmental risks requires sophisticated environmental accounting systems that support informed decision-making and service planning [16]. Environmental management accounting in urban contexts also helps municipalities and service organizations monitor environmental impacts, allocate resources appropriately, and ensure equitable service delivery. Such practices contribute to stronger urban governance structures and more resilient environmental systems [16].

The global expansion of sustainability reporting obligations—instituted by governments, stock exchanges, and international regulatory bodies—has reinforced the need for structured environmental accounting frameworks. Sustainability accounting strengthens corporate accountability by integrating environmental, social, and economic performance into a unified reporting framework that aligns with stakeholder expectations [2]. In many countries, sustainability reporting has become an essential requirement for publicly traded companies, prompting organizations to adopt robust systems that measure environmental impacts, disclose environmental expenditures, and articulate sustainability initiatives. This integration of environmental information into corporate reporting frameworks enhances transparency, promotes responsible investment, and accelerates the transition toward circular economy models [17].

Environmental disclosure practices continue to attract significant scholarly attention, particularly in emerging economies that face institutional and regulatory challenges. Recent literature emphasizes that the determinants of environmental disclosure include organizational size, stakeholder pressure, regulatory structures, and managerial attitudes toward environmental responsibility [18]. The expansion of environmental disclosure obligations has encouraged firms to adopt standardized reporting frameworks that communicate environmental risks, mitigation strategies, and environmental expenditures more effectively. These practices strengthen corporate legitimacy and ensure that organizations remain accountable to both regulatory authorities and the broader community [18].

At the core of environmental accounting lies the capacity to enhance ecological sustainability. Empirical studies demonstrate that green accounting significantly influences ecological outcomes by encouraging firms to internalize environmental impacts and adopt sustainable production practices [19]. Green accounting supports sustainable decision-making processes by linking environmental performance with financial indicators, thereby incentivizing firms to develop eco-efficient innovations and environmentally friendly technologies. These systems contribute to reduced pollution, improved resource allocation, and greater environmental resilience within industrial and urban systems [19].

Environmental accounting continues to evolve in response to rapid global environmental changes, policy reforms, and stakeholder expectations for sustainability. As industries in developing countries navigate the complexities of environmental regulation, technological advancement, and economic growth, there is an increasing need for ecosystem-based accounting frameworks that capture the dynamic interactions between industrial activities and environmental systems. Such frameworks provide holistic insights into ecological impacts, resource use, carbon emissions, and environmental costs, enabling policymakers and industry leaders to design sustainable strategies grounded in scientific and economic evidence. Building on these global research developments, the present study focuses on identifying and explaining ecosystem accounting criteria tailored to industrial contexts. The aim of this study is to explain and categorize ecosystem accounting criteria in the industrial sectors of Iraq.

## 2. Methodology

The present research is a qualitative study, and the collection, as well as the analysis, of the data were conducted through interviews with professional accounting experts in Iraq in 2024. The statistical population consisted of managers of leading companies and university faculty members engaged in activities related to the research topic. Since the study emphasizes the formation of a conceptual framework or the development of theory and requires the elicitation of experts' tacit knowledge in this field, the "thematic analysis" strategy was employed. Furthermore, a purposive sampling technique was used for data collection, and the interviewed experts served as the research sources. Therefore, in the first stage, the theoretical foundations, related studies, and the research background were examined, analyzed, and organized using a systemic approach. In the second stage, the goal was to obtain a deep and rich description of the experiences and perceptions of the participants regarding the explanation of ecosystem accounting criteria in Iraqi industries. Accordingly, to identify the ecosystem accounting criteria in Iraqi industries under current conditions, the required qualitative data were collected through in-depth and exploratory individual interviews with purposefully selected academic experts. Using content analysis as a research technique, the main and subsidiary themes and factors were identified and analyzed. These themes formed the basis for developing and explaining the ecosystem accounting criteria in Iraqi industries.

The primary source of data was interviews. Initial interviews were exploratory and descriptive, and gradually, after each interview, coding of the interview data was performed. Through the method of constant comparative

analysis, theoretical codes emerged via open coding. In this manner, open coding was performed on all 11 interviews, and the concepts and main and subcategories were identified. It should be noted that the densification and saturation of core categories were based on theoretical sampling, such that interviews with the research population continued until the concepts related to each category became rich and dense. It is important to note that theoretical sampling for interviews was conducted not based on the number of interviewees but rather on the extent of their contribution to saturating the themes. Although interview questions and the conceptual model required asking each interviewee about various dimensions, the interview process indicated that each participant, based on their area of expertise, could contribute more significantly to specific categories. This is one of the advantages of theoretical sampling in qualitative research, as data collection continues based on theoretical saturation. The interviewees consisted of two women and nine men, all of whom met the expert criteria described in Chapter Three. At this stage, coding was performed using MAXQDA software.

## 3. Findings and Results

As shown in Table (1), examples of transcribed interview texts are presented first, and similarly, open coding was conducted for all 11 interviews, and the initial themes were extracted from the interview data.

**Table 1. Examples of verbal evidence or spoken statements and concepts extracted from open coding**

| Initial Themes (Indicators) | Verbal Evidence or Spoken Statements | Source |
|---|---|---|
| Modernization of machinery – production ideas for reducing pollution – employee and managerial training – holding conferences for organizational training – encouraging non-polluting organizations – providing facilities for non-polluting organizations – granting tax incentives to non-polluting organizations | "... Factors that influence environmental accounting include companies focusing on planning and developing their machinery, modernizing and optimizing facilities, and adopting production ideas aimed at creating products with reduced pollution, thereby creating beneficial conditions for the organization. Studying, evaluating, and training companies with polluting products through various seminars or conferences, and encouraging relevant organizations through subsidies or low-interest facilities and providing low-pollution machinery, as well as providing tax incentives for industries and companies that incur such costs ..." | Part of Interview No. 1 |
| Managerial accountability – stakeholders' concern for environmental issues – macro environmental policymaking – international pollution-reduction strategies – the role of management accounting | "... The most important factor in adopting environmental strategies and managerial accountability toward achieving environmental strategic goals is stakeholder sensitivity. This will materialize only when stakeholders fully understand and perceive the importance of environmental protection, which itself depends on macro-level policies at the national level for domestic companies and at the global level for multinational companies, and we must address carbon accounting as part of management accounting ..." | Part of Interview No. 2 |
| Public support for environmental protection – environmental inspections – conducting environmental audits – disclosing environmental activities in financial reports – increasing shareholder trust – increasing market value of shares – increasing shareholders' wealth – economic decision-making policies – sustainable development – optimal resource utilization | "... Public interest in environmental protection has increased the pressure on managers and organizations to intensify inspections of the environmental damages caused by business units, which has led to conducting environmental audits. On the other hand, with proper environmental disclosure in financial reporting, a positive view among shareholders and the capital market can be created, resulting in increased share value and, consequently, increased shareholder wealth. Moreover, the long-term effects of this matter on economic and environmental decision-making policies and the creation of sustainable development for optimal resource utilization and value-chain optimization must also be considered ..." | Part of Interview No. 3 |
| Transparency – public satisfaction – cleanliness and beauty of the environment – public health – reducing government costs | "... If environmental issues are given proper attention in society, there will definitely be consequences such as transparency, public satisfaction, environmental cleanliness and beauty, public health, and reduced governmental costs ..." | Part of Interview No. 4 |

| | | |
|---|---|---|
| Enactment of preventive regulations – uniform enforcement of laws – public awareness and cultural development – creation of new accounting methods – transparency in environmental accounting – development of environmental protection laws and regulations – adherence to environmental requirements | "... Relevant factors include the enactment of preventive regulations for compliance with environmental issues, the existence of legal requirements and uniformity in enforcing laws, cultural development, formulation of new accounting methods, governing laws and requirements for ensuring transparency in environmental accounting, and compliance with environmental considerations ..." | Part of Interview No. 5 |
| Increased customer satisfaction – higher profitability – improved human quality of life – public opinion – international pollution-reduction strategies – government performance | "... Observing environmental considerations by business owners not only increases customer satisfaction and profitability but also improves the quality of human society. Public opinion is also shaped by monitoring from international organizations regarding governmental performance ..." | Part of Interview No. 6 |
| Managerial responsibility – competitive advantage – environmental performance evaluation – corporate success | "... An environmentally compatible organization primarily relies on the commitment of top management, which can ultimately lead to an enhanced competitive advantage. Manufacturing and service companies face various costs, including environmental costs. Environmental performance is one of the most significant factors in assessing a company's success ..." | Part of Interview No. 7 |
| Implementation of efficient policies – environmental protection laws and regulations – government policymaking – government oversight – increased social responsibility – optimal management | "... Implementing proper and efficient policies is essential, one of the most important of which is the enactment of laws and regulations determined by the government. However, continuous and consistent oversight of these laws can help achieve environmental objectives. We have water and soil resources, and we must consider what alternative policies exist. We also have resources we utilize, and in return for using these resources, we have social responsibilities. Discussions on energy flow, fuel consumption, waste disposal, and environmental pollution require optimal management. Carbon accounting can serve as a method for value-chain optimization ..." | Part of Interview No. 8 |
| Reducing environmental costs – eliminating non-value-added activities – performance evaluation – cost management – accurate costing – product pricing – environmentally friendly technologies – competitive ability – international environmental strategies – competitive markets | "... By making better decisions, investing in green industries, and redesigning their processes and products, managers can reduce or eliminate many environmental costs, as some of these costs create no added value for the organization. Understanding environmental costs and being informed of the environmental performance of processes and products can improve costing and pricing and help companies design more environmentally compatible products. The more compatible a product is with the environment and the lower its pollution, the more effectively it can be used in the environmental cycle. It has been proven that environmentally friendly products hold competitive advantages in the market. The more a product aligns with environmental and global standards—and if qualitative and pricing factors are also controlled—it can surpass competitors in competitive markets ..." | Part of Interview No. 9 |
| Lack of employee expertise – employee inefficiency – employee negligence in production – geographical environment of the company – production inefficiency – increased environmental costs – tracking environmental costs – value-chain optimization | "... Lack of employee expertise and efficiency, as well as negligence among some personnel in the production process, can negatively affect output. The geographical conditions of a company—whether healthy or unhealthy—can result in production inefficiency and increased environmental costs. Tracking environmental costs can significantly reduce waste and production expenses. Moreover, carbon accounting management in the supply chain, as a powerful tool for measuring, reducing, and reporting greenhouse gas emissions throughout product life cycles, is rapidly evolving. Due to increased awareness of climate change and regulatory and social pressures, demand for products and services with lower carbon footprints is increasing ..." | Part of Interview No. 10 |
| Enforcement of environmental laws – government oversight – competitive market – improved quality of life – increased loyal customers – increased sales | "... With environmental enforcement by regulatory institutions, laws can be effectively applied, leading to business competition. This results in improved quality of life for citizens, increased customer loyalty, and consequently, higher sales for companies ..." | Part of Interview No. 11 |

Following the initial open coding of the interview texts, as partially presented in Table (1), the ecosystem accounting criteria were identified and extracted. Table (2) presents the complete set of indicators extracted during the first stage of coding, along with their sources. The source column indicates from which interviews the respective indicators were derived, thereby reflecting the frequency of each indicator across interviews.

**Table 2. List of Indicators Extracted in the Open-Coding Stage**

| Indicator Code | Initial Codes (Indicators) | Source |
|---|---|---|
| A1 | Enforcement of environmental laws | P11, P5 |
| A2 | Employees' environmental awareness in the organization | P10, P11 |
| A3 | Tracking environmental costs | P10, P3, P11 |
| A4 | Reduction of environmental costs | P10, P5 |
| A5 | Efficiency of production | P10, P5, P2 |
| A6 | Healthy geographical environment of the company | P1, P10 |
| A7 | Employees' negligence in product manufacturing | P4, P10 |
| A8 | Lack of employee efficiency | P3, P10, P5 |
| A9 | Lack of employee expertise | P6, P10 |
| A10 | Environmental satisfaction | P9, P11 |
| A11 | Elimination of non–value-added activities | P7, P9 |
| A12 | Competitive market | P9, P11, P10 |
| A13 | Competitive ability | P3, P9, P11 |
| A14 | Alignment of managers with environmental plans | P9, P5 |
| A15 | Proper managerial decision-making | P9, P7 |
| A16 | Organizational performance evaluation | P7, P9, P4 |
| A17 | Standards for observing consumption patterns | P8, P3 |
| A18 | Optimal management | P8,87 |
| A19 | Government supervision | P4, P8, P5 |
| A20 | Government policymaking | P8, P9 |
| A21 | Implementation of proper and efficient policies | P3, P8 |
| A22 | Correct pricing of products | P7, P9 |
| A23 | Accurate costing | P7, P9, P4 |
| A24 | Cost management | P9, P1, P7 |
| A25 | Environmentally friendly technologies | P9, P5, P7 |
| A26 | Corporate success | P3, P7 |
| A27 | Competitive advantage | P8, P7 |
| A28 | Environmental performance evaluation | P10, P7 |
| A29 | Sustainable organizations | P3, P7 |
| A30 | Managerial responsibility | P9, P7, P5 |
| A31 | Increasing managers' capabilities | P7, P4, P3 |
| A32 | Job improvement | P2, P7 |
| A33 | Business growth | P1, P7 |
| A34 | Improvement in quality of life in society | P6, P11, P8 |
| A35 | Government performance | P1, P6 |
| A36 | Public opinion | P8, P6 |
| A37 | Increased production | P3, P6, P10 |
| A38 | Increased customer satisfaction | P5, P6 |
| A39 | Increased qualitative level of products and services | P6, P11 |
| A40 | Earning higher profit | P10, P6, P3 |
| A41 | Increased sales and profitability | P5, P6, P7, P8 |
| A42 | Increased public trust | P5, P9 |
| A43 | Creation of new accounting methods | P11, P5, P2 |
| A44 | Examination of internal control systems | P9, P5, P3 |
| A45 | Uniformity in compliance with the law | P5, P11 |
| A46 | Enactment of preventive regulations | P6, P5, P4 |
| A47 | Benefits exceeding costs | P7, P5 |
| A48 | Changes in environmental accounting methods | P4, P5, P10 |

| | | |
|---|---|---|
| A49 | Observance of environmental issues | P6, P5 |
| A50 | Transparency in environmental accounting | P5, P3, P2 |
| A51 | Non-concealment of costs by managers | P9, P5 |
| A52 | Disclosure of environmental costs | P1, P5, P9 |
| A53 | Proper disclosure of information | P3, P5 |
| A54 | Public cultural development | P5, P8, P10 |
| A55 | Consumers' use of low-pollution goods | P4, P5 |
| A56 | Reduction of government costs | P9, P4 |
| A57 | Public health | P10, P4, P1 |
| A58 | Cleanliness and beauty of the environment | P4, P7 |
| A59 | Public satisfaction | P3, P4, P10 |
| A60 | Transparency | P10, P4 |
| A61 | Use of modern and efficient equipment | P3, P4, P9 |
| A62 | Governmental support and business promotion | P4, P8 |
| A63 | Allocation of appropriate budget by the government | P2, P4 |
| A64 | Use of online systems for financial reporting | P4, P5 |
| A65 | Organizational culture | P3, P4, P2 |
| A66 | Managerial training | P2, P4 |
| A67 | Existence of efficient managers | P4, P6, P10 |
| A68 | Existence of expert managers | P8, P4 |
| A69 | Existence of social accounting reports | P3, P7 |
| A70 | Environmental opportunity costs | P2, P3, P9 |
| A71 | Preservation of environmental resources | P11, P3 |
| A72 | Social environmental education | P3, P5 |
| A73 | Development of environmental protection laws and regulations | P3, P5, P6, P8 |
| A74 | Optimal use of resources | P11, P3 |
| A75 | Sustainable development | P7, P3 |
| A76 | Economic decision-making policies | P2, P5, P3 |
| A77 | Increase in shareholders' wealth | P3, P9 |
| A78 | Increase in market value of shares | P9, P3 |
| A79 | Increased shareholder trust in the company | P3, P11 |
| A80 | Disclosure of environmental activities in financial reports | P5, P3, P9 |
| A81 | Conducting environmental audits | P1, P3 |
| A82 | Existence of inspections for environmental activities | P4, P3, P5 |
| A83 | Public support for the environment | P3, P4 |
| A84 | Higher product sales | P2, P4, P5 |
| A85 | Achieving the "my ideal city" model | P2, P11, P10 |
| A86 | Greater supervision over quality control | P8, P2 |
| A87 | Non-use of non-biodegradable materials | P3, P2, P6 |
| A88 | Increased social responsibility | P2, P8 |
| A89 | Optimal environmental performance | P3, P5 |
| A90 | Managerial accountability | P2, P3, P8 |
| A91 | Stakeholder satisfaction | P2, P9 |
| A92 | Corporate advertising emphasizing environmental friendliness | P6, P2, P8 |
| A93 | International exchange of environmental information | P5, P2 |
| A94 | Prioritizing environmental costs | P7, P2 |
| A95 | Environmental reports | P11, P2, P1 |
| A96 | Managers' attention to environmental issues | P2, P5 |
| A97 | Product and service quality | P3, P2, P8 |
| A98 | International pollution-reduction strategies | P6, P9, P2 |
| A99 | Macro-level environmental policymaking | P2, P5 |
| A100 | Stakeholders' concern for environmental issues | P7, P2 |
| A101 | Managers' responsiveness | P9, P2, P5 |
| A102 | Reducing organizational production costs | P1, P11 |
| A103 | More secure profit | P5, P1, P7 |
| A104 | Increased sales | P11, P1 |

| | | |
|---|---|---|
| A105 | More diverse products | P7, P1 |
| A106 | Greater international investment opportunities | P5, P2, P1 |
| A107 | Attracting shareholders | P1, P9 |
| A108 | Increase in loyal customers | P11, P1 |
| A109 | Increased life expectancy across generations | P5, P1 |
| A110 | Healthy organizational environment | P7, P1 |
| A111 | Granting tax incentives to non-polluting organizations | P1, P4, P2 |
| A112 | Providing facilities to non-polluting organizations | P6, P1 |
| A113 | Encouraging non-polluting organizations | P10, P1 |
| A114 | Holding conferences for organizational training | P1, P11, P2 |
| A115 | — | — |
| A116 | Production ideas for reducing pollution | P1, P7 |
| A117 | Modernization of machinery | P2, P3, P1 |
| A118 | Reduction of low-quality outputs | P1, P2 |
| A119 | Reduction of product unit cost | P1, P8, P11 |
| A120 | Improvement of product quality | P2, P1, P5 |
| A121 | Competitive power | P1, P4 |
| A122 | Shareholder decision-making | P1, P6, P8 |
| A123 | Value-chain optimization | P2, P8, P10 |
| A124 | Transformation in production | P1, P2, P10 |

**Table 3. Ecosystem Accounting Criteria**

| Overarching Themes | Organizing Themes | Initial Codes |
|---|---|---|
| Environmental Accounting | Environmental laws and regulations | Uniformity in compliance with laws; enactment of preventive regulations; observance of environmental issues; enforcement of environmental laws; creation of environmental protection laws and regulations; granting tax incentives to non-polluting organizations; providing facilities to non-polluting organizations; economic decision-making policies; international pollution-reduction strategies; macro-level environmental policymaking. |
| | Product quality control | Increased supervision over quality control; non-use of non-biodegradable materials; efficiency of production; reduction of organizational production costs. |
| | Optimal production | Benefits exceeding costs; optimal use of resources; production ideas for reducing pollution; transformation in production. |
| | Cost management | Correct pricing of products; accurate costing; cost management; reduction of low-quality outputs; reduction of product unit cost; tracking environmental costs; reduction of environmental costs; environmental opportunity costs; prioritizing environmental costs. |
| | Organizational technologies | Environmentally friendly technologies; use of modern and efficient equipment; modernization of machinery. |
| Sustainability Reporting | Public trust | Increased public trust; achieving the "my ideal city" model; increase in loyal customers. |
| | Public cultural development | Standards of consumption patterns; public opinion; public cultural development; social environmental education; consumers' use of low-pollution goods; stakeholders' concern for environmental issues. |
| | Healthy society | Improvement in quality of life in society; public health; cleanliness and beauty of the environment; public satisfaction; public support for the environment; increased life expectancy across generations. |
| | Organizational vitality | Corporate advertising emphasizing environmental friendliness; international exchange of environmental information; greater international investment opportunities. |
| | Healthy organizational environment | Healthy geographical environment of the company; environmental satisfaction; healthy organizational environment; job improvement. |
| | Product quality | Increased customer satisfaction; increased qualitative level of products and services; improved product quality; increased sales and profitability; earning higher profit; higher product sales; product and service quality; more diverse products. |
| | Competitiveness | Competitive market; competitive ability; competitive advantage; business growth; competitive power. |
| | Organizational sustainability | Sustainable organizations; increased production; sustainable development. |
| Carbon Accounting | Value-chain optimization | Carbon accounting as a method for value-chain optimization; managers' attention to environmental issues. |

| | | |
|---|---|---|
| | Measurement and control of the supply chain | Carbon accounting as part of the management accounting system. |

The final stage in thematic analysis is writing. In this section, an attempt is made to present a narrative of the phenomenon of the antecedents and criteria of ecosystem accounting. In the story-like narrative, an effort has been made to bring each of the themes into the storyline and provide extensive explanations.

From the experts' perspective, if companies reduce their environmental costs, this can lead to the production of better products, and for companies to remain committed to the principles of complying with environmental laws, they must first seek to reduce the production costs of their goods. In this regard, one of the experts stated: "... paying attention to public follow-up, creating facilities for that region, and in some industries such as automobile manufacturing must lead to higher-quality production ..." (p8)

Another expert stated: "... tracking environmental costs can play an effective role in reducing waste and production costs ..." (p10)

An organizational system requires efficient and optimal mechanisms for improving the organization. The presence of expert managers and capable leadership in critical organizational decision-making can move the organization toward an efficient system. In this regard, one of the experts stated: "... selecting expert and efficient managers in the relevant field in companies is one of the factors that leads to a reduction in environmental costs ..." (p4)

Another expert stated: "... accounting strategies, which are very broad, can be used to gain substantial benefits, including those that can embody the enhancement of managerial capability ..." (p7)

If accounting reports in an organization are prepared efficiently and optimally, and if financial managers and accountants of companies consider environmental disclosure, and on the other hand there are requirements for presenting such disclosures, and the standard setters and lawmakers in accounting oblige companies to use environmental accounting principles and standards, this will certainly provide significant support in the area of environmental strategies. In this regard, one of the experts stated: "... on the other hand, with appropriate disclosure in financial reporting, a positive perspective can be created among shareholders and the capital market ..." (p3)

Another expert stated: "... accounting reports, with the support of shareholders as the community, can oblige executive managers of companies to present reports in the field of environmental accounting ..." (p3)

If organizations disclose environmental accounting information and are able to follow an appropriate strategy and, at the same time, are accountable to the stakeholders in society, they can create trust in society and among the stakeholders of organizations. In this regard, one of the experts stated: "... this leads to an increase in shareholders' wealth, which in turn results in their satisfaction ..." (p3)

Another expert stated: "... indeed, this will lead to transparency and public satisfaction and to shareholder satisfaction ..." (p4)

If organizations implement environmental strategies and reduce environmental pollution, this can influence the lives of all individuals in society and can provide a healthy environment for both current and future generations. In this regard, one of the experts stated: "... cleanliness and beauty of the environment and public health are among the factors that result from observing environmental accounting ..." (p4)

Another expert stated: "... maintaining the sustainability of natural and environmental resources, including water, soil, air, minerals, and so forth, will have a direct impact on the quality of life of human society and other living beings ..." (p6)

If organizations comply with environmental accounting and their managers are accountable, this will help increase the health of the corporate environment, enabling companies to demonstrate their capabilities at the national and global levels. In this regard, one of the experts stated: "... you may use a different accounting strategy to improve the organization and your job, strategies and methods that are highly valuable ..." (p7)

Another expert stated: "... having a healthy and energetic environment in the organization is another aspect of environmental accounting ..." (p1)

For a company to be able to achieve competitive power in the marketplace and attain sustainability, it must use environmental accounting to support its business strategies. In this regard, one of the experts stated: "... competitive power against rivals through improved product quality is among the issues that can be mentioned ..." (p1)

Another expert stated: "... an environmentally compatible organization is mainly based on the commitment of top management, which can ultimately lead to the achievement of an enhanced competitive advantage ..." (p7)

If organizations respect environmental laws and regulations and environmental accounting, apply and follow them, and, on the other hand, use low-pollution equipment and machinery, this can help reduce environmental costs. One expert stated: "... the strategies that are effective for environmental accounting include companies focusing on planning and developing their machinery and creating modernization and optimization of facilities ..." (p1)

Another expert stated: "... the enactment of preventive regulations on observing environmental issues, the existence of legal obligations, and uniformity in compliance with the law are also effective ..." (p5)

If necessary training is provided to employees and managers in the organization, and, on the other hand, they receive adequate training on environmental accounting so they can contribute to the company's strategies, progress can be made. One of the experts in this regard stated: "... the negligence of some personnel in product manufacturing will have negative effects on outputs, and they must be given the necessary training ..." (p10)

Another expert stated: "... examining, studying, and training companies that have polluting products through various seminars or conferences has been possible ..." (p1)

If the government supports companies and enacts laws through which low-pollution companies can be distinguished from highly polluting or non-compliant companies, and then undertakes the necessary policymaking in this field while also including supervision of companies' compliance with principles and regulations in its agenda, this can lead to a reduction in environmental pollution. In this regard, one of the experts stated: "... among other issues, one can refer to the laws and directives ratified by legislative bodies and governments to safeguard national interests, such as the enactment of pollution-levy laws and the issuance of related directives in the relevant chapter ..." (p610)

Another expert stated: "... the policies determined by the government, coupled with continuous and ongoing supervision of them, can help us reach the desired environmental position ..." (p8)

## 4. Discussion and Conclusion

The findings of this study demonstrate that ecosystem accounting in Iraqi industries is shaped by several interrelated environmental, organizational, and regulatory dimensions that collectively strengthen environmental performance, corporate accountability, and sustainable development. The thematic analysis identified core components such as environmental cost reduction, improved managerial competencies, enhanced environmental reporting, stakeholder responsiveness, environmental compliance, adoption of clean technologies, governmental policy support, and employee training. Together, these dimensions reflect a growing recognition in Iraqi industries

of the importance of integrating environmental considerations into accounting systems to enhance ecological and organizational outcomes. These results align closely with global literature emphasizing that environmental accounting is becoming an indispensable element of strategic business management in both developing and advanced economies [2].

One of the central findings—highlighting that reducing environmental costs improves product quality and organizational efficiency—is strongly supported by previous studies. The data revealed that experts believe reducing waste, minimizing pollution, and lowering environmental costs directly contribute to improved production performance and optimized value chains. This is consistent with research showing that environmental management accounting enhances both environmental and financial performance by improving internal cost structures and decision-making efficiency [5]. Similarly, prior scholarly work emphasizes that green accounting contributes to better resource allocation, reduced environmental depletion, and increased organizational sustainability [19]. These congruent findings reinforce the notion that environmental cost management is not merely a compliance activity but rather a strategic capability that enhances competitive positioning.

The findings also underscore the crucial role of managerial expertise and leadership commitment in advancing environmental accounting practices. Experts consistently noted that skilled and environmentally aware managers enable efficient environmental accounting implementation, ensure compliance with environmental regulations, and drive continuous improvement. This experience-based insight supports prior research demonstrating that strategic leadership significantly improves firm performance through environmentally oriented decision-making and competitive advantage [15]. Similarly, environmental management accounting literature stresses the importance of managerial competence in designing systems that integrate sustainability principles into operational and strategic frameworks [7]. These parallels confirm that managerial capacity is one of the strongest predictors of successful environmental accounting integration.

The study's results also show that environmental disclosure and transparency are essential for building stakeholder trust, improving the firm's legitimacy, and strengthening corporate social responsibility. Experts highlighted that proper environmental disclosure positively influences shareholder perceptions and increases market confidence. This observation aligns closely with research indicating that environmental reporting enhances stakeholder engagement and supports the social license to operate, particularly in environmentally sensitive industries [4]. Similarly, environmental disclosure is widely recognized as a determinant of corporate legitimacy, influencing investor behavior and driving sustainable investment practices [18]. Consistent with these findings, green reporting has been described as a foundation of ecological sustainability that helps organizations communicate environmental commitments and performance to stakeholders [12]. Altogether, these studies reinforce the present finding that transparency in environmental accounting significantly influences corporate reputation and societal trust.

Another major theme identified was the significance of environmental accounting in fostering societal well-being, especially through improved environmental quality, public health, and intergenerational sustainability. Experts stressed that environmental accounting promotes cleaner production, reduces pollution, and creates healthier communities. This observation aligns with research demonstrating that environmental management and green accounting positively affect long-term ecological health by reducing environmental degradation and supporting sustainable development trajectories [13]. Likewise, environmental accounting frameworks emphasize the preservation of natural resources as a vital component of sustainable societal progress [1]. These consistent

findings suggest that ecosystem accounting contributes not only to economic and organizational outcomes but also to broader ecological and social welfare.

The findings further indicate that environmental accounting strengthens organizational competitiveness, as firms that adopt environmentally responsible strategies are more likely to achieve higher product quality, enhanced consumer satisfaction, and stronger competitive positioning. Experts noted that firms with sustainable production systems enjoy greater market acceptance. This observation echoes literature showing that environmentally responsible firms are more likely to develop dynamic capabilities that help them compete effectively in circular economy contexts [17]. Likewise, green tax incentives and green financing have been found to improve firms' strategic positioning and corporate social responsibility performance by promoting eco-innovation [11]. These findings collectively confirm that environmental accounting plays a central role in enhancing corporate competitiveness, particularly in markets increasingly influenced by environmental consciousness.

The study also highlights that adherence to environmental laws and regulations remains a fundamental requirement for implementing ecosystem accounting practices, as regulatory compliance provides a structural foundation for environmental governance. Experts emphasized that preventive regulations, environmental inspections, and governmental supervision are vital in motivating companies to adopt environmentally sound practices. This observation is consistent with research showing that effective institutional frameworks and environmental policies encourage firms to adopt environmental management accounting practices, especially in emerging economies where regulatory enforcement shapes organizational behavior [16]. Similar studies also emphasize that corporate environmental responsibility is significantly influenced by governmental policy frameworks and compliance mechanisms [3]. These aligned findings confirm the necessity of strong environmental regulatory systems for achieving ecosystem accounting objectives.

Another significant theme emerging from the results is the role of technology and innovation in enhancing environmental accounting. Experts noted that modern, low-pollution equipment, energy-efficient technologies, and digital reporting systems strengthen environmental monitoring, reduce emissions, and enhance the reliability of environmental reports. This finding is directly supported by research demonstrating that environmental technologies significantly increase the effectiveness of green accounting systems and strengthen sustainable development outcomes [13]. Similarly, carbon accounting frameworks highlight the value of technological tools in accurately measuring emissions and improving sustainability reporting quality [9]. These parallels confirm that integrating modern technologies is indispensable for effective ecosystem accounting.

Finally, the findings emphasize the importance of training and capacity development among employees and managers to ensure successful environmental accounting adoption. Experts emphasized that insufficient expertise among staff undermines environmental accounting effectiveness and that targeted training initiatives can address this gap. Previous studies support this observation, highlighting that knowledge deficiencies are a primary barrier to environmental management accounting implementation and that training is a vital motivator for organizational adoption [8]. Environmental auditing literature also reinforces the necessity of training personnel to ensure proper application of environmental accounting standards and reporting principles [14]. Thus, these aligned findings confirm that environmental skill-building is a foundational requirement for improving ecosystem accounting systems.

Overall, the results of this study align strongly with international research, demonstrating that ecosystem accounting requires a multifaceted approach that integrates environmental cost management, managerial capability, technological innovation, regulatory compliance, transparency, and societal engagement. Collectively,

these elements provide a coherent framework for strengthening environmental governance and promoting sustainable industrial development.

This study was conducted using qualitative interviews with a limited number of experts, which may restrict the generalizability of the findings. The insights captured reflect expert perceptions at a specific point in time and may evolve as environmental policies, technologies, and industrial practices continue to change. In addition, the research relied heavily on self-reported experiences, which may be subject to personal bias or selective recall. Another limitation is the absence of quantitative data that could validate the thematic findings and measure the relative influence of each identified criterion.

Future studies could incorporate quantitative methods to measure the strength and statistical significance of the relationships identified in this qualitative analysis. Researchers may also consider developing standardized assessment tools for evaluating ecosystem accounting maturity within organizations. Comparative studies across countries or regions could offer deeper insights into contextual differences in environmental accounting adoption. Additionally, future research could explore how digital technologies, such as artificial intelligence or blockchain, may further enhance transparency and reliability in ecosystem accounting.

Organizations should prioritize environmental training programs for employees and managers to strengthen competency in environmental reporting and sustainability decision-making. Firms should also integrate environmental cost tracking systems into their financial and managerial processes, ensuring that environmental impacts are systematically monitored. Policymakers should promote supportive environmental regulations and incentives that encourage companies to adopt low-carbon technologies and sustainable production practices. Finally, firms should cultivate a culture of transparency and environmental responsibility to strengthen stakeholder trust and ensure long-term sustainability.

## 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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