



THE ROLE OF ECOSYSTEM ACCOUNTING IN REDUCING ENVIRONMENTAL COSTS

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Article history:	Abstract:
<p>Received: 6th December 2023 Accepted: 4th January 2024 Published: 08th February 2024</p>	<p>This study aims to determine the role of ecosystem accounting in the process of reducing environmental costs.</p> <p>To achieve the goal of study. The Researchers presented the problem of study and previous studies related to ecosystems. Ecosystem accounting. Researchers also presented some previous studies on cost management tools. The Researchers focused on cost management tools that have the greatest impact on reducing environmental costs, and their impact on achieving environmental system integration. In order to determine the relationship between ecosystem accounting and environmental costs.</p> <p>Researchers also relied on designing survey list to test study hypothesis. It distributed into three groups. First group consisted of employees of companies working in field of environment. Second group consisted of university faculty. Third group consisted of employees in accounting and auditing offices. Study hypothesis tested using statistical program SPSS.</p> <p>The study concluded there is a direct relationship between application of ecosystem accounting and reduction of environmental costs.</p>

Keywords: Ecosystem Accounting, Environmental Costs, Reducing Environmental Costs

1- PREVIOUS STUDIES DEALT WITH SUBJECT OF RESEARCH:

Analyzing previous studies on the subject of ecosystem accounting and environmental costs, we notice that Researchers have paid attention to them from several aspects. Some of these studies can be presented as follows:

First: Previous studies related to ecosystem accounting:

Previous studies on ecosystem accounting have been linked to many variables, such as: integrating accounting information about biodiversity - ecosystem services into decision-making processes - social responsibility - shared values for stakeholders in the facility - negative effects of increasing rates of degradation of biodiversity on the performance of ecosystems - using theory Stakeholders in interpreting management's motives towards disclosing certain types of environmental information - lack of information and lack of expertise and competencies - risk management - availability of information technology- availability of computer simulation systems - strength of corporate governance structure as one of the important factors in directing establishments to account for ecosystems. . The diversity of variables associated with ecosystem accounting indicates its importance and novelty. Some previous studies related to ecosystem accounting can be presented as follows:

The study (Van and Busch 2013) was concerned with determining the relationship between increasing investors' awareness of biodiversity issues and its effects on the performance of ecosystems. The study focused on businesses that are directly related to ecosystem issues. The study found an increase in demand for information related to the



extent of the impact of business activities and decisions on biodiversity and the performance of ecosystems. The study also found that financial institutions have begun to reformulate financing standards by adding more conditions and guarantees associated with business establishments with high risks associated with ecosystems.

Researchers believes that relationship between increasing investor awareness and application of biological accounting systems is interconnected. Relationship requires continuous awareness of importance of ecological regulation for all egments of society .Relationship requires continuous interaction between role of the state and the role of individuals to achieve goals of ecosystems.

Attention paid to ecological accounting systems to support environmental accounting .

The study (Murabit 2020) aimed to study the dimensions of the green economy as an interactive system with social and environmental systems. The means and mechanisms provided by the green economy work to combine sound environmental policies with the rules of development. By defining the paths of the green economy as a three-dimensional interactive system that includes integration between the economic, social and environmental dimensions. Determine the repercussions of the transition to a green economy. The study also showed that providing ecosystems helps provide trillions of dollars in clean water, protection from floods, fertile lands, clean air, and disease control. Which indicates the importance of ecosystem services.

Researcherss believes that integration between the dimensions of green economy included within state's strategic plans. State must allocate necessary funds to support green economy activities within state budget. Including ecosystems within green economy budget is one of mechanisms required to achieve ecosystem goals.

The study (Al-Zamar 2020) also focused on clarifying the variables and elements of biological diversity. The elements of biological diversity represent the fundamental factor influencing the performance of ecosystems. The elements of biodiversity in businesses are linked to a variety of direct and indirect inputs and services. Business activities and decisions directly and indirectly affect the variables and elements of biological diversity. Business decisions also affect the performance of ecosystems, either positively or negatively. The positive impact of business activities and decisions on biological diversity and ecosystems represented by the preservation of ecosystems. Reducing the degradation of ecosystems. The negative impact of business enterprises on ecosystems reflected in the enterprise's performance and reputation in the markets through its exposure to many business risks associated with the negative impact.

Researchers believes that biological diversity factors are increasing day after day. Biodiversity factors include multiple areas. Biodiversity factors include: environmental factors - air pollution - water pollution - radiation - disasters - earthquakes - volcanoes - beach erosion - global warming - other factors. Researchers believes it is necessary to identify all biodiversity factors when preparing accounting systems for ecological factors.

The study (Harmáčková 2021) also focused on clarifying the role of accounting for biodiversity and ecosystems. Ecosystem accounting works in a systematic way to monitor and evaluate the performance of ecosystems and the services they provide. Ecosystem accounting is considered a new field of accounting to study the impact of changes in ecosystems. Ecosystem accounting helps measure and trace the flow of services from ecosystems to economic activities. Ecological accounting systems focus on studying the impact of changes in the stock of ecosystems. Determine the extent of its ability to generate services in the future.

Researchers believes that accounting for ecosystems should focus on methods of measuring and disclosing ecosystem factors. Ecosystem accounting must focus on impacts of biological risks. Evaluating effects of biological agents requires developing different models for the risks of biological agents for hedging. Future risk report is one of the reports required to be provided. Providing a future risk report helps provide good accounting information from ecosystem accounting systems.

Researchers believes that diversity of studies on ecosystem accounting indicates its importance, as scientific problems associated with it are diverse. this is evident from following:



- Problem of lack of accounting information related to accounting for biodiversity is considered one of important problems that requires finding continuous solutions with continuous updating. And provide its own data. The problem of lack of future information related to biodiversity risks is one of important issues that focused on more.
- Accounting information on ecosystem services helps in decision-making processes, as decision-making processes result in many social and cost impacts. The more methods for managing risks associated with ecological diversity are available, the greater the ability to avoid the costs associated with biological diversity.
- Accounting information related to ecosystems is considered one of means of success and management of social responsibility. The responsibility for managing social responsibility falls on individuals, the state, and institutions. All individuals in the country share the impact of the risk associated with ecological changes.
- Shared values of facility's stakeholders are considered one of primary drivers for managing risk processes associated with ecosystem accounting.
- Negative effects of increasing rates of biodiversity degradation on performance of ecosystems must be identified. Avoiding the negative effects of ecological diversity on costs of reducing ecological diversity risks.
- Ecological diversity accounting systems are also linked to the use of stakeholder theory in explaining management's motivations towards disclosing certain types of environmental information.
- Emphasis must be placed on the problem of lack of information and lack of expertise and competencies to manage the risks associated with ecodiversity systems.
- (Information technology and dynamic systems - availability of computer simulation systems) must be available in order to manage ecosystem risks.
- Strength of the corporate governance structure also helps in providing accounting information for ecosystems. The corporate governance structure is considered one of the important factors in directing enterprises to account for ecosystems.

Second: Previous studies related to cost reduction and management:

The study (El-Gendy 2019) focused on presenting criticisms directed at cost management systems. The most important criticism directed at cost management systems is that cost management systems are not compatible with the developments taking place in manufacturing systems. Which leads to a deficiency in providing the information necessary to make decisions. Cost management systems developed in companies include several types, including: the activity-based costing system - the target costing system - the continuous improvement system - the reference measurement system - the accounting system for resource consumption - the achievement accounting system.

Researchers believes that ecological accounting systems are directly linked to cost accounting systems. Ecological accounting systems are also linked to management accounting systems. Quantifying cost associated with ecosystems is difficult. Ecosystem costs include various types of costs : direct costs - indirect costs. Measuring and counting cost associated with ecosystems is an important factor in providing information for managing efficiency of ecological accounting systems.

The study (Mohamed 2019) of previous cost management systems also added: product life cycle cost systems - total quality management systems - theory of constraints - balanced scorecard - strategic cost management. The study also focused on the approach accounting for resource consumption in providing essential information about interrelationships between resources and activities and between resources and each other. The study concluded that the approach to accounting for resource consumption is considered the most responsive approach to cost



management systems to developments in the business environment, as it integrates the accounting system for Resource consumption between the advantages of activity-based costing and the German cost approach. It measures the cost of the product and provides management with the information necessary to make sound decisions.

Researchers believes that all cost systems associated with ecological accounting systems aim to provide accounting information about cost. Cost information for ecological accounting systems used to manage ecological risks. Ecological risk management helps avoid danger. Ecological risk management also helps reduce expected costs resulting from biological diversity.

The study (Al-Ekiadi 2019) also aimed to use resource consumption accounting approach to develop budgets prepared on the basis of activity. The resource consumption accounting approach focuses on integrating the activity-based costing system. The German cost management model. Focus on the facility's resources. Avoid criticism of traditional cost systems.

Researchers believes that ecological accounting systems are linked to process of resource consumption. Concept of ecosystem accounting extends to include both natural and non-natural resources. Ecological accounting systems are increasingly paying more attention to natural resources. Ecosystem accounting is also increasingly interested in environmental resources.

In addition to the new philosophies of cost management and reduction, the study (Mohamed 2019) presented a four-dimensional matrix consisting of:

- Flexible production systems or the humanitarian systems approach (the waste-free approach).
- Target cost input.
- Introduction to minimizing Six Sigma deviations
- Information technology.

The study (Al-Maghrabi 2022) aimed to highlight the importance of the role played by the use of cost databases in increasing effectiveness of cost information system in the modern manufacturing environment. The study concluded that use of cost databases helps provide important characteristics in information outputs of cost information system. The most important characteristics of the cost accounting information system include: the field characteristic - the synchronization characteristic - the aggregation characteristic - Integration characteristic. Which in turn leads to increasing the effectiveness of the cost information system in the modern manufacturing environment system.

Researchers believes that the biggest problem in the process of determining characteristics of ecological accounting systems related to cost is providing information about cost. There are various classifications of ecosystem costs according to their purpose. Process of determining cost characteristics of ecosystems helps in decision-making process. Process of determining cost characteristics of ecosystems also helps in managing information for decision-making.

The study (Hamouda 2023) also aimed to test the effect of Saudi industrial joint-stock companies' . Use of the resource consumption accounting system on reducing environmental costs, in addition to testing the effect of Saudi industrial joint-stock companies' use of the resource consumption accounting system on reducing the costs of: environmental prevention - environmental control - environmental inventory and measurement. - Costs of environmental failure. The study found a positive impact of using the resource consumption accounting system on reducing environmental costs through: providing a comprehensive view of resources - determining the cost of idle energy - allocating indirect costs accurately - reducing environmental prevention costs - reducing environmental control costs - reducing environmental inventory and measurement costs - Reducing environmental costs of failure.



Reviewing previous studies on the research topic, the Researchers sees that there is diversity in the variables associated with accounting for ecosystems and environmental costs. In addition to the many branches of accounting that include ecological variables and environmental cost variables.

Reviewing previous studies on research topic, Researchers finds following:

- There is diversity in variables associated with ecosystem accounting and costs associated with them.
- Importance and role of environmental costs are increasing in process of managing and reducing the costs resulting from ecosystem risks.
- Environmental costs associated with ecosystems are not limited only to actual environmental costs. Future environmental costs must be taken into account to avoid future environmental risks.
- There are many branches of accounting that include ecological variables, including (environmental accounting - financial accounting - cost accounting - management accounting).
- Providing complete accounting information requires increased focus on accounting standards that support the process of measuring impact of ecological diversity, especially with regard to future assessments of effects of ecological diversity.

Based on previous variables, Researchers believes that research problem and its hypotheses can be determined.

2- RESEARCH PROBLEM:

Despite the continuous increase in environmental changes in all fields, and despite the increasing environmental risks of ecological diversity and the environment. However, there are many problems facing containing environmental and ecological changes in general. Solve accounting problems related to ecosystem accounting in particular. Among the most important problems facing ecosystem accounting in its ability to reduce environmental costs are:

- Lack of data on changes in ecosystems.
- The connection of ecosystems to the future and the state of uncertainty, which results in many risks.

The process of reducing environmental costs in ecosystem accounting is also considered an important and essential pillar for containing the problems associated with ecosystem accounting. To determine the relationship between ecosystem accounting and reducing environmental costs.

3- RESEARCH OBJECTIVES:

The general objective of the study is to determine the relationship between ecosystem accounting and reducing environmental costs, and to determine the impact of using ecosystem accounting on reducing environmental costs.

4- IMPOSING THE SEARCH:

Hypothesis of study are : There is a statistically significant relationship between the use of ecosystem accounting and the reduction of environmental costs.

5- The importance of research:

Research derives its importance from the following:

A- Practical importance:

Various environmental changes sweeping throughout the year, threatening the health and food security of humans on the planet, more attention must be paid to ecosystems, climate diversity, and the environment in general in all fields.

B- Scientific importance:

This study presents many accounting issues related to accounting for ecosystems, and their connection to environmental costs. The study of ecosystem accounting is considered one of the important scientific areas



that must be focused on. Scientific studies of ecosystem accounting can contribute to reducing environmental costs.

6- RESEARCH METHODOLOGY:

Researchers relied on both inductive approach and deductive approach to achieve objectives of study :

Inductive method: Reviewing and extrapolating studies dealt with research topic by following book study method of Arab and foreign.

Deductive approach: logical thinking and an attempt to determine relationship between ecosystem accounting and reducing environmental costs. Identifying cost management tools that have the most impact on reducing environmental costs. Contributing to reducing the gap in the lack of environmental information associated with ecosystem accounting.

7- SCOPE OF THE SEARCH:

Research focuses on determining the relationship between ecosystem accounting and reducing environmental costs by presenting the concepts associated with ecosystems and ecosystem accounting. It presented the most important cost management tools and identified the tools most used to influence the reduction of environmental costs.

8- SEARCH VARIABLES:

The independent variable is ecosystem accounting and can be determined by presenting the theoretical framework of ecosystems and ecosystem accounting. The dependent variable is reducing environmental costs, and it can be clarified by presenting cost management tools and identifying the tools most closely related to reducing environmental costs.

9- RESEARCH PLAN:

In light of the research limits and hypotheses and to achieve its objectives, the Researchers can divide the research into the following:

9-1 Ecosystems:

Ecosystems are linked to many environmental and climate variables, such as: local temperature regulation - carbon storage - real estate value proxy - air pollution reduction - green space density - surface runoff regulation - income proxy - population density. The concept of ecosystems combines many ecological and social variables (Ibrahim 2023).

The ecosystem is considered one of the most important systems that takes into account the conditions of the surrounding environment and works to develop it. The ecosystem is defined as: the participation of surrounding environment of business facilities, including products and requirements. Creating a change in nature of products to keep pace with the demands of the surrounding environment. The ecological system represents the study of the mutual needs between the facility and the environment and the work to develop it to keep pace with the increasing needs (Abu Al-Maati 2013).

The ecosystem, in accordance with the quality standard (ISO14001), aims to increase environmental concerns in all aspects and activities carried out by economic units. Emphasizing the importance of every individual in the economic unit bearing responsibility towards the surrounding environment and society to achieve environmental



interaction and balance. By providing a framework in which environmental objectives are one of the main inputs to the decision-making process (Cauchick 2015).

9-2 Ecosystem Accounting:

Recently, the Society of Chartered Accountants in England and Wales called on business organizations to include the results of social and environmental performance in financial reports. Reflecting the health of the ecosystem. France also called on professional accounting associations to oblige professional organizations to disclose their social performance in order to know the degree of social commitment to ecosystems (Youssef 2020).

The Researchers believes that ecosystem accounting includes many accounting aspects and dimensions. Ecosystem accounting can be viewed according to the perspective of financial accounting, which deals with aspects of measurement , disclosure of variables related to dimensions and ecosystems within the scope of accounting standards that include aspects of measurement, risks, and future expectations in accordance with the text of accounting standards for each of: accounting policies and changes - disclosure of future assumptions - disclosure of Risks - estimating effects and uncertain future events of the book values of assets and liabilities - Cash flows and discount rates depending on the risks.

Ecosystem accounting can also be linked to both cost accounting and management accounting. Regarding cost management methods. Cost reduction operations.

The Researchers believes that for the purposes of environmental costs, the focus will be on ecosystem accounting from perspective of cost accounting and management accounting using cost management tools for the purposes of reducing environmental costs.

9-3 Environmental costs:

Environmental costs help management in making rational administrative decisions. It is an important part of accounting information. Especially in industrial companies. Therefore, it is necessary to provide a cost system that helps companies identify and measure environmental costs (Qamish 2020).

Environmental costs can be defined as all costs incurred by the company to reduce the negative impact of its activities on the environment, compliance with environmental laws and legislation, costs of monitoring and controlling sources of environmental pollution, and costs of eliminating any negative impact that the company has on the environment. In addition to the costs of activities to measure and monitor potential sources of environmental damage (Hamouda 2023).

Environmental costs can be classified as follows:

- Classification of costs according to activities, including: costs of prevention activities - costs of inventory and measurement activities - costs of control activities - costs of environmental failure activities.
- Classification of environmental costs according to the accounting cycle, including: capital environmental costs - current environmental costs.

From the above, the Researchers believes that ecosystem accounting can be represented by an accounting information system that includes a set of inputs related to ecosystems, biological diversity, and the various surrounding environmental variables. In order to produce environmentally friendly products with the lowest environmental costs. Ecosystem variables and environmental costs are closely related.

9-4 The relationship between technological diversity and ecosystem services:

There is a reciprocal relationship between technological diversity and ecosystem services. Within the framework of only two types of services provided by biological diversity and ecosystems (Al-Sawy 2014):



- The first type relates to supply services, which are the group of services produced by ecosystems, such as fuel, natural medicines, wood, fibers, etc., and this group is considered a major input for some types of business facilities.
- The second type relates to regulatory services related to climate regulation. Regulating the chemical composition of the atmosphere. Temperature regulation and more. Regulatory services are linked to ecosystem and are not consumed directly. Regulatory services are indirectly related to performance of business enterprises.

The Researchers believes that in light of the interconnected relationships between ecosystems and environmental costs, methods and models for evaluating ecosystem variables and environmental costs must be determined.

9-5 Methods and models for evaluating variables and elements of biodiversity and ecosystem services:

There are many methods for evaluating ecosystems, the most common of which are: the resource rent method, the replacement cost method, and the damage avoidance method can be explained as follows (Vardon 2015):

- Supplier rent method depends on estimating the supplier rent as the remaining revenues after subtracting all costs. It expresses the return on natural assets used in the production process according to the following equation:

$$RR=TR-(IC + Lc +Fc)$$

Whereas:

RR	Supplier rental value
TR	Total revenues: Expresses the value of sales at basic prices , i.e. their value before subtracting government subsidies, if any , taxes on products and add value added tax.
IC	Only current operating costs, not capital costs.
Lc	Labor costs used.
Fc	Depreciation and capital cost

- Damage avoidance cost method used in absence of a suitable alternative to ecosystem services. Under this method, the value of ecosystem services is estimated based on the costs that could have been borne in the absence of ecosystem services.

From the above, the Researchers sees multiple accounting problems related to ecosystem variables and environmental costs. The Researchers also believes it is necessary to use cost management tools to reduce environmental costs. Identifying the most appropriate cost management tools to use to reduce environmental costs.

9-6 Using cost management systems to reduce costs in ecosystems:

1. Using an activity-based costing system helps reduce costs in ecosystem accounting through:
 - Providing comprehensive information about environmental activities related to ecosystems.
 - Increasing the effectiveness of the control system by monitoring the activities that cause indirect costs and then identifying those causing the increase in costs.
 - Determine the current and future constraints faced by industrial companies by identifying the risks associated with identifying exploited and unexploited energy.
 - Reducing costs in environmental industrial companies by identifying and enhancing activities that add value and excluding activities that do not add value.
2. Applying a continuous improvement system in ecosystems helps to carry out continuous development and improvement processes during the stages of production and interaction in ecosystems, and helps to:
 - Reducing waste in activities leading to product production.
 - Reducing costs by removing performance obstacles.



- 3 .The target cost system helps reduce costs in accounting for ecosystems despite the criticism directed at it regarding its ability to confront environmental challenges. This is due to:
 - Lack of information related to ecosystem accounting included in the facility's internal databases.
 - The difficulty of continuing to maintain the targeted cost for industrial companies operating in the environmental field had a direct and indirect impact on ecosystems, with the high degree of risks associated with the change and diversity of biological factors.
- 4 .The achievement accounting system is linked to ecosystem accounting through two basic measures:
 - Inventory measure: While inventory expresses the amount of money invested in industrial companies in purchasing raw materials, in-process products, and finished products for the purpose of reselling them, the concept of inventory in ecosystems is linked to the stock of natural resources and its ability to produce products from ecosystems.
 - Operating expenses measure: It measures the money spent by industrial companies in converting inventory into completion productivity. It expresses external flows and is not linked to specific function.
- 5 .The resource consumption accounting system combines activity accounting and cost accounting by allocating the planned and actual costs on the basis of the resources consumed measured in quantitative form. The cost flows from resource pools to various cost measurement topics, which include: activities - operations - products - customers, with interconnected relationships between the resources.

Resource consumption accounting is considered an entry point to cost management through the optimal use of the facility's resources. Do not burden the products with the cost of unused resources. By applying the principle of causality in the process of allocating the cost of the resources consumed to cost purposes, whether they are the products or services that you benefited from. In order to achieve the following goals (Safaa Abdel Dayem 2014):

- Providing a comprehensive overview of the facility's available resources and their costs, with a focus on the mutual relationships between them.
 - Controlling the use of the facility's resources by tracking quantities of used and unused resources. Identifying the untapped energy from each resource on an ongoing basis. Which helps rationalize resource consumption costs. Achieving optimal exploitation of available resources.
 - Measuring the extent to which the goals of reducing costs of used and unused resources are achieved with aim of activating idle capacities. And development of the energy used.
 - Taking about account principle of causality when charging products with cost of resources consumed by the facility's activities, which helps in calculating cost of product more accurately and objectively.
- 6 .Flexible production systems can be used to reduce costs in ecosystem accounting by reducing stagnant inventory and using a spot purchasing policy. Relying on systems that operate within specified cost limits. Robotic technologies can be used in production processes to reduce costs.

The Researchers believes that using various methods of cost management in ecosystem accounting can help narrow the gap resulting from the lack of information in ecosystem accounting. Which helps in decision-making processes. This depends on the organization's ability to find solutions to the difficulties facing the use of cost management systems in accounting for ecosystems to reduce environmental costs.

9-7 Difficulties in using cost management systems to reduce environmental costs in ecosystems:

- 1- The difficulties of applying activity-based costing system in ecosystems are: cost application is high - the lack of experience and competence of those working in the application - the application difficulties related to information technology - reliance on financial standards only.
- 2- The difficulties of applying target cost systems in ecosystems are: the difficulty of continuing to maintain the target cost with ongoing technological developments - the lack of precise determination of the level of target costs.



3- The difficulties of applying the achievement accounting system in ecosystem accounting are represented in: The achievement accounting system cannot be applied alone. The implementation of the completion accounting system must be linked to other cost management systems so that it can achieve its role in reducing costs based on reducing completion time.

9-8 Disclosure of environmental costs:

The concepts contained in the Global Sustainability Initiative, and the concepts associated with national environmental accounting, include (Wahib 2019):

- The concept of sustainable development. It includes the necessity of meeting the needs of those present without compromising the ability of future generations to meet needs.
- The concept of sustainability reporting considered an accounting practice to measure the performance of an economic unit towards achieving the goal of sustainable development and disclosing performance. Bearing responsibility before the concerned internal and external parties, including addressing economic, environmental and social impacts. This report should accurately and objectively explain the performance of the economic units preparing this report with regard to sustainability.
- Environmental variables can be disclosed in accordance with the United Nations Integrated System of National Accounts for the purpose of providing environmental accounting information as follows:

**Accounting Disclosure
list for productive assets**

Items	Value
A- The balance of economic assets at beginning of the period	
Added to it: <ul style="list-style-type: none"> ▪ The total capital formation of all productive assets other than those produced for environmental protection. ▪ The total capital formation of assets produced to protect the environment. ▪ Other accumulations of productive economic assets and capital accumulations. 	
(-) incomplete: <ul style="list-style-type: none"> ▪ Consumption of fixed capital other than productive assets for environmental protection. ▪ Fixed capital consumption of productive assets for environmental protection. ▪ Deterioration of productive assets that is not reflected in the market value of assets. 	
B - Capital accumulations of productive assets (corrected net domestic product - other changes in the volume of productive assets other than deterioration). <ul style="list-style-type: none"> ▪ Plus/minus/gains/losses on ownership of productive assets. 	
C- End-of-term balance of productive assets.	

**Accounting Disclosure
Non-produced assets**

Items	Value
A- The beginning balance of non-productive economic assets	
In addition: the capital formation of all other non-productive economic assets.	
Minus: exhaustion (consumption) of non-productive economic assets.	
The deterioration of non-productive economic assets is reflected in the market	



value of assets. The deterioration of non-productive economic assets is not reflected in market value.	
B- Net capital accumulations of non-productive economic assets (corrected output) Minus: other changes in the volume of non-productive economic assets other than exhaustion Plus/minus: gains or losses on non-productive economic assets.	
C- End-of-period balance of non-productive economic assets.	

Source: Wahib . 2019. pp. 18-19

10 FIELD STUDY:

– **Objective of field study:**

Researchers aims to determine the relationship between ecosystem accounting and reducing environmental costs.

– **Assignment:**

What is the relationship between ecosystem accounting and reducing environmental costs?

– **Community and sample :**

Study sample consists of three groups:

- Employees of environmental companies.
- University faculty members.
- Auditing office employees.
- Study sample consists of 75 individuals.
- Sample members were divided equally into three groups.
- Each group consists of 25 items.
- Response rate of recovered lists for statistical analysis determined after determining initial sample for all study categories.
- Researchers sorted professor in explorations in next table:

Table of response rate and validity of retrieved lists

Study sample	Distributed lists	Recovered lists		Rejected lists		Lists suitable for analysis		
		Number	Ratio *	Number	Ratio **	Number	Ratio **	Ratio ***
Employees of environmental companies	25	25	100%	1	4%	24	96%	34.78%
University faculty members	25	25	96%	2	8.33%	22	91.67%	31.88%
Workers in accounting and auditing offices	25	23	92%	0	0%	23	100%	33.33%
Total	75	72	96%	3	4.17%	69	95.83%	100%

*Percentage of distributed lists.

** Percentage of lists recovered.

*** Percentage of the total sample.

Comments:

- Response rate to lists is 96%. The response rate is very high.
- Response rate to valid lists is 90% for each category of the study.



- Response rate for all lists is 95.83%, which is a good percentage.

- Data collection method

Researchers relied on:

- Identify important points for ecosystem accounting.
- Identify important factors that affect reducing environmental costs.
- Researchers relied on a survey list containing a set of questions to test validity of research hypotheses.

- Structural design:

- First section : personal data.
- Second section: Questions of survey list.

The survey list also includes two sets of inquiries as follows:

The first group:

Group includes questions test whether or not there is a relationship between variables of study hypothesis.

Group includes:

- Questions express independent variable for study hypothesis, ecosystem accounting , and are expressed in a number of (9) statements.
- Questions express dependent variable of study hypothesis, reducing environmental costs, and expressed in a number of (6) statements.

- Statistical methods:

Researchers relied on five-tiered Likert model, to design answer to inquiries in a gradual way. Likert scale determines the degree of agreement by determining the arithmetic mean.

Opinion trend of five-point Likert scale

Direction Opinion of five-point Likert scale		
Degree of approval	(Weights)	Opinion direction (approval decision)
Very disagree	1	Average from 1 to 1.79: Very disagreeable
not agree	2	Average from 1.80 to 2.59: disagree
neutral	3	Average from 2.60 to 3.39: neutral
OK	4	Average from 3.40 to 4.19: Agree
Very ok	5	Average of 4.20 to 5: Very OK

Some statistical methods contained in Statistical Package for Social Sciences (SPSS) used.

- Study tool:

First: Frequency and relative distribution of basic data of respondents

Frequency and relative distribution of basic data of respondents

According to educational qualification			According to years of experience		
Qualification	Repetition	Rratio	Years of Experience	Repetition	Ratio
PHD	9	13%	less than five years	13	18.8%
Master's	18	26.1%	From five years to less than ten years	13	18.8%
Professional diplomas and certificates	15	21.7%	From ten years to less than fifteen years	14	20.3%
Bachelor's	27	39.1%	Fifteen years and over	29	42%
Total	69	100%	Total	69	100%

Testing hypothesis of study



1- Testing hypothesis of study

Describing opinions about the statements that define the ecosystem accounting variable

The Elements (statements) that define the ecosystem accounting variable	Descriptive statistics measures			
	Arithmetic mean	standard deviation	relative weight %	approval order
1- 1- Ecosystems represent a major component of natural capital, which lies in natural resources and environmental assets from which resources and services flow to the business sector. Ecosystems represent a dynamic complex of communities of living organisms and their non-living environments interacting as a functional unit.	**4.2	0.759	84%	1
2- 2- Ecosystems consist of the physical, biological, and chemical components of ecosystems, such as soil, water, living organisms, and nutrients.	**4.13	0.764	82.6%	4
3- There are two types of products of ecosystems. The first type includes that are consumed directly, such as water, foodstuffs, medicines, fibers, and wood. The second type of ecosystem products includes products that are consumed indirectly, such as food recycling processes.	**4.03	0.766	80.6%	9
4- With the expansion of the circle of environmental dimensions, increased awareness of facility stakeholders, and increased interest in the risks of biodiversity degradation, the role of using cost reduction tools increases with ecosystem accounting.	**4.13	0.821	82.6%	6
5- Integrating accounting information into ecosystem accounting affects the ability and flexibility to use cost reduction tools.	**4.13	0.726	82.6%	3
6- Ecosystem accounting begins from the perspective of ecosystems and their services originate and flow to the economic activities of business enterprises. As systematic way to monitor and evaluate performance of ecosystems and the services they provide.	**4.04	0.794	80.8%	8
7- Biodiversity is considered one of the environmental assets that influence ecosystem accounting as a store of value. Biodiversity is also considered one of inputs to economic production processes.	**4.12	0.796	82.4%	7
8- Ecosystem accounting can be classified into three types affected by ecosystems include: <ul style="list-style-type: none"> - Business establishments that have a direct impact on ecosystems, such as establishments operating in extractive industries, chemicals, fertilizers, and contracting sectors. - Establishments cycle of operations depend mainly on ecosystems, such as establishments operating in agricultural, food, and pharmaceutical sectors. - Business establishments indirectly affected by ecosystems, such as establishments operating in financial services sector 	**4.13	0.765	82.6%	5
9- Cash flows classified under ecosystem accounting according to their connection to business practice into four groups: <ul style="list-style-type: none"> - Purchased inputs include biological materials derived from 	**4.17	0.839	83.4%	2



renewable and non-renewable sources and are included in material costs and operating expenses.				
- Inputs that businesses depend on and are not purchased include components of biodiversity and ecosystem services that live in the ecosystem and from which businesses benefit. They are linked to some elements of indirect costs such as wages, salaries, and machinery depreciation.				

It is noted from that:

- Arithmetic mean values of all respondents'. Responses refer to all items (greater From 3) Opinions tend to favor agreement on ecosystem accounting variable.
- Relative weight ratios of all the elements, which exceed 60%, representing the choice of "neutral".
- Arithmetic means of all the expressions were statistically significant at a significant level (0.05).
- There are differences (significant differences) in the opinions of respondents among the observed values.
- The value (3) is representative of neutral selection.
- Descriptive statistics for variable of reducing environmental costs .

Describing opinions about the statements that reflect the variable of reducing environmental costs

The elements (statements) that define the variable of reducing environmental costs	Descriptive statistics measures			
	Arithmetic mean	standard deviation	relative weight %	approval order
1- Overcoming the difficulties of applying activity-based costing system in ecosystems, represented by (high cost of application - the lack of experience and competence of those working in the application - the application difficulties associated with information technology - relying on financial standards only) helps reduce environmental costs.	**4.55	0.582	91%	1
2- Overcoming the difficulties of applying target cost systems in ecological systems, represented by (the difficulty of continuing to maintain the target cost with continuous technological developments - the lack of precise determination of the level of target costs) helps reduce environmental costs.	**4.48	0.655	89.6%	4
3- Overcoming the difficulties of applying the achievement accounting system in ecosystem accounting represented by (the impossibility of applying the achievement accounting system alone) helps in reducing environmental costs.	**4.42	0.673	88.4%	5
4- The implementation of the completion accounting system must be linked to other cost management systems so that it can achieve its role in reducing costs based on reducing completion time.	**4.48	0.633	89.6%	3
5- Integration of cost management tools in ecosystem accounting helps reduce environmental costs.	**4.32	0.757	86.4%	6
6- Providing and disclosing complete information about ecosystems helps reduce environmental costs .	**4.48	0.609	89.6%	2

**** Statistically significant at a significant level of 0.05**

From table :

- Arithmetic mean values of all respondents' responses refer to all items (greater From 3).
- Opinions tend to favor agreement on reducing environmental costs >
- Relative weight ratios of all elements, which exceed 60%, representing choice of "neutral".
- All arithmetic means of all expressions were statistically significant at a significant level (0.05).



- There are differences (significant differences) in opinions of respondents among observed values. The value (3) is representative of neutral selection.

In light of descriptive analysis of data related to study's hypothesis, Researchers believes that study sample agrees on importance ecosystem accounting and its role in reducing environmental costs, which supports validity of study's hypothesis. To confirm this agreement.

Researchers addresses discrepancy (extent of agreement and disagreement) in the opinions of the sample groups regarding the related statements. Study assumed through Kruskal-Wallis Test is applied to variables whose data do not follow a normal distribution to measure variance between several independent samples, as follows:

Analysis of variance between opinions of sample groups about data of study hypothesis

Elements (dimensions) associated with study hypothesis	sample category	Views	Rank average	arrangement	Morale test Kruskal-Wallis
Elements that define ecosystem accounting indicators	Employees of environmental companies	24	34.98	2	0.509
	University faculty members	22	38.55	1	
	Workers in accounting and auditing offices	23	31.63	3	
	Total	69			
Elements that determine the variable of reducing environmental costs	Employees of environmental companies	24	35.06	2	0.99
	University faculty members	22	35.07	1	
	Workers in accounting and auditing offices	23	34.87	3	
	Total	69			

***Statistically significant at a significant level of 0.05**

Previous table clear:

- Average values of ranks and rankings indicate that highest group in agreement with data of study hypothesis is sample category belonging to university faculty members. with average ranks of (38.55, 35.07) for first and second variables of study hypothesis, respectively.
- Values of level of significance of Kruskal-Wallis Test for data related to two study hypothesis variables reached (0.509) (0.99), respectively, which is greater than 5%. This indicates that there are no differences between the groups representing the sample under investigation, and there is agreement among them on the role and importance of accounting. Ecosystems in reducing environmental costs.

After descriptive analysis of the study hypothesis data and showing the extent of agreement of study sample categories, Researchers tests validity of study hypothesis through correlation and regression analysis through following research point:

Study hypothesis tested through correlation and regression analysis as follows:

a) Correlation analysis of study hypothesis variables:

Correlation between variables of study hypotheses

dependent variable	Independent variable	Correlation data	(Y): Reducing environmental costs
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(X): Indicators for measuring the ecosystem accounting variable	Correlation coefficient (R)	0.621
	Moral level	**0.000

** It indicates a significant correlation coefficient at a significance level of 0.01

- Sign and value of correlation coefficient (0.621) indicate that there is a direct relationship between ecosystem accounting and reducing environmental costs. This means that the more the company commits to applying ecosystem accounting, the lower its environmental costs.
- Significance of correlation coefficient (0.00), which is less than the level of significance (0.01), confirms acceptance of assumption that there is a significant, statistically significant correlation between ecosystem accounting and reducing environmental costs.

a) Regression analysis of study hypothesis variables:

The following table shows results of simple regression analysis for variables of study hypothesis, as follows:

Results of regression analysis of study hypothesis variables

Statement	Regression coefficient (B)	t-test values	Moral level	Statistical significance
constant amount (BO)	2.458	7.890	0.000	Statistically significant
(X) Ecosystem accounting measurement indicators	0.484	6.485	0.000	Statistically significant
Explanatory value of model: coefficient of determination $[R]^2 = 0.386$				
Overall significance of model: level of significance for ANOVA analysis = 0.000				
F test value = 42.052				

Following results are evident from previous table:

- Positive sign of regression coefficient indicates that there is a direct effect of using ecosystem accounting and reducing environmental costs, and the value of regression coefficient indicates that whenever independent variable increases one unit, this leads to an increase in the dependent variable (by 0.484) units.
- Significance of t-test for independent variable (0.00), which is less than level of significance (.05), confirms acceptance of hypothesis that there is a relationship between the use of ecosystem accounting and reducing environmental costs.
- Coefficient of determination (R^2), which is (0.386), indicates the extent to which independent variable explains dependent variable, as it explains it by (38.6%), and the rest of percentage is due to other variables and reasons.

Researchers concludes from the above that there is a relationship between the use of ecosystem accounting and reducing environmental costs, which supports validity of study's hypothesis.

11-SEARCH RESULTS:

- The main problem in ecosystem accounting is the lack of information related to biological diversity. In addition to the connection of information to the future and the difficulty of predicting it.
- The difficulty of predicting future information in ecosystem accounting results in many risks. Organizations work to reduce these risks as much as possible.
- Ecosystem accounting helps reduce future risks to biodiversity by reducing environmental costs.
- Ecosystem accounting is linked to several types of accounting, including financial accounting, cost accounting, and management accounting.
- Overcoming the difficulties facing cost management methods accounting for ecosystems helps reduce environmental costs.



- Overcoming the difficulties of applying activity-based costing system in ecosystems, represented by (cost of application - the lack of experience and efficiency of working in the application - the difficulties of application associated with information technology - reliance on financial standards only) helps reduce environmental costs.
- Overcoming the difficulties of applying target cost systems in ecological systems (the difficulty of continuing to maintain the target cost with ongoing technological developments - the lack of precise determination of the level of target costs) helps reduce environmental costs.
- Overcoming the difficulties of applying the achievement accounting system in ecosystem accounting represented by (the impossibility of applying the achievement accounting system alone) helps reduce environmental costs.
- The application of the completion accounting system must be linked to other cost management systems in order to be able to achieve its role in reducing costs based on reducing completion time.

12-RESEARCH RECOMMENDATIONS:

- The need to reformulate financing standards by adding more conditions and guarantees related to business enterprises with high risks associated with ecosystems.
- The need for the concerted efforts of many specialists, such as accountants, economists, and environmental scientists, to provide accounting information that can be used by decision makers in the public and private sectors.
- The necessity of developing specific mechanisms to deal with the increased demand for information related to the extent of the impact of business activities and decisions on biodiversity and the performance of ecosystems.

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