World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

USING PRODUCT LIFE CYCLE COSTS IN ACCORDANCE WITH SUSTAINABILITY ACCOUNTING STANDARDS TO ACHIEVE CLEANER PRODUCTION-AN APPLIED STUDY IN THE NATIONAL COMPANY FOR CHEMICAL AND PLASTIC INDUSTRIES

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Article history:

Received: 8th January 2025
Accepted: 7th February 2025

Abstract:

This research aims to apply the notion of product life cycle costs in agreement with sustainability accounting standards, in order to achieve cleaner production, reduce costs, and reduce environmental risks. The use of this technology, which classifies costs into costs that are harmful to the environment and others that are harmless according to the stages of production, will contribute to providing accurate Details on the environmental factors linked to industrial activities inside the factory, which helps to understand their environmental impacts and damages. The research problem is the continuous increase in product costs and environmental risks resulting from lack of adaptation to modern developments, as well as the growing gap between increasing material needs and shortage of natural resources. Therefore, promoting the concept of sustainability and product life cycle accounting towards cleaner production is crucial for global economic and social development.

Keywords: product life cycle, sustainability accounting standards, cleaner production, Chemical standard.

INTRODUCTION:

The rapid development of industry has led to the recovery and prosperity of the global economy, and on the other hand, it has also inflicted harm on the ecosystem. due to the waste generated during the production process, and this is reflected in the costs that each unit should spend to solve the impact of waste and environmental emissions. The problem of the research was the increasing costs of products and their environmental risks because of not staying abreast of contemporary advancements, with the increasingly apparent contradiction between increasing material needs and decreasing natural resources. Promoting the transition of sustainability and product life cycle accounting to cleaner production has become an important issue in global economic and societal advancement. With the technological development that the world has achieved today to enhance the social and economic conditions of humanity and attain human well-being through the unjustified exploitation of natural resources, which causes major problems and puts pressure on the environment, the latter has become global. Obtaining it from industrial waste has become a requirement for protection, and it has become necessary for institutions to adopt modern practices to protect the environment. Given the nature of the activity of industrial enterprises and the risks they pose to the environment and society, they have resorted to introducing sustainable accounting standards according to the sections related to all industries.

The first section: research methodology and previous studies

The first axis: research methodology

- THE RESEARCH PROBLEM.

The study focuses on the growing costs of goods and the environmental risks associated with the failure to adapt to modern improvements, as well as the growing contradiction between increasing material needs and decreasing natural resources. Therefore, it has become necessary to promote the transition of sustainability accounting and product life

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

cycle costs towards cleaner production, as this is vital in global economic and social development. In the context of Based on the research problem, the subsequent questions might be articulated:

1. What are product life cycle costs, and how do they contribute to achieving cleaner production?
2. What is the extent of understanding among Iraqi industrial economic units about the significance of information derived from the product life cycle costs in achieving cleaner production requirements?
3. Does applying the product life cycle in accordance with sustainability accounting standards lead to achieving cleaner production?

- **RESEARCH OBJECTIVES:**

Within the framework of This research primarily seeks to examine the influence of product life cycle costs in alignment with sustainability accounting standards and its significance in facilitating cleaner manufacturing within economic entities. The research aims to accomplish the following objectives:

1. Examine and evaluate product life cycle costing technologies, encompassing its expenses, operational stages, prerequisites, advantages, and effects on minimizing waste and environmental harm.
2. Examine and evaluate sustainability accounting standards to achieve cleaner production.
3. Study and analyze the application of product life cycle costs according to sustainability accounting standards and its impact on cleaner production.

- **The importance of research:**

The significance of the research stems from the potential additions it can provide on the scientific level, through the impact of product life cycle costs according to sustainability accounting standards in promoting clean production. This, in turn, contributes to achieving environmental, economic and social indicators.

- **Research hypothesis**

To address its problem, in line with its objectives, the research relies on two main hypotheses, which are as follows:

1. A substantial correlation exists between the incorporation of product life cycle expenses in accordance with sustainability accounting standards and cleaner production.
2. The utilization of product life cycle expenses in accordance with sustainability accounting rules significantly influences cleaner production.

- **Research methodology**

In the context of an attempt to achieve the research objectives and prove the validity of its hypotheses, two approaches were adopted:

1. Inductive approach: To review the literature that dealt with research topics and paragraphs for the purpose of arriving at theoretical analysis and conclusions that support the researchers' ideas and perceptions.
2. 2. Descriptive (analytical) approach: To examine the efficacy of the accounting system in assessing the product life cycle within the framework of sustainability accounting standards in the Iraqi industrial context, and to analyze it in accordance with cleaner production requirements and indicators to achieve the intended outcomes of the research.

Sixth: Previous studies:

1. **(** Saeed**&** ali) for the year 2022 entitled This research seeks to examine the influence of product life cycle costing technologies and cleaner manufacturing strategies on cost reduction. This can be achieved by analyzing the product life cycle and working to protect the environment by reducing pollutants resulting from production processes, focusing on the concept of cleaner production. Among the main findings, It turns out that using product life cycle costing technology provides valuable information that contributes to accurate pricing and effective cost management. The basic recommendations also include the need for the company to pay attention to the post-production stage, especially in the field of marketing, by providing multiple marketing channels in various geographical locations.
2. (Klymenko et al) for the year 2021 designated The digitization of industrial processes seeks to gather data and information that enhances sustainability accounting systems, so improving decision-making and promoting more sustainable corporate operations. A key conclusion is that the organizations in issue depend on digital technology for automation and robotics, resulting in the generation of substantial digital data pertaining to operations. Nonetheless, this data is excluded from the computation of environmental and social values. A crucial advice is to examine diverse accounting difficulties via a sustainability lens to augment understanding in this domain.
3. (Oliveira et al) for the year 2021 titled Development in the Context of Industry. This research seeks to do a thorough literature assessment to delineate the research landscape about the application of industrial revolution

World Economics & Finance Bulletin (WEFB)
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Vol. 44, March, 2025
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technologies in advancing sustainable development and enhancing product life cycle management inputs. A key conclusion is that sectors and institutions are increasingly embracing disruptive innovation, facilitated by either digital transformation or a shift towards sustainability.

4. (Al-Ghozi) for the year 2022 designated This research seeks to examine, evaluate, and ascertain the characteristics of the factors, prerequisites, and essential resources for cleaner manufacturing technology. One of the key findings is the potential to get competitive advantage in the business landscape by minimizing costs and improving sustainability dimensions (environmental, social, and economic) through the utilization of cleaner manufacturing technologies. A key recommendation was the necessity for more studies and research to enhance the understanding of clean production technology and its use in economic units. ThereforeThis study complements earlier research by employing the product life cycle costing approach in accordance with sustainability accounting requirements to attain cleaner production.

The second section: The theoretical aspect

Business entities face significant challenges as they try to survive and remain competitive. Therefore, it needs to improve its capabilities in the hope of retaining its customers by providing environmentally friendly products and its ability to meet environmental, legal, social and economic requirements and achieve competitive advantages that will allow it to maintain its position in the business market. Therefore, the product life cycle concept and sustainability accounting standards are important to achieve cleaner production and protect the environment. Therefore, this research offers a comprehensive understanding of the product life cycle, sustainability accounting standards, and the principles of cleaner production.

- The concept of product life cycle technology

The product life cycle is a contemporary approach designed to minimize product expenses throughout its lifespan. It addresses the phases preceding, occurring during, and following manufacturing. The product life cycle encompasses the duration a product undergoes, beginning with research, development, and engineering, and concluding with its disposal. fees connected to the product life cycle encompass all expenditures incurred over this duration, including disposal fees. (Hansen,2009:483), Life cycle costing offers a comprehensive perspective, including the total expenses associated with a product throughout its life cycle. (Blocher et al., 2010, p. 561). The product life cycle technology idea is employed to identify and assess the comprehensive costs associated with items throughout their lifespan, encompassing research and development expenses as well as waste disposal costs. This approach aids in cost reduction and rationalization, hence enhancing competitiveness and facilitating the decision-making process. Basili et al. (2017, p. 316) According to Grieves, it is a holistic, information-centric methodology encompassing all phases of a product's lifecycle, including design, manufacturing, utilization, maintenance, decommissioning, and final disposal. (Grieves ,2005:72) By Shank, Govindarajan, by product life cycle costs, we refer to all expenditures spent by the firm during the product's lifespan. The examination of product life cycle costing emphasizes the correlation between the price consumers pay for a product and the overall expenses incurred in its acquisition. (Shank, Govindarajan ,2012:2005) According to Drury, this management tool allows facilities management to gain insights that facilitate the understanding and management of overall expenditures incurred at various phases of the product life cycle . It also helps identify areas where cost reduction may be more effective. (Drury, 2018: 59) (Horngren et al.,) (Horngren et al.,) This entails monitoring all expenses related to the product throughout the activation of the value chain, commencing with the research and development phase and concluding with the end-customer service and support phase. (Horngren et al., 2012: 448).

- Requirements for applying product life cycle technology

To use this technology, several requirements must be considered:

1. Convincing senior management of the objectives and characteristics of the application, achieving integration between the various departments of the unit, and providing communication channels that allow easy flow of information (Al-Nashar, 2005:388).
2. Determine the life of the product by seeking the opinions of specialists from production engineers and benefiting from previous experiences related to similar products when determining the life of the product. (Lindholm& Suomala , 2007:688).
3. Taking into account the uncertainties in application, although it is possible to reduce the uncertainties associated with forecasts through the use of valid historical data and the use of statistical methods and sensitivity analysis procedures. (Oliveira& Andreatta, 2021: 119).

From the above, it is clear that it is necessary to convince management of the advantages and objectives of applying this technology, as well as the availability of communication channels between the various sections of the unit to

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

ensure the easy flow of information between them. With regard to design and design to enable the production process and even consumption regarding the product, Furthermore, the product life cycle encompasses all phases of a product's existence, including pre-production, production, and post-production. The concept of product life cycle technology aims to identify and assess the total costs incurred throughout the product life cycle. In a manner that mitigates and optimizes expenses while enhancing competitiveness, namely by concentrating on the phases of the product life cycle to attain this objective.

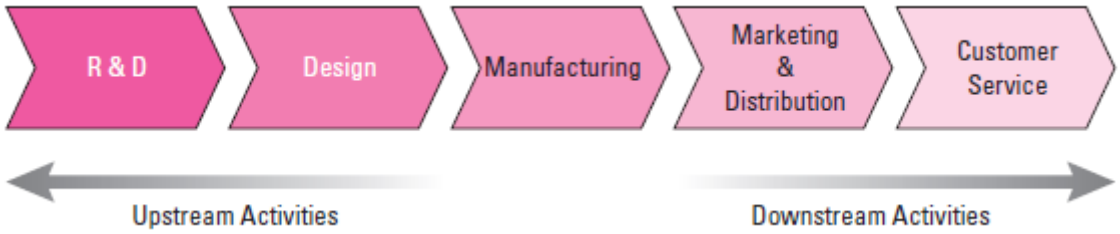
- **Technical stages of the product life cycle :**

The specific stages in the product life cycle from a production perspective often include the following (Atwa, 2020: 70-71):

1. Pre-production stage: It includes a series of activities (research and development, product design, input testing) carried out by the entity before the product appears in physical form.
2. The production stage: - It begins with implementing some activities that aim to use the elements of production (materials, wages, services) to complete the production process. These activities include (inputs, processes, outputs). The basic processes vary from one product to another and according to the type and quality of the product. And proven production method.
3. Post-production stage: It begins after the completion of the final product and begins with the process of marketing it, the sales process, achieving the desired profits, and maintaining the market share of the product. This stage is considered one of the most important stages in planning related to the product.

When the design is completed and the manufacturing phase begins, costs for selecting features and production methods are determined. Hence, developing a cost-effective design becomes extremely important. Target costing focuses largely on using the design process to improve the product and reduce its costs, as shown in the following figure:

Figure No. (1)
The life cycle cost of a product or service



Source: Blocher, E., Stout, D. E., & Cokins, G. (2010). Cost management: A strategic emphasis. (Fifth Edition).

Methods are used to plan costs throughout the life cycle of a product (or service), where costs in the early stages of this cycle are considered a tool to help the organization design the product to achieve the target profit. Whereas previously managers focused only on manufacturing costs, they now address costs in the upstream (pre-manufacturing) and downstream (post-manufacturing) stages of the product life cycle , to obtain a comprehensive analysis of the product's costs and profitability.

Fourth: Analysis of environmental product life cycle technology costs

Attention and consideration of environmental costs throughout the product life cycle is crucial. Hence, the concept of product life cycle analysis emerged from an environmental perspective, which is a methodological tool used to evaluate the environmental impacts associated with products. This analysis aims to achieve the following objectives: (Ciambrom, 1997:4).

1. Preventing pollution: Most units tend to achieve international standards for preserving the environment (ISO 14000), and thus it has become obligatory for the units to measure the costs of preventing pollution and preserving the environment from the harm that may be caused to it.
2. Preservation of natural resources: The environment in which units reside and carry out their activities may be characterized by natural resources. Therefore, these entities must produce products and provide services that prevent the depletion of these natural resources. For this reason, the total cost is very high, as companies and economic entities spend money to preserve these natural resources.
3. Achieving sustainable ecosystems: This goal entails progress and growth for society as a whole and therefore many costs must be incurred to achieve this goal.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

4. Improving the economic system : To achieve this goal, it is necessary to study the costs of the product life cycle and examine the profits and flows generated at each stage of the product life cycle to determine whether the products are economically viable or not, and then improve the economic system. Product Profitability Products to improve the profitability of the entire plant and this will ultimately affect the improvement of the economic system. To the state.

Product life cycle assessment technology can also help with: (ISO14040,2006:V)

- B- Informing decision makers in the industrial sector or in governmental and non-governmental organizations, for the purposes of strategic planning, setting priorities, designing or redesigning products or processes.
- Identify environmental performance indicators and associated measurement techniques.
- Marketing (for example, introduction of an eco-labeling system, introduction of environmental advertising or introduction of advertising for environmental products).

Köpffer & Renner see the main basic details that distinguish LCA from other evaluation techniques as follows (Klöpffer & Renner, 2008:95):

1. Evaluation takes place from the beginning to the end of production.
2. All flows of materials, energy and resources used and their potential environmental impacts are linked to a functional unit that defines the benefits of the system.
3. LCA is essentially a comparative approach that aims to compare the current state of a system with its future state. Hence, the international standard ISO 14040 for life cycle assessment was recognized, as this technique is defined as "a method for evaluating the environmental aspects and potential impacts associated with a product over its life cycle ." (ICCA, 2013:4). Therefore, the life cycle assessment study consists of four stages. Researchers focused on studying the stages of the product life cycle of chemicals because they are considered to have high environmental impacts on the surrounding area, especially in the chemical and plastics industries (VHK, 2005: 1).
4. "It is clear from the above that the basic classifications of environmental costs have been classified into four types in the economic unit. Therefore, environmental costs before production can represent environmental prevention costs and environmental detection costs, that is, detecting environmental damage before they occur, while environmental costs during the operation of production processes represent The costs of prevention and the costs of internal failure, while the costs subsequent to the production process represent the costs of external and internal failure, In addition, product life cycle technology helps improve decisions, identify opportunities to improve environmental performance, and define environmental performance indicators. Therefore, the product life cycle can be more effective when applied in accordance with sustainability accounting standards issued by accredited bodies with the aim of obligating economic entities to develop indicators. Environmental performance and its implementation more efficiently".

- **The concept and definition of sustainability accounting**

Sustainability accounting is one of the most common topics proposed by stakeholders regarding the management and/or disclosure of environmental risks (Dixon & Sharma, 2017:1) The idea of economic entities voluntarily disclosing sustainability-related information seems far-fetched, and sustainability has been viewed as a very difficult issue as no economic entity can voluntarily disclose information. When considering the allocation of resources to sustainability and the disclosure of sustainability information, it has been assumed that, in general, business entities face a trade-off between maximizing shareholder value or recognizing a broader commitment to society beyond profit maximization (CSHS,: 2015: 4). A subfield of accounting, which deals with activities, methods and systems for recording, analyzing and reporting on the environmental and social impacts of an economic entity, its subunits or activities. (Burritt et al., 2009: 3) As defined by Marshall, management is "collecting information on environmental and social costs and linking it to financial benefits, as well as showing how external environmental and social costs can decrease over time while meeting the three aspects of sustainability" (Marshall, 2006:95). Kolk points out that sustainability accounting has gradually evolved into a management tool used by economic entities to become more sustainable. Since the publication of the first separate environmental reports in 1989, an increasing number of economic entities have begun publishing information about their environmental policies and their impacts. Social and sustainability issues have increased significantly. (SASB, 2013: 3)

Accordingly, sustainability accounting is an important source of information for managers and stakeholders, as it contributes to the assessment and management of social and environmental risks, and helps determine the efficiency of resource use and the basis of cost savings in the life of economic entities. It links social and environmental improvements with financial opportunities. In addition, the most important aspect of sustainability accounting is the

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

interactions and linkages between social, environmental and economic issues, which constitute the three dimensions of sustainability. Schaltegger & Buritt 2006:43).

- **"Sustainability Accounting Standards Board SASB"**

The Sustainability Accounting Standards Board (SASB) was established in 2011 as an independent, non-profit organization aimed at developing sustainability accounting standards. SASB standards focus mainly on material financial issues, helping economic units around the world prepare reports on sustainability topics (Al-Bably, 2020:355). In 2017, the economic unit underwent a change in governance with the aim of creating a more formal separation between control, management and finance (SASB Foundation). SASB is developing industry-specific sustainability accounting standards to meet parent information disclosure requirements submitted to the Securities and Exchange Commission. (SEC) (E&Y, 2014:13). Each standard consists of three basic elements: accounting standards associated with each industry-specific disclosure topic, the technical protocol for data collection, and activity measures adopted in the normalization process. (Al-Bably, 2020:357) Sustainability accounting standards aim to provide guidance to the management of business entities, which ultimately bear responsibility for identifying material information. These standards also provide uniform sustainability metrics, designed to showcase performance in sustainability areas at an industry level. When reporting on sustainability issues, facilities can utilize SASB standards to ensure that their reporting is consistent, useful, acceptable and comparable. SASB standards also seek to develop "suitable standards that have the following characteristics." (4: 2017 (SASB

1. Objectivity: Standards must be free of bias.
2. Measurability: Standards must provide consistent or reasonable quantitative measurements of the subject.
3. Completeness: Criteria should be comprehensive enough to avoid ignoring important factors that may influence conclusions about the topic.

Relevance: Standards should be closely related to the topic.

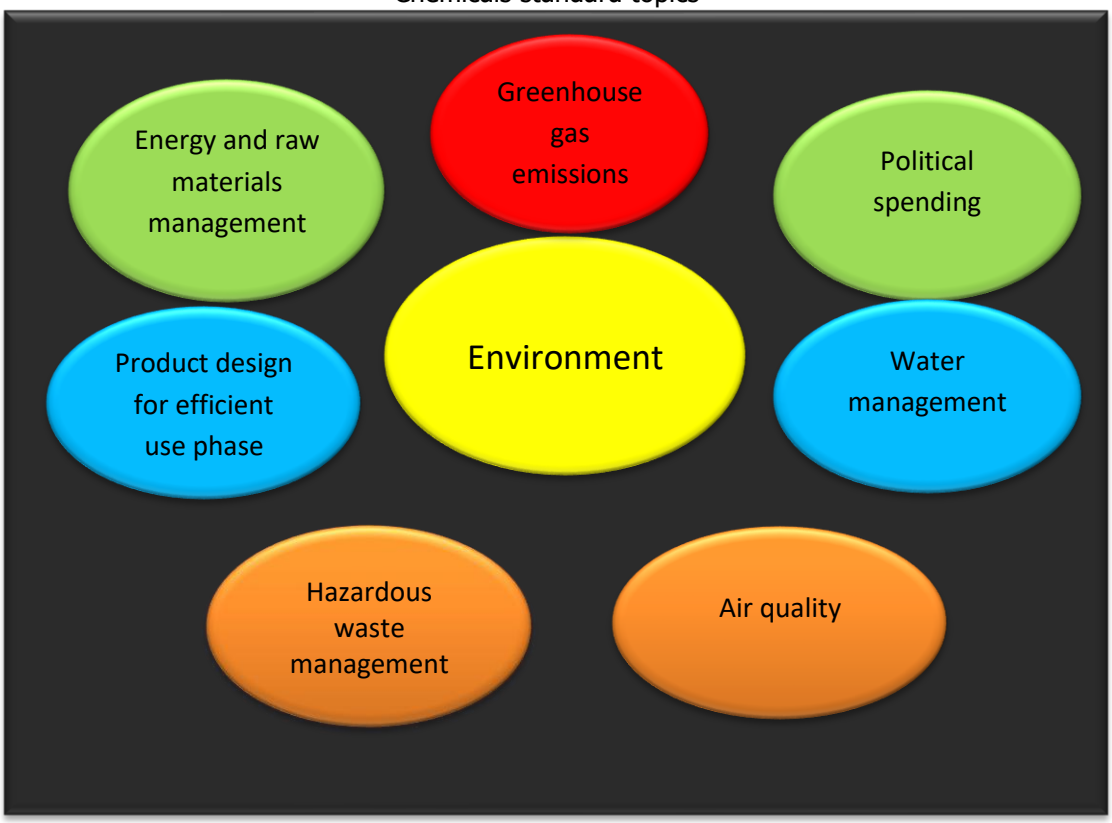
It is clear from the previous information that the Sustainability Accounting Standards Board provides specialized standards in the field of sustainability accounting, including resource conversion standards, such as the chemicals standard, which is considered the first in a group of resource conversion standards. This set represents the seventh series of sustainability accounting standards prepared by the Council. These standards are considered an effective tool for translating sustainability concepts between economic entities, as they depend on providing comprehensive quantitative and financial information aimed at enhancing efforts to achieve sustainability.

Seventh: Chemicals Standard (0101).

Companies in the chemicals industry transform raw materials, both organic and inorganic, into more than 70,000 diverse products, used in a wide range of industrial, pharmaceutical, agricultural, residential, automotive, and consumer applications. Manufactures and sells these products on a global level, and is usually divided into three main categories: basic (commodity) chemicals, agricultural chemicals, and specialty chemicals. Specialty chemicals include a range of products such as paints, coatings, agricultural chemicals, sealants, adhesives, dyes, and industrial gases. The criteria for the following topics have been identified for disclosure, as shown in Figure No. (2).

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

Figure No. (2)
Chemicals standard topics



Source: Prepared by researchers.

Greenhouse gas emissions

"In addition to process emissions from the chemical conversion of raw materials, chemical production produces many direct emissions from the burning of fuel and cogeneration during manufacture. Due to climate protection measures, gas emissions cause climate change and put chemical businesses at risk of regulatory compliance expenses. Companies can cost-effectively reduce gas emissions from operations by increasing energy efficiency, using cleaner fuels or improving manufacturing processes". (SASP, 2017: 5).

- **The concept and definition of cleaner production**

Since the inception of production and consumption activities, they have generated negative consequences for the environment (Tsai, et. al., 2015: 178) through the introduction and use of products and their waste. In response to this, a growing global movement emerged during the second half of the twentieth century that attempted to change the way industry interacts with the environment. Governments have also contributed (Nilson, et. al., 2007:19) Contributing to environmental protection requires the adoption of "clean production", which aims to conserve raw materials, water and energy, and reduce the use of toxic and dangerous raw materials. It also contributes to reducing the toxicity of emissions and waste at their source during the production process. In this context, green accounting provides quantitative data on environmental and financial performance, making it essential for achieving "cleaner production". (Giannetti, et. al., 2020:3327) (Hens, et. al.,) defines cleaner production as a sustainable approach that includes implementing a comprehensive preventive environmental strategy, applied to processes, products and services with the aim of enhancing overall efficiency and reducing risks to humans and the environment. (Hens, et. al., 2017: 3325) El-Mashad defines cleaner production as the continuous application of a comprehensive and preventive strategy in the production processes of products and services, with the aim of enhancing process efficiency and reducing potential risks to humans and the environment. El-Mashad, Glavic & Lukman (2018) agree Cleaner production can be defined as an organized and planned approach aimed at improving production activities, achieving positive impacts on the environment. These activities include reducing resource consumption and increasing environmental efficiency, with the

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

aim of enhancing environmental protection and reducing risks. On living organisms (Glavic & Lukman,2007) Defined by (Giannetti, et. al.,) the concept of cleaner production is considered one of the basic concepts in which new procedures and technologies are constantly emerging, as it presents methods and practices aimed at protecting the environment and reducing the damage that may be caused to it. (Giannetti, et. al., 2020: 1)

- **Requirements for adopting cleaner production**

The use of an industrial organization is linked to the principles of clean production, which is a set of requirements that must be adopted in its various practices and activities in preparation for the transformation into a clean organization. Below we present the foundations upon which the writers have unanimously agreed, including: (Hamza, 2007, 3-4)

1. **Substituting environmentally friendly materials**

The use of raw materials as an input to the industrial process that have inherently dangerous properties and compositions, or their results when they interact or transform in these processes, is one of the sources of waste and pollutants that affect humans, and the components harm the natural environment. environment.

2. **Capacity building and training**

It is determined by the availability of technical human skills in the industrial organization and for all levels of management and the workforce who are aware of the effective role of clean production and the mechanisms for adopting them in the organization's practices for its various activities. The lack of these skills has become an obstacle to moving forward in this direction.

3. **Development in manufacturing processes**

The amount of waste and pollutants that arise or accompany the industrial production process is affected by the type of production system. The shift from intermittent production systems to continuous systems and the introduction of a self-control system will save the levels of energy, raw materials and water consumed per unit and quantity of goods, as well as the amount of spoiled production disposed of as a type of production. lose.

4. **Waste management**

Since the waste of industrial processes - which cannot be avoided in any industrial process - represents the main source of forms of industrial pollution due to the negative effects it causes or results on humans and the environment in general, this requires the management of the industrial organization to implement effective and effective management aimed at finding means and methods. To convert this waste into materials of economic value while reducing potential risks.

5. **Quality and environmental management**

Although it is currently encouraged to obtain an environmental quality assurance certificate (ISO 14001) to consider the environmental aspects of production, it is not a substitute for cleaner production, as this certificate does not necessarily require cleaner production, but rather encourages the assumption of its production.

6. **Effective product life cycle**

Product life cycle analysis and evaluation is an effective way to monitor all possible negative impacts of the product, starting from the stage of preparing and supplying raw materials, through the processes of design, manufacturing, transportation, storage, use, until the disposal stage and beyond. (Higgins, 1995, 70).

Tenth: Clean technology strategies

In its applications, clean technology relies on the following strategies: (Al-Awaina,2021:200)

1. **Recycling:** It denotes the process of repurposing waste materials such as glass, paper, plastic, and metal, facilitating their enhanced utilization. These materials are more conducive to recycling, since they promote environmental conservation and mitigate the exhaustion of Earth's resources.
2. **Environmental restoration:** In addition to addressing different chemical and biological processes, it entails removing all sources of pollution that impact environmental components like soil, water, and air. Strict precautions are necessary to protect the environment because industry is one of the primary sources of pollution. Regulators who are concerned have created laws that punish people who cause environmental damage severely.
3. **Renewable energy sources:** To provide energy for their populations, nations and businesses turn to using renewable resources, as complete reliance on fossil fuels has become impossible. Hence, the main sources of renewable energy include water, sun, wind, and others.
4. **Alternative fuels:** In addition to utilizing natural renewable energy sources, scientists work to discover substitutes for conventional fuels. Fuel cells and hydrocarbons are two of the most popular choices. To lessen carbon dioxide emissions and their detrimental effects on the environment, interest in clean coal has grown.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

5. **Sustainable development of the environment:** A collection of techniques and procedures are used by architectural designers to create fully environmentally friendly structures. This is dependent on the building's location and the use of efficient technologies to capitalize on the environment, such as solar energy.
6. **Green nanotechnology**: Based on a collection of materials, this technique seeks to make the industrial sector more ecologically friendly. The goal of this technique, which is founded on engineering and chemistry concepts, is to prevent environmental damage.

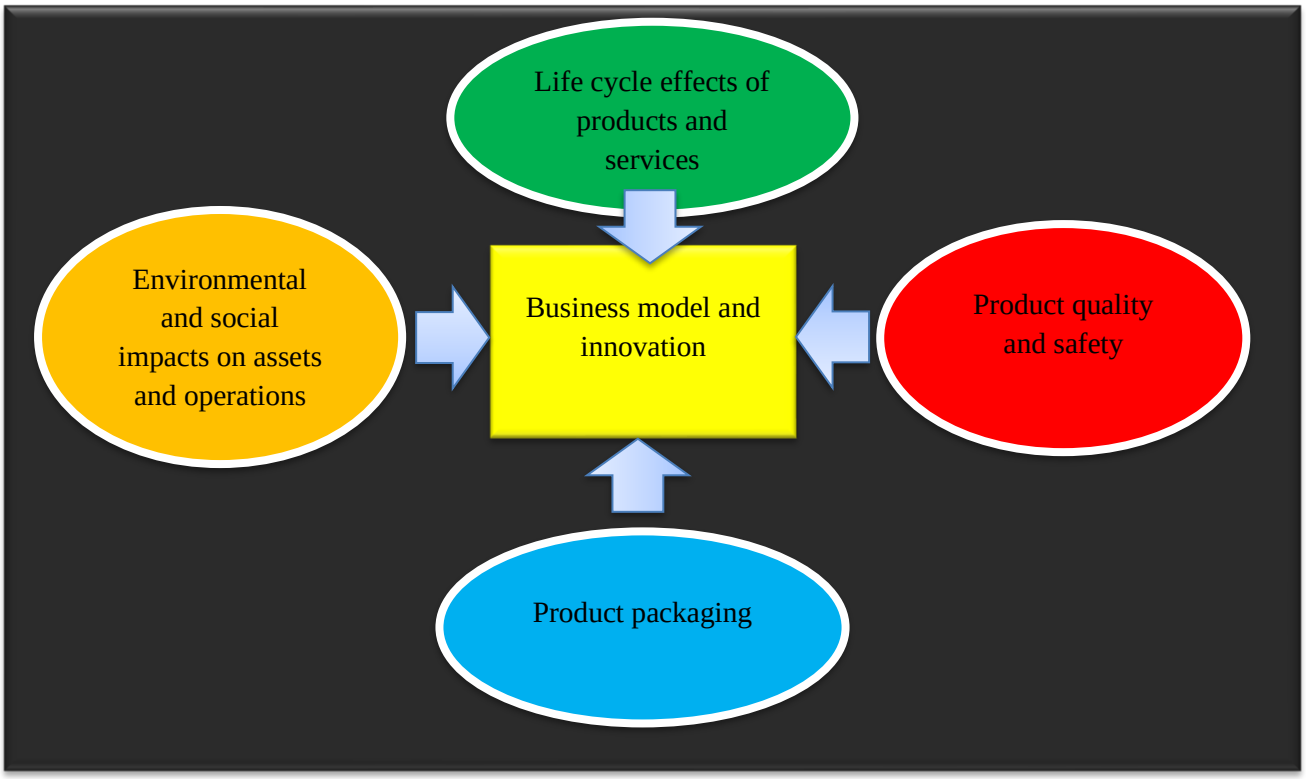
- **Product life cycle management and innovation to achieve environmental efficiency.**

Units face challenges resulting from external environmental factors during the use phase of their products, which prompts them to avoid or minimize the use of chemicals of concern in their products. In addition, the units seek to avoid customer pressure to reduce environmental damage caused by their products. (SASB,2017: 22).

1. Material sources

The chemical and plastics industries are exposed to supply chain risks from the use of metals. Proactive audits and supply chain management can contribute to protecting units from reputational and regulatory risks. Units in this industry also face increasing competition due to the growing global demand for these minerals from other sectors, which may lead to significant price increases and supply risks (SASB, 2017: 22). Figure No. (3) shows the environmental and social impacts associated with product production and innovation.

Figure No. (3)
Business model and product innovation



Source: Prepared by researchers.

In view of the above and during the process of reviewing the standard, many disclosures were included in the chemicals standard, as it is one of the sustainability accounting standards that should be applied and modified according to the work environment and in view of the standards related to reducing costs and environmental risks, as well as the importance of standards for improving product life cycle technology. This will help reduce costs and achieve cleaner production and therefore environmentally friendly products.

Twelfth: Cleaner production in terms of product life cycle technology and sustainable accounting standards.

The stages of the product life cycle begin with the first stage (product launch stage). The beginning of this stage refers to the initial costs, including R&D and design costs, prototype testing costs, engineering costs, EMS costs, system

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Vol. 44, March, 2025
ISSN: 2749-3628,

implementation costs, operation and maintenance costs, and certification costs. Environmental management system, pre-production costs and costs of industrial economic entities that use environmental costs for this. We carry out hygiene work in production to prevent air or water pollution and protect the environment. As in the production stage (growth and maturity stage), this stage includes environmental costs that may arise during the production process, costs of waste treatment and disposal, costs of environmental facilities and equipment, costs of compliance with government laws and regulations to prevent environmental damage and costs of the subsequent production stage. It is the (level of deterioration) that includes the cost of waste disposal, represented by machinery, equipment, and labor costs for collecting waste and rubbish. Transportation costs, disposal costs, treatment costs, and reuse and reprocessing costs, including the costs of implementing a reuse and reprocessing strategy to recover the waste. Production and recycling waste.

According to chemical standards, the focus is on preventing environmental damage and pollution with the aim of cleaner production, especially reducing environmental risks as products pass through several stages during their life cycle .

The product life cycle includes environmental risks that the economic entity must protect. One of the priorities of the standard is sustainability, and sustainability means maintaining the sustainability of products in the market, which requires setting appropriate and correct standard indicators In the production stage, which includes the growth and maturity stages, environmental risks arise related to the raw materials used, as these materials contain multiple types of pollutants that negatively affect the internal and external environment of the unit. To avoid these risks, environmentally friendly raw materials should be used, free of chemical elements and gases that may harm the environment. Furthermore, because of the risks to the environment and society, laws and regulations that restrict the use of substances that harm the environment must be followed. It is evident from the study's result that a product's life cycle is dependent on a series of phases that it goes through, where the environmental, every step requires consideration of social and economic factors. Following sustainability accounting standards are necessary for this, especially the chemicals standard, which lists topics and metrics that economic entities must measure and completely report. Therefore, the primary focus of this study was the current sustainability accounting standards established by the Sustainability Accounting Standards Board, which should be applied in economic units. To achieve cleaner production, the impact of the product life cycle was also examined in compliance with sustainability accounting requirements. But, This is still a theoretical assumption, and without doing a real study which will be the main topic of discussion in the third section—it is difficult to anticipate the outcomes.

The third section: Analysis of the results of the practical study.

First: a brief introduction to the National Company for Chemical and Plastic Industries

A mixed joint stock company established pursuant to Certificate of Incorporation No. 968 dated October 23, 1962, registered in Baghdad, its main office in Baghdad/Al-Zafaraniya, and subject to Companies Law No. (21) of 1997 (amended). Note that the objectives of starting a business are the production of chemicals, plastics, semi-finished products and finished materials (all kinds of sponges, six types of PVC granules, agricultural covers, bags, pallets, containers of different sizes, boxes, etc.). and aims to ensure its stability and popularity in accordance with the latest principles of soft drinks and technical vegetables and to achieve the company objectives contained in the company contract.

Sample description

The tables below show the statistical description of the study sample according to demographic factors

First: sex

It is clear from Table No. (1) below that the percentage of males represents about (67.5%) of the total study sample, while the percentage of females is about (32.5%) from the same sample. Table No. (1)

Table No. (1)
Sex

Details	Number	Ratio %
Male	27	67.5
Feminine	13	32.5
Total	40	100

Second: age

It is clear from Table No. (2) below that (17.5%) of the total study sample members are less than (25) years old, while (37.5%) are between (25) and (35) years old, and (25% of them are between 35 and 45 years old, while 20% of them are over 45 years old.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

Table No. (2)
The age

Details	Number	Ratio %
Less than 25 years old	7	17.5
From 25 to 35 years old	15	37.5
From 35 to 45 years	10	25
More than 45 years old	8	20
Total	40	100

Third: Academic achievement

It is clear from the table and Figure No. (3) below that (37.5%) of the study sample members hold a bachelor's degree, while (12.5%) hold a master's degree, (5%) hold a chartered accountant's degree, and (20%) hold have a doctoral degree, while (25%) have other qualifications.

Table No. (3)
Academic achievement

Details	Number	Ratio %
Bachelor's degree	15	37.5
Master's	5	12.5
Accountant	2	5
Ph.D	8	20
Other	10	25
Total	40	100

Fourth: Service

From the table and Figure No. (4) below, it is clear that (17.5%) of the study sample members have less than (5) years of service, and (42.5%) their years of service range from (5) years to (10) years, and (20%) Their years of service must range between (11) and (15) years, and (20%) their years of service must exceed (15) years.

Table No. (4)
Number of years of service

Details	Number	Ratio %
Less than 5 years	7	17.5
From 5 to 10 years	17	42.5
From 11 to 15 years	8	20
More than 15 years	8	20
Total	40	100

Fifth: Job title

It is clear from the table and Figure No. (5) below that (55%) of the study sample members work as accountants, while (17.5%) of them work as auditors, (20%) in administrative fields, and (7.5%) as technicians.

Table No. (5)
Number of years of service

Details	Number	Ratio %
accountant	22	55
Auditor	7	17.5
Administrative	8	20
Technical	3	7.5
Total	40	100

Scale stability test

When a questionnaire is reliable, it is stable and free of internal contradictions, meaning that when we reapply it to the same sample, the results remain the same. The Cronbach's alpha coefficient was used by the researchers to determine the questionnaire's reliability.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

Cronbach's alpha coefficient

Using a sample of 40 people, who were not included in the overall sample, the researchers employed Cronbach's Alpha to assess the degree of stability of the study tool (questionnaire). Table No. (6) shows the reliability coefficients of the study instrument.

Table No. (6)
Reliability coefficients for the study measures according to the Cronbach's alpha method.

Variables	Number of questions	Alpha coefficient
The first .axis: using product life cycle costs in accordance with sustainability accounting standards	10	0.897
The second. axis: cleaner production	10	0.879
Total	20	0.935

The table above makes it evident that the study's axes have strong overall reliability coefficient values, with the total number of questionnaire questions (20) reaching 0.935. The reliability score for the first axis was 0.897, while the reliability score for the second axis was 0.879. Based on the Nunley scale, which defines (0.7) as the lowest level of reliability, this shows that the questionnaire has a high degree of reliability, making it suitable for use in the study's field application.

Analysis of questionnaire items

Analysis of the paragraph s of the first axis: using product life cycle costs in accordance with sustainability accounting standards:

According to sustainability accounting standards, the researchers computed the arithmetic mean, standard deviation, and relative weight of the sample members' answers to the questionnaire on the axis of using product life cycle costs, as indicated in the table below:

Table No. (7)
Responses' averages and variations on the first axis, which deals with using product life cycle costs in accordance with sustainability accounting standards.

The hub	Number of parag:raphs	Average	Stand"ard deviation	Rela"tive weight	Result
Using product life cycle costs in accordance with sustainability accounting standards	10	4.353	0.194	87.01	Totally agree

It is clear from Table No. (7) According to the respondents, the predicted score for the axis of applying product life cycle costs in line with sustainability accounting standards earned a relative weight of (87.01), indicating full agreement.

To achieve more accurate results, the two researchers analyzed each paragraph separately.

As indicated in the accompanying table, the researchers determined the arithmetic means, standard deviations, relative weights, and rankings for every paragraph of the axis of applying product life cycle costs in compliance with sustainability accounting rules:

Table No. (8)
Means and variances for those who answered the first axis question: Utilizing product life cycle costs in accordance with sustainability accounting guidelines.

Sequence	question	Aveerage	Stan-dard deviation	R-elative weight	R-anking	R-esult
1	Product life cycle costs contribute to identifying opportunities to improve the environmental performance of products during the various stages of their lives.	4.375	0.628	87.500	7	Totally agree
2	Product life cycle costing according to sustainability accounting standards leads to the effective identification of environmental impacts associated with greenhouse gas emissions.	3.725	0.816	74.500	10	I agree

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

3	The economic entity concerned does not follow an adequate strategy to reduce the amount of emissions emitted into the air related to air quality in accordance with sustainability accounting standards.	4.275	0.679	85.500	9	Totally agree
4	The economic entity concerned faces high fines if it does not reduce air emissions in accordance with sustainability accounting standards.	4.400	0.591	88.000	4	Totally agree
5	Applying product life cycle costing in accordance with sustainability accounting standards helps the accountant disclose the total energy consumption from all sources in application of the energy management standard.	4.600	0.591	92.000	1	Totally agree
6	According to the sustainability accounting standard, the accountant of the relevant economic entity discloses the total amount of fresh water withdrawn, the recycling percentage, and the high water stress percentage.	4.575	0.594	91.500	2	Totally agree
7	The product life cycle costing technique works to prevent risks in the production stage where materials containing different types of environmental pollutants are used using environmentally friendly materials.	4.400	0.810	88.000	5	Totally agree
8	Product life cycle costing technology reduces waste and carbon emissions, improves company reputation and helps comply with environmental regulations.	4.350	0.770	87.000	8	Totally agree
9	The concerned economic body indicates the amount of operational waste, the hazardous part and the recycled part according to the waste management dimension.	4.425	0.501	88.500	3	Totally agree
10	According to the health, safety and emergency management dimension, the business entity concerned is committed to safety to protect employees and workers.	4.400	0.591	88.000	6	I agree

From Table No. (8), The assessment values for the first axis points, which employ product life cycle costs in accordance with sustainability accounting standards, are evidently, were between (92-74.5), meaning I completely agree.

1. P-aragraph No. (1) earned seventh position with a relative weight of 87.5 and an arithmetic average of 4.375, achieving an exact match.
2. P-aragraph No. (2) rated eighth, achieving a comparable outcome with a mean of 3.725 and a relative weight of 74.5.
3. P-aragraph No. (3) achieved the exact same result, ranking ninth with a mean of 4.275 and a relative weight of 85.5.
4. P-aragraph No. (4) came in fourth place with a relative weight of (88) and an arithmetic average of (4.4), achieving the exact same outcome.
5. P-aragraph No. (5) won first place with a relative weight of 92 and an arithmetic average of 4.6, achieving performances that were the same.
6. P-aragraph No. (6) came in second with a relative weight of 91.5 and an arithmetic average of 4.575, achieving an exact match.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

7. P-aragraph No. (7) reached fifth position with a relative weight of (88) and an arithmetic average of (4.4), achieving an exact match.
8. P-aragraph No. (8) came in eighth place with a mean of 4.35 and a relative weight of 87, achieving the exact same outcome.
9. P-aragraph No. (9) secured third place with a relative weight of 88.5 and an arithmetic average of 4.425, achieving an exact match.
10. P-aragraph No. (10) received an agreed-upon result, placing sixth with an arithmetic average of (4.4) and a relative weight of (88).

Analysis of the paragraphs of the second axis: cleaner production

The following table displays the arithmetic mean, standard deviation, and relative weight of the sample members' answers to the cleaner production axis questionnaire, which were determined by the researchers:

Table No. (9)
Diagrams and deviations to answer questions related to the second axis: cleaner production

The hub	Number of para-graphs	A-verage	s-tandard deviation	R-elative weight	R-esult
Cleaner production	10	4.370	0.207	87.4	Totally agree

It is clear from Table No. (9) that the respondents' estimated score for the cleaner production axis was given a relative weight of (87.4), indicating total agreement.
For additional findings, the researchers looked at each paragraph independently:
The following table shows the arithmetic means, standard deviations, relative weights, and ranks that the researchers determined for each paragraph of the cleaner production axis:

Table No. (10)
It displays respondents' averages and variations from questions pertaining to the second axis, cleaner production.

Sequ ence	question	Aveerag e	Stan-dard deviation	R-elative weight	R-anking	R-esult
1	The economic entity concerned depends on cleaner production to protect the environment.	4.375	0.807	87.500	6	Totally agree
2	The concerned economic entity provides financial and technical support to achieve cleaner production.	4.475	0.599	89.500	3	I agree
3	The concerned economic entity relies on devices and machines that help reduce and limit environmental pollution.	4.625	0.540	92.500	1	Totally agree
4	Packaging is based on recyclable packaging.	4.250	0.670	85.000	9	Totally agree
5	Products are developed according to sustainability accounting standards to protect the environment.	4.350	0.770	87.000	8	Totally agree
6	The economic entity concerned is based on the positive treatment and management of waste resulting from the production process.	4.450	0.504	89.000	4	Totally agree
7	The economic entity concerned recycles the waste resulting from the production process.	4.425	0.594	88.500	5	Totally agree
8	Renewable energies are used in production processes to reduce environmental impact.	4.375	0.628	87.500	7	Totally agree

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

9	The economic entity in question relies on the use of technologies that use fewer raw materials.	3.800	0.853	76.000	10	I agree
10	The business entity concerned relies on modern devices and technologies to manage and save energy.	4.575	0.594	91.500	2	I agree

It is clear from Table No. (10) that the second axis's cleaner production products received rating scores ranging from 92.5 to 76, or fully agree to agree.

1. Paragrap.h No. (1) came in sixth place with a relative weight of 87.5 and a mean of 4.375, achieving a fully compatible outcome.2. With a relative weight of 89.5 and an arithmetic average of 4.475, P-aragraph No. (2) came in third place and produced a consensus.
2. Paragrap.h No. (2) received a result of "Agreed," ranking third with an arithmetic average of 4.475 and a relative weight of 89.5."
3. Paragrap.h No. (3) came in first place with a relative weight of 92.5 and a mean of 4.625, achieving a totally compatible outcome.
4. Paragrap.h No. (4) came in ninth place with a relative weight of 85 and a mean of 4.250, yielding a result that was entirely compatible.
5. Paragrap.h No. (5) ranked ninth with a relative weight of (87) and an arithmetic average of (4.350), yielding an exact match.
6. Paragrap.h No. (6) came in fourth place with a relative weight of (89) and a mean of (4.450), yielding a result that was entirely consistent.
7. Paragrap.h No. (7) placed sixth with a relative weight of 88.5 and an arithmetic average of 4.425, achieving an exact match.
8. Paragrap.h No. (8) attained a similar outcome, placing seventh with an arithmetic average of 4.375 and a relative weight of 87.5.
9. Paragrap.h No. (9) rated ninth with a relative weight of (76) and an arithmetic average of (3.800), yielding an exact duplicate of the result.
10. Paragrap.h No. (10) placed second, achieving a result of "Agreed" with a mean of 4.575 and a relative weight of 91.5."

Data analys-is and hypothesis testing

In order to determine the function of employing product life cycle costs in accordance with sustainability accounting standards for cleaner manufacturing, the study's hypotheses were addressed, and the statistical findings were presented and analyzed in this part.

Hypothesis testing

- Production and life integration in the use of product cycle costs in compliance with sustainable accounting standards are substantially connected, per the results of the first hypothesis test. This table presents the findings of an investigation into the relationship between the independent variable (using product life cycle costs in compliance with sustainability accounting guidelines) and the variable (cleaner production):

Table No. (11)
findings by examining the correlation between the independent and dependent variables.

Variables	Using product life cycle costs in accordance with sustainability accounting standards	Cleaner production
Using product life cycle costs in accordance with sustainability accounting standards	1.000	.932**
Cleaner production	.932**	1.000

**S-tatistically signifiicant at a significance level (0.01)
* S-tatistically signifiicant at a significance level (0.05)

The table above makes it evident that, at a significance level of 0.01 percent, the correlation coefficient between the independent variable (using product life cycle costs in compliance with sustainability accounting standards) and the dependent variable (cleaner production) is statistically significant. This suggests that there is a significant and positive

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

relationship between the two variables, indicating that the likelihood of attaining cleaner manufacturing increases with the amount of product life cycle expenses utilized in accordance with sustainability accounting standards.

The results of testing the second hypothesis were obtained, which states that there is a significant effect of using product life cycle costs according to sustainability accounting standards on cleaner production. To evaluate this hypothesis, simple linear regression was used to determine the effect of the independent variable (use of product life cycle costs according to sustainability accounting standards) on the dependent variable (cleaner production).

Table No. (12)
Simple linear regression results

Variables	B	T	Sig.
Fixed limit	0.537	2.232	0.032
Using product life cycle costs in accordance with sustainability accounting standards	0.873	15.888	0.000
Test- value (F)	252.430	Probabiliity value	0.000
Coefficient of determination (R2)	.869	Adjusted coefficient of determination (R2)	.866
Durbin--Watson	2.151		

The findings displayed in the above table demonstrate the model's importance through statistical analysis, as the F-statistic's (Sig.) value was less than 0.05 and reached 0.000, indicating that the model is dependable and suitable for testing. At 2.151, the Durbin-Watson value was higher than the R-squared value, which was 87%, It explains why there is no false regression nor autocorrelation. Regarding the R-squared result, it was 0.869, indicating that 87% of the variance in the mediating variable can be explained by the independent variables. Even though the adjusted R-squared value was 0.866, meaning that the independent variables have an 87% impact on the mediating variable, additional factors outside the model account for 13% of the variance, in addition to random errors brought on by the accuracy of the measurement units and the sample testing , etc.

Interpretation of the hypothesis result

The statistical analysis's findings demonstrated that the independent variable's value (Sig.) pertaining to the application of product life cycle costs in accordance with sustainability accounting standards is less than 0.05 and approaches 0.000. This suggests that applying sustainability accounting rules to product life cycle costs has a major impact on cleaner production. The simple linear regression equation can be represented as follows:

$$\boldsymbol{Y = 0.537 + 0.873X1}$$

Whereas:
Y: Cleaner production.
X1: applying the expenses of the product life cycle in compliance with sustainable accounting guidelines.

By testing the first research hypothesis, which says, the practical aspects of characterizing the study sample and its variables, evaluating the findings, and testing hypotheses are made evident from the presentation above: "According to sustainability and production accounting standards, there is a statistically significant link between usage and product life cycle cost. This is confirmed by examining the correlation between the independent and dependent variables" There is a direct and strong connection between the variables, as demonstrated by the statistical significance at the significance level (0.01) found by assessing the correlation link between the independent and dependent variables. Concerning the outcomes of the second hypothesis's testing, It claims that employing product life cycle costs in accordance with sustainability accounting standards has a considerable impact on cleaner manufacturing. The impact of the independent variable on the dependent variable was ascertained using simple linear regression. The value of sig was shown by the statistical study. Utilizing product life cycle costs in accordance with sustainability accounting rules has a considerable impact on cleaner manufacturing, as seen by the independent variable's value of less than 0.05 and approaching 0.000.

Conclusions

1. If the factory does not apply the three product life cycle techniques according to the cost profile, this will result in a lack of knowledge regarding the environmental elements of the factory's manufacturing process and the inability to assess the environmental effect and harm.
2. Laboratory R&D departments struggle to identify and replace contemporary, eco-friendly equipment and technology. These technologies aim to reduce environmental impact and eliminate waste, in addition to seeking to reduce costs, especially the cost of raw materials used in producing products.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

3. If sustainability accounting standards are not adopted, it will be difficult in the management of hazardous waste, whether liquid or solid, which negatively affects environmental protection and increases the costs of producing products.
4. Communities surrounding factories, especially factory workers, often face high costs and environmental risks because they do not use product life cycle costing techniques that meet sustainable accounting standards.
5. The factory management lacks attention to the pre.-production stage, which is one of the stages that mainly affects the design of standard liquid acid batteries according to customer demand quality and environmental safety requirements. If this is taken seriously, it will lead to the design of new environmentally friendly products, which will be reflected in costs and increase the factory's market share.

Recommendations

1. We strive to focus on the pre-production stage to design products according to customer needs, thus increasing market share and protecting the environment.
2. When applying product life cycle costing techniques to identify and manage environmental impacts, the cost department must classify costs into environmental costs and non-environmental costs.
3. We want to rely on modern technologies to produce environmentally friendly products, especially the technology of calculating product life cycle costs.
4. The focus in the Research and Development Department is on the presence of modern, environmentally friendly equipment and machinery to reduce costs and environmental impact.
5. Companies should strive to adopt cost accounting standards for cleaner production by applying sustainability accounting standards, especially the chemicals standard.

Sources

1. International Standard Organization (ISO) 14040, (2006), "Environmental Management – Life cycle Assessment – Principles and Framework", 2ed ed., Switzerland.
2. Abbas Nawar Kahit Al-Moussawi, Abdul Redha Latif Jassim Al-Yasiri, & Nawras Qasim Khalifa Al-Shahmani. (2019). Using the product life cycle assessment technique to account for environmental costs under sustainability accounting standards. Al Kut Journal of Economics and Administrative Sciences, 1(32).
3. Al-Ghozi, M. M. A. A. (2022). USE CLEANER PRODUCTION TECHNOLOGY TO REDUCE COSTS AND ACHIEVE PRODUCT SUSTAINABILITY STRATEGY/APPLIED STUDY AT YOUR PUBLIC COMPANY IN DHI QAR. World Economics and Finance Bulletin, 17, 227-245.
4. Al-Nashar, Tahani Mahmoud, (2005), "Using the product life cycle method to improve costs, a proposed framework," College of Commerce Journal for Scientific Research, first issue, Egypt.
5. Basili, Makram Abdel Masih, Ahmed, Noha Gawdat Attia (2017) "A proposed framework for integration between cost management and product life cycle evaluation to support sustainable development, an applied study for treating medical waste in hospitals," Journal of Business Studies and Research, Volume S37, No. 3, Egypt.
6. Bin Zakoura Al-Awaina, (2021) The Environment and the Importance of Clean Technology in Light of the Corona Pandemic, Journal of Advanced Economic Research, Volume 6, Issue 1.
7. Blocher, E. J., Stout, D. E., & Cokins, G. (2010). Cost Management, A Strategic Emphasis" by The McGraw-Hill Companies.
8. Burritt, Roger L., Thoradeniya, Prabanga, & Saka, Chika, (2009), "Influences on Sustainability Accounting in the Public Sector", Osaka, Japan.
9. Center for Safety and Health Sustainability, (2015), "The Accounting Revolution and the New Sustainability", Implications for the OSH Professional, December.
10. Ciambrom ,David F.(1997),"Environmental Life cycle Analysis ,(CRC- Press LLC1 Edition).
11. Dixon and Sharma, (2017), "Weil Discusses 2018 10-K and Proxy Season: Spotlight on Corporate Sustainability", Accepted for publication in: Journal of Cleaner Production, doi: 10.1016/j.jclepro. http://clsbluesky.law.columbia.edu/2018/01/24/weil-
12. Drury, Colin, (2018), Management and Cost Accounting 10th ed, cengage learning
13. El Bably ,Shaker Fathy, H. "(2020). "Evaluating the Impact of Current Sustainability Accounting Practices on Accounting Reporting–An Empirical Study". The Scientific Journal of Business and Environmental Studies, Vol (11), No (1), Part(2), pp (342-375).
14. El-Mashad, S. (2018). Application of cleaner production techniques in dairy industries, PhD Institute of Environmental Studies and Research, Ain Shams University.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

15. Ernst Young, E. Y. (2014)."Sustainability Reporting the time is now". EYGM limited. Preuzeto sa sajta dana, 31(08).
16. Giannetti, B. F., Agostinho, F., Eras, J. C., Yang, Z., & Almeida, C. M. V. B. (2020). Cleaner production for achieving the sustainable development goals. Journal of Cleaner Production, 271, 122127.
17. Glavic, P. and Lukman, R. (2007). Review of sustainability terms and their definitions, Journal of Cleaner Production, 15(18), 1875-1885.
18. Grieves, M. W. (2005). Product lifecycle management: the new paradigm for enterprises. International Journal of Product Development, 2(1-2), 71-84.
19. Hamza, Ahmed,(2007), "Modern trends in cleaner production in the vegetable oil industry," The Sixth Arab International Conference on Edible Oils and Fats, Arab Federation for Food Industries, 10-14, 6, 2007, Damascus, Syria.
20. Hansen:Don R;Mowen :Maryanne M,Guan:Liming.,(2009)"Cost Management Accounting & Control". Thomson South-Western. 6th ed
21. Hassan Muhammad Hassan Atwa, H. (2020). Analyzing the relationship between the two methods of product life cycle costing and target cost and their impact on the success of medium and small projects. Scientific Journal of Business and Environmental Studies, 11 (4th issue), 58-81.
22. Hens, L., Block, C., Cabello-Eras, J. J., Sagastume-Gutierez, A., Garcia-Lorenzo, D., Chamorro, C., ... & Vandecasteele, C. (2017). On the evolution of "Cleaner Production" as a concept and a practice. Journal of cleaner production, 172, 3323-3333.
23. Horngren, Charles T., Datar, Srikant M., Rajan, Madhav V., (2012), Cost Accounting A Managerial Emphasis 14th ed, Prentice-Hall, USA.
24. International Council of Chemical Associations (ICCA) (2013), "How to Know If and When it's Time to Commission a "Life cycle Assessment".
25. Klöpffer, Walter and Renner, Isa, (2008), "Life-Cycle Based Sustainability Assessment of Products", in Schaltegger et al., "Environmental Management Accounting for Cleaner Production", Springer Science and Business Media, pp (91-102).
26. Klymenko, O., Lillebrygfjeld Halse, L., & Jæger, B. (2021). The enabling role of digital technologies in sustainability accounting: Findings from Norwegian manufacturing companies. Systems, 9(2), 33.
27. Lindholm, A., & Suomala, P. (2007). Learning by costing: Sharpening cost image through life cycle costing?. International journal of productivity and performance management, 56(8), 651-672.
28. Marshall, C. W. (2006). The stagecraft and performance of Roman comedy. Cambridge University Press.
29. Nilsson, L. (2007). Cleaner production: technologies and tools for resource efficient production (Vol. 2). Baltic University Press.
30. Oliveira, M. M. D., Andreatta, L. G., STJEPANDIĆ, J., & JUNIOR, O. C. (2021). Product Lifecycle Management and Sustainable Development in the Context of Industry 4.0: A Systematic Literature. In Transdisciplinary Engineering for Resilience: Responding to System Disruptions: Proceedings of the 28th ISTE International Conference on Transdisciplinary Engineering, July 5–July 9, 2021 (Vol. 16, p. 213). IOS Press. ISO 690
31. Pelzeter, A. (2007). Building optimisation with life cycle costs–the influence of calculation methods. Journal of Facilities Management, 5(2), 115-128..
32. Saeed, H. M. M. (2022). The Role Of Product Lifecycle Cost Technology And Cleaner Production Strategy In Reducing Costs. *Journal of Positive School Psychology*, 1125-1139.
33. Schaltegger, Stefan, and Roger L. Burritt, (2006), "Corporate Sustainability Accounting: A Nightmare or a Dream Coming True?", Business Strategy and the Environment, 15, 293–95 https://doi.org/10.1002/bse.537
34. Shank, J. K., & Govindarajan, V. (2012). Strategic Cost Management and Value Chain. Retrieved from http://www. Study mode.com/essays/strategic-costmanagement-And the value
35. Sustainability Accounting Standards Board (SASB). (2013). SASB conceptual framework.
36. Sustainability Accounting Standards Board (SASB). (2017). SASB conceptual framework.
37. Thomas E. Higgins, 1995," Pollution prevention" : Hand Book , Lewis pub. U.S.A.
38. Tsai, S. B., Xue, Y. Z., Huang, P. Y., Zhou, J., Li, G. D., Guo, W. F., Shang, Z. W., (2015). Establishing a criteria system for green production. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, Vol. 229, No 8.

World Economics & Finance Bulletin (WEFB)
Available Online at: https://www.scholarexpress.net
Vol. 44, March, 2025
ISSN: 2749-3628,

39. VHK. 2005. Methodology Study Eco-design of Energy-Using Products. Final report: MEEUP Product Cases Report. Delft, Netherlands: VHK. http://ec.europa.eu/enterprise/policies/sustainable business/ecodesign/methodology/files/finalreport2_en.pdf