USING MATERIAL FLOW COSTS ACCOUNTING TO ACHIEVE PRODUCT SUSTAINABILITY: AN APPLIED STUDY IN A WASIT WEAVING AND KNITTING FACTORY

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ABSTRACT

The research aims to study the effect of using material flow accounting and its importance in providing appropriate information to achieve product sustainability by economic units, especially the availability of appropriate and necessary information in reducing environmental pollution, increasing profits, improving productivity and product sustainability, as the research problem was the weak use of industrial economic units. The information provided by the material flow cost accounting technique improves manufacturing processes, increases profits, and reduces environmental pollution, thus reflecting on the product's sustainability. To test the primary hypotheses of the research, a practical case study was adopted in a Wasit textile and knitting factory, through which the impact of material flow cost accounting procedures on achieving product sustainability indicators was identified. A set of conclusions was reached, the most important of which was that economic units that adopt material flow cost accounting provide information that leads to benefits for environmental preservation, waste management, cost reduction, and contribution to product sustainability, among others. It also appears from the analysis of the results of the practical study that accounting for material flow costs contributes to achieving product sustainability. Product sustainability variables are significantly affected in material flow costs accounting, which fulfills the second hypothesis of the research.

Keywords: Material flow costs accounting, Product sustainability, Environmental manageme nt accounting, Flow Costs.

INTRODUCTION

The rapid developments in the industry, the depletion of natural resources, and the increasing environmental awareness of economic units have shifted their interest from achieving short-term profits to long-term strategies to achieve sustainable management, and this in turn requires attention to these resources internally in order to achieve product sustainability and how to manage the costs of these resources, The adoption of product sustainability, as well as maintaining the competitiveness of economic units is a general goal in all economic units and because of this trend, an innovative and goal-based management method is necessary to achieve optimal utilization and reduce environmental pollution associated with materials, as managing the flow of materials contributes to the use The

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complete sustainable management of the economic unit, which provides a new framework for economic research and standardization or calibration processes for sustainable management, because the flow of materials and their effects are direct causes of environmental problems, as the management of the flow of materials can be used to address the roots of the problem directly and facilitate the reduction of environmental pollution that leads to reducing costs.

RESEARCH METHODOLOGY

Research problem

The research problem is represented in the inefficient use of the Iraqi industrial-economic units of the information provided by the material flow cost accounting technique in improving manufacturing processes, increasing profits, and reducing environmental pollution and then its reflection on the product's sustainability, In light of the research problem, the following questions can be formulated:

a) What is meant by material flow cost accounting? How do you contribute to achieving product sustainability?
b) What is the level of awareness of the Iraqi industrial economic units of the importance of the information provided by material flow cost accounting to help achieve product sustainability requirements?
c) Does applying the material flow cost accounting technique and the information it provides help achieve product sustainability in the economic unit under research?

Research Aims

In light of the research problem and the questions raised, the research mainly aims to study the impact of material flow cost accounting and its importance in providing the appropriate information necessary to achieve product sustainability by economic units, especially the availability of appropriate and necessary information in reducing environmental pollution, increasing profits, improving productivity, and achieving product sustainability. In addition to striving to achieve the following goals:

a) Study and analyze the accounting of material flow costs, requirements, benefits and their impact on reducing waste and environmental damage.
b) Study and analyze the concept of product sustainability and indicators of sustainable production. How to achieve sustainable production?
c) Study and analyze the importance of using material flow cost accounting technology in providing the appropriate information necessary to achieve product sustainability requirements in economic units.

Research Importance

The research derives its importance from the importance of applying material flow cost accounting in the Iraqi industrial-economic units because this technology provides information related to materials, energy, waste, and others that have environmental impacts and that help economic units reduce the effects they leave and thus contribute to achieving returns to the economic unit and improving the environment And then achieve product sustainability.

Research Hypothesis

The research is based on two main hypotheses, which are the following:

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1) The Iraqi industrial units do not use the information provided by the material flow cost accounting technology to preserve the environment and achieve product sustainability.
2) The use of material flow cost accounting technology helps provide the appropriate and necessary information to preserve the environment and achieve product sustainability.

Research Methodology

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

a) **The inductive approach**: To review the literature that dealt with the research's topics and paragraphs to arrive at analyses and theoretical conclusions that support the researchers' ideas and perceptions.
b) **The descriptive (analytical) approach**: To study the reality of the accounting system and its suitability for evaluating the accounting of material flow costs in the Iraqi industrial environment and analyzing it in light of the requirements and indicators of product sustainability to reach the desired results of the research.

Search Limits

a) **Spatial boundaries**: The research included a practical case study in a Wasit weaving and knitting factory located in Kut, the center of Wasit Governorate, affiliated with the Iraqi Ministry of Industry and Minerals.
b) **Time limits**: The research was conducted during the year 2020 based on the analysis and testing of the employees' answers on the axes of the questionnaire questions distributed to them.

Data sources

The study and analysis of the reality of the accounting system of the factory in question were relied upon, and the measurement of the appropriateness of the data and information is provided for costs in its cost side to support the application of material flow technology, as well as enhancing this by analyzing and testing the answers and opinions of the workers in this factory on a particular questionnaire form prepared for this purpose from before the researcher.

LITERATURE REVIEW

The study of Mashkour, 2006 aimed to identify and allocate waste costs that arise from operational activities using the material flow technique, which requires the development of traditional management accounting systems to have a comprehensive framework that includes financial and material flow information, as well as that environmental management accounting helps provide information about environmental trends. The economic unit and its impact on its future and its relationship with investors.

Mahawat study, 2010, aimed to study the importance of environmental costs in achieving product sustainability and concluded that environmental deterioration is divided into two parts. An essential element in achieving product sustainability, advancing production, preserving and protecting the environment, and achieving stability and growth in the economic and social field.

Burritt & Christ 2015 study dealt with the international standard ISO 14051 for managing material flow costs as one of the new techniques for collecting financial and material information as a basis for achieving environmental efficiency.

Dhahi & Abdullah 2023 study aims to clarify the cognitive foundations of material flow cost accounting and how to measure the cost of a sustainable product, in addition to

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studying the material flow cost accounting technique that helps reduce the cost of products and increase green productivity. The study concluded that accounting for material flow costs contributes to measuring the cost of a sustainable product, which helps the economic unit reduce costs and identify environmental costs represented by waste and emissions resulting from the production process.

Based on the preceding, the current study came to complement what previous researchers concluded by addressing the issue of using material flow costs accounting technology to achieve product sustainability.

THE FIRST AXIS: THEORETICAL FRAMEWORK

The Concept of Material Flow Costs Accounting

It is a technique used to measure the flow of raw materials and energy during the manufacturing process in terms of physical and financial units. It was developed in Germany in the late nineties of the last century as it represents an accounting technique for environmental protection, as it was then adopted in (2000) in Japan. Significant progress has been made concerning its application to the activities of Japanese economic units. In September (2011) the (ISO 14051) standard of the International Organization for Standardization and Metrology was issued for the accounting of material flow costs entitled (Environmental management - accounting for material flow costs - for the general framework), which drew attention in a way Largest to this type of accounting in the world (Takakuwa & Tang, 2008).

It was also known as "*a tool to improve material productivity in order to reduce the relative consumption of materials, energy and water linked to environmental administrative accounting*" (Jasch, 2008).

Material flow cost accounting was also defined by (ISO 14051) as: "*a tool for measuring the flows and balances of materials within processes or production lines in both physical and financial units*" (Huang et al., 2019).

It is also known as an accounting technique used to measure input flows related to a specific economic unit, production process, or product in both physical and financial units (Salim, 2017: 198).

They may define MFCA as "*It is a new method of cost measurement that aims to reduce both costs and environmental impacts at the same time by excluding and reducing waste, which leads to improved productivity, rationalization of cost and support for the competitive advantage of companies and institutions*" (Elshabasy, 2022).

The importance of material flow costs accounting (MFCA) is highlighted by (Hyrslova et al., 2008):

a) **Economic level:** MFCA primarily focuses on material costs. In manufacturing enterprises, they represent a very significant cost item; in comparison with them, costs relating to, for example, waste management are insignificant. Traditional accounting systems do not provide sufficient information on material costs. In enterprises, there is no available detailed information on how particular materials pass through the enterprise.
b) **Environmental level**: MFCA focuses on reducing costs through a reduction in quantities (volumes) of consumed materials and energies. This also has positive environmental impacts. Materials and energies are

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better used and waste flows burdening the environment are being reduced. MFCA so represents a very important tool for environment-oriented management and improvements in eco-efficiency. Environmental benefits are realized even if it is not a willful intention of the enterprise.

The objective of Material Flow Cost Accounting is "to motivate and support the efforts of organizations to enhance both environmental and financial performance through improved material and energy use" by means (Schmidt et al., 2013):

a) Improving the transparency of material flows and energy consumptions as well as related costs and environmental aspects.
b) Support of decisions within organizations in fields of process technology, production planning, quality management and supply chain management as well as.
c) Improving the coordination and communication regarding material as well as energy consumption within the organization.

Since the sole calculation of quantities does not provide sufficient support for decision-making, the additional main element in material flow costing is the evaluation of the cost of flows that are cost objectives, which are called flow costs, and to which all costs that they contain and flows cause that or that can be allocated, relate to it. The International Organization for Standardization and Metrology (ISO) refers to the proposal of the main cost elements to classify the flow costs (Sygulla et al., 2011):

a) **Material costs:** They are determined by multiplying the physical quantity of input materials by their prices and aggregating the results after that, as the use of fixed input prices by deducting will allow the customer to collect the following steps.
b) **Energy costs:** are calculated similarly to material costs, and energy costs are understood as part of material costs.
c) **System costs:** represent all costs incurred in dealing with material flows within the economic unit except for material costs, energy costs, and waste management costs, such as (labor, maintenance, and transportation costs).
d) **Waste management costs**: are all costs that occur when dealing with material losses within a specific quantity centre, as they are allocated to material losses only.

Material flow cost accounting aims to reduce material inputs through analysis. All input materials equal the amount of finished products (positive products) as well as the resulting waste (negative products). This equation represents the determination of the material balance. When the number of positive products is constant, the number of negative products decreases, which reduces environmental impacts and the amount of waste produced (Huang et al., 2019). Figure 1 shows the workflow of material flow cost accounting

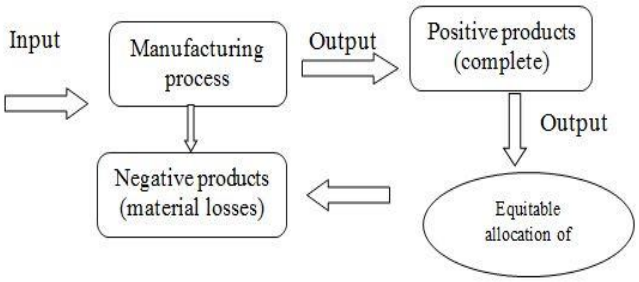

Figure 1
WORKFLOW OF MATERIAL FLOW COST ACCOUNTING

Source: Kokubu et al., (2009). Material Flow Cost Accounting with ISO 14051. ISO Management Systems.

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From the above, it becomes clear that material flow cost accounting is one of the main tools for environmental management accounting because it encourages increased transparency in material use practices by tracking material flows and calculating the quantity of those flows and material balances within the economic unit in financial and material units, as it tracks all input materials that It flows through production processes and works to measure the output of final products and waste. This is in contrast to traditional cost accounting, which did not succeed in providing sufficient insight into what happens during the flow of materials within manufacturing processes.

Material flow cost accounting is one of the environmental management accounting tools to improve resource management efficiency

It is one of the environmental management accounting tools developed to be environmentally friendly and economically effective use and a tool for tracking material flows to reach the final outputs of its positive and harmful products. That is, it includes quantitative details of materials, energy, and associated costs, which can be easily applied according to the capabilities of the economic unit. Material flow costing is a specialized accounting method for identifying inefficiencies in the use of materials and energy and their financial evaluation. Material flow costs can attract and direct decision-makers to the total costs due to waste. It provides detailed and in-depth information on wastage costs by analyzing material and energy flows in production processes. The information gained from material flow costs catalyzes economic units and managers looking for opportunities to simultaneously generate financial benefits by improving material efficiency and reducing material costs and impacts. Simultaneously, accounting studies indicate that the objective of material flow costs is to stimulate and support the efforts of economic units to enhance environmental and financial performance by improving the use of materials and energy. The application of material flow cost accounting consists of three steps (Nyide, 2016):

a) Modernization of the flow structure: To modernize the system of flow of materials and energy, the limits should be established mainly, which can extend to one or several processes or the entire economic unit, as well as the need to specify the period.
b) Quantity of Flows: Depending on the structure of the flow, material flows should measure quantities in physical units such as mass, length, volume, or the number of pieces.
c) Evaluate the cost of quantitative flows: The last step is to estimate the amount of material flows in terms of monetary units to evaluate them.

It is clear from the above that material flow costs and the requirements they contain work to achieve optimal use of resources and energy and reduce environmental impacts represented by emissions and waste, in addition to determining losses as a result of the use of materials through the material flow costing technique and then is reflected in achieving the sustainability of the product with all its indicators represented by the indicators. Environmental, economic, and social indicators, and this will be discussed in the following paragraphs.

THE SECOND AXIS: PRODUCT SUSTAINABILITY

The Concept of Product Sustainability

It is not easy to give a comprehensive and accurate concept of a sustainable product, as it depends on many things, including culture, the time factor, and the provision of raw

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materials. However, in general, it can be said that a sustainable product uses environmentally friendly materials that can self-decompose. With the need to follow them throughout the stages of their life cycle to ensure that they remain within environmental compliance, and this includes (Dhahi & Abdullah, 2023):

a) Do not use harmful preservatives.
b) Use minimum energy.
c) Use the minimum amount of raw materials.
d) Do not use toxic substances.
e) Use recyclable packaging or use it after completing the content of the packaging.

Product sustainability means sustainable and connected, which does not conflict with the environment, and assumes the preservation of natural assets for growth and development in the future without compromising the ability of future generations (Gendron, 2006).

Product sustainability means a multi-issue approach that provides a comprehensive perspective, taking into account the impacts of each stage of the product life cycle, from the extraction of raw materials and manufacturing of the product through its use and disposal (International Institute for Sustainable Development, 2023)

Sustainable products are defined as those "with positive social and environmental attributes (Luchs et al., 2010).

Product sustainability information is documented information linked to the attributes (i.e., origin, production methods and characteristics) or key impacts of the product throughout its life cycle - or "*hotspots*" - in relation to the economic, social and environmental dimensions of sustainability. Therefore, product sustainability information can be made available to consumers through various channels, such as directly on the product packaging, at the point of sale, online, via social media, television or radio advertisements, in instruction manuals, or through other forms of marketing (International Institute for Sustainable Development, 2023).

Principles of sustainable production

Sustainability principles are mainly related to moving economic units to a state of sustainable production by addressing various aspects such as resource use, energy practices, and product and waste management, thus making economic units more responsive to sustainability. The principles of sustainable production can be reviewed as follows (Alayon et al., 2017):

a) Products, packaging and services are designed to be safe and environmentally sound throughout their life cycles.
b) Environmentally incompatible waste and by-products are reduced, disposed of or recycled.
c) Energy and materials are conserved, and the forms of energy and materials used are the most appropriate for the desired ends.
d) Chemicals or physical agents and conditions that pose a threat to human health or the environment are eliminated.
e) Workplaces and technologies are designed to reduce or eliminate chemical and physical hazards.
f) The management is committed to an open and participatory process of continuous evaluation and improvement, with a focus on the long-term economic performance of the economic unit.
g) Work is organized to maintain efficiency and enhance employee creativity.
h) The security and well-being of all employees is a priority, as is the continuous development of their talents and abilities.

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i) The communities surrounding workplaces are respected and strengthened economically, socially, culturally and physically, thus promoting justice and equity.

Sustainable production and its indicators

Sustainable production is one of the essential pillars of sustainable development, balancing three dimensions (social, economic, and environmental). As shown in Figure 2, the Lowell Center for Sustainable Production (LCSP) defined sustainable production as the creation of goods and services using existing non-polluting processes and systems and the conservation of energy and natural resources that are economically viable, safe, and healthy for workers, communities, and consumers (Krajnc & Glavic, 2003).

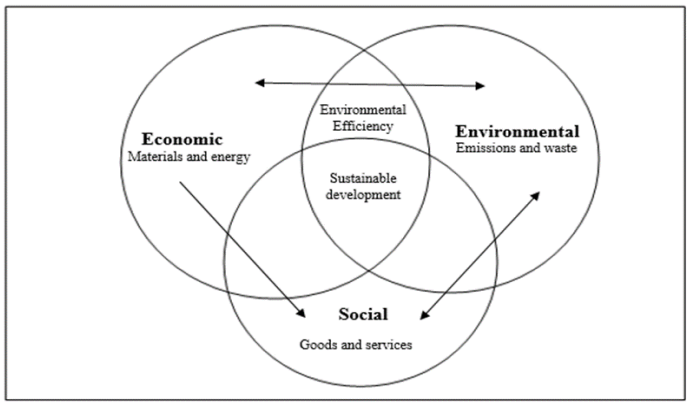

Figure 2
PRODUCT SUSTAINABILITY MODEL

Source: krajnc & Glavic, (2003). Indicators of sustainable production. University of Maribor.Faculty of Chemistry and Chemical Engineering.

It is clear from Figure 2 that material flow costs have an effective role in achieving product sustainability through the interaction of technical requirements of material flow costs, represented by Material costs, Energy costs, System costs, and Waste costs, with Indicators or dimensions of sustainable production, represented by the economic dimension, the environmental dimension, and the social dimension. Product sustainability also requires economic units to reduce emissions and waste generated as a result of not using materials and energy optimally and not switching to modern technology that reduces environmental impacts to the lowest level.

Certified Sustainability Standards

The global approach adopted for measuring product sustainability is the use of sustainability indicators that should cover the environmental, economic, and social impacts of a process or product and take into account the equality between generations and the most prominent globally adopted approaches in the measurement that focus more on the use of resources and emissions rather than impacts. This entry suggests the use of four keys for environmental performance indicators of the manufacturing process or industrial activity: material use, energy consumption, pollutant release, and unproductive output. In addition, there is a set of indicators suggested in this entry, as in Table 1 (Koltun, 2010).

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Table 1
TRIPLE AND UNIFIED INDICATORS OF SUSTAINABLE DEVELOPMENT

Environmental indicators		**Economic indicators**		**Social indicators**	
environmental influences	Environmental Efficiency	Financial indicators	human capital indicators	Ethical indicators	well-being indicators
resource usage	Material and energy density	Value Added	Employees' contribution	Preserving cultural values	Income Distribution
Global Warming	material recycling	Contribution to GDP	Staff turnover	Inclusion of stakeholders	Employee satisfaction
ozone depletion	Product durability	spending on environmental protection	Spending on health and safety	Participation in community projects	Satisfaction of social needs
Acids	service intensity	Environmental Responsibilities	Investing in employee development	Trade Deals, Fair Prices.	ـــــ
nutritional enrichment	voluntary action	ethical investments	Inclusion of stakeholders	ـــــ	ـــــ
Car and factory exhaust	environmental management	ـــــ	ـــــ	ـــــ	ـــــ
Solid waste caused by humans	Supplier evaluation	ـــــ	ـــــ	ـــــ	ـــــ

Source: Koltun (2010). Materials and Sustainable Development. Process Science and Engineering Australia. Progress in Natural Science: Materials International. p 18.

It is clear from Table 1 that product sustainability includes important aspects in providing growth opportunities in important areas, including those related to environmental indicators and the efficiency achieved in the use of materials and energy, environmental improvements, environmentally friendly products, the durability of those products, solid waste, etc., in addition to economic indicators and their contribution to the output. Local and support social welfare by supporting health and safety, employee development and other important indicators that are achieved through the material flow costing technique as one of the environmental management accounting techniques.

THE THIRD AXIS: THE ROLE OF MATERIAL FLOW COST ACCOUNTING IN ACHIEVING PRODUCT SUSTAINABILITY

Achieving sustainable production

Many characteristics must be met to ensure that production processes and the use of products and materials operate within environmental limits. If sustainable production goals are to be achieved, economic units must minimize all types of waste and use natural resources, raw materials, and energy. They must design, produce, distribute, dispose or recycle products in such a way that their associated environmental impacts and levels of resource use are at least compatible with the Earth's estimated carrying capacity. This goal requires fundamental thinking in the design of a product to take into account all stages of the product's life cycle and a shift in manufacturing processes from cleaning techniques To clean technologies, which reduces the actual level of emissions produced as well as the energy and other resources used during processing. There is a set of conditions that economic units must meet to be sustainable, including (krajnc & Glavic, 2003):

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a) Minimize or avoid defects or waste.
b) Reducing the use of materials and energy in products and their production.
c) Reuse and recycling of products.
d) Dispose of non-recyclable products or production waste in an environmentally acceptable manner.
e) Layout products that are easy to repair, adaptable, and have a longer life.
f) Minimizing transportation needs.
g) Apply cleaner production techniques and procedures throughout the product life cycle.
h) Research and development in environmentally sound technologies.

Using material flow cost accounting to achieve product sustainability

The role of material flow costs in achieving product sustainability stems from the benefits it provides, whether internal or external and concerning the benefits of material flow costs accounting for the economic unit, it has been mentioned (Fakoya, 2014) the following benefits:

a) Material flow cost accounting provides internal and external benefits that enable the economic unit to achieve more profits with fewer negative environmental impacts (Figure 3).
b) The possibility of evaluating the costs of production processes more accurately and reducing the costs of waste by adopting changes to the design of existing products and the type of raw materials used.
c) Material flow cost accounting encourages improvement in the supply chain by cooperating with the supplier and the buyer to reduce environmental and social costs.
d) When the losses generated from manufacturing operations are divided by different departments and sections, the accounting of material flow costs will be influential in determining the responsibilities of each of these losses.
e) Material flow cost accounting is instrumental in determining the amount and costs of discontinued products by calculating the relevant costs of raw materials and production-in-progress for these products.

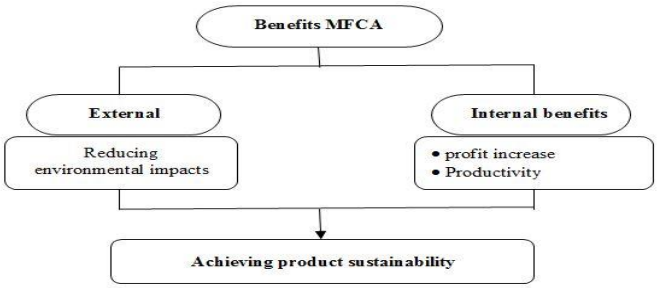

Figure 3
MATERIAL FLOW COST ACCOUNTING BENEFITS

Source: Kokubu et al., (2009). Material Flow Cost Accounting with ISO 14051. ISO Management Systems.

From the above, it is clear that the adoption of material flow cost accounting by economic units as one of the environmental management accounting tools will provide information that leads to reducing costs and environmental impacts, as it does not represent a solution to reduce costs and environmental impacts, but rather acts as an indicator of the upper limits of waste that the economic unit can eliminate by making waste Materials within manufacturing processes are visible and known. In other words, economic units often have information about material losses within manufacturing processes, but it is not possible to determine which stage they generate. Even if they are identified, it is not possible to determine which stage is responsible for generating the largest amount of these losses. By

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using material flow cost accounting, the information related to material losses and their financial values will help the economic unit determine the amount of losses generated at each stage and serve as an indicator to identify the necessary problems that must be addressed. All of this will be reflected in achieving the sustainability of the products, and proving this or not will be discussed on the practical side in the next research.

METHOD

Analysis of the Results of the Practical Study

Research tool and measurement method

In order to achieve the research objectives and test its hypotheses, the questionnaire method was adopted as a research tool for obtaining data, as the questionnaire is the main means of collecting data, which is defined as "*a group of diverse questions and inquiries that are linked to each other in a way that achieves the goal - or goals - that the researcher seeks*." *In light of the topic and problem I choose to research*". A closed-type questionnaire was designed that included a section for general information about the respondents, in addition to two axes, the first of which was devoted to revealing the characteristics and requirements of applying material flow cost accounting. In contrast, the second axis included a set of questions to test the relationship of material flow cost accounting in achieving product sustainability. Relying on the five-point Likert Scale, whose response points range from (5) very influential to (1) not influential at all, while the number (3) expresses the neutrality of the scale.

Place of application

The views of department managers and a sample of public administration employees, production departments, and workers in the Wasit Textile and Weaving Factory were surveyed, given that industrial activity represents a fertile environment for the application of industrial technologies and its urgent need to develop its production and administrative reality in light of the many economic challenges it faces, most notably the intensity of its competition with foreign products and its low cost. As (25) valid questionnaire s were collected for analysis after excluding the invalid ones.

The validity and reliability of the research tool

The validity and reliability of the questionnaire were confirmed by calculating the reliability coefficient (Cronbach's alpha); as a result, it was (0.836). This indicates the high stability of the measuring instrument.

The statistical methods used

The ready-made statistical set (SPSS) was mainly used to analyze the data and test the research hypotheses. The statistical tests were: (Arithmetic Mean), (Weighted Mean), (Standard Deviation), (Simple Correlation Coefficient), (Multiple Regression Equation), coefficient of determination (R), Test (F), and test (T).

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RESEARCH HYPOTHESIS TESTING

Descriptive Statistics

To give an idea of the data used in the statistical analysis process, Table 2 shows its descriptive statistics. In addition, this Table includes the presentation of the arithmetic mean of the questionnaire answers and the standard deviation.

Table 2
DESCRIPTIVE STATISTICS FOR RESEARCH VARIABLES

Variable type	variable symbol	Mean	Std. Deviation
independent variables	x1	3.79	.588
	x2	3.54	.779
	x3	3.71	.751
	x4	3.83	.761
	x5	3.83	.917
	x6	3.54	.658
	x7	3.75	.737
dependent variables	y1	3.79	.833
	y2	3.79	.658
	y3	3.63	.647
	y4	3.54	.779
	y5	3.63	.711
	y6	3.79	.833
	y7	3.63	.924
	y8	3.88	.947

Note: the output of the SPSS program.

Simple Linear Correlation Coefficient (Independent Variables)

Table 3
SIMPLE LINEAR CORRELATION MATRIX BETWEEN INDEPENDENT VARIABLES

Independent variables: Material flow cost accounting	X1	X2	X3	X4	X5	X6	X7
X1	1	.162	.053	210.	.148	.429	.476
X2	.162	1	.133	452.	.375	.336	.019
X3	.053	133.0	1	.139	.074	.246	.373
X4	.210	.452	.139	1	.145	.448	.387
X5	.148	.375	.074	.145	1	.372	.193
X6	.429	.336	.246	.448	.372	1	.112
X7	.476	.019	.373	.387	.193	.112	1

Note: the output of the SPSS program.

The results of Table 3 showed positive indicators that helped to continue the process of statistical analysis of the empty data from the questionnaire without resorting to methods of addressing the problem of multi-linearity, as it became clear that the majority of the correlation coefficients were below the level (0.50). This is a good indicator of the integrity of the statistical analysis model of the research data from the problem of multi-linearity.

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Multiple Regression Analysis

The results of the multiple regression analysis to test the hypotheses for the independent and dependent variables with regard to the requirements of accounting for material flow costs and indicators of product sustainability, they have been presented in Table 4. The results showed that there is a significant effect of these modern forms or indicators combined in the use of material flow accounting mechanisms, as it becomes clear that the calculated value of (F) for all dependent variables is at a level of significance (5%) (Table 5 & Table 6), which means that the use of material flow accounting mechanisms is affected The various indicators of product sustainability, and the value of the coefficient of determination (R Square) ranged between (51% - 83%), and these percentages show the amount of change in the dependent variables (product sustainability indicators) as a result of the change in the independent variables (material flow cost accounting mechanisms), As for the rest of the change (Table 7 & Table 8), it is the result of other unspecified factors included within the error limit (e), and in order to know the product sustainability indicators that have the main effect on the morale (F) at the level of the selected systems as a whole (Table 9), this is evident through the (Sig) values calculated on the basis of Test the relationship of each dependent variable with a set of independent variables, and it is clear from the tables below that the relationship is significant (Table 10 & Table 11).

Table 4
THE RELATIONSHIP BETWEEN (SOCIAL INDICATOR Y1) AND SOME INDEPENDENT VARIABLES FOR ACCOUNTING FOR MATERIAL FLOW COSTS

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
Y1	X2	.205	.222	.919
	X3	.066	.231	.287
	X4	.263	.259	1.016
	X7	.456	.257	1.778
(Value of the coefficient of determination R= .658) ;(P-value (Sig)=.015); (computed F value= 7.000)				

Table 5
THE RELATIONSHIP BETWEEN (ENVIRONMENTAL INDICATOR Y2) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
Y2	X2	.082	.199	.412
	X3	.543	.214	2.534
	X4	-.256-	.228	-1.121-
	X5	.204	.175	1.164
	X6	-.059-	.246	-.241-
	X7	.582	.234	2.486
(Value of the coefficient of determination R= .733) ;(P-value (Sig)=.025); (computed F value= 4.611)				

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Table 6
THE RELATIONSHIP BETWEEN (ECONOMIC INDICATOR 3Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
	X1	.221	.283	.782
Y3	X2	-.226-	.170	-1.332-
	X3	.225	.178	1.265
	X4	.271	.202	1.343
	X5	.576	.156	3.698
	X6	-.264-	.262	-1.007-
	X7	.282	.223	1.266
(Value of the coefficient of determination R= .568) ;(P-value (Sig)=.032); (computed F value= 3.005)				

Table 7
THE RELATIONSHIP BETWEEN (ECONOMIC INDICATOR 4Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
Y4	X2	.216	.207	1.044
	X3	.767	.222	3.449
	X4	-.340-	.237	-1.435-
	X5	.106	.182	.583
	X6	-.520-	.255	-2.039-
	X7	.281	.243	1.155
(Value of the coefficient of determination R= .601) ;(P-value (Sig)=.042); (computed F value= 2.846)				

Table 8
THE RELATIONSHIP BETWEEN (ENVIRONMENTAL INDICATOR 5Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
Y5	X1	.502	.175	2.875
	X2	-.051-	.212	-.243-
	X4	.187	.248	.755
	X6	.120	.211	.567
	X7	.242	.282	.859
(Value of the coefficient of determination R= .513) ;(P-value (Sig)=.016); (computed F value= 3.792)				

Table 9
THE RELATIONSHIP BETWEEN (ECONOMIC INDICATOR 6Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
Y6	X2	-.025-	.225	-.110-
	X3	.146	.262	.557
	X4	.463	.260	1.783
	X7	.580	.234	2.482
(Value of the coefficient of determination R= .835) ;(P-value (Sig)=.006); (computed F value= 3.931)				

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Table 10
THE RELATIONSHIP BETWEEN (ENVIRONMENTAL INDICATOR 7Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
	X1	-.051-	.308	-.166-
Y7	X2	.122	.366	.333
	X3	.760	.404	1.879
	X4	.220	.322	.682
	X5	-.255-	.514	-.495-
	X6	.062	.283	.221
	X7	.076	.476	.160
(Value of the coefficient of determination R= .530) ;(P-value (Sig)=.047); (computed F value= 1.994)				

Table 11
THE RELATIONSHIP BETWEEN (ECONOMIC INDICATOR 8Y) AND SOME INDEPENDENT VARIABLES FOR MATERIAL FLOW COST ACCOUNTING

Variables		Regression Coefficient	Standard Error	Calculated T value
Dependent Variable	Independent Variable			
	X1	.233	.241	.965
Y8	X2	.222	.286	.775
	X3	.628	.317	1.981
	X4	.418	.253	1.654
	X5	.210	.403	.522
	X6	.268	.221	1.211
	X7	.023	.373	.063
(Value of the coefficient of determination R= .593) ;(P-value (Sig)=.022); (computed F value= 3.329)				

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

a) Economic units that adopt material flow cost accounting provide information that leads to benefits for preserving the environment, managing waste, reducing costs, contributing to product sustainability, and others.
b) The economic units compare environmental costs with other units that would help them successfully apply the material flow cost accounting technique, improve their performance, reduce their environmental impacts, and achieve product sustainability.
c) The interaction of product sustainability indicators with material flow accounting mechanisms reduces environmental impacts and emissions from the factory in place of application.
d) The analysis of the results of the practical study showed that the accounting of material flow costs contributes to achieving product sustainability and that product sustainability variables are significantly affected in material flow costs accounting.

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Recommendations

a) Develop the skills of the management accountant and increase his awareness of environmental management accounting techniques as a modern and vital trend in accounting and the use of its information in decision-making processes.
b) Awareness of senior management and employees of the importance of applying material flow accounting technology in achieving product sustainability in a Wasit textile and knitting factory to reach the correct information about production processes, whether material or financial information, would help evaluate future decisions taken.
c) Iraqi economics units, whether industrial, service or commercial, should use the material flow cost accounting technique because of its importance in reducing environmental impacts and achieving product sustainability, as well as recommending the expansion of studies and research to use this technology and the rest of the environmental management accounting techniques.

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