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Employing a Green Manufacturing System for Environmental Sustainability

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Extracted

The importance of the study in showing the importance of green manufacturing strategies as one of the requirements of environmental performance that contributes to reducing the effects and damage on the surrounding environment, and the role it can play in the success of the economic unit. There are three main variables which are agile production with its requirements (organization and arrangement of the work site, continuous improvement, comprehensive productive maintenance, modular parts and working methods, flexible workforce, cellular arrangement, kanban card, withdrawal system, quality at the source , visual management, supplier participation, equal load of workstations) and green manufacturing with its requirements (downsizing, recycling, reuse, recycling, environmental management system, green procurement, green design, social and environmental responsibility) and project success with its factors (support to senior management, goal setting, error detection and remediation, project planning and scheduling, project team, communications, customer satisfaction). This topic of study was chosen because of the importance it offers to the oil sector by the resource economy and the delivery of environmentally friendly projects .

The deductive approach was adopted in the theoretical aspect of the study as well as the inductive approach in the practical aspect.

1. Introduction

The green manufacturing system is one of the modern contemporary systems in the field of production and operations management being a method that reduces industrial waste through modern methods and methods in the manufacture of goods that do not harm humans and the environment, so it has been considered one of the best systems that improve the efficiency of manufacturing processes globally and below presented some definitional aspects of this system and this section includes a theoretical framework about the green manufacturing system and what is provided of (the emergence and development of the system, concept, objectives, principles, benefits and aspects of importance, and green manufacturing system strategies).

Because of the importance of this, the green manufacturing system was applied in the General Company for Rubber and Tire Industries and its relationship with environmental sustainability was demonstrated to achieve the objectives of the research.

Where the research is divided into detectives, where the first section deals with the methodology of the research. The second section includes the knowledge pillars of the green manufacturing system and its relationship to environmental sustainability, while the third section includes the application of the green manufacturing system and the most important conclusions reached by the study.

. First Section/Research Methodology

2. Study Methodology.

This section deals with a set of paragraphs, which are represented by the problem of research, its importance, objectives, hypothesis, scientific methodology, sources of data collection and its limits, which are as follows:

2.1.Research Problem.

The production of environmentally friendly products at low cost and high quality where the traditional strategic cost management techniques used in the work environment have become unable to face the difficulties and challenges that surround them, so it has become necessary for us to move towards the use of modern techniques and methods that enable us to produce environmentally friendly products at a low cost.To achieve this goal will be relied on the green manufacturing system in order to achieve sustainability and starting from what is mentioned above the problem of research can be formulated through the following question:

((Does the use of a green manufacturing system help in achieving environmental sustainability effectively)).

2.2. Research Importance

The importance of the research stems from the importance of using the green manufacturing system in the production of environmentally friendly products of high quality and low cost, which in turn reflects on the economic units operating in the industry through the production of products free of pollution and at low cost.

2.3. Research Objectives

The research aims to use the green manufacturing system in order to achieve environmental sustainability and to achieve this general goal the following sub-objectives will be addressed:

a. Addressing the knowledge pillars of the green manufacturing system and achieving environmental sustainability.
b. Using the Green Manufacturing System to Reduce Unnecessary and Unjustified Costs.
c. Using the Green Manufacturing System in Achieving Environmental Sustainability.

2.4. Research Hypothesis

The research is based on the main premise that the following:

(The use of a green manufacturing system helps achieve environmental sustainability.)

2.5. Researsh Science

To achieve the objectives of the research, two scientific methodologies are followed, namely the deductive approach and the inductive method, the deductive approach is followed in the theoretical aspect, while the inductive approach is followed in the applied side of this research, and the sources of data collection can be clarified according to these two approaches through the following:

a. Deductive Approach ; Arabic and foreign books available in libraries have been relied upon, as well as researches, periodicals, letters and published treatises as well as the Internet.
b. Inductive Approach ; Reliance was placed on field visits to the research sample, as well as personal interviews with managers and officials of the research sample, and to see the data that was used are the
c. reports, financial and costly data.

2.6. Research Boundaries

The limits of the search are as follows:

a. Spatial boundaries of the research:. The General Company for Rubber and Tire Industries was selected as a sample for research one of the formations of the Ministry of Industry and Metals, because of the importance of the company and the presence of the possibility of applying the technology of the green manufacturing system, and providing high quality products at a price that can suit the needs and requirements of customers.
b. Temporal limits of research:. The reports and financial and costly data in the factory were relied on the research sample for the year of research because it is closer to the current reality of the performance of the laboratory than previous years for the purpose of meeting the requirements of the practical side of this research.

2.7. Previous studies

The studies can be illustrated through the following:.

a. A study (Al-Azzawi and Al-Sabawi, 2013) "The Role of Green Manufacturing Strategies in Promoting Sustainable Development" The study aimed at there is an impact of green manufacturing strategies on sustainable development in the researched company, measuring the dimensions of green manufacturing and sustainable development in the researched company, measuring the extent of the impact of green manufacturing strategies in promoting sustainable development in the researched company , The most important conclusions reached by the study are the existence of a positive moral correlation between the strategies of green industrialization combined with sustainable development, the existence of a positive moral correlation between each of the strategies of green industrialization with sustainable development, and the recycling strategy and the strategy of reuse and reduction of the source have achieved the highest link to sustainable development, the impact of sustainable development with the green manufacturing strategies adopted by the research company and this reflects that sustainable development derives the elements of its enhancement from the strategies of sustainable development. Green Manufacturing.
b. Study (Al-Lami , 2019) "Integration of environmental and quality costs in accordance with sustainability accounting standards to promote sustainable strategic planning" The study aimed to study and analyze the role of sustainability accounting standards on accounting procedures for environmental costs and quality costs, assess the level of awareness of Iraqi economic and industrial units of the importance of integration between environmental costs and quality costs prepared in accordance with sustainability standards in supporting sustainable strategic planning, Provide a proposed model for a cost accounting system that provides appropriate information for purposes Sustainable strategic planning in Iraqi industrial economic units, the most important conclusions reached by the study Sustainability reporting is one of the most important elements of the Business Sustainability Initiative, as it is the main means through which information is communicated to various stakeholders, As an important tool for sustainable planning, the multiplicity of areas of accounting disclosure leads to the ease of identifying fault centers and the possibility of controlling them, and also enhances the confidence of customers in products and their loyalty to the economic unit, sustainability accounting standards are one of the most prominent tools for translating sustainable strategic plans of units, because they provide quantitative and financial information that enhances the strategic planning process.
c. Study 2018,Jayant & Giri (Global Green Manufacturing Strategy Selection using Hybrid Grey Relational Analysis HGRA Choosing a global strategy for green manufacturing using hybrid gray relational, the study confirmed that there is difficulty in choosing the most appropriate global strategy for green manufacturing for an industrial company, so three methods of decision-making techniques VIKOR, TOPSIS and Theory GRA Gray will be used to facilitate decision-making in the most appropriate strategy, the study aimed to determine the most appropriate alternative global green manufacturing strategy by maximizing the goals,

the most prominent conclusions reached by the study The problem was analyzed by choosing the most appropriate strategies using sub-alternatives Choosing the best alternatives, the recycling and reuse strategy was chosen 9.3% and 10.5% with high weights according to the results of the analysis.

d. Study (2019, Bellini et al) Public Sector(Un)Sustainbility : a study of GRI adherence and sustainability reporting disclosure standards in Public Institution and State – owned Companies of the Public Agency Sector Public Sector Sustainability (UN): A study on compliance with the Global Reporting Initiative and Standards for Disclosure of Sustainability Reports in Public Institutions and State-Owned Enterprises in the Public Agency Sector, the study aims to analyze compliance with the Global Reporting Initiative (GRI) and the criteria for disclosing sustainability reports to the public in public institutions and state-owned enterprises. This study covers a seven-year time period from 2011-2017 for a sample of 177 public agencies, and has reached a set of conclusions including: It was found that there has been an evolution in the disclosure of sustainability reports according to GRI)) by public agencies except for 2017, which saw a decrease in all items analyzed, that the quality of reports depends on the issuance of integrated reports and adherence to GRI guidelines so a large part of those reports do not correspond to the category Integrated reports, producing reports of low quality and reliability.

The second section

Origin and Development of Green Manufactacturing System

In the seventies of the last century, the world witnessed an increase in social and moral awareness at all levels due to the high rates of environmental pollution in the Swedish capital Stockholm (UNEP), where the United Nations Environment held in 1972 a conference known as (Conference on the Human Environment) that represents one of the foundations of the history of the development of environmental thought after it an important and fundamental element in the preservation of the environment (Al-Naama, 2007:52), then appeared environmental trends in (1990) which focused on the concept of product control beyond Manufacturing processes, minimizing environmental impacts, and focusing on international standards and specifications such as the Environmental Management System (ISO:14001), the Quality Management System (ISO:9001), and the Occupational Health and Safety Assessment System (OHSAS:180001) in order to minimize the negative impact of production processes on the natural environment. (Hassan,41:2019)

3. Concept Green Manufacturing System

There are many concepts that have dealt with the subject of green manufacturing.

a. Callie & Side, 2012:23

Waste disposal, addressing the social and environmental impacts of production processes and reducing costs borne by the company due to inefficient methods in production processes.

b. Moses and Jamil ,2012:53

Design and manufacture of green products and apply manufacturing processes effectively through the use of environmentally friendly raw materials and less energy taking into account environmental issues.

c. Al-Azzawi en Al-Sabawi, 2013:88

Transforming materials and energy into useful products through manufacturing with highly efficient processes, reducing waste and environmental pollution, delivering to customers with minimal environmental impact and achieving a clean and sustainable environment**.**

d. Barbarian ,2018: 1

This system that renews production processes to create environmentally friendly products based mainly on manufacturing..

4. Objectives Green Manufacturing System

Most organizations aspire to be the leader in the markets globally and to get a lot of profits and gain a lot of customers and this requires them to use materials that do not negatively affect the external environment and design their green production processes to reach an environmentally friendly project and from this logic the objectives of green manufacturing are as follows:

(Amin,188:2014),(Abdulkarim,251:2016),(AlRubaie,80:2017Nazli,80:2018),(Hassan, 43:2019)

a. Maximize the financial returns achieved from the implementation of the green manufacturing system and reduce industrial waste..
b. Achieve the highest amount of production and reduce waste in order to improve manufacturing processes.
c. Preserving the environment and its resources and achieving environmental quality using sustainable methods.
d. Work on recycling and reusing waste and disposing of the rest with the least damage to the environment.
e. Produce manufactured and environmentally friendly products that can be reused and disposed of..

5. Importance Green Manufacturing System

The importance of green manufacturing lies in the use of non-hazardous materials in the inputs and outputs of the manufacturing process and helps in increasing the efficiency of resources and energy as well as works to prevent loss and waste instead of treating them at the end of manufacturing and through the mentioned objectives of manufacturing there is an importance of green manufacturing drawn by economic units to reach sustainability, which is summarized as follows: -

(Al-Jarjari, 2012:222),(Hamoudi et al.,406:2018),(Al-Sabbagh ,75:2018)

a. Achieving an increase in profitability and competitiveness through the efficiency of use of the treated waste, which contributes to reducing the costs and taxes imposed on it in the event of disposal.
b. Materials entering and exiting during production processes are not hazardous.
c. Reduces complexities in industrial processes and product design.
d. Conserves resources from energy and raw materials and reduces their depletion.
e. Provide a cleaner source of energy through new technology or methods .

6. Strategies Green Manufacturing System

Green manufacturing aims to increase the effectiveness and efficiency of manufacturing processes in the company by using a set of clean materials to reduce waste in the materials used and producing products conforming to specifications by saving energy, using low-pollution raw materials, recycling, and using materials..

A.Strategy (reduction) reduction from source

The drawing of a well-defined strategy is one of the elements of the advancement of the green industry, which can be achieved through the implementation of the planned goals, and the strategies vary according

to the objectives adopted by the economic units and according to the internal and external factors affecting them such as costs, quality, the desires of investors, environmental pressures, laws and legislation governing the green manufacturing process, which will be addressed the most important green manufacturing strategies addressed by researchers of various orientations. (Al-Azzawi and al-Sabawi, 2013: 89).

B.Strategy of reduction or reduction from the source

Most researchers have agreed that one of the most important strategies of green manufacturing is the strategy of reducing the source, which should be worked on by economic units, it means not to buy more than the need for raw materials, the more inputs raw materials are in the amount of need, the energy consumption is less and the outputs from waste are less and controllable, preventing waste before it occurs is less expensive than treatment and disposal and to activate this strategy requires the search for materials free of pollutants and toxic substances Or when used it does not produce contaminated materials or waste or can be used for a long time and reused during the manufacturing phase or recycling its waste after the end of its useful life or can remanufacture expired products. ((Al-Rubaie,80:2017)

C. Reuse Strategy

It means the use of materials a second time instead of dealing with them as waste and benefiting from them, i.e. reusing the product again, which leads to reducing the use of materials or their depletion, and the strategy of reuse can be clarified as the process by which one of the components of the product is reused at the end of its life cycle for the same purpose that was used (Al-Jarjari, 224:2012), and the reuse of products or part of their components after the end of the need or function for which they are designed to benefit from them Again, which is related to the direct reuse of waste materials entering the production process in their natural form or change their shape in order to reduce new purchase costs and reduce waste, and reuse is an effective means of implementing green manufacturing that converts the linear path of materials into a circular flow that helps in the use of materials as much as possible, which leads to reducing waste in energy and the implementation of reuse requires determining the remaining production life of the product. (Amin,189:2014)

D. Recycling Strategy

The waste of raw materials is not utilized when adopting a strategy (reuse) and is put forward in specialized places in order to be collected, separated and prepared for the purpose of recovery and benefit from it through recycling, and the term recycling has two meanings, the first is the reprocessing of materials that cannot be used and converted into useful new products used for the same purpose as the original product such as (recycling waste) surplus to the process of paper production and processing to be used in the production of paper but with quality Less than the original product and the second meaning is to convert the old products into completely new products where they are considered effective alternatives to the original product such as recycling plastic and converting it into granules that are used in the production of a new product (Al-Sahoki,31:2017)

E. Remanufacturing strategy

The strategy of remanufacturing has emerged recently, especially in electronic devices, cars and devices that can be dismantled as it focuses on dismantling the product into parts and repairing the damaged part of it, thus achieving mitigation of environmental effects because it preserves the product instead of being considered as a waste as well as achieving financial savings from selling the product again as refurbished instead of damaging it, which achieves economic and environmental benefits. Final (for example, Xbox,

the production of electronic devices, is replacing the damaged parts of its devices after it assembles them from its centers and then (Leong et al,. 2019:13 offers them for sale.)

Third Section
Application of the Green Manufacturing System in the Diwaniya Tire Laboratory

After talking in the first and second sections of this chapter about a brief summary of the society and the place of study and the statement of the environmental reality of the laboratory, and work on the application of reverse engineering technology, in this section will work on the application of the green manufacturing system in the place of study (Diwaniya tire factory), and consider the possibility of applying green manufacturing strategies (4R) to it to reach an environmentally friendly product and individuals by following the steps to reduce or prevent pollution resulting from wrong manufacturing processes or Traditional and minimize the waste arising from these processes, while working as much as possible to make use of those wastes in the production of by-products by reuse, recycling or recycling them as much as possible to reduce the cost of the products that are charged with the costs of those residues and pollutants, or at least reduce the costs of disposal, and for the purpose of implementing the following:

Treatments to be available to achieve the green manufacturing system:

1. - Extracting the percentage of rubber materials spent on each stage from the total costs of raw materials specified in the pricing card developed by the Planning Division, based on the equivalency form prepared by the Planning Division, and according to the data of the Production Section available from the Planning Division regarding the plant, the plant passed during 2016 a set of tires and sizes and each tire has a certain amount of raw materials included in the production of the frame size (1200-24)(1200-20)which is the following

Due to the multiplicity of tires manufactured in the factory, the frame size (1200-24) (1200-20) was chosen to clarify the calculation mechanism to extract the ratio of the cost of spent rubber materials to the total cost of raw materials from the calculation of commodity supplies32 as in table (1).

Table(1)
Ratio of the cost of rubber disbursed to the total costs of the tire size(1200-24)

Details	Unit of Measurement	Quantity Spent	Price Unit /dinar	Value/ dinar	Relative to total costs
Rubber 1500 inches	Dinar	4.107	3245	13327	%0.5
Natural rubber	Dinar	34.828	3272	113957	%48
Carbon FEF	Dinar	0.724	1190	862	%3.6
Carbon GPF	Dinar	0.736	1190	876	%3.7
Carbon ISAF	Dinar	6.361	1190	7569	%0.0
Carbon SRF	Dinar	7.620	1190	9068	%0.3
Inox HB	Dinar	0.376	7497	2819	%0.0
CBS	Dinar	0.179	8895	1592	%6.7
Scores	Dinar	0.023	2975	68	%2.9
IPPD	Dinar	0.295	9163	2703	%0.0
IT MBTS	Dinar	0.015	2695	40	%1.7
OBTS	Dinar	0.258	5593	1443	%6.1
Rinaset	Dinar	0.031	16660	516	%2.2
Resocionol	Dinar	0.077	9044	696	%2.9
Retarder	Dinar	0.055	7675	422	%1.8

Stearic acid	Dinar	0.912	1309	1194	%5.0
Zinc oxide	Dinar	1.572	1785	2806	%0.0
NY1402 F100	Dinar	5.987	8330	49872	%0.2
NY1402 F75	Dinar	1.977	8330	16468	%0.6
Banoub	Dinar	0.060	25287	1517	%6.4
Malikan	Dinar	0.040	35700	1428	%6.0
Iron wire	Dinar	3.415	1428	4877	%0.0
Kilim rubber	Dinar	0.044	825	36	%1.5
Deuterex Oil	Dinar	2.541	150	381	%1.6
Calcium carbonate	Dinar	0.407	415	169	%7.1
Hexacoated	Dinar	0.041	579	24	%1.0
Matchsticks	Dinar	0.926	474	439	%1.8
Paraffin wax	Dinar	0.440	1030	453	%1.9
total costs				**235657**	%100

Source: Preparation of the researcher based on the pricing card

It was shown from the previous table that the rubber materials spent in this frame cost (253657) dinars per volume, and were extracted by multiplying the amount of rubber spent for the tire by the unit price and as in the following equation:

Cost of rubber materials for tire size(1200-24)= 34.828 kg ×3272 dinars = 113957 dinars

The percentage of rubber raw materials (48%) of the total costs spent for the tire amounted to (1200-24) which were extracted by dividing the costs of rubber materials by the costs of the total materials spent for the tire size (1200-24) and according to the following equation:

Percentage of rubber = 113957÷235657 = 48%

In the same way, other proportions of the cost of the rest of the materials spent on the frame were extracted (1200-24) which were not taken into account because their percentage is very low and the resulting waste cannot be used or the cost of returning them is more than the cost of selling them.

To clarify the calculation mechanism to extract the ratio of the cost of rubber spent to the total cost of raw materials from the calculation of commodity supplies 32 for the size frame (1200-20) as in table (2).

Table(2)

Ratio of the cost of spent rubber materials to the total costs of the tire size(1200-20)

Details	Unit of Measurement	Quantity Spent	Price Unit /dinar	Value/ dinar	Relative to total costs
Rubber 1500 inches	Dinar	3.664	3245	11889	%0.05
Natural rubber	Dinar	29.770	3272	97407	%48
Carbon FEF	Dinar	0.626	1190	744	%3.6
Carbon GPF	Dinar	0.631	1190	750	%3.7
Carbon ISAF	Dinar	5.523	1190	6572	%0.03
Carbon SRF	Dinar	6.066	1190	7218	%0.03
Inox HB	Dinar	0.323	7497	2421	%0.01
CBS	Dinar	0.172	8895	1529	%7.5
Scores	Dinar	0.018	2975	53	%2.6
IPPD	Dinar	0.257	9163	2354	%0.01
IT MBTS	Dinar	0.012	2695	32	%1.5

OBTS	Dinar	0.200	5593	1118	%5.5
Rinaset	Dinar	0.028	16660	466	%2.3
Resocionol	Dinar	0.037	9044	334	%1.6
Retarder	Dinar	0.042	7675	322	%1.5
Stearic acid	Dinar	0.795	1309	1040	%5.1
Zinc oxide	Dinar	1.353	1785	2415	%0.01
NY1402 F100	Dinar	6.120	8330	50979	%0.2
NY1402 F75	Dinar	0.824	8330	6863	%0.03
Banoub	Dinar	0.047	25287	1188	%5.8
Malikan	Dinar	0.029	35700	1035	%5.1
Iron wire	Dinar	2.547	1428	3637	%0.01
Kilim rubber	Dinar	0.037	825	30	%1.4
Deuterex Oil	Dinar	2.119	150	317	%1.5
Calcium carbonate	Dinar	0.345	415	143	%7.0
Hexacoated	Dinar	0.019	579	11	%5.4
Matchsticks	Dinar	0.814	474	385	%1.9
Paraffin wax	Dinar	0.383	1030	394	%1.9
Total costs				**201646**	%100

Source: Preparation of the researcher based on the pricing card

It was shown from the previous table that the rubber materials spent in this frame cost (201646) dinars per volume, and were extracted by multiplying the amount of rubber materials spent for the tire by the unit price and as in the following equation:

The cost of rubber materials for the tire size(1200-20)= 29.770 kg ×3272 dinars = 97407 dinars

The percentage of rubber raw materials (48%) of the total costs spent for the tire amounted to (1200-24) which were extracted by dividing the costs of rubber materials by the costs of the total materials spent for the tire size (1200-20) and according to the following formula:

Percentage of rubber = 97407 ÷ 201646 = 48%

In the same way, other proportions of the cost of the rest of the materials spent on the frame were extracted (1200-20) which were not taken into account because their percentage is very low and the resulting waste cannot be used or the cost of returning them is more than the cost of selling them.

2. Extract the cost of rubber raw materials to the total costs of the tire size (1200-24) (1200-20) by multiplying its percentage by the total cost of raw materials disbursed as in the following equation:
   The cost of rubber raw materials = 7759717 ×48% = 3724664 dinars
3. Based on the experience of Ray, the production manager and the official of the production division, and after reviewing the tires before and after production, and since the tire comes from raw materials and in different shapes and sizes and has appendages that cannot be utilized, it was found that the percentage of waste in it reaches (10%) of them (4%) before the production stage and (6%) after the production stage, which is allowed within the normal limits, and after the cost of rubber materials disbursed during the year has been determined, the cost of damage and waste that arises before the production process will be extracted Separations through the removal of rubber appendages that cannot be used so that the raw rubber is ready for the production process, as well as the residues that arise after the production process where rubber molds are used on the frame and cut according to the proposed stages of production, resulting in residues that cannot be used at the production stage.
   We note that the percentage of waste in 2016 is (32.18%) is a very large percentage, which is the result of the reasons mentioned above, which results in large losses to the economic unit of the research sample, as well as that the factory was stopped for many years, which leads to frequent holidays in the machines during production, which causes a high percentage of damage, and the percentage of waste for 2017 was lower than

the previous year because of the presence of some consideration by the economic unit of the reasons that led to damage in the course of the process Productivity, through annual maintenance at the end of 2016, however, the percentage is still large and requires the required efforts to reduce it.

The application of green manufacturing strategies to the factory leads to the benefit of those rubber residues and the disposal of the rest of them safely and soundly, as well as leads to the achievement of financial savings through the use of these strategies, which contributes to reducing the total costs of the product as well as contributing to reducing the costs of applying those strategies, which will be applied in the study as follows:

a. - Strategy (reduction) reduction from source

The strategy of reducing the source in its application depends on the agreement with the supplier to receive rubber raw materials in the form of ready-made parts for the production of the tire without rubber appendages, thus achieving a reduction of the waste causing pollution from the source of its receipt instead of disposing of it during the production process, which entails additional costs and waste, and its percentage has been determined to be approximately (4%) of the amount of rubber materials according to the production manager, and the cost of these wastes has reached (148986) dinars by multiplying the cost of rubber materials that have been made Use during the year in the percentage of residues that have been determined according to the following equation:

Waste cost before production = 3724664× 4% = 148986 dinars

Thus, the amount of waste before it is received can be reduced and thus reduce the costs of disposal and pollution resulting from its accumulation in the factory and the communicable diseases and unpleasant odors it causes and the costs that follow to address all this.

b. Reuse Strategy

The reuse strategy is based on the possibility of the factory benefiting from rubber waste produced after the production process and which can be used in the production of by-products (such as industrial bumps - chairs) and all these products can be produced from excess rubber parts, and this is achieved by financial savings of the lowest costs of their manufacture, which contributes to the achievement of two objectives: The first is the safe disposal of these wastes, and the second is the collection of revenues from the sale of these wastes after their reuse instead of disbursing additional costs for the purpose of disposal, and the cost of these wastes amounted to (214541) dinars (after subtracting the waste that is disposed of by applying the strategy of reducing from the source) because the waste resulting from rubber appendages cannot be used for reuse as in the following equation:

Cost of waste after production = (3724664-148986) × 6% = 214,540 dinars

Where the factory can benefit from these wastes by reusing them during the production process by opening a production line specialized in reuse and taking advantage of the large number of employees, whose presence represents additional costs on the plant and raises the costs of production, and this is done by preparing them and assigning them to the reuse process and does not cost that work any other expenses because employees receive their wages monthly regardless of the existence of production or not, so the reuse strategy contributes to the achievement of additional revenues for the plant Reduce production costs so that the plant can compete with the imported product.

c. Recycling Strategy

The strategy of recycling waste can be carried out in the event that the strategies of reduction or reuse are not implemented, because when working with them the need to work with the recycling strategy to avoid the absence of rubber waste can be utilized, and that strategy can be worked by the factory itself in case it has the material and human capabilities to achieve this, or through the sale of those wastes to factories that work to recycle waste for the frame and that use tires in their production processes such as the manufacture of bumps Or the packaging of some products or other areas, where these factories use waste by conducting some operations on it to convert it into other products, and through the sale of those wastes, which were estimated at (372466) dinars (in case of failure to apply the strategies of reduction and reuse) by

multiplying the cost of the raw materials of the tire by the cost of waste generated before and after production because the application of the recycling strategy achieves the benefit of all rubber waste and as in the following equation:

Waste cost before and after production = 3724664×(4% + 6%) = 372466 dinars

d. Remanufacturing Strategy

The remanufacturing strategy is based on the treatment of finished materials that have been produced in advance and that have damage or manufacturing defects, the defect in them is fixed to return as a product with the same specifications as the original product but with a lower quality due to the damage that arose as a result of the obsolescence caused by poor storage and is in the tire factory, where the tires in the stores of the tire factory that were damaged as a result of poor storage can be remanufactured through remanufacturing them, and treating the damage to them (such as their disintegration). The number of sections in which the tire is produced during the year 2016 reached four sections of the tire size (1200-24) (1200-20) and the damaged quantity was stored (347) frames as in the production report and the cost of these products amounted to (63062742) dinars, which was extracted by multiplying the costs of one tire by its share of the damaged quantity and according to the following table:

Table(3)

The cost of damaged products is stored

The Size	Production Costs for frame(1)	Damaged quantity for frame(2)	Damaged frame costs (1×2=3)
1200-24	201147	116	23333052
1200-20	171990	231	39729690
The total	**373137**	**347**	**63062742**

Source: Preparation of the researcher based on the production report

After calculating the costs of remanufacturing one tyre, the total remanufacturing costs of the damaged quantity are calculated by multiplying the damaged amount of stored materials for 2016 for the tire by the size (1200-24)(1200-20), by the costs of remanufacturing them and as in the following equation:

Total costs of tire remanufacturing = 116 tires × 36 dinars = 4176 dinars

Total costs of tire remanufacturing = 231 tires ×30 dinars = 6930 dinars

The costs of remanufacturing are added to the total costs of damaged materials in storage to extract the total cost of recycled materials, so that the total costs of those materials remanufactured () are dinars and as in the following formula:

Total costs of damaged materials = 63062742 + 11106 = 63073848 dinars

Remanufactured products can be offered on the market at competitive prices, such as at cost price, and enables the company to reduce waste while collecting revenues that reduce the costs incurred as a result of poor storage.

From the above it is clear how much savings can be collected when following these strategies, which achieve a reduction in the value of raw rubber materials purchased, which amounted to during 2016 and as in the following table:

Table(4)

(4R) The amount of reduction achieved by the application

Cost of rubber raw materials before application	3724664	3724664	3724664	3724664

Applicable Strategies	Reduction amount	Reduction amount	Reduction amount	Reduction amount
Reducing the Source	148986	.....	.....	.....
Reuse	.....	214540	.....	.....
Recycling	.....	.....	372466	.....
Recycle	.....	.....	.....	63073848
Cost of rubber raw materials after application	3575678	3510124	3352198	(59349184)

Source: Preparation of the researcher

From the previous table, it is clear to the researcher how much reduction can be achieved when applying these strategies, noting that the trade-off is made between the application of strategies, as the application of the strategy of reduction from the source and reuse means that there is no significant waste to be used in the application of the recycling strategy, and that the adoption of the strategy (reduction from the source) will reduce the cost of rubber materials by (4%), and the application of the strategy (reuse) achieves a reduction of (6%), while the application of the strategy (recycling) It achieves a reduction of (10%) in the event that the previous two strategies are not applied, and with regard to (remanufacturing strategy) it works in isolation from the rest of the strategies because it is specialized in rubber waste damaged as a result of poor storage, so the amount of reduction achieved by the application of these strategies or some of them is as follows:

a. 148987 dinar is achieved from the application of the strategy of reducing from the source..
b. 214540 dinar is achieved from the application of the reuse strategy.
c. 372466 dinars to be achieved from the implementation of the recycling strategy
d. (59349184) JOD is achieved from the implementation of the remanufacturing strategy.

From the above it is clear that the main goal of green manufacturing is to dispose of waste safely and produce environmentally friendly products and this is what achieves sustainability for the products of the factory, which is what was reached in this section, as well as achieving financial savings from the investment of rubber waste and by applying green manufacturing strategies to it, as well as the application of the green manufacturing system achieves sustainability in its dimensions (environmental - economic - social - technological), as the environmental dimension is achieved through the treatment of waste that causes environmental pollution and what has it From a negative impact on man and his environment and achieving the environmental quality of workers by equipping them with the necessary health protection tools and equipment to reduce the effects of gas emissions resulting from the use of chemicals in production, and achieve economic sustainability as the application of green manufacturing strategies provided a reduction in the costs of disposal of waste as well as the collection of revenues as a result of its sale, and social sustainability is achieved by providing a suitable atmosphere for workers and discussing the spirit of cooperation and teamwork among them to carry out their tasks safely, and is achieved Technological sustainability Use of Technolo

Conclusions and recommendations

First:. Conclusions

During this research, a set of conclusions was reached, which are as follows:.

1. Weak ability and capabilities of the factory in the application of green manufacturing strategies as a result of the administration's lack of awareness of the importance of these strategies and ignorance of the

development of activities concerned with the recovery of its obsolete products and the optimal exploitation of raw material residues in the manufacturing process and improving their efficiency.

2. - Sustainability accounting is a branch of accounting concerned with the recording, analysis and use of financial and non-financial information and is complementary to financial accounting, but it is not limited to economic aspects only, but has expanded the boundaries of accounting by focusing on social, environmental and technological aspects as well, and reporting information related to sustainability, sustainability accounting aims to measure the performance of economic units from the environmental, economic, social and technological point of view, and ensure the application of accountability, transparency and disclosure of the results of the activity.
3. The green manufacturing system achieves the goal of the economic unit in reducing and eliminating sources of waste, damage and waste, which reduces production costs and reduces environmental pollution, which gives the economic unit a competitive advantage.
4. There is a significant weakness in the application of the proposed green manufacturing strategies.

Secondly:. Recommendations

In the light of the conclusions reached, the research recommends the following:

1. The use of modern technology in the production departments of the factory, especially in the preparation department for the recycling of volatile materials, which contributes to reducing the rates of environmental pollution as well as reducing the costs resulting from the loss of part of the raw materials, which contributes to reducing the amount and proportions of waste.
2. The need to increase knowledge and knowledge of the strategies of the green manufacturing system and interest in the latest manufacturing technologies and what has been reached by international industrial companies and try to benefit from them to apply the scientific methods that support those strategies.
3. The government side provides electricity to the economic unit without interruption to help it control the high rates of damage, which is the main reason for the occurrence of power outages.
4. The need to keep abreast of industrial developments, especially in the tire industry, through the introduction of modern equipment that enjoys high speed and accuracy in the production and manufacture of the tire while intensifying training courses for workers to certify this equipment.

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