Using Material Flow Cost Accounting Method to Cost Rationalization (Applied Study)

DR. Mohiy Samy Mohamed Elshabasy*

Abstract

The Purpose of The Research is: to use Material Flow Cost Accounting Method to measure and rationalize the cost through Applying it to the Misr Oil and Soap Company, for the Edible Oil manufacturing activity only for the year ending on 30/6/2021.

Design/Methodology/Approach/Results: The research is based on the deductive and inductive method, and conducting an applied study On the Misr Oil and Soap Company Using material flow cost accounting method (MFCA), and the researcher reached the validity of Research hypotheses, And The total costs under the current costing system of sunflower oil amounted to 29,763,081 EGP while it amounted to 29,107,640 EGP under MFCA a decrease of 655,441 EGP, As for cottonseed Oil, the total costs of amounted to 8,449,540 EGP under the current costing system, under MFCA 8,263,254 EGP, a decrease of 186,286 EGP, as for the Mixed oil, the total costs amounted to 1,354,434,680 EGP under the current cost accounting system, while under MFCA, it amounted to 1,320,800,171 EGP a decrease of 33,634,509 EGP, as well The Gross profit for edible oils under the current cost accounting system amounted to 93,207,103 EGP while it amounted to 127,683,339 EGP a difference of 34,476,236 EGP, while the net profit amounted 2,756,419 EGP. And other results confirm that the proposed method contributes to rationalizing cost and improving the environment, leading to increased profitability.

* **Lecturer Of Accounting Department, Faculty of Commerce & Business Administration, Helwan University.**

Originality/Value: To provide a scientific addition in the field of Costing and managerial accounting through using the method of material flow cost accounting (MFCA) in Cost rationalization and Protecting the Environment.

Keywords:
Material Flow Cost Accounting (MFCA), Cost Rationalization, Misr Oil & Soap Company.

استخدام أسلوب محاسبة تكاليف تدفق المواد لترشيد التكلفة (دراسة تطبيقية)

د. محي سامي محمد الشباسي*

الملخص:

تهدف هذه الدراسة إلى استخدام أسلوب محاسبة تكاليف تدفق المواد لترشيد التكلفة بالتطبيق على شركة مصر للزيوت والصابون لنشاط تصنيع زيوت الطعام للسنة المالية المنتهية في ٢٠٢١/٦/٣٠، وقد توصل الباحث إلي ثبات صحة فرض البحث، وأن التكاليف الإجمالية في ظل نظام التكاليف الحالي بلغت ٢٩,٧٦٣,٠٨١ جنيه لزيت عباد الشمس بينما بلغت ٢٩,١٠٧,٦٤٠ جنيه وفقاً (MFCA) بانخفاض قدره ٦٥٥,٤٤١ جنيه، أما زيت بذرة القطن بلغت التكاليف الإجمالية في ظل نظام التكاليف الحالي ٨,٤٤٩,٥٤٠ جنيه بينما بلغت ٨,٢٦٣,٢٥٤ وفقاً (MFCA)، بانخفاض قدره ١٨٦,٢٨٦ جنيه، أما عن الزيت المختلط فقد بلغت التكاليف الإجمالية في ظل نظام التكاليف الحالي ١,٣٥٤,٤٣٤,٦٨٠جنيه، بينما بلغ ١,٣٢٠,٨٠٠,١٧١جنيه وفقاً (MFCA)، بانخفاض قدره ٣٣,٦٣٤,٥٠٩ جنيه، كما بلغ مجمل الربح لزيوت الطعام في شركة مصر للزيوت والصابون في ظل نظام التكاليف الحالي ٩٣,٢٠٧,١٠٣ جنيه بينما بلغ ١٢٧،٦٨٣،٣٣٩ جنيه وفقاً (MFCA) بفارق ٣٤،٤٧٦،٢٣٦ جنيه بينما بلغ صافي الربح ٢،٧٥٦،٤١٩ جنيه لنشاط تصنيع زيوت الطعام للسنة المالية المنتهية في ٢٠٢١/٦/٣٠ وغيرها من النتائج التي تؤكد أن الطريقة المقترحة تسهم في ترشيد التكلفة والمحافظة على البيئة وتؤدي إلى زيادة الربحية.

الكلمات المفتاحية: محاسبة تكاليف تدفق المواد، ترشيد التكلفة، شركة مصر للزيوت والصابون.

* مدرس بقسم المحاسبة – كلية التجارة وإدارة الأعمال – جامعة حلوان

1. Introduction

Material Flow Cost Accounting (MFCA) Is one of the most important cost management tools that with measuring the cost of the product and measuring material losses and associated costs, which Contribute to rationalizing and controlling costs and preserving the environment. Whereof MFCA is a special allocation method for distributing the costs in a production system to both the products and the material losses. Both types of flows are the final cost purposes, and MFCA enables companies to identify the added value they lose because of material losses. (Mario, 2015, P 1311).

Thus, become the cost resulting from material loss is an incentive for management to take ways that help study and take advantage of possible improvement opportunities, which in turn help reduce operating costs by reducing material losses. So, that material flow cost accounting can help companies achieve financial benefits and reduce negative environmental impacts.

Hence, it must be considered that the term "material flow Cost accounting" does not mean accounting for the cost of materials used in production only, but also includes the costs of all other resources exhausted in production processes from energy costs, system costs, and waste costs, but for simplicity only and that the material component is the most important Component Production All resources have been placed under "Material Flow".

MFCA has received remarkable attention from researchers for a long time, especially in the field of cost measurement and rationalization, and environmental preservation. Among the most important of these studies that dealt with Material Flow Cost Accounting As follows: Dana, 2011, PP 7-18; Katherine, Roger, 2015, PP 1-9; Claudia, Others, 2018, PP 193 - 200; Michiyuki, Katsuhiko, July 2018, PP 1-43; Michiyuki, Katsuhiko, 2019, PP 823–837; Ali & Others, 2019, PP 616 – 628; Akira, 2021, PP 695-718; Zhimin, Fanrong,2022, PP 1-18.

So The Research Problem based on That the traditional cost accounting system does not provide sufficient and detailed information on the cost of materials, does not record data on material inputs to and from cost centers in production, but it Depends on the general accounts provided by the production planning system, which may not reflect the actual situation of the company, in addition, it calculates material loss using inaccurate loss ratios that may not reflect for actual losses incurred during Production, this is what distinguishes MFCA which overcomes all previous difficulties. Where it Relies MFCA on the analysis of the relationship between inputs and outputs in production processes, and the loss is represented as the difference between inputs and outputs. (Katsuhiko, 2015, P 1281), and it enhances material and energy efficiency by reducing material and energy losses and by Rationalization the material used in products this can be achieved within the Company without reference to other companies but in other

cases collaboration between two or more Company's in a supply chain can achieve even more reduction of total material losses throughout the supply chain. (ISO 14052, 2017, P 2). Despite this, MFCA has not been used enough in companies despite the many benefits it brings. This may be due to the Top Management's lack of awareness of the importance of this method, as well as the lack of trained workers to apply it, in addition to confronting workers with any change.

Therefore, the research problem lies in the difficulty of determining the appropriate method for measuring and rationalizing costs in the Edible Oils industry. Here, several Research Questions arise regarding the application of this proposed method, which is:

RQ1. What are the Theoretical Steps on which the Proposed Method can be based?

RQ2. Does the Proposed Method Contribute to measuring and Rationalizing the Cost of Edible Oils?

2. Research design and Methodology.

This research aims to use the Material Flow Cost Accounting Method to measure and rationalize the cost through Applying it to the Misr Oil and Soap Company, this research is based on the main hypothesis, which is: "Material Flow Costs Accounting Method Contributes to the Measurement and rationalization of cost in the Edible Oils Industry".

The research is based on both the deductive and inductive approach and the method of theoretical study through the study,

analysis, and extrapolation of books, periodicals, and publications closely related to the topic, and the method of Applied Study through the application on the Misr Oil and Soap Company according to the method of material flow cost accounting to measure and rationalize the cost.

The application was limited to accounting for the costs of the edible oil manufacturing activity only for the year ending on 30/6/2021, and the researcher was not exposed to the industrial vegetable margarine manufacturing activity due to the absence of production for this year, as well as the soap and animal feed activity due to the different nature of the manufacturing process from the process of manufacturing edible oil as well as the cost elements differ for each of them, and the researcher did not address anything else in the application except to serve the purpose of the research.

3. Theoretical Framework of Material Flow Cost Accounting (MFCA)

The Concept of Material Flow Cost Accounting (MFCA) figured as an outcome of environmental management projects in Germany in the late 1980s and early 1990s by Professor Bernd Wagner and it was developed through environmental management Accounting Projects conducted by the Ministry of Economy, Trade, and Industry of Japan in the 2000s. (Kimitaka & Others, 2022, P 3).

It appeared MFCA during this period as an accounting method that reduces cost and improves the environment by tracking the

flow of materials and energy, identifying any waste, and working to eliminate or reduce it.

And MFCA became more important when the ISO allocated the Special standards of MFCA as ISO 14051, Environmental management — Material flow cost accounting — General framework in 2011, like ISO 14052, " Environmental management — Material flow cost accounting — Guidance for practical implementation in a supply chain" in 2017, and as ISO 14053, Environmental management — Material flow cost accounting — Guidance for phased implementation in organizations " In 2021. Since the standardization of ISO standards.

MFCA began to spread all over the world, especially in the continent of Asia such as India, Malaysia, Taiwan, Thailand, and Vietnam, and This may be due to the diffusion project implemented by the Asian Productivity Organization". (Kimitaka & Others, Op. Cit, P 3)

The Concept of Material Flow Cost Accounting (MFCA) may be defined as: "A tool for measuring the flows and stocks of materials in operations or production lines in both physical and monetary units". (ISO 14053, 2021, P 2).

It is also defined as: "is a management tool which was established to measure the material flow in production lines in terms of both physical and monetary values for management purpose". (Jo Yee Ho & Others, 2021, P 562)

And the researcher 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".

3.1. Objectives Of MFCA

The objective of MFCA is to motivate and support Firm's to both financial, environmental Performance through Optimum use of resources from material and labor, energy, Measuring and rationalizing cost use through the following: (ISO 14051, 2011, P 4; Elham, Naeimeh, Esmaeil, 2017, P 531).

1- supporting and increasing the transparency of material flows and labor, energy use, the related costs, and environmental aspects.

2- supporting management decisions in areas such as process engineering, production planning, quality control, Cost Management, Product design, supply chain management, Measuring and Controlling Costs.

3- Improving and Increasing coordination and communication Between different Management and departments within Companies on Material and Energy.

3.2. Steps Apply of MFCA As a Proposed Method

Relies on Material Flow Cost Accounting Apply through Of Several Steps, as following: (Dana, Op. Cit, PP 7-8; Katherine, Asian Productivity Organization, 2014, PP 8-10, Roger, 2017, PP 604-605; Bernd, 2015, P 1256; Majid, Morteza, 2019, P 461).

Firstly: Planning

includes management involvement, identification of necessary expertise, setting limits, Period for MFCA data collection, and identification of appropriate quantitative centers.

Secondly: implementation

It depends on several points as follows:

1- Determine and create the quantity centers.

2- Determining the quantity and value of inputs and outputs for each quantity center, requires achieving a material balance equal to the quantitative inputs and outputs for each of the quantitative centers and this helps us to identify the missing quantities or represent a loss. (Sosuke & Others, 2021, P 2).

3- Each product is categorized into a positive product (required) and a negative product (waste or recyclable product).

4- Costs are measured for the positive product and the negative product.

5- Costs are measured at all stages of manufacturing until the product is finished.

6- Divide all costs, whether industrial or service, into the following categories:

A- Material costs: They are represented in the costs of the main materials in addition to the various sub-materials and additional materials that enter the manufacturing and production process.

B- Energy costs: are the cost of energy sources such as electricity, fuel, steam, heat, compressed air, and any other costs that have an impact on energy consumption.

C- System costs: are all costs necessary to facilitate the flow of materials except for the cost of materials and the cost of energy, such as wages, depreciation, transportation, and other overhead costs. And which must be allocated to quantity centers.

D- Waste Management Cost: It means the costs incurred to treat waste in the quantity center, Activities include (reform of defective products, recycling and disposal operations waste and air emissions, and Others).

And illustrates Figure 1. Nature of MFCA Work, And the division of costs according to material flow cost accounting.

7- Preparing production cost statement according to MFCA Method.

8-Setting the flowchart for the cost of the product according to the MFCA method.

Thirdly: Verification

It includes the interpretation and summarization of the MFCA data and the transmission of their findings to Top management.

Fourthly: Improvement

It focuses on analyzing the previous point by Comparison between the Current Costing System & The Application of MFCA to identify losses and the reasons for their occurrence to identify and evaluate opportunities for improvement.

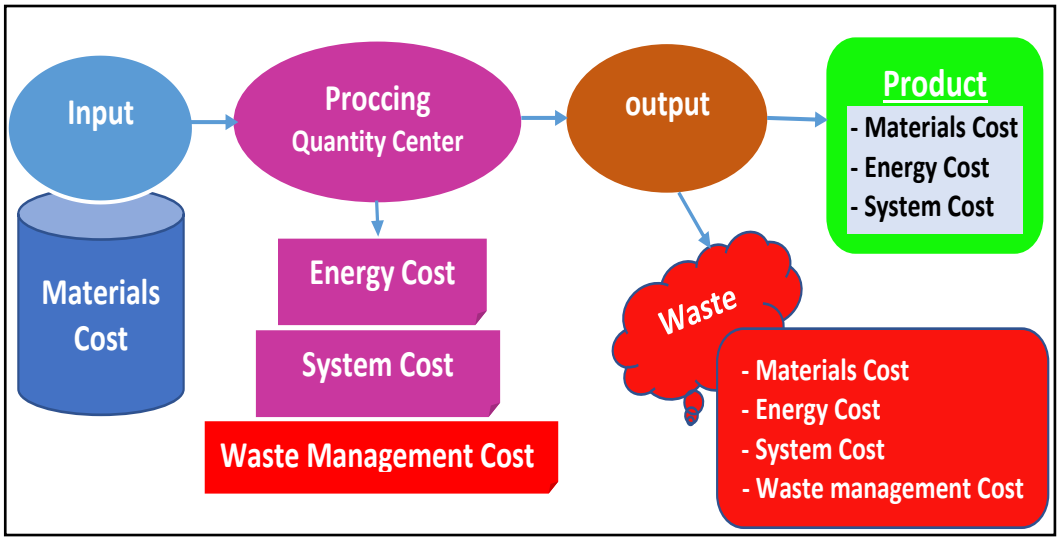


Figure 1. Nature of MFCA Work (Prepared by Researcher)

3.3. Benefits Applying of MFCA

Managerial Accounting has neglected the analysis of material flows from an environmental dematerialization and eco-efficiency perspective for a long time besides managing material usage. and Reduced access to many resources and increased costs of handling, storing, and disposing of waste have created a demand for improving material efficiency Which calls to the need for an MFCA. (Stefan, Dimitar, 2015, PP 1333 – 13334)

So, there are many benefits that many of to a company when Applying Material Flow Cost Accounting (MFCA), which are: (Katherine, Roger, 2015, P 1382; Yoke & Others, 2015, P 603).

1- Contributes to cost Rationalization and Control as it is one of the most important cost management tools, which with measuring the cost of the product and measuring waste in materials and associated costs.

2- Improved efficiency and a reduction in direct material costs, other manufacturing costs, A reduction in the amount of waste generated, and reduced ecological impact.

3- Improving the quality of the information system as more detailed information with which the matching between physical and financial data can.

4- Improving organizational structures and procedures, due to the presence of communication between departments as quantitative centers.

5- Focusing on materials and energy as a key factor in improving the company's environmental and financial performance.

6- It provides incentives and motives for developing new products, improving production quality, and re-engineering processes.

7- Providing information that helps in making decisions to activate the supply chain management process and customer relations, especially in the medium and long term.

8- It provides information that helps check the performance of individuals and departments in support of administrative control systems.

9- Expanding the Scope of wastage losses to include recognizing waste as a loss and not as a cost, because the loss in any production process means the inefficiency of the process and not a cost that the company must bear, and thus opens the way for the need to find appropriate measures to reach the aim zero waste or reduce the waste as much as possible.

4. Applied Study

The applied study aims to test the ability of the Proposed Method to measure the cost of material flow to achieve cost rationalization.

The applied study includes the following points:

4.1. Introducing the field of application "Misr Oil & Soap Company"

The company was established to the royal decree issued in El-Montazah Palace on 7/11/1938 published in the Egyptian Gazette Supplement No. 33 issued on the first of December 1938, a joint-stock company in the name of (Misr Oil Industry and Trade Company) and some companies into it under Minister of Industry Decree No. 889 of 1963 published in The Egyptian Gazette No. 76 on November 30, 1965.

And the decision of the board Egyptian General Corporation for Food Industries in its two sessions held on February 1, 1967, headed by the Minister of Industry and the decision of the board of directors of the Egyptian General Corporation for

Food Industries in its session No. 83 on 19/9/1967 Headed by the Minister of Industry and the decision of the Board of Directors of the Egyptian General Corporation for Food Industries in its 83rd session on 19/9/1967 headed by the Minister of Industry to become the name of the company (Misr Oil and Soap) an economic unit of the public sector units fully owned by the state, then owned by the Holding Company for Industries The company issued its articles of association as a subsidiary of the Holding Company for Food Industries with an authorized capital of 30 million EGP and an issued capital of 20 million EGP distributed over 400,000 shares at a value of 50 EGP and published in the Egyptian Gazette Issue 98 on 2/5/1993. **(https://www.misroil.com)**

Misr Oil and Soap Company are one of the most important companies specialized in the manufacture of edible oils of all kinds (sunflower oil, cottonseed oil, mixed oil especially for the ration system, and the company can produce any other packages of oils according to customer requests), vegetable margarine, and all kinds of soap. Animal feed, fish feed, poultry feed. And The company includes five factories located in the governorates of Egypt, other than the main center.

The issued and paid capital of the company during the financial period ending on 30/6/2021 amounted to 60,000,000 EGP and Total Owners equity 538,589,880 EGP, and profits for the period 3,647,472 EGP, total assets 169,068,495 EGP, Total Liabilities 115,209,515 EGP, and Net sales 1,585,782,269 EGP. (Financial Report, Misr Oil & Soap Company, year ending 30 June 2021).

4.2. Limits and Scope of the Applied Study.

The application was limited to accounting for the costs of the edible oil manufacturing activity only for the year ending on 30/6/2021, and the researcher was not exposed to the industrial vegetable margarine manufacturing activity due to the absence of production for this year, as well as the soap and animal feed activity due to the different nature of the manufacturing process from the process of manufacturing edible oil as well as the cost elements differ for each of them, and the researcher did not address anything else in the application except to serve the purpose of the research.

4.3. The stages of Manufacturing Edible Oils in The Company under the application.

The Process of Manufacturing Edible Oils in the Company under application is carried out through three basic stages, as follow:

Firstly: Pressing Stage:

This stage includes a set of activities, as followings:

(A) The Activity of seeds preparation & Cleaning:

This stage includes a set of activities, as follows:

- **The process of seeds receiving:**

In this process, seeds are received in open and closed warehouses and then transferred to the silos.

- **The process of seeds sifting and cleaning:**

In this process, the Seeds are sifted and cleaned of impurities, and dust and dirt are separated from them.

- The process of removing the husk from seeds:

In this process, the husks of the seeds are removed and disposed of, because if they are not removed, the productivity of the extracted oil will decrease.

(B) Seeds grinding & cooking Activity:

This activity includes a set of operations, the most important of which are:

- grinding process:

In this process, clean seeds are conveyed through belts to crushing devices, and in this process, the seeds are broken into suitable sizes for easy cooking.

- Cooking process:

In this process, the Seeds are cooked in pots by steam, and this process facilitates the flow of oil and kills bacteria.

(C) The Activity of Seeds Pressing:

After completing the operations of preparing, cleaning, grinding, and cooking the Seeds, as we explained in the previous operations, the cooked Seeds are then pressed to produce crude oil through mechanical pressing.

(D) The Activity of Transportation Crude Oil:

In this stage, the crude oil is transferred from the pressing stage to the refining stage by pumps.

Secondly: Oil Refining & Purification Stage:

This stage depends on a set of purification and refining processes through a physical separation and chemical separation, which are:

(A) The Process for removing free fatty acids and waxes, pigments:

In this process, the crude oil is processed from free fatty acids, waxes, and pigments by adding phosphoric acid (H3PO4), sodium hydroxide (NaOH), and adjusting the acidity of the oil.

(B) The Process for removing Sodium hydroxide, color, and bleaching:

In this process, the crude oil is purified by removing the trace of sodium hydroxide, removing color, and bleaching by heating the oil at a temperature equivalent to 40-85 °C, then adding to it bleaching earth at a ratio of 1-2% of the weight of the oil at a temperature equivalent to 82-90°C.

(C) The process of distillation & removal of taste and odor:

In this process, the bleached oil in the previous process is rid of the impurities that give the oil an undesirable smell and taste by heating the oil at a temperature equivalent to 225-250°C, to reach the oil in its final form according to the Egyptian and international standards.

Thirdly: The Oil Packaging stage

This stage is the last stage of the production and manufacture of edible oils, at this stage, purified and refined oil is filled in the previous stages in plastic containers of different capacities, and then badges are placed on them.

Must be Noted that a sample is taken through the Quality Department to check the quality of the oil by Egyptian and international standards in all previous stages, starting from the stage of receiving seeds, passing through the stage of pressing and refining, even filling.

4.4. The Current Costing System for Misr Oil & Soap Company.

The Firm's Cost system is based on the Process Cost System, and The manufacture of oil goes through three basic stages: (Pressing Stage, Purification & Refining stage, Packaging Stage), The company Produces three types of Edible Oils Follows: (Sunflower Oil, Cottonseed Oil, Mixed Oil designated for the Ministry of Supply) and Each type of oil consumes many different Elements of Cost, and therefore it is possible to review the total costs of each type of oil and the cost details as shown in Table 1. The Total cost statement of Edible Oils for the Fiscal year Ending On 30/6/2021.

The researcher has Prepared a Summary of the quantitative data to the Misr Oil and Soap Company based on the actual data of the company, to use in applying the proposed method, as shown in Table 2. Summary of Quantitative Data for Edible Oils.

Table 1. The Total Cost Statement of Edible Oils for the Fiscal year Ending on 30/6/2021 (Value in EGP*)

Description	Sunflower Oil	Cottonseed Oil	Mixed Oil	Total cost Oil
Cost Elements				
Raw Materials				
Pressing stage	**17,255,000**	**4,900,000**	**785,787,250**	**807,942,250**
Refining stage	**441,756**	**123,990**	**19,542,683**	**20,108,429**
Total Materials Cost	**17,696,756**	**5,023,990**	**805,329,933**	**828,050,679**
labor cost	**1,748,811**	**496,475**	**79,583,503**	**81,828,789**
Total direct cost	**19,445,567**	**5,520,465**	**884,913,436**	**909,879,468**

* **Egyptian Pound Abbreviation**

Indirect costs:				
Electricity expense	**915,043**	**259,775**	**41,641,141**	**42,815,959**
gas expense	**1,006,131**	**285,633**	**45,786,165**	**47,077,929**
water expense	**680,099**	**193,075**	**30,949,360**	**31,822,534**
steam expense	**206,757**	**58,696**	**9,408,933**	**9,674,386**
Cost of maintenance and spare parts	**133,436**	**37,881**	**6,072,299**	**6,243,616**
Costs of Quality Management for pressing and Refining	**195,877**	**55,608**	**8,913,815**	**9,165,300**
Depreciation Expense	**293,027**	**83,188**	**13,334,840**	**13,711,055**
Other Industrial Costs	**77,797**	**22,086**	**3,540,324**	**3,640,207**
Total indirect costs	**3,508,167**	**995,942**	**159,646,877**	**164,150,986**
Total Oil Cost during the period	**22,953,734**	**6,516,407**	**1,044,560,313**	**1,074,030,454**
inventory change	**4,786,961**	**1,358,986**	**3,066,906**	**9,212,853**
Cost of Oil sold	**27,740,695**	**7,875,393**	**1,047,627,219**	**1,083,243,307**
Cost of Oil Filling and Packaging	**1,719,437**	**488,136**	**127,346,775**	**129,554,348**
Advertising, selling, and distribution expenses	**179,499**	**50,965**	**89,168,498**	**89,398,962**
The cost of Sales of bottled Oil	**29,639,631**	**8,414,494**	**1,264,142,492**	**1,302,196,617**
General and administrative expenses	**123,450**	**35,046**	**90,292,188**	**90,450,684**
Total cost of bottled Oil	**29,763,081**	**8,449,540**	**1,354,434,680**	**1,392,647,301**

Table 2. Summary of Quantitative Data for Edible Oils

Description	Sunflower Oil	Cottonseed Oil	Mixed Oil		Total cost Oil
Production Quantity (tons)	**1,357**	**386**	**59,944**		**61,687**
Inventory change (tons)	**283**	**422**	**176**		**881**
Sales Quantity (tons)	**1,640**	**808**	**60,120**		**62,568**
Edible Oil Sales Percentage (%)	**2,62%**	**1.29%**	**96,09%**		**100%**
Selling Price Per tons (EGP)	**22,800**	**22,720**	**22,283**		**-**
Waste Quantity (tons)	**74**	**25**	**3,571**		**3,670**
Seeds and Raw Materials used in the Pressing stage					
Quantity (tons)	**2,030**	**784**	**23,111**	**94,295**	**120,220**
Purchase price (EGP)	**8,500**	**6,250**	**8,500**	**6,250**	**-**

4.5. Application of the Proposed MFCA Method of Cost Rationalization.

Misr Oil and Soap Company produce three types of oils: (Sunflower Oil, Cottonseed Oil, and Mixed Oil), Therefore, the steps for measuring the cost of edible oil will be applied according to the MFCA method for each type Separately as Previously Presented in the theoretical framework.

Firstly: Sunflower Oil:

The steps for measuring the cost of Sunflower Oil will be applied according to MFCA as follows:

1- Planning

As for the period? The period is determined in a full year, starting from 1/7/2020 until 30/6/2021. As for the quantity centers under the Sunflower Oil manufacturing stages system, they are represented in three main centers, namely the oil pressing center, the oil refining and purification center, and the oil Packaging center.

2- Implementation

Implementation depends on determining the quantity centers represented in the sunflower oil industry in three basic stages as follows:

- **Oil Pressing Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 3, he explained that the number of inputs for the materials amounts to 2,030 tons at 17,255,000 EGP and that the outputs of the positive product from the materials were 2,001 tons at 17,008,500 EGP and the Waste was 29 tons at 246,500 EGP and that the total cost of inputs was 21,635,263 and the total

value of outputs from the positive product was 21,087,121, and the total cost of Waste was 548,142 EGP.

Table 3. Sunflower Oil (Cost of Oil Pressing stage "Quantity center")

Cost Elements	Cost of Oil Pressing Stage (Quantity center)*					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (tons)	2,030	17,255,000	2,001	17,008,500	29	246,500
Energy Cost (kW)	1,007,037	2,364,438	975,947	2,287,157	31,090	77,281
System cost	-	1,876,330	-	1,791,464	-	84,866
Waste Management Cost	-	139,495	-	-	-	139,495
Total Cost	-	21,635,263	-	21,087,121	-	548,142

- **Oil Refining & Purification Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 4, he explained that the number of inputs for the materials amounts to 28 tons at 441,756 EGP and that the outputs of the positive product from the materials were 27.664 tons at 436,455 EGP and the Waste was 0.336 tons at 5,301 EGP and that the total cost of inputs was 1,318,471 EGP and the total value of outputs from the positive product was 1,258,292 EGP and the total cost of Waste was 60,179 EGP.

* For More details on Sunflower Oil Costs See Appendix I.

Table 4. Sunflower Oil (Cost of Oil Refining stage "Quantity center")

Cost Elements	Cost Of Oil Refining & Purification Stage (Quantity center)					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (tons)	28	441,756	27.664	436,455	0.336	5,301
Energy Cost (kW)	216,196	443,592	205,064	420,290	11,132	23,302
System cost	-	417,140	-	401,547	-	15,593
Waste Management Cost	-	15,983	-	-	-	15,983
Total Cost	-	1,318,471	-	1,258,292	-	60,179

- **Oil Packaging Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 5, he explained that the number of inputs for the materials amounts to 1,550,000 bottles at 1,382,659 EGP and that the outputs of the positive product from the materials were 1,536,000 bottles at 1,370,171 EGP and the Waste was 14,000 bottle at 12,488 EGP and that the total cost of inputs was 1,719,437 EGP and the total value of outputs from the positive product was 1,672,317 EGP and the total cost of Waste was 47,120 EGP.

Table 5. Sunflower Oil (Cost of Oil Packaging stage "Quantity center")

Cost Elements	Cost Of Oil Packaging Stage (Quantity center)					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (bottle)	1,550,000	1,382,659	1,536,000	1,370,171	14,000	12,488
Energy Cost (kW)	54,839	87,742	52,371	83,793	2,468	3,949
System cost	-	228,317	-	218,353	-	9,964
Waste Management Cost	-	20,719	-	-	-	20,719
Total Cost	-	1,719,437	-	1,672,317	-	47,120

- The statement of the Total cost of sunflower oil according to the MFCA method as shown in Table 6, showed that the total cost of the input was 24,673.171 EGP and the output of the positive product was 1,357 tons at a total cost of 24,017,730 EGP and the waste was 74 tons at a total cost of 655441 EGP.

Table 6. Sunflower Oil (Production Costs According to "MFCA")

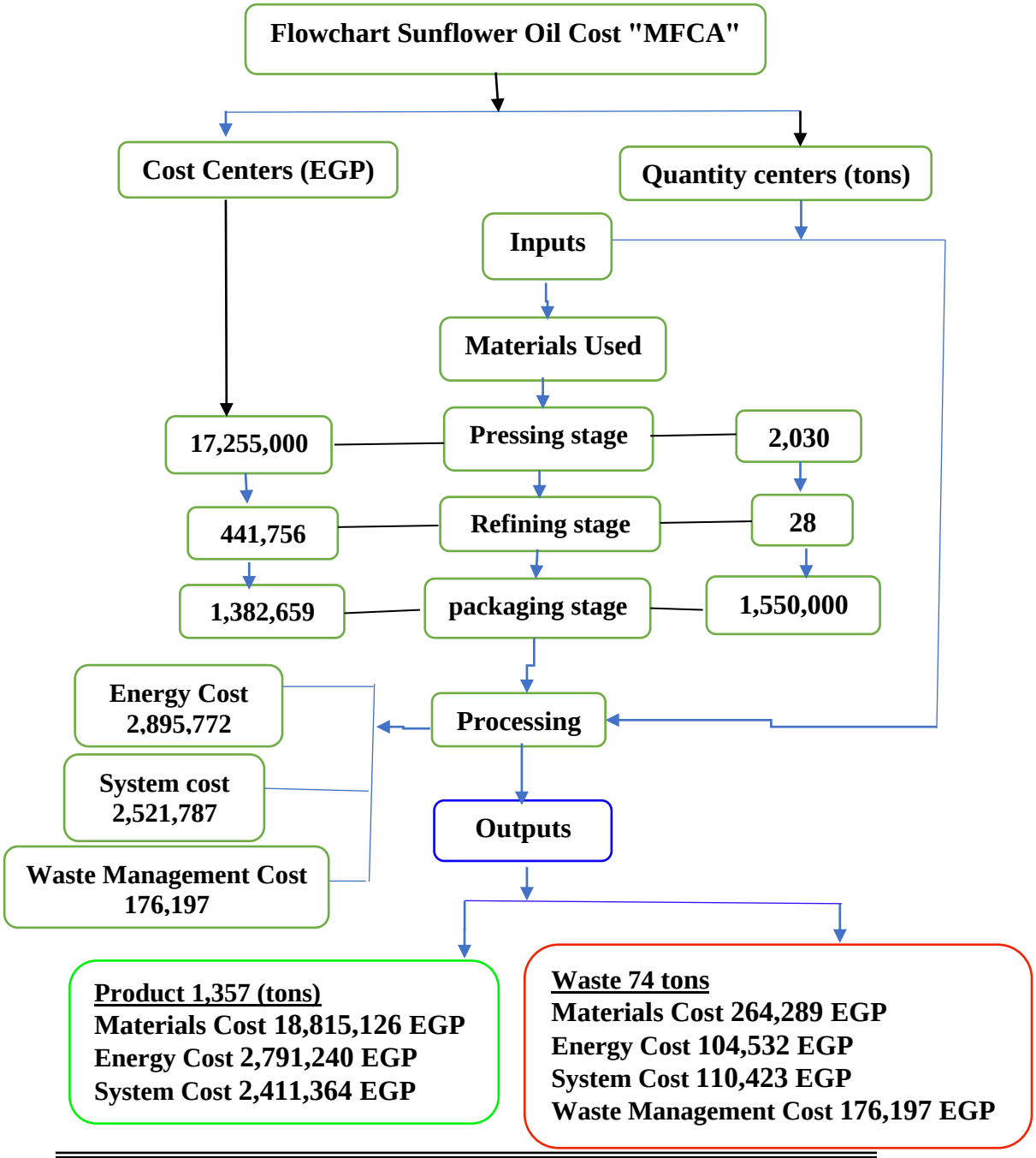
Description	Production Costs According to "MFCA"		
		Output	
	Input	Product	Waste
Quantity produced (tons)	-	1,357	74
Cost Elements			
Cost of Materials Used	19,079,415	18,815,126	264,289
Energy Cost	2,895,772	2,791,240	104,532
System cost	2,521,787	2,411,364	110,423
Waste Management Cost	176,197	-	176,197
Total Cost	24,673,171	24,017,730	655,441

- Setting the Flowchart Sunflower Oil Cost according to the MFCA method as shown in Figure 2, It shows the quantities and cost of the three quantity centers and the elements of costs and inputs and outputs in detail.

3- **Verification**:

By presenting the results of MFCA application of sunflower oil to senior management in preparation for comparison with the current costing system to identify deficiencies.

Figure 2. Flowchart Sunflower Oil Cost "MFCA" (Prepared by Researcher)



4- Improvement:

It focuses on the analysis of the previous point by comparing the current cost system and the application of MFCA by Preparing the Statement of the total cost of sunflower oil as in Table 7, It shows that the total cost is 29,763,081 according to the current costing system, while under MFCA it amounted to 29,107,640 a difference of decrease of 655,441 EGP which contributes to cost rationalization. As well shows the statement of Profit & Loss for sunflower oil as in Table 8, The gross profit is 7,752,369 according to the current cost system. While under MFCA it amounted to 8,407,810 which is an increasing difference of 655,441 EGP which represents the value of the difference in cost reduction previously presented. As for the net profit, we will find that it is the same under the current cost system or the application of MFCA, which is 7,628,919 given that according to the current costing system the loss is considered part of the cost and not measured and knowing its causes and it is charged to the cost of production, which is considered a waste of the company's resources. On the contrary, we find that MFCA considers it a loss and not a cost element that requires treatment, which contributes to assessing the management's efficiency from exploiting its resources, rationalizing cost, achieving accurate cost measurement, and setting a price fair product.

Table 7. Total Cost of Sunflower Oil (The Current Costing System vs "MFCA")

Description	The Current Costing System	MFCA	Cost differences
Total Oil Cost during the Period	24,673,171	24,017,730	655,441
inventory change	4,786,961	4,786,961	0
Cost of Oil Sold	29,460,132	28,804,691	655,441
Advertising, selling, and distribution expenses	179,499	179,499	0
The cost of Sales of bottled oil	29,639,631	28,984,190	655,441
General and administrative expenses	123,450	123,450	0
The total cost of bottled oil	29,763,081	29,107,640	655,441

Table 8. Profit & Loss Statement of Sunflower Oil (the Current Costing System vs "MFCA")

Description	The Current Costing System		MFCA	
Sales Revenue		37,392,000		37,392,000
The cost of Sales of bottled oil		(29,639,631)		(28,984,190)
Gross profit		7,752,369		8,407,810
General and administrative expenses		(123,450)		(123,450)
Waste costs losses				
Cost of Materials Used	0		(264,289)	
Energy Cost	0		(104,532)	
System cost	0		(110,423)	
Waste Management Cost	0		(176,197)	
Total Waste costs losses		0		(655,441)
Bottled Oil Net Profit		7,628,919		7,628,919

Secondly: Cottonseed Oil:

The steps for measuring the cost of Cottonseed Oil will be applied according to MFCA as follows:

1- Planning

As for the period? The period is determined in a full year, starting from 1/7/2020 until 30/6/2021. As for the quantity centers under the Cottonseed Oil manufacturing stages system, they are represented in three main centers, namely the oil pressing center, the oil refining and purification center, and the oil Packaging center.

2- Implementation

Implementation depends on determining the quantity centers represented in the Cottonseed oil industry in three basic stages as follows:

- **Oil Pressing Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 9, he explained that the number of inputs for the materials amounts to 784 tons at 4,900,000 EGP and that the outputs of the positive product from the materials were 776 tons at 4,850,000 and the Waste was 8 tons at 50,000 EGP and that the total cost of inputs was 6,143,532 EGP and the Total value of outputs from the positive product was 5,996,802 EGP and the total cost of Waste was 146,730 EGP.

Table 9. Cottonseed Oil (Cost of Oil Pressing stage "Quantity center")

Cost Elements	Cost of Oil Pressing Stage (Quantity center)*					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (tons)	784	4,900,000	776	4,850,000	8	50,000
Energy Cost (kW)	285,895	671,253	275,420	646,058	10,475	25,195
System Cost	-	530,503	-	500,744	-	29,759
Waste Management Cost	-	41,776	-	-	-	41,776
Total Cost	-	6,143,532	-	5,996,802	-	146,730

- **Oil Refining & Purification Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 10, he explained that the number of inputs for the materials amounts to 7.859 tons at 123,990 EGP and that the outputs of the positive product from the materials were 7.701 tons at 121,497 EGP and the Waste was 0.158 tons of 2,493 EGP and that the total cost of inputs was 372,881 EGP and the total value of outputs from the positive product was 355,902 EGP and the total cost of Waste was 16,979 EGP.

Table 10. Cottonseed Oil (Cost of Oil Refining stage "Quantity center")

Cost Elements	Cost Of Oil Refining & Purification Stage (Quantity center)					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (tons)	7.859	123,990	7.701	121,497	0.158	2,493
Energy Cost (kW)	61,376	125,931	58,257	119,561	3,119	6,370
System cost	-	117,427	-	114,844	-	2,583
Waste Management Cost	-	5,533	-	-	-	5,533
Total Cost	-	372,881	-	355,902	-	16,979

*** For More details on Cottonseed Oil Costs See Appendix II.**

- **Oil Packaging Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 11, he explained that the number of inputs for the materials amounts to 440,000 bottles at 392,527 EGP and that the outputs of the positive product from the materials were 435,000 bottles at 388,067 EGP and the Waste was 5,000 bottle at 4,460 EGP and that the total cost of inputs was 488,130 EGP and the total value of outputs from the positive product was 465,553 EGP and the total cost of Waste was 22,577 EGP.

Table 11. Cottonseed Oil (Cost of Oil Packaging stage "Quantity center")

Cost Elements	Cost Of Oil Packaging Stage (Quantity center)					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (bottle)	440,000	392,527	435,000	388,067	5,000	4,460
Energy Cost (kW)	15,568	24,909	14,633	17,043	935	7,866
System cost	-	64,685	-	60,443	-	4,242
Waste Management Cost	-	6,009	-	-	-	6,009
Total Cost	-	488,130	-	465,553	-	22,577

- The statement of the Total cost of Cottonseed oil according to the MFCA method as shown in Table 12, showed that the total cost of the input was 7,004,543 EGP and the output of the positive product was 386 tons at a total cost of 6,818,257 EGP and the waste was 25 tons at a total cost of 186,286 EGP.

Table 12. Cottonseed Oil (Production Costs According to "MFCA")

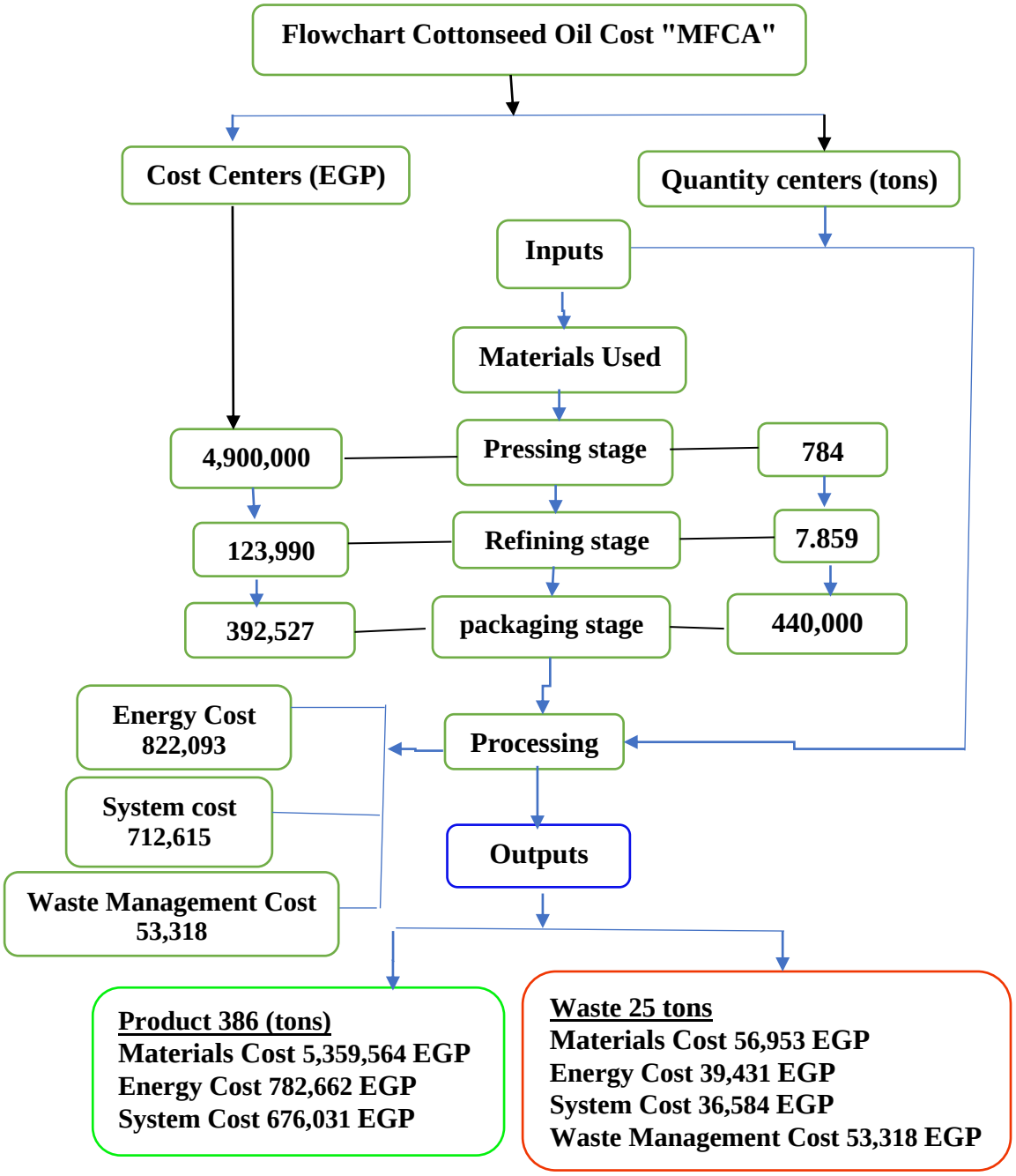
Description	Production Costs According to "MFCA"		
		Output	
	Input	Product	Waste
Quantity produced (tons)	-	386	25
Cost Elements			
Cost of Materials Used	5,416,517	5,359,564	56,953
Energy Cost	822,093	782,662	39,431
System cost	712,615	676,031	36,584
Waste Management Cost	53,318	-	53,318
Total Cost	7,004,543	6,818,257	186,286

- Setting the Flowchart Cottonseed Oil Cost according to MFCA method as shown in Figure 3, It shows the quantities and cost of the three quantity centers and the elements of costs and inputs and outputs in detail.

3- **Verification**:

By presenting the results of the MFCA application of Cottonseed oil to senior management in preparation for comparison with the current costing system to identify deficiencies.

Figure 3. Flowchart Cottonseed Oil Cost "MFCA" (Prepared by Researcher)



4- Improvement:

It focuses on the analysis of the previous point by comparing the current cost system and the application of MFCA by Preparing the Statement of the total cost of Cottonseed Oil as in Table 13, It shows that the total cost is 8,449,540 according to the current costing system, while under MFCA it amounted to 8,263,254 a difference of decrease of 186,286 EGP which contributes to cost rationalization. As well shows the statement of Profit & Loss for Cottonseed Oil as in Table 14, The Gross profit is 9,943,266 according to the current cost system. While under MFCA it amounted to 10,129,552 which is an increasing difference of 186,286 EGP which represents the value of the difference in cost reduction previously presented. As for the Net Profit, we will find that it is the same under the current cost system or the application of MFCA, which is 9,908,220 EGP given that according to the current costing system the loss is considered part of the cost and not measured and knowing its causes and it is charged to the cost of production, which is considered a waste of the company's resources. On the contrary, we find that MFCA considers it a loss and not a cost element that requires treatment, which contributes to assessing the management's efficiency from exploiting its resources, rationalizing cost, achieving accurate cost measurement, and setting a price fair product.

Table 13. Total Cost of Cottonseed Oil (the Current Costing System vs "MFCA")

Description	The Current Costing System	MFCA	Cost differences
Total Oil Cost during the Period	7,004,543	6,818,257	186,286
inventory change	1,358,986	1,358,986	0
Cost of Oil Sold	8,363,529	8,177,243	186,286
Advertising, selling, and distribution expenses	50,965	50,965	0
The cost of Sales of bottled oil	8,414,494	8,228,208	186,286
General and administrative expenses	35,046	35,046	0
The total cost of bottled oil	8,449,540	8,263,254	186,286

Table 14. Profit & Loss Statement of Cottonseed Oil (the Current Costing System vs "MFCA")

Description	The Current Costing System		MFCA	
Sales Revenue		18,357,760		18,357,760
The cost of Sales of bottled oil		(8,414,494)		(8,228,208)
Gross profit		9,943,266		10,129,552
General and administrative expenses		(35,046)		(35,046)
Waste costs losses				
Cost of Materials Used	0		(56,953)	
Energy Cost	0		(39,431)	
System cost	0		(36,584)	
Waste Management Cost	0		(53,318)	
Total Waste costs losses		0		(186,286)
Bottled Oil Net Profit		9,908,220		9,908,220

Thirdly: Mixed Oil:

The steps for measuring the cost of Mixed Oil will be applied according to MFCA as follows:

1- Planning

As for the period? The period is determined in a full year, starting from 1/7/2020 until 30/6/2021. As for the quantity centers under the Mixed Oil Manufacturing stages system, they are represented in three main centers, namely the oil pressing center, the oil refining and purification center, and the oil Packaging center.

2- Implementation

Implementation depends on determining the quantity centers represented in the Mixed oil industry in three basic stages as follows:

- **Oil Pressing Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 15, he explained that the number of inputs for the materials amounts to 117,406 tons at 785,787,250 EGP and that the outputs of the positive product from the materials were 115,810 tons at 774,979,750 EGP and the Waste was 1,596 tons at 10,807,500 EGP and that the total cost of inputs was 987,092,155 EGP and the Total value of outputs from the positive product was 962,735,146 EGP and the total cost of Waste was 24,357,009 EGP.

Table 15. Mixed Oil "Oil for the Ministry of Supply"(Cost of Oil Pressing stage "Quantity center")

Cost Elements	Cost of Oil Pressing Stage (Quantity center)*					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used (tons)	117,406	785,787,250	115,810	774,979,750	1,596	10,807,500
Energy Cost (kW)	46,167,487	107,948,617	44,361,676	103,734,738	1,805,811	4,213,879
System cost	-	87,381,485	-	84,020,658	-	3,360,827
Waste Management Cost	-	5,974,803	-	-	-	5,974,803
Total Cost	-	987,092,155	-	962,735,146	-	24,357,009

- **Oil Refining & Purification Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 16, he explained that the number of inputs for the materials amounts to 1,239 tons at 19,542,683 EGP and that the outputs of the positive product from the materials were 1,187 tons at 18,722,279 EGP and the Waste was 52 tons at 820,404 EGP and that the total cost of inputs was 57,617,940 EGP and the total value of outputs from the positive product was 54,243,206 EGP and the total cost of Waste was 3,374,734 EGP.

Table 16. Mixed Oil "Oil for the Ministry of Supply" (Cost of Oil Refining stage "Quantity center")

Cost Elements	Cost Of Oil Refining & Purification Stage (Quantity center)					
	Input		Output			
			Product		Waste	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
Cost of Materials Used	1,239	19,542,683	1,187	18,722,279	52	820,404

*** For More details on Mixed Oil Costs See Appendix III.**

(tons)						
Energy Cost (kW)	**9,386,631**	**19,657,936**	**8,878,523**	**18,613,828**	**508,108**	**1,044,108**
System cost	**-**	**17,441,202**	**-**	**16,907,099**	**-**	**534,103**
Waste Management Cost	**-**	**976,119**	**-**	**-**	**-**	**976,119**
Total Cost	**-**	**57,617,940**	**-**	**54,243,206**	**-**	**3,374,734**

- **Oil Packaging Stage**: The Quantity and value of inputs and outputs from a positive and lost product were determined, and the cost elements were determined from material cost, energy cost, system cost, and waste management cost, as shown in Table 17, he explained that the number of inputs for the materials amounts to 102,243,000 bottles at 91,200,975 EGP and that the outputs of the positive product from the materials were 99,993,000 bottles at 89,193,975 EGP and the Waste was 2,250,000 bottle at 2,007,000 EGP and that the total cost of inputs was 127,196,993 EGP and the total value of outputs from the positive product was 121,294,227 EGP and the total cost of Waste was 5,902,766 EGP.

Table 17. Mixed Oil "Oil for the Ministry of Supply" (Cost of Oil Packaging Stage "Quantity center")

Cost Elements	**Cost Of Oil Packaging Stage (Quantity center)**					
	Input		**Output**			
			Product		**Waste**	
	Quantity	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**
Cost of Materials Used (bottle)	**102,243,000**	**91,200,975**	**99,993,000**	**89,193,975**	**2,250,000**	**2,007,000**
Energy Cost (kW)	**6,354,688**	**10,167,501**	**5,986,116**	**9,577,786**	**368,572**	**589,715**
System cost	**-**	**23,813,892**	**-**	**22,522,466**	**-**	**1,291,426**
Waste Management Cost	**-**	**2,014,625**	**-**	**-**	**-**	**2,014,625**
Total Cost	**-**	**127,196,993**	**-**	**121,294,227**	**-**	**5,902,766**

- The statement of the Total cost of Mixed oil according to the MFCA method as shown in Table 18, showed that the total cost of the input was 1,171,907,088 and the output of the positive product was 59,944 tons at a total cost of 1,138,272,579 EGP and the waste was 3,571 tons at a total cost of 33,634,509 EGP.

Table 18. Mixed Oil "Oil for the Ministry of Supply" (Production Costs According to "MFCA")

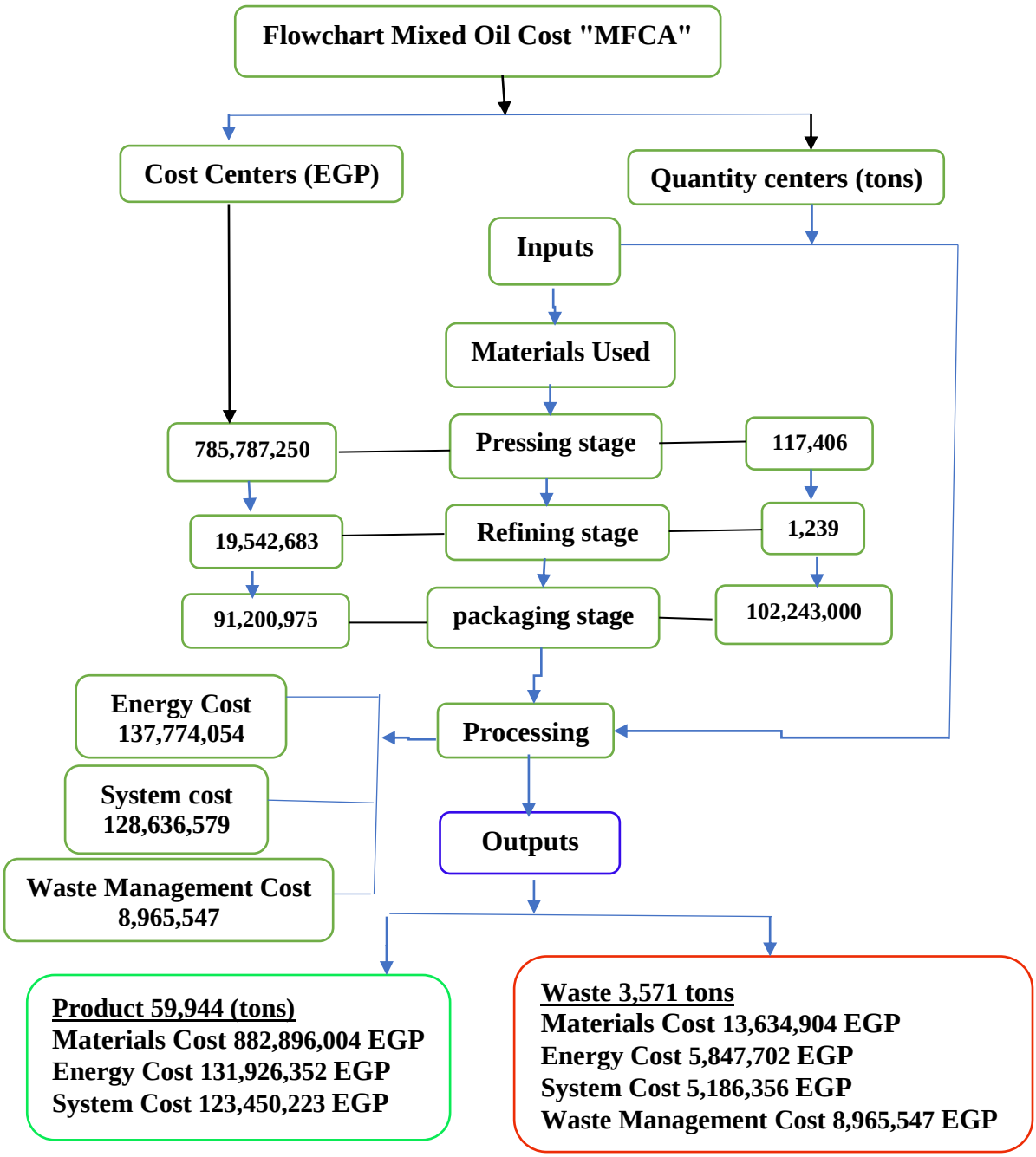
Description	Production Costs According to "MFCA"		
		Output	
	Input	Product	Waste
Quantity produced (tons)	-	59,944	3,571
Cost Elements			
Cost of Materials Used	896,530,908	882,896,004	13,634,904
Energy Cost	137,774,054	131,926,352	5,847,702
System cost	128,636,579	123,450,223	5,186,356
Waste Management Cost	8,965,547	-	8,965,547
Total Cost	1,171,907,088	1,138,272,579	33,634,509

- Setting the Flowchart Mixed Oil Cost according to MFCA method as shown in Figure 4, It shows the quantities and cost of the three quantity centers and the elements of costs and inputs and outputs in detail.

3- **Verification**:

By presenting the results of MFCA application of Mixed Oil to senior management in preparation for comparison with the current costing system to identify deficiencies.

Figure 4. Flowchart Mixed Oil Cost "MFCA" (Prepared by Researcher)



4- Improvement:

It focuses on the analysis of the previous point by comparing the current cost system and the application of MFCA by Preparing the Statement of the total cost of Mixed Oil as in Table 19, It shows that the total cost is 1,354,434,680 according to the current costing system, while under MFCA it amounted to 1,320,800,171 a difference of decrease of 33,634,509 EGP which contributes to cost rationalization. As well shows the statement of Profit & Loss for Mixed Oil as in Table 20, The Gross profit is 75,511,468 according to the current cost system. While under MFCA it amounted to 109,145,977 which is an increasing difference of 33,634,509 EGP which represents the value of the difference in cost reduction previously presented. As for the Net Loss, we will find that it is the same under the current cost system or the application of MFCA, which is (14,780,720) EGP given that according to the current costing system the loss is considered part of the cost and not measured it and knowing its causes and it is charged to the cost of production, which is considered a waste of the company's resources.

On the contrary, we find that MFCA considers it a loss and not a cost element that requires treatment, which contributes to assessing the management's efficiency from exploiting its resources, rationalizing cost, achieving accurate cost measurement, and setting a price fair product.

Notes that the Mixed oil achieves a net loss in contrast to the rest of the oil types and this is because the total costs are greater than the total sales revenue, although this Oil represents the best, Therefore, attention should be given to this type of oil to rationalize the cost, and this is what MFCA achieves.

Table 19. Total Cost of Mixed Oil (the Current Costing System vs "MFCA")

Description	The Current Costing System	MFCA	Cost differences
Total Oil Cost during the Period	1,171,907,088	1,138,272,579	33,634,509
inventory change	3,066,906	3,066,906	0
Cost of Oil Sold	1,174,973,994	1,141,339,485	33,634,509
Advertising, selling, and distribution expenses	89,168,498	89,168,498	0
The cost of Sales of bottled oil	1,264,142,492	1,230,507,983	33,634,509
General and administrative expenses	90,292,188	90,292,188	0
Total cost of bottled oil	1,354,434,680	1,320,800,171	33,634,509

Table 20. Operating Profit Statement of Mixed Oil (the Current Costing System vs "MFCA")

Description	The Current Costing System		MFCA	
Sales Revenue		1,339,653,960		1,339,653,960
The cost of Sales of bottled oil		(1,264,142,492)		(1,230,507,983)
Gross profit		75,511,468		109,145,977
General and administrative expenses		(90,292,188)		(90,292,188)
Waste costs losses				
Cost of Materials Used	0		(13,634,904)	
Energy Cost	0		(5,847,702)	
System cost	0		(5,186,356)	
Waste Management Cost	0		(8,965,547)	
Total Waste costs losses		0		(33,634,509)
Bottled Oil Net Profit/Loss		(14,780,720)		(14,780,720)

- The statement of the Total cost of Edible oil according to the MFCA method as shown in Table 21, showed that the total cost of the input was 1,203,584,802 EGP and the output of the positive product was 61,687 tons at a total cost of 1,169,108,566 EGP and the waste was 3,670 tons at a total cost of 34,476,236 EGP.

Table 21. Total Cost of Edible Oils According to "MFCA"

Description	Total Cost of Edible Oils According to "MFCA"		
		Output	
	Input	Product	Waste
Quantity produced (tons)	-	61,687	3,670
Cost Elements			
Cost of Materials Used	921,026,840	907,070,694	13,956,146
Energy Cost	141,491,919	135,500,254	5,991,665
System cost	131,870,981	126,537,618	5,333,363
Waste Management Cost	9,195,062	-	9,195,062
Total Cost	1,203,584,802	1,169,108,566	34,476,236

- The statement of the Total cost of Edible Oils of positive products only according to the MFCA method as shown in Table 22, showed that the total cost of Sunflower Oil was 29,107,640 EGP and the total cost of Cottonseed Oil was 8,263,254 EGP and the total cost of Mixed Oil was 1,320,800,171 EGP and the total cost of Edible Oils of positive products only was 1,358,171,065 EGP.

Table 22. Total Cost of Edible Oils of positive products only "MFCA"

Description	Sunflower Oil	Cottonseed Oil	Mixed Oil	Total cost Oil
Cost Elements				
Cost of Materials Used	**18,815,126**	**5,359,564**	**882,896,004**	**907,070,694**
Energy Cost	**2,791,240**	**782,662**	**131,926,352**	**135,500,254**
System cost	**2,411,364**	**676,031**	**123,450,223**	**126,537,618**
Total Oil cost during the period	**24,017,730**	**6,818,257**	**1,138,272,579**	**1,169,108,566**
inventory change	**4,786,961**	**1,358,986**	**3,066,906**	**9,212,853**
Cost of Oil Sold	**28,804,691**	**8,177,243**	**1,141,339,485**	**1,178,321,419**
Advertising, selling, and distribution expenses	**179,499**	**50,965**	**89,168,498**	**89,398,962**
The cost of Sales of bottled oil	**28,984,190**	**8,228,208**	**1,230,507,983**	**1,267,720,381**
General and administrative expenses	**123,450**	**35,046**	**90,292,188**	**90,450,684**
Total cost of bottled oil	**29,107,640**	**8,263,254**	**1,320,800,171**	**1,358,171,065**

- Comparing the current cost system and the application of MFCA by Preparing the Statement of the total cost of Edible Oil as in Table 23, It shows that the total cost is 1,392,647,301 EGP according to the current costing system, while under MFCA it amounted to 1,358,171,065 EGP a difference of decrease of 34,476,236 EGP which contributes to cost rationalization. As well shows the statement of Profit & Loss for Edible Oil as in Table 24, The Gross profit is 93,207,103 EGP according to the current cost system. While under MFCA it amounted to 127,683,339 EGP which is an increasing difference of 34,476,236 EGP which represents the value of the difference in cost reduction previously presented. As for the Net profit, we will find that it is the same under the current cost system or the application of MFCA, which is 2,756,419 EGP given that according to the current costing system the loss is

considered part of the cost and not measured and knowing its causes and it is charged to the cost of production, which is considered a waste of the company's resources.

On the contrary, we find that MFCA considers it a loss and not a cost element that requires treatment, which contributes to assessing the management's efficiency from exploiting its resources, rationalizing cost, achieving accurate cost measurement, and setting a price fair product.

Table 23. Total Cost of Edible Oils (the Current Costing System vs "MFCA")

Description	The Current Costing System	MFCA	Cost differences
Total Oil Cost during the Period	1,203,584,802	1,169,108,566	34,476,236
inventory change	9,212,853	9,212,853	0
Cost of Oil Sold	1,212,797,655	1,178,321,419	34,476,236
Advertising, selling, and distribution expenses	89,398,962	89,398,962	0
The cost of Sales of bottled oil	1,302,196,617	1,267,720,381	34,476,236
General and administrative expenses	90,450,684	90,450,684	0
Total cost of bottled oil	1,392,647,301	1,358,171,065	34,476,236

Table 24. Profit & Loss Statement of Edible Oils (the Current Costing System vs "MFCA")

Description	The Current Costing System		MFCA	
Sales Revenue		**1,395,403,720**		**1,395,403,720**
The cost of Sales of bottled oil		**(1,302,196,617)**		**(1,267,720,381)**
Gross profit		**93,207,103**		**127,683,339**
General and administrative expenses		**(90,450,684)**		**(90,450,684)**
Waste costs losses				
Cost of Materials Used	**0**		**(13,956,146)**	
Energy Cost	**0**		**(5,991,665)**	
System cost	**0**		**(5,333,363)**	
Waste Management Cost	**0**		**(9,195,062)**	
Total Waste costs losses		**0**		**(34,476,236)**
Bottled Oil Net Profit		**2,756,419**		**2,756,419**

- Comparing the current cost system and the application of MFCA by Preparing the Statement of the Total unit Cost of Edible Oil As in tables 25, 26 It shows that The cost of a ton under the current costing system of sunflower oil amounted to 21,933 EGP while it amounted to 21,450 EGP under MFCA, a decrease of 484 EGP, As for cottonseed oil, the cost of a ton reached 21,890 EGP under the current costing system, under MFCA 21,407 EGP, a decrease of 483, as for the Mixed oil, the cost per ton reached 22,595 under the current cost accounting system, while under MFCA, it amounted to 22,034 EGP a decrease of 561 EGP.

Table 25. Total unit Cost of Edible Oils (Current Costing System).

Description	Sunflower Oil	Cottonseed Oil	Mixed Oil	Total cost Oil
Total cost of bottled oil	29,763,081	8,449,540	1,354,434,680	1,392,647,301
Production Quantity (tons)	1,357	386	59,944	61,687
Total unit cost (ton Oil) EGP	21,933	21,890	22,595	-

Table 26. Total unit Cost of Edible Oils of Good products only "MFCA"

Description	Sunflower Oil	Cottonseed Oil	Mixed Oil	Total cost Oil
Total cost of bottled oil	29,107,640	8,263,254	1,320,800,171	1,358,171,065
Production Quantity (tons)	1,357	386	59,944	61,687
Total unit cost (ton Oil) EGP	21,449	21,407	22,034	-

5. Conclusions and Recommendations and Research Suggestions

Material Flow Costs Accounting Method (MFCA) is a new method of cost measurement that aims to reduce both costs and environmental impacts at the same time by reducing waste, which leads to improving productivity, rationalizing cost, and supporting the competitive advantage of companies and institutions, and in Preparing This Study the researcher reached many results and based on these results, he presents a set of Recommendations and Research Suggestions, and this is what the researcher will illustrate in the following points:

5. 1. Results

Under both the Theoretical and Applied Study of The Research, The Following Results were Reached:

1- The validity of the Research hypothesis that "Material Flow Costs Accounting Method Contributes to the Measurement and rationalization of cost in the edible oils industry", and this

hypothesis was consistent with the objective of the research, the Theoretical study, and the applied study carried out by the Researcher.

2- Under the method of MFCA, the total costs of materials used in the manufacture of positive edible oils amounted to 907,070,694 EGP, while the cost of materials that were consumed on the waste is 13,956,146 EGP, and the total costs of energy that were used to manufacture the positive edible oils 135,500,254 EGP, while the costs of energy that were consumed on the waste 5,991,665 EGP, as for the total system costs that were used to manufacture the positive edible oils 126,537,618 EGP, while the system costs that were consumed on the waste are 5,333,363 EGP.

3- Under the method of MFCA, the total waste costs in the edible oils industry amounted to 34,476,236 EGP and the Waste Management Cost in the edible oils industry was 9,195,062 EGP and the percentage of waste costs in the edible oils industry was 2.86%.

4- The total costs under the current costing system of sunflower oil amounted to 29,763,081 EGP while it amounted to 29,107,640 EGP under MFCA a decrease of 655,441 EGP, As for cottonseed Oil, the total costs amounted to 8,449,540 EGP under the current costing system, under MFCA 8,263,254 EGP, a decrease of 186,286 EGP, as for the Mixed oil, the total costs amounted to 1,354,434,680 EGP under the current cost

accounting system, while under MFCA, it amounted to 1,320,800,171 EGP a decrease of 33,634,509 EGP.

5- The total costs of edible oil under the current costing system amounted to 1,392,647,301 EGP while it amounted to 1,358,171,065 EGP under MFAC a decrease of 34,476,236 EGP, and this indicates the ability of the proposed method in rationalizing the cost by excluding waste.

6- The cost of a ton under the current costing system of sunflower oil amounted to 21,933 EGP while it amounted to 21,450 EGP under MFCA, a decrease of 484, As for cottonseed oil, the cost of a ton reached 21,890 EGP under the current costing system, under MFCA 21,407 EGP, a decrease of 483 EGP, as for the Mixed oil, the cost per ton reached 22,595 EGP under the current cost accounting system, while under MFCA, it amounted to 22,034 EGP a decrease of 561 EGP.

7- The Mixed oil allocated to the Ministry of Supply represents the highest sales percentage, reaching 96.09%, despite this achieving a net loss, because the value of the sales revenue amounted to 1,339,653,960 EGP less than the total cost, which amounted to 1,354,434,680 EGP, which achieves a net loss of 14,780,720 EGP, and this is clearly shown as we find that the selling price The ton is 22,595 EGP, less than the total cost of the ton 22,283 EGP, i.e. a net loss of 312 pounds per ton under the current cost accounting system, but when applying MFCA method, we find that the selling price of the ton is 22,595 EGP, greater than the total cost of the ton 22,034 EGP with a net profit of 561 EGP per ton.

8- The Gross profit for edible oils under the current cost accounting system amounted to 93,207,103 EGP while it amounted to 127,683,339 a difference of 34,476,236 EGP, while the net profit amounted to 2,756,419 EGP.

5. 2. Recommendations

Based on the research results, the researcher recommends the following:

1- Interest in Mixed Oil because it achieves a Net loss in Contrast to the rest of the other types of oils, although it is the best seller, where the percentage of sales volume is 96.09%, so the researcher believes that it is necessary to activate MFCA application, which contributes to rationalizing and reducing costs and thus transforming the product into a net profit instead of a net loss As well as the need to reconsider the re-pricing of this Product.

2- That companies use this proposed method MFCA to achieve both goals of cost rationalization and preservation of the environment and which improves the quality of information.

3- Achieving integration and cooperation between departments and different quantity centers to achieve effective communication between the centers that make up the flow model to ensure the effectiveness of the application of MFCA.

4- Training and qualifying workers to apply the proposed method, especially technical and cost departments.

5- The use of the professors at Egyptian universities, training centers, and houses of expertise to design an effective system for the application of material flow cost accounting, as well as

holding several workshops, courses, and scientific seminars to explain the importance and benefits of applying MFCA method.

5. 3. Research Suggestions

The researcher recommends completing some Points that the current study did not address, but which receive great attention on the Scientific and Practical levels, The most important of which are:

1- Using the Material flow cost accounting method Applied to The Petrochemical sector.

2- Integration between the material flow cost accounting method and the Achievement accounting method to support the competitive advantage.

3- Using the material cost accounting method Applied to Cement Companies.

4- Integration between the theory of constraints and the Material flow cost accounting method.

5- Preparing an Analytical study to study the impact of the application of material flow cost accounting on improving the quality of the information contained in The Financial Statements.

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Appendix I

(Sunflower Oil Cost Analysis)

(A) Waste (Material Loss) of Sunflower Oil

Quantity Centers	Price Per tons	Quantity of Seeds and Raw Materials (tons)	Total Cost	Quantity Waste (tons)	Cost Waste
Pressing Stage	8,500	2,030	17,255,000	29	246,500
Refining & Purification Stage	15,777	28	441,756	0.336	5,301
Packaging Stage	892	1,550	1,382,600	14	12,488
Total	----	3,608	19,079,356	43.336	264,289

(B) Waste (Energy Loss) of Sunflower Oil "Pressing Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	466,636	746,618	10,266	16,426
Gas Expense (meters)	3.25	261,789	850,814	8,900	28,925
Water Expense (liters)	3.20	200,767	642,454	8,032	25,702
Steam Expense (kW)	1.60	77,845	124,552	3,893	6,228
Total	----	----	2,364,438	----	77,281

(C) Waste (Energy Loss) of Sunflower Oil "Refining & Purification Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	105,265	168,425	3,685	5,896
Gas Expense (meters)	3.25	47,789	155,317	2,868	9,321
Water Expense (liters)	3.20	11,764	37,645	471	1,507
Steam Expense (kW)	1.60	51,378	82,205	4,111	6,578
Total	----	----	443,592	----	23,302

(D) Waste (Energy Loss) of Sunflower Oil "Packaging Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	54,839	87,742	2,468	3,949

(E) Waste (System Loss) of Sunflower Oil

Quantity Centers	Total Cost	Cost Waste	Waste Management Cost
Pressing Stage	2,015,825	84,866	139,495
Refining & Purification Stage	433,123	15,593	15,983
Packaging Stage	249,036	9,964	20,719
Total	2,697,984	110,423	176,197

Appendix II

(Cottonseed Oil Cost Analysis)

(F) Waste (Material Loss) of Cottonseed Oil

Quantity Centers	Price Per tons	Quantity of Seeds and Raw Materials (tons)	Total Cost	Quantity Waste (tons)	Cost Waste
Pressing Stage	6,250	784	4,900,000	8	50,000
Refining & Purification Stage	15,777	7.859	123,991	0.158	2,493
Packaging Stage	892	440	392,480	5	4,460
Total	----	1,231.859	5,416,471	13.158	56,953

(G) Waste (Energy Loss) of Cottonseed Oil "Pressing Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	132,480	211,968	3,975	6,360
Gas Expense (meters)	3.25	74,320	241,539	3,122	10,147
Water Expense (liters)	3.20	56,996	182,387	2,052	6,566
Steam Expense (kW)	1.60	22,099	35,359	1,326	2,122
Total	----	----	671,253	----	25,195

(H) Waste (Energy Loss) of Cottonseed Oil "Refining & Purification Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	29,883	47,812	1,256	2,010
Gas Expense (meters)	3.25	13,567	44,094	679	2,207
Water Expense (liters)	3.20	3,340	10,688	162	518
Steam Expense (kW)	1.60	14,586	23,337	1,022	1,635
Total	----	----	125,931	----	6,370

(I) Waste (Energy Loss) of Cottonseed Oil "Packaging Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	15,568	24,909	935	1,496

(J) Waste (System Loss) of Cottonseed Oil

Quantity Centers	Total Cost	Cost Waste	Waste Management Cost
Pressing Stage	572,279	29,759	41,776
Refining & Purification Stage	122,960	2,583	5,533
Packaging Stage	70,694	4,242	6,009
Total	765,933	36,584	53,318

Appendix III

(Mixed Oil Cost Analysis)

(K) Waste (Material Loss) of Mixed Oil

Quantity Centers	Price Per tons	Quantity of Seeds and Raw Materials (tons)	Total Cost	Quantity Waste (tons)	Cost Waste
Pressing Stage					
Seeds Sunflower	8,500	23,111	196,443,500	370	3,145,000
Seeds Cottonseed	6,250	94,295	589,343,750	1,226	7,662,500
Total Pressing Stage	----	117,406	785,787,250	1,596	10,807,500
Refining & Purification Stage	15,777	1,239	19,542,683	52	820,404
Packaging Stage	892	102,243	91,200,975	2,250	2,007,000
Total	----	220,888	896,530,908	3,898	13,634,904

(L) Waste (Energy Loss) of Mixed Oil "Pressing Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	21,538,985	34,462,376	753,865	1,206,184
Gas Expense (meters)	3.25	11,818,166	38,409,039	520,000	1,690,000
Water Expense (liters)	3.20	9,112,915	29,161,328	291,613	933,162
Steam Expense (kW)	1.60	3,697,421	5,915,874	240,333	384,533
Total	----	----	107,948,617	----	4,213,879

(M) Waste (Energy Loss) of Mixed Oil "Refining & Purification Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	4,374,824	6,999,719	192,493	307,989
Gas Expense (meters)	3.25	2,269,885	7,377,126	111,906	363,695
Water Expense (liters)	3.20	558,760	1,788,032	29,056	92,979
Steam Expense (kW)	1.60	2,183,162	3,493,059	174,653	279,445
Total	----	----	19,657,936	----	1,044,108

(N) Waste (Energy Loss) of Mixed Oil "Packaging Stage"

Cost Elements	Average price	Quantity	Total Cost	Quantity Waste	Cost Waste
Electricity Expense (kW)	1.60	6,354,688	10,167,501	368,572	589,715

(O) Waste (System Loss) of Mixed Oil

Quantity Centers	Total Cost	Cost Waste	Waste Management Cost
Pressing Stage	93,356,288	3,360,827	5,974,803
Refining & Purification Stage	18,417,321	534,103	976,119
Packaging Stage	25,828,517	1,291,426	2,014,625
Total	137,602,126	5,186,356	8,965,547