

The Role of Material Flow Cost Accounting (MFCA) in Implementing the Cost Leadership Strategy and Rationalizing Operational Decisions (An Applied Study in the Baghdad Soft Drinks Company)

Azhar Ghailan Marhoon AL-Zubaidi ^a, Ali Abdul-Hussein Hani Al-Zameli ^b,
Asaad Sasaa Agrab ^c

^a *Financial & Banking Sciences Department, Administration & Economic College, Al-Qadisiya University, Iraq.
E-mail: azhar.marhoon@qu.edu.iq*

^b *Accounting Department, Administration & Economic College, Al-Qadisiya University, Iraq.
E-mail: ali.alzameli@qu.edu.iq*

^c *Chemical Engineering Department, Engineering College, Al-Qadisiya University, Iraq.
E-mail: asaad.saad@qu.edu.iq*

Abstract

The current research aims to address the knowledge bases of material flow cost accounting (MFCA) and determining its role in implementing the cost leadership strategy and rationalizing operational decisions in a way that is compatible. The research was applied in the Baghdad Company for Soft Drinks for data for the year 2020. The current research concluded possibility application material flow cost accounting (MFCA) in the research sample company, as the company was divided into quantity centers and calculating costs for each center with regard to the costs of materials, energy, system and waste management. The research concluded that the application (MFCA) can help in implementing a cost leadership strategy and rationalizing operational decisions.

Keywords: Material Flow Cost Accounting (MFCA), Cost Leadership Strategy, Operational Decisions.

Introduction

As a result of economic developments in the world, we find that management accounting needs to develop in order to provide appropriate information for decision-making in light of the increasing interest in the environment and natural resources, and it is known that industrial economic units have greatly caused pollution and emissions and destroyed many natural resources, which increased interest. Using techniques that can reduce pollution and emissions resulting from the exercise of productive activity, and accordingly there is a need to provide information on environmental costs and revenues in order to rationalize decision-making processes and achieve integration between all economic and environmental aspects. Therefore, it improves the efficiency and effectiveness of companies' performance, implements the cost leadership strategy, as well as rationalizes operational decisions.

Research Methodology & Previous Studies

1. Research Methodology

▪ Research the Problem of Research

The problem of the current research is clear shortcomings and weaknesses of the Iraqi industrial companies in using natural resources correctly and not providing environmentally friendly products, which led to the generation of large quantities of waste affecting the environment and society, and thus the negative impact on operational decisions. The problem of this research is expressed in the following question: (Does material flow cost accounting help companies in implementing strategy of cost leadership strategy and rationalizing operational decisions?).

▪ The Importance of Research

The research derives its importance from the importance of material flow cost accounting as it is one of the modern technologies that achieve efficiency and effectiveness in the use of natural materials and providing environmentally friendly products in a way that helps in implementing strategy of cost leadership and rationalizing operational decisions.

▪ The Objectives of Research

The current research aims to address the theoretical framework in detail about material flow cost accounting (MFCA) and to indicate its role in implementing the cost leadership strategy and rationalizing operational decisions.

▪ The Hypothesis of Research

The hypothesis of the current research is as follows: (Accounting material flow costs helps economic units implement a cost leadership strategy and rationalize operational decisions).

▪ The Sample of Research

Baghdad Soft Drinks Company was selected as a sample for the research in order to conduct the practical aspect of the data for the fiscal year 2020.

2. Previous Studies and Contribution of the Current Research

There are a set of previous studies that are related to the current research, and they are as follows:

1. A study (Okada, et. al., 2015): The study aimed to compare the cases in which material flow cost accounting was introduced to individual economic units and the supply chain, and the study concluded that the effect of introducing (MFCA) in supply chains differs from the effect of introducing it in individual establishments, as it was found that the high loss rates were greater than in supply chains compared to its introduction in individual establishments.
2. A Study (Doorasamy & Rhodes., 2017): The study aimed to demonstrate the effectiveness of material flow costs accounting and its use as a tool to improve the quality of sucrose in sugarcane manufactures in South Africa. The study concluded that the efficient use of material flow cost accounting enables economic units to improve their profitability as well as improve the efficiency of resource use, as this system works to classify production costs into four categories, namely, material, system, energy and waste costs, thus reduce costs related to the product. negative.
3. A study (Tu & Huang, 2019): The study aimed to use material flow cost accounting and green design at the same time, through the use of material flow costs in Achieving efficiency in the use of materials and reducing waste, and the use of green design for the purpose of energy conservation and production of environmentally friendly designs in order to achieve financial, social and environmental goals. The

materials must be equal to the output quantity of materials in the form of a healthy product or a defective product or residual materials in the form of waste.

The current research deals with the issue of MFCA and its role in implementing the cost leadership strategy and improving profitability. Contribute to laying down a rationale for the application of material flow cost accounting (MFCA) in the Iraqi industrial economic units in order to assist these units in implementing strategy of cost leadership and improving their profitability.

The Theoretical Side of the Research

1. Concept and Objectives of Material Flow Cost Accounting (MFCA)

Material flow cost accounting (MFCA) is seen as one of the environmental management accounting techniques that aims to reduce environmental impact and reduce costs at the same time, as well as using it as a tool for making and rationalizing decisions (Doorasamy & Garbhaoran, 2015).

Material flow cost accounting (MFCA) is also seen as a tool for measuring the flows and balances of materials in operations or production lines in both physical and monetary units during a certain period (Christ & Burritt: 2016). Thus, it is the process of analyzing the flow of materials within production processes with the aim of assisting management in making decisions, reduce costs, and strive to achieve economic and environmental goals through using less and more efficient materials (Sgulla, et.al., 2011).

Material flow cost accounting (MFCA) mainly aims to support the efforts made by economic units to enhance their financial and environmental performance by improving the use of both materials and energy through the following: (Goetz, et. al., 2013).

1. Improving coordination with regard to materials and energy consumption, and providing information about quantities of materials in the manufacturing process.
2. Work to reduce the amount of internal and external damage and defect in the product and exclude costs that do not add value to it.
3. Improving the transparency of material flows, energy consumption and related costs, as well as improving environmental aspects, improving resource efficiency and cost reduction processes.

Based on the foregoing, it can be said that MFCA is one of the most developed techniques of accounting as it works to provide material and financial information about material flows and balances to support making of decision and optimal use of materials and energy, which contributes to increasing productive, reducing costs and reducing environmental impacts.

2. Basic Concepts in Material Flow Cost Accounting (MFCA)

Since the emergence of the concept of material flow cost accounting (MFCA) in the late nineties of the last century, it has quickly been widely applied by many economic units, and this use is due to many reasons, the most important of which are the scarcity of natural resources, the high prices of materials and energy, the increase in the volume of waste and gas emissions. In the air and weak information on environmental influences, which negatively affected the environment and society (Hyslova, et. al., 2011).

The concept of material flow cost accounting (MFCA) consists of three main concepts, and these concepts can be clarified through the following:

First: Cost Accounting: According to the (MFCA) approach, the flows of materials entered into the production process are tracked, and then the physical units are determined in the form of (mass or volume) and their costs are determined as costs are divided into four types, which are as follows: (APO, 2014).

1. Material costs: include all the costs of the main and secondary materials and auxiliary materials used in the industry such as detergents, catalysts, etc., and the costs of material flow are the costs incurred by economic units for each material that they purchase from the suppliers, which are entered into the quantities centers with the aim of converting them into products Completed after the end of production operations (Schmidt, et.al., 2015).
2. Energy costs: It means all the costs of energy sources used within the centers of the quantity used by the economic unit in order to process materials such as electricity and fuel costs and any other costs that affect energy (Hyslova, et. al., 2011).
3. System costs: A distinction is made between two types of system costs, namely, energy-related system costs, which include all expenses incurred in the field of internal generation and energy transmission, in addition

to system costs related to materials, which include all costs incurred in the internal handling of material flows except for material costs. Energy and system costs related to energy and waste management (Anent & Uwe, 2012).

4. Waste management costs: They are the costs of treating waste that are generated in quantity centers, and economic units may bear these costs internally and externally, such as eliminating gas emissions into the air, treating defective products, treating solid waste and others (Schmidt & Nakajima, 2013).

Second: Flow: It is the tracking of all the input materials, whether they are directly handled from the supplier or transferred to from the warehouses and introduced to quantity centers and then to the production lines that continue along the operations and are in the form of a final product or are lost through the treatment process in the form of waste (APO, 2014).

Third: Materials: They are the main pillar in the production processes that are entered into the quantity centers. They may be mainly raw materials used at the beginning of the processes, or auxiliary materials added during production processes (APO, 2014).

Accordingly, cost, flow and materials are the basic concepts of the MFCA approach, and these concepts should be taken care of when applying this approach in practice, with the need to calculate the costs of materials, energy, system and waste management.

3. Application Stages of Material Flow Cost Accounting (MFCA)

The application of material flow cost accounting (MFCA) requires cooperation between different departments in the economic unit, and there are a set of steps for applying material flow cost accounting (MFCA), which are as follows: (Al-Ghazi, 2020).

1. Planning: It is represented by the administration's participation in identifying the required expertise, the spatial limits in which the application is carried out, the time required to obtain the data, and the identification of quantity centers in which the materials are handled and the necessary treatments are performed on them.
2. Execution: are all activities that occur during production processes, starting from the introduction of materials into quantity centers and their continuation in the production stages until they end in the form of outputs. In each stage of production, material and energy flows are tracked, and material flows are measured in quantity centers in monetary and in-kind units.
3. Verification: This concept is represented by two aspects. The first aspect relates to data analysis and interpretation, and the second aspect is through which results are presented and reported.
4. Correction: This step represents the improvements necessary to address the defects and weaknesses in the second plan related to implementation, which caused the emergence of some unsatisfactory results represented by poor material and energy flows during the production process.

There are those who believe that the stages of applying the MFCA approach are selecting the target product, collecting the required data, calculating material flow costs, identifying improvement points, providing solutions, implementing solutions, and evaluating solutions (Kasemest & Bonmee, 2015).

Thus, it can be said that the best steps for applying Material Flow Cost Accounting (MFCA) are (plan - implement - check - correct), because these steps can achieve the purpose or goal for which they came efficiently and effectively.

4. The Role of Material Flow Cost Accounting (MFCA) in Implement Strategy of Costs Leadership

Strategy of cost leadership refers to the ability of an economic unit to provide products to customers that can meet their needs at a lower cost compared to what is offered by competitors, taking into account an acceptable level of quality (Blocher, et. al., 2010).

This strategy is based on a scientific assumption that the economic unit has a competitive advantage that enables it to carry out design, manufacturing, marketing and customer service operations at the lowest cost compared to competitors, which enables this unit to sell its products to customers at competitive prices lower than those offered by competitors (Wang, et. al., 2011).

MFCA provides information through which a cost leadership strategy can be reduce costs, it achieves advantages in improving the productivity of materials and increasing profits in company during year (Kokubu, et. al., 2019).

MFCA reduces the amount of material losses through recycling or waste manufacturing, which helps in reducing waste production, which leads directly to reducing material inputs and cost, And then reducing the direct cost, and reducing waste production increases the efficiency of operations and waste treatment activities, which leads to the effective and efficient implementation of the cost leadership strategy (Nakajima, et. al., 2015).

Based on the above, it can be said that material flow cost accounting (MFCA) can help in implementing a cost leadership strategy, by reducing the amount of material losses and recycling or manufacturing waste in a way that helps in providing products to customers that can meet their needs at low cost and quality. High.

5. The Role of Material Flow Cost Accounting (MFCA) in Rationalizing Operational Decisions

Material flow cost accounting helps rationalize a range of operational decisions, the most important of which are decisions pricing decisions and decisions to add or dispose of a production line. The role of material flow cost accounting (MFCA) can be clarified in rationalizing operational decisions with regard to both pricing decisions and decisions to add or dispose of a production line. This role can be clarified through the following:

1. **Pricing Decisions:** Pricing decisions are among important operational decisions taken by the economic unit, as it is determine the selling prices of its products in order to maintain its continuity, and material flow cost accounting (MFCA) helps in reaching the best selling price, By knowing the relationship between cost and selling price (Manes & Anges, 2009).
2. **Decisions to Add or Dispose of a Production Line:** MFCA gives information about costs of production lines, as well as helps reduce costs concerned with unimportance activities and thus assists in making decisions about adding or getting rid of one of the production lines in the economic unit (Deeviski, 2016).

It is clear from the above, that material flow cost accounting (MFCA) can help the economic unit in rationalizing operational decisions, especially pricing decisions and decisions to add or dispose of a production line, where work is done to track the flow of materials, determine their cost, and divide the products of the economic unit into positive products.

The Practical Aspect of Research

1. An Introduction to the Baghdad Soft Drinks Company

The company was established in 1989 with a capital of (70) million Iraqi dinars, and the company signed an exclusive concession contract with Pepsi, making it the exclusive producer and distributor, and on December 31, 2015 the capital was modified to become (133) billion Iraqi dinars, and the company aims to encourage citizens' savings And their investment in the activities of the private sector due to the importance of the role it plays in industrial development in the field of soft and mineral drinks and by using modern technology. The soft drink industry goes through several stages, and these stages can be clarified through the following.

1. Water purification stage: Water is purified from impurities, organic matter and bacteria by mixing gelatinous or fluke precipitates such as aluminum sulfate in water.
2. The stage of water purification, sterilization and removal of chlorine: Filtered water is poured through a sand filter to remove fine particles, and a small amount of free chlorine is added to it. The chlorinated water remains in the soft drink tank until the reaction is complete.
3. The stage of mixing the components: During this stage, carbohydrates, sugar, proteins, fats, sodium, carbonated water and Pepsi flavor are mixed by means of advanced machines to regulate flow rates and fluid proportions, and the vessels are pressurized using carbon dioxide.
4. The carbonation stage of the soft drink: During this stage, carbon is added to the final product in order to carefully control the temperature of the liquid.
5. Packaging: The final product is transferred to bottles or cans at very high flow rates. The cans are closed immediately with a pressure-resistant cap, and then they are filled with plastic containers with a capacity of (1) liter and then beat in cartons for each (6) liters (called a kabsa), Then it is sent to finished production warehouses or directly to customers.

2. Application of Material Flow Cost Accounting (MFCA) in Baghdad Soft Drinks Company

There are a set of stages for the application of material flow cost accounting (MFCA) in the research sample company, which are as follows:

Plans: This Stage Includes the Following Steps

1. Determining the required expertise: The two researchers relied on the administrative, engineering and technical expertise in the research sample company, in order to collect the descriptive, quantitative and financial data required for the application of material flow cost accounting (MFCA) in this company.
2. Determining implementation limits and time period: Execution limits extend to all the company's activities from obtaining raw materials until the product is delivered to the customer, according to the accounting period data from 1/1/2020 – 31/12/2020.

3. Determining the centers of quantities: The company's quantity centers divide the research sample into (5) centers, which are: water purification, water purification and sterilization, removing chlorine from it, mixing ingredients, carbonation of soft drinks, and packaging.

Carried Out: This Stage Includes the Following Steps

1. Determining the material inputs and outputs: The physical inputs consist of aluminum sulfate, free chlorine, carbohydrates, sugar, proteins, sodium, carbonated water, Pepsi flavor, carbon, electric energy, and packaging. The commodity outputs are represented by the Pepsi-Cola product, while the non-commodity outputs are damaged plastic cans, damaged cartons and liquids. Waste and waste with an environmental impact and gaseous waste, and technical expertise in the research sample company, in order to collect the descriptive, quantitative and financial data required for the application of MFCA. The material input and output of Pepsi-Cola product in Baghdad Soft Drink Company during the year 2020 as follows:

Table 1: The Physical Input and Output of the Pepsi-Cola Product

Physical input	Commodity output
Aluminum sulfate	Pepsi-Cola product
Free chlorine	
Carbohydrate	
Sugar	
Proteins	Non-commodity output
Sodium	Damaged plastic boxes
Carbonated water	Damaged cartoon
Pepsi flavor	Damaged fluids
Carbon	Environmental waste
Electrical power	Gaseous waste
Packaging	Lost energy

Source: The company's costs department.

2. Quantitatively measuring flows (physical flows): Physical flow of the Pepsi-Cola product in the research sample company as follows:

Table 2: The Physical Flow of the Pepsi-Cola Product

Physical Input		Commodity output	
Details	Quantity	Details	Quantity
Aluminum sulfate	4512 kg	Pepsi-Cola product	1578600 liters
Free chlorine	6712 kg		
Carbohydrate	875 kg		
Sugar	244 kg	Non-commodity output	
Proteins	128 kg	Details	Quantity
Sodium	196 kg	Damaged plastic boxes	613 cans
Carbonated water	2716400 liters	Damaged cartoon	596 cartoon
Pepsi flavor	245 kg	Damaged fluids	7518 kg
Carbon	116 kg	Environmental waste	2851 kg
Electrical power	18376000 kw	Gaseous waste	174 kg
Packaging	1579213 packet	Lost energy	2716 kw

Source: The company's costs department.

It turns out that the commodity output of Pepsi-Cola product during the year 2020 was (1578,600) liters, and it is clear that the quantity of non-commodity outputs increased, especially spoiled ones and environmentally harmful waste.

3. Measurement of financial flows (financial flows): During this step, the quantitative (physical) flows of inputs and outputs in each quantitative center are translated in financial form, as shown in the following:
 - a. Inventory of Quantity Centers Costs: According to Material Flow Cost Accounting (MFAC), there are four types of costs, namely material costs, energy costs, system costs, and waste management costs. These costs can be clarified as follows:
 - 3/a/1: Material costs: The costs of materials in the Baghdad Soft Drinks Company as follows:

Table 3: Material costs in Baghdad Soft Drinks Company

Quantity Centers	Materials	Quantity	Cost per unit	Total material costs
Water purification	Aluminum sulfate	4512 kg	510 dinars/kg	2301120
Water purification, sterilization and removal of chlorine	Free chlorine	6712 kg	322 dinars/kg	2161264
Mixing the components	Carbohydrate	875 kg	712 dinars/kg	623,000
	sugar	244 kg	800 dinars/kg	195200
	Proteins	128 kg	600 dinars/kg	76800
	Sodium	196 kg	275 dinars/kg	53900
	Carbonated water	2716400 liters	65 dinars/L	176566000
	Pepsi flavor	245 kg	118 dinars/kg	28910
	Total	-	-	177543810
Carbonation of the soft drink	Carbon	116 kg	125 dinars/kg	14500
Packaging	Plastic boxes	1579213 packet	25 dinars/pack	39480325
	Cartons	263696 cartoon	55 dinars/carton	14503280
	Total	-	-	53983605
Total cost	-	-	-	236004299

Source: The company's costs department.

It turns out that costs of materials for each of the water purification center, water filtration and sterilization center, dechlorination center, components mixing center, carbonation center, and packaging center were (2301120), (2161264), (177543810), (14500), (53983605)) dinars, respectively, and thus the total costs of materials for all quantities centers was (236004299) dinars.

3/a/2: Energy costs: The energy costs of the Baghdad Soft Drink Company as follows:

Table 4: Costs of Energy in the Baghdad Soft Drinks Company

Quantity Centers	Consumption (kw)	Cost per kilowatt (dinar/kw)	Total energy costs (dinar)
Water purification	6982880	0.822	5739927
Water purification, sterilization and removal of chlorine	4777760	0.822	3927319
Mixing the components	3491440	0.822	2869964
Carbonation of the soft drink	1653840	0.822	1359456
Packaging	1470080	0.822	1208406
Total cost	18376000	0.822	15105072

Source: The company's costs department.

It turns out that energy costs for each of the water purification center, water filtration and sterilization center, dechlorination center, ingredient mixing center, carbonation center, and packaging center were (5739927), (3927319), (2869964), (1359456), (1208406).) dinars respectively, and thus the total energy costs for all quantities centers was (15105072) dinars, and it is clear from this table that the water purification center has consumed the largest amount of energy, while the packaging center has consumed the least amount of energy for the research sample company during the year 2020.

3/a/3: System costs: The costs of the system in Baghdad Soft Drinks Company as follows:

Table 5: Costs of System in Baghdad Soft Drinks Company

Quantity Centers	Costs elements							Total Cost
	Wages	Maintain	Depreciation	Transfers	Rents	Quality control	Industrial Safety	
Water purification	5413575	824996	224458	317439	413667	129452	76312	7399899
Water purification, sterilization and removal of chlorine	3628122	644756	234087	645908	232886	100562	89434	5575755
Mixing the components	5008225	877453	115321	122342	223170	98765	72902	6518178
Carbonation of the soft drink	1817645	256313	128008	75412	114078	75403	55735	2522594
Packaging	2545636	125867	98245	312897	102564	66523	44319	3296051
Total cost	18413203	2729385	800119	1473998	1086365	470705	338702	25312477

Source: The company's costs department.

It turns out that system costs for the purification of the water purification center, the water filtration and sterilization center, the removal of chlorine from it, the component mixing center, the carbonation center of the soft drink and the packaging center were (7399899), (5575755), (6518178), (2522594), (3296051) dinars, respectively, and thus the total system costs for all quantity centers was (25312477) dinars, as it is clear from this table that the system costs for the water purification center were greater than the costs of other centers in the company.

3/a/4: Waste management costs: The costs of waste management in the Baghdad Soft Drink Company as follows:

Table 6: Costs of Waste Management in Baghdad Soft Drinks Company

Quantity Centers	Materials	Quantity of waste	Cost per unit	Total waste management costs
Water purification	Aluminum sulfate	528 kg	510 dinars/kg	269280
Water purification, sterilization and removal of chlorine	Free chlorine	683 kg	322 dinars/kg	219926
Mixing the components	Carbohydrate	32 kg	712 dinars/kg	22784
	Sugar	85 kg	800 dinars/kg	68000
	Proteins	35 kg	600 dinars/kg	21000
	Sodium	42 kg	275 dinars/kg	11550
	Carbonated water	6538 liters	65 dinars/L	424970
	Pepsi flavor	27 kg	118 dinars/kg	3186
	Total	-	-	551490
Carbonation of the soft drink	Carbon	22 kg	125 dinars/kg	2750
Packaging	Plastic boxes	613 attic	25 dinars/pack	15325
	Cartons	596 cartoon	55 dinars/carton	32780
	Total	-	-	48105
Total cost	-	-	-	1091551

Source: The company's costs department.

It turns out that costs of waste management for each of the water purification center, water filtration and sterilization center, dechlorination center, ingredient mixing center, carbonation center, and packaging center were (269280), (219926), (551490), (2750), (48105) dinars, respectively, and thus the total waste management costs for all quantity centers was (1091,551) dinars.

The total costs of the quantities centers in the Baghdad Company for Soft Drinks during the year 2020, for each of the materials costs, energy costs, system costs and waste management costs as follows:

Table 7: The Costs of the Quantities Centers in the Baghdad Company for Soft Drinks

Quantity Centers	Cost element				Total costs
	Material costs	Energy costs	System costs	Waste management costs	
Water purification	2301120	5739927	7399899	269280	15710226
Water purification, sterilization and removal of chlorine	2161264	3927319	5575755	219926	11884264
Mixing the components	177543810	2869964	6518178	551490	187483442
Carbonation of the soft drink	14500	1359456	2522594	2750	3899300
Packaging	53983605	1208406	3296051	48105	58536167
Total costs	236004299	15105072	25312477	1091551	277513399

Source: Based on Tables No. (3), (4), (5) and (6).

It turns out that costs of the water purification center, water filtration and sterilization center, components mixing center, carbonation center and packaging center were (15710226), (11884264), (187483442), (3899300), (58536167) dinars, respectively. The costs for all centers were (277513399) dinars.

- b. Allocating the costs of quantity centers for cost purposes (good and lost products): After counting the costs of quantity centers, the costs of these centers will be allocated to good and lost products in the research sample company, and this is done by tracking the losses in each of the quantity centers as follows:

Table 8: Allocating the Costs of Volume Centers on Cost Purposes (Good and WASTE Products) in the Baghdad Soft Drink Company

Quantity Centers	Good products (positive products)	Waste (negative products)	Total costs
Water purification	13982101	1728125	15710226
Water purification, sterilization and removal of chlorine	9150883	2733381	11884264
Mixing the components	157486091	29997351	187483442
Carbonation of the soft drink	2924475	974825	3899300
Packaging	44487487	14048680	58536167
Total costs	227560987	49952412	277513399

Source: Based on table No. (7).

It turns out that costs of the positive and negative products for the water purification center were (13982101), (1728125) dinars, respectively, and for the water purification, sterilization and dechlorination center (9150883), (2733381) dinars, respectively, and for the center of mixing components (157486091), (29997351) dinars, respectively, and for the carbonation center of the soft drink (2924475), (974825) dinars, respectively, and for the packaging center (44487487), (49952412) dinars, respectively, so the total cost of positive products (227560987) dinars and the cost of negative products (49952412) dinars.

Check: This Stage Includes the Following Steps

1. Summarizing the data and analyzing the results: During this step, the material flow accounting (MFAC) data in the Baghdad Soft Drink Company and each of the quantities centers are summarized by focusing on the cost of new and lost inputs and then the outputs of the center, which are inputs to the next center as follows:

Table 9: Summarizing the Material Flow Accounting (MFAC) Data in Baghdad Soft Drinks Company

Quantity Centers	Details	Costs elements				Total costs
		Material costs	Energy costs	System costs	Waste management costs	
Water purification	From the previous quantity center	-	-	-	-	-
	new entries	2047997	5108535	6585910	239659	13982101
	wastage	253123	631392	813989	29621	1728125
	output	2301120	5739927	7399899	269280	15710226
Water purification, sterilization and removal of chlorine	From the previous quantity center	2301120	5739927	7399899	269280	15710226
	new entries	1664173	3024036	4293331	169343	9150883
	wastage	497091	903283	1282424	50583	2733381
	output	4462384	9667246	12975654	489206	27594490
Mixing the components	From the previous quantity center	4462384	9667246	12975654	489206	27594490
	new entries	149136800	2410770	5475270	463251	157486091
	wastage	28407010	459194	1042908	88239	29997351
	output	182006194	12537210	19493832	1040696	215077932
Carbonation of the soft drink	From the previous quantity center	182006194	12537210	19493832	1040696	215077932
	new entries	10875	1019592	1891946	2062	2924475
	wastage	3625	339864	630649	687	974825
	output	182020694	13896666	22016427	1043445	218977232
Packaging	From the previous quantity center	182020694	13896666	22016427	1043445	218977232
	new entries	41027540	918389	2504998	36560	44487487
	wastage	12956065	290017	791052	11546	14048680
	output	236004299	15105072	25312477	1091551	277513399
Total costs		236004299	15105072	25312477	1091551	277513399

Source: Based on table No. (7).

It turns out that costs of each of the new and lost stores, and for each of the quantity centers in the company, the research sample. It is noted that the cost of the waste is relatively high to the total cost of (277513399) dinars. Including the ingredient mixing center, the carbonation center of the soft drink, and the packaging center (1728125), (2733381), (29997351), (974825), (14048680) dinars, respectively, and thus the percentage of losses to the total cost of these centers was (0.62%), (0.98%), (10.81%), (0.34%), (5.06%), and thus the total percentage of waste to total cost (17.82%), which is a high percentage, and the reason for this high percentage is due to the increase in losses in the mixing center of components.

2. Communicating the results: Once the analysis of the results is completed after applying the material flow accounting (MFAC), these results must be communicated to the management to take appropriate measures regarding the high cost, especially the high cost of waste in the ingredients mixing center and the packaging center, as the percentage of wastage to the total The cost (10.81%) and (5.06%) respectively in these two centers.

Correct: This Stage Includes the following Steps

1. Identifying possible opportunities for improvement, including reducing waste: In order to implement this step, effective plans must be created and possible opportunities to reduce waste, especially in the ingredient mixing center and the packaging center.

2. Implementation of improvement processes and follow-up of these processes: After developing the possible plans for improvement, these plans must be implemented and follow-up on their implementation to ensure that the objectives are effectively achieved.

3. Implementation of Cost Leadership Strategy and Rationalization of Operational Decisions By Using Material Flow Cost Accounting (MFCA) in Baghdad Soft Drinks Company

After applying material flow cost accounting (MFCA) in Baghdad Soft Drinks Company, the strategy of cost leadership and rationalization of operational decisions will be implemented in this company, as follows:

First: Implementation of the cost leadership strategy in the Baghdad Soft Drinks Company: The application of material flow cost accounting (MFCA) has helped provide information about losses in each of the quantity centers, as the cost of losses in the water purification center, the water purification and sterilization center and the removal of chlorine Including the ingredient mixing center, carbonation center, and packaging center (1728125), (2733381), (29997351), (974825), (14048680) dinars, respectively, and thus the total waste cost in all quantities centers in the company amounted to (49482362) dinars, that is, the share of the only product from the waste is 31.35 dinars, and after deliberation with the administrators and production engineers in the company, the research sample regarding the possibility of reducing the waste, it became clear that there is a possibility to reduce the waste by one third (1/3), that is, there is a possibility to reduce the total Costs in the amount of (16494120.67), Reducing the cost per liter of (10.49) dinars, and all of these things are positive indicators that indicate the possibility of implementing the cost leadership strategy by making the company's product (Pepsi-Cola) bear a cost less than that borne by competitors, thus helping to maintain existing customers and gain new clients.

Second: Rationalizing the operational decisions of the Baghdad Soft Drinks Company:- The management of the Baghdad Soft Drinks Company wishes to set the selling price of its product at a price that is 10% more than the total cost of the product, and it has become clear that there is a possibility to deviate the target selling price after reducing the costs related to wastage. Thus, the company can sell its product at the price it desires, which is (450) dinars per unit liter and achieve the target profit margin. As for the decision to add or dispose of one of the production lines. MFCA can be applied to any production line in company to identify the extent His contribution to making a profit or bearing a loss, and thus helping to rationalize decisions to add or get rid of one of the production lines in the company.

It turns out that MFCA can helps Baghdad Soft Drinks Company in rationalizing operational decisions, especially pricing decisions and decisions to add or dispose of a production line.

Conclusions & Recommendations

1. Conclusions

1. Material flow cost accounting (MFCA) is one of the environmental management accounting techniques that provide physical and financial information about material flows and balances to support decision-making and optimal use of materials and energy.
2. Cost, flow and materials are the basic concepts of the MFCA approach, and attention should be paid to these concepts when applying this approach in practice, with the need to calculate the costs of materials, energy, system and waste management.
3. The best steps for applying the MFCA approach are (plan - implement - check - correct), because these steps can achieve the goal for which it came efficiently and effectively.
4. Material flow cost accounting (MFCA) helps in implementing cost leadership strategy, rationalizing operational decisions, tracking material flow and determining its cost accurately.
5. There is a possibility to apply material flow cost accounting (MFCA) rationalizing product pricing decisions and decisions to add or dispose of a production line. The waste cost of (4948,362) dinars has been determined, which could be reduced by (16494120.67) dinars.

2. Recommendations

1. The necessity of applying material flow cost accounting (MFCA) as it provides appropriate information related to positive and negative products, as well as assistance in providing environmental and economic information. It helps implementing the competitive strategies of company.
2. Commitment to the steps of applying material flow cost accounting (MFCA), which are (plans - implement - check - correct) in order to achieve the objectives effectively and efficiently.

3. The need to benefit from the information provided by the material flow cost accounting (MFCA) in order to help determine the material losses borne by the economic unit, and work to get rid of them.
4. Benefiting from the environmental information provided by MFCA with the aim of eliminating waste and gaseous emissions.
5. The adoption of the Iraqi industrial companies in general and the Baghdad Soft Drinks Company in particular on the methodology specified in this research in order to apply the (MFCA) approach to help implement the cost leadership strategy and rationalize operational decisions.

References

- Al-Ghazi, M.A.H. (2014). *Integration of Material Flow Cost Accounting and Green Design to Achieve a Sustainable Competitive Advantage*. Master's Thesis in Accounting, College of Management and Economics, Wasit University.
- Annett, B., & Uwe, G. (2012). Energy Cost Accounting: Conventional and Flow oriented Approaches. *Journal of Competitiveness*, 4(2), 128-144.
- Asian Productivity Organization (APO), (2014). *Manual on Material Flow Cost Accounting: ISO 14051*. Hirakawa Kogyosha, Japan.
- Blocher, E.J., Stout, D.E., & Cokins, G.R. (2010). *Cost Management: A Strategic Emphasis*. 5th ed., McGraw-Hill Irwin Inc., USA.
- Christ, K.L., & Burritt, R.L. (2016). ISO 14051: A New Era for MFCA Implementation and Research. *Spanish Accounting Review*, 19(1), 1 – 12.
- Deeviski, S.E. (2016). Joint Costs Allocation Methods for Joint Products and By-products. *Economic Alternatives Journal*, 3(4), 64-70.
- Doorasamy, M., & Rhodes, B. (2017). Effectiveness of MFCA as a tool to improving sucrose quality in sugarcane production. *Environmental Economics*, 8(3), 102–110.
- Doorasamy, M., & Garbharran, H.L. (2015). The Role of Environmental Management Accounting as a Tool to Calculate Environmental Costs and Identify their Impact on a Company's Environmental Performance. *Asian Journal of Business and Management*, 3(1), 8 – 30.
- Fakoya, M.B., & Van Der Poll, H.M. (2013). Integrating ERP and MFCA systems for improved waste-reduction decisions in a brewery in South Africa. *Journal of Cleaner Production*, 40, 136-140.
- Gotze, U., Schmidt, A., Hache, B., & Herold, F., (2013). Material Flow Cost Accounting with Umber. *Management Accounting and Control Journal*, 231- 247.
- Hyrslava, J., Vagner, M., & Palasek, J. (2011). Material Flow Cost Accounting (MFCA) - Tool for the Optimization of Corporate Production Processes. *Business Management and Education*, 9(1), 5-18.
- Kasemset, C., & Bonmee, J. (2015). Application of MFCA in Waste Reduction: Case Study on a Small Textile Factory in Thailand. *Journal of cleaner production*, 108, 1342-1351.
- Kokubu, K., Campos, M.K., Furukawa, Y., & Tachikawa, H. (2019). Material flow cost accounting with ISO 14051. *ISO Management Systems*, 15-18.
- Manes, F., & Angles, D. (2009). Allocation Approaches the Joint Costs on Productions. *Accounting Researches Journal*, 29(12), 1-12.
- Nakajima, M., Kimura, A., & Wagner, B. (2015). Introduction of material flow cost accounting (MFCA) to the supply chain: a questionnaire study on the challenges of constructing a low-carbon supply chain to promote resource efficiency. *Journal of Cleaner Production*, 108, 1302-1309.
- Okada, K., & Kokubu, K. (2016). Impact of Introducing Material Flow Cost Accounting: A Comparative Review of Supply Chains and Individual Companies. In *Proceedings-International Conference on Industrial Engineering and Operations Management*, Kuala Lumpur, Malaysia.
- Schmidt, A., Götze, U., & Sygulla, R. (2015). Extending the scope of Material Flow Cost Accounting—methodical refinements and use case. *Journal of Cleaner Production*, 108, 1320-1332.
- Schmidt, M., & Nakajima, M. (2013). Material flow cost accounting as an approach to improve resource efficiency in manufacturing companies. *Resources*, 2(3), 358-369.
- Sygulla, R., Götze, U., & Bierer, A. (2014). Material flow cost accounting: a tool for designing economically and ecologically sustainable production processes. In *Technology and manufacturing process selection*, 105-130.
- Tu, T.H., Kuo, C.H., & Huang, W.C. (2019). Relationship Between Green and Material Flow Cost Accounting in the Context of Resource Utilization. *Spine Journal*, 30(1), 168–174.

- Wang, W.C., Lin, C.H., & Chu, Y.C. (2011). Types of competitive advantage and analysis. *International Journal of Business and Management*, 6(5), 100-104.
- Yagi, M., & Kokubu, K. (2018). Corporate material flow management in Thailand: The way to material flow cost accounting. *Journal of Cleaner Production*, 198, 763-775.
- Young, H., & Suzuki, C. (2012). Costs Allocation in Water Resources. *Journal of Engineering Researches*, 27(2), 212-225.