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Analysis of the potential implementation of Material Flow Cost Accounting (MFCA) in muslim fashion SMEs Y

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Abstract
Purpose: Conducting analysis on the current inventory control and proposing suggestions and improvements related to inventory control in SMEs Y using the Material Flow Cost Accounting (MFCA) approach.
Research methodology: This research adopts a case study approach with research methods including observation, document analysis and interviews.
Results: Based on the summation of raw material costs, energy costs, and system costs, the total allocation of product costs and allocation of material loss costs can be calculated. In the cost flow matrix, it is concluded that the company experiences a material loss of 7.5%. In fact, every production stage generates waste, and although the percentage of material loss may not always be significant, by reducing that percentage, the company can enhance the cost efficiency of its production.
Limitations: The focus on manufactured firms especially SMEs Y limits the generalizability of the study findings to other sectors of the economy and scalability.
Contributions: The results of this study can be used as a consideration in formulating policies related to the management of fashion raw material inventory in Indonesia, particularly for other SMEs in managing their inventory and if they intend to implement Material Cost Flow Accounting in their production processes.
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1. Introduction

Indonesia ranks 3rd globally in the modest Muslim fashion sector, according to data from the State of the Global Islamic Economy Report 2020-2021 (Dinar Standard, 2021). The global market for Muslim fashion currently records $270 billion, equivalent to IDR 3,830 trillion. According to the news from the Badan Pusat Statistik (2023) Indonesia's economy grew by 5.31 percent in 2022, higher than the achievement of 3.70 percent growth in 2021. According to data from 2017, the fashion industry in Indonesia contributed 3.87 percent to the national Gross Domestic Product (GDP), with export value reaching 11.97 million US dollars (Kemenparekraf, 2023).

Inventory management of raw materials is crucial for manufacturing companies in terms of business development as it influences cost efficiency, production sustainability, and business outcomes (Pristianingrum, 2017). Balkhi et al. (2022) explained in their research that inadequate inventory management can potentially lead to excess stock, which means that additional assets are tied up in inventory, thereby limiting cash flow and organizational growth. Inventory management also serves as a determinant of competitiveness, including through efficient inventory management practices and

minimizing inventory investment (Saad & Bahadori, 2019). In manufacturing companies, the production process is a crucial activity for the survival of the company. Manufacturing inventory consists of three types, namely raw material inventory, work-in-progress inventory, and finished goods inventory. The scope of this research focuses on raw material inventory for the production process (Aprilianti & Hidayat, 2019).

SMEs Y is a company engaged in the Muslim fashion industry since 2017. SMEs Y conducts production after receiving prior orders from partners, and these partners directly sell the products to end customers. Based on the gathered information, SMEs Y currently lacks clear inventory control for raw materials in its production process. Currently, there are several issues in inventory management at SMEs Y. SMEs Y often overlooks its production process by running each process independently, resulting in wastage of raw materials and negative company performance. This wastage contributes to inefficiencies in resource management during the production process. The notion that material loss costs are not significant and do not affect the production cost of goods is often disregarded by SMES Y, leading to unnecessary expenses that ultimately erode the generated profits (Dierkes & Siepelmeyer, 2019).

In an effort to address the issue of reducing raw material waste, management accounting has developed a method for capturing production waste called Material Flow Cost Accounting (MFCA), which provides information on both economic and non-economic waste. This method is valuable for managers in decision-making regarding how to reduce waste of company raw materials (Fakoya, 2015). In a previous study by Alfian et al. (2020) the implementation of MFCA at PT Unipres Indonesia led to a significant reduction in material loss costs of Rp 650,325 per spare part produced. This reduction was achieved through various measures such as energy savings, optimizing human resources, and reducing overhead costs. Additionally, PT Unipres Indonesia effectively manages production waste by selling scrap or leftover materials to third parties, resulting in increased revenue and improved financial performance. The study conducted by Huang et al. (2019) concluded that the implementation of Material Flow Cost Accounting (MFCA) can help companies reduce waste and improve resource utilization efficiency. With MFCA, companies can obtain more accurate and detailed information about the cost incurred at each stage of production, enabling them to determine strategies to minimize waste and optimize resource utilization.

The implementation of Material Flow Cost Accounting is expected to help address the existing issues in SMEs Y. The following are the problems faced by SMEs Y in their business processes:
1. Waste of raw materials, resulting in a significant amount of leftover material scraps.
2. Inconsistency between the quantity of raw material orders and the incoming orders.
3. Lack of analysis regarding the procurement of raw materials and scheduling of orders to ensure timely delivery to customers.

Based on the aforementioned issues, it is necessary to conduct an analysis of raw material inventory management, encompassing upstream and downstream activities in SMEs Y. This research is titled "Analysis of Material Flow Cost Accounting (MFCA) Implementation in the Muslim Fashion SMEs Y".

1.1. Problem Formulation

Referring to the background of the issues that have been outlined, the research questions that the author proposes to address the research problems are as follows:
1. How is the production process in SMEs Y assessed from the perspective of the Material Flow Cost Accounting (MFCA) framework?
2. What are the strategies for production efficiency in SMEs Y?

2. Literature review

2.1. Environmental Management Accounting (EMA)

Graff et al. (1998) explain that Environmental Management Accounting (EMA) is a method that takes into account the environmental costs and material usage in business operations. According to IFAC, (2014) EMA is the management of environmental and economic performance through the development and implementation of accounting systems and practices related to the environment. EMA is considered an extension of management accounting to address environmental issues (Jun et al., 2017). Management accounting aims to improve the quality of environmental information and integrate it into decision-making processes, such as investment assessment, capital budgeting, and strategic management, as management accountants play a crucial role in verifying the integrity and reliability of information in the process of searching, collecting, and disclosing information, and they have a more strategic role in policy-making and planning (Burritt et al., 2002).

2.2. Material Flow Cost Accounting (MFCA)

MFCA (Material Flow Cost Accounting) is one of the most important environmental management tools that enhances transparency in material usage practices by developing material flow models, reducing environmental impacts, and improving business efficiency. The ISO Technical Committee (ISO/TC 207) aims to standardize MFCA practices by developing the ISO 14051 standard, published in 2011, which complements the ISO 14000 series for environmental management systems, life cycle assessment (ISO 14040, ISO 14044), and environmental performance evaluation (ISO 14031) activities (APO, 2014).

Kokubu & Kitada (2015) stated that highly competitive Japanese companies have identified a broader scope for improvement by utilizing MFCA, as the concept of losses in MFCA differs from the conventional concept of suitability in traditional business management. The ISO 14051 standard assists organizations in implementing the MFCA framework, which includes developing material and energy flow frameworks, calculating costs related to material, energy, systems, and operations, and identifying opportunities to improve efficiency. The mission of MFCA is to provide environmental management accounting tools and practices that help companies clarify material flows in relation to cost allocation. The outcomes of MFCA aim to assist organizations in making more comprehensive decisions to optimize production process efficiency (APO, 2014).

2.2.1. Objectives and Elements of Material Flow Cost Accounting (MFCA)

Alfian et al. (2020) stated that MFCA has the ability to enhance transparency in material flow and energy usage, as well as to consider associated costs and environmental impacts. The information obtained from MFCA can support decision-making in companies. This can be achieved by adhering to the four core principles of MFCA methodology, which are as follows:

1. Understanding material flow and energy usage
2. Connecting physical and monetary information data
3. Ensuring accuracy, completeness, and comparability of physical data
4. Estimating and determining material loss costs.

2.2.2. Steps of Implementing Material Flow Cost Accounting (MFCA)

2.2.2.1. Involving Management and Determining Roles and Responsibilities

To succeed in implementing all stages of MFCA, full support from management and a bottom-up approach in the field are key factors. The implementation of MFCA will be easier if management understands the benefits and implications of its application in achieving the company's environmental and financial targets, as well as the commitment of the entire organization. Additionally, collaboration and support among internal departments of the company are also important in ensuring the success of MFCA implementation (APO, 2014).

2.2.2.2. Scope and Limitations of Process and Determination of Material Flow Modes
To implement MFCA, the next step is to determine the boundaries that encompass the scale of MFCA activities. This begins by focusing on a specific product or initial process and then expanding it for use with other products or processes.

2.2.2.3. Cost Allocation
MFCA divides costs into the following categories:
1. Raw material costs, which include costs for all raw material inputs entering the quantity center.
2. Energy costs, which include costs for electricity, fuel, steam, heat, and compressed air.
3. System costs, which include labor costs, depreciation and maintenance costs, and transportation costs.
4. Waste management costs, which include costs for waste handling generated at the quantity center.

2.2.2.4. Interpreting and communicating the results of MFCA
MFCA provides information about material losses, unused raw material utilization, energy costs, and system costs associated with material losses during the production process. This information enhances operational awareness within the company and provides opportunities for managers to improve efficiency in material usage and overall business performance.

2.2.2.5. Recommendations for Implementation Based on MFCA Results
The information obtained from the MFCA analysis can be utilized to identify opportunities for improving environmental and financial performance. One way to achieve this is by incorporating new business processes based on the identified material losses and transforming them into new products.

2.3. Conceptual Framework

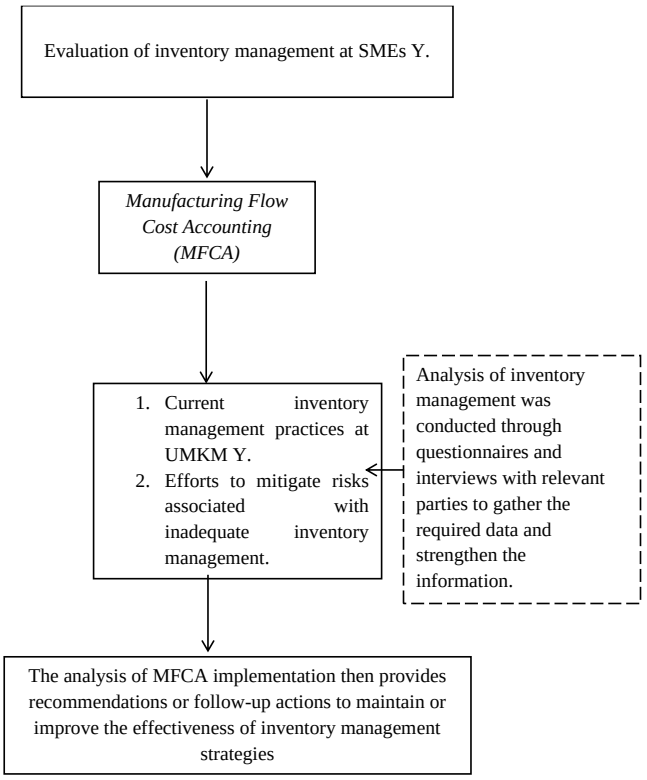

Figure 1. Conceptual Framework

3. Methodology
This study focuses on a micro-enterprise in the Muslim fashion industry as the research object. The company currently lacks reliable inventory management and planning, which hinders its ability to determine the estimated quantity of units for warehousing/inventory activities. This study adopts a

qualitative research methodology that focuses on the interpretation and understanding of experiences in the world where people exist. The study utilizes both primary and secondary data. Primary data is obtained directly through interviews with individuals who serve as informants within relevant entities, possessing expertise and involvement in the issues under investigation. The primary data used in this study includes Sales Reports and Inventory Reports of SMEs Y in the year 2022. The findings can provide a depiction or description of an object that was previously unclear, resulting in a clearer understanding after conducting the research (Saunders et al., 2020). Yin (2018) defines a case study as a research plan that takes place in various fields, particularly in the realm of evaluation. A case study involves conducting an in-depth analysis of a particular event, often a program, event, activity, process, or individual.

3.1. Data Analysis

3.1.1. Descriptive Quantitative Analysis

Quantitative descriptive analysis, according to Creswell & Creswell (2018), is a method used to create an objective overview or description through numbers. It involves collecting data, interpreting the data, and presenting the results. Quantitative descriptive analysis is conducted using the ISO 14051 guidelines on MFCA calculations.

3.1.2. Content Analysis

Content analysis aims to code quantitative data to analyze content within the themes under investigation (Vaismoradi et al., 2013). The content analyzed consists of data found within the collected texts. Researchers classify words, themes, and concepts found in the texts, and then analyze them using Nvivo 12 Pro software. The content analysis process involves several steps, including topic identification, determination of content categories, testing of content categories, data collection, and content analysis to draw conclusions. In this study, the focus of the researched themes is related to waste materials and production processes in SMEs Y, as well as the implemented management strategies.

4. Results and discussions

4.1. Company Overview

SMEs Y was established and has been in operation since 2015. SMEs Y is a company that provides Muslim fashion products including hijab, abaya, gamis, baju koko, and other supporting accessories. The company initially started with the sale of hijabs and later expanded its market coverage through partnerships, resulting in a broader market reach. Based on initial interviews and the owner's experience and passion for selling, within a short period of time, SMEs Y has attracted many new customers and partners who have become regular buyers (subscribers) because SMEs Y maintains the quality of its products with the slogan “Beauty in Simplicity”. SMEs Y embraces the principle that Muslim fashion business is not just about selling and treating it as a mere commodity, but also fosters a close sense of family among its partners and the women workers supported by SMEs Y.

Indonesia has great potential to become a globally competitive producer of Muslim fashion, as global Muslim consumer spending reaches USD 295 billion, and the national textile and textile products (TPT) industry has shown a growth of 13.44% in the third quarter of 2022. The development of the Muslim fashion industry ecosystem begins with the initial stages related to access to raw materials, production, branding, and exhibition and promotional activities. It is also important to have industry human resources with adequate qualifications and competencies. Therefore, a national qualification scheme is needed that integrates the fields of education, job training, and the business world (Kepemenperin, 2022).

4.2. Result and Analysis

4.2.1. The Production Process SMEs Y

In the Research Findings section, the focus was only on the fabric production cycle during the period of November 2022 to April 2023. In November 2022, UMKM Y received an order for 66,000 sets of sarimbit products, requiring a total of 53,416 yards of morena fabric and 30,612 yards of jacquard

fabric. The production process at UMKM Y consists of 7 stages. Each stage of the fabric takes three to four days to complete, starting from the input of the main raw materials until the finished product is obtained. The production process is illustrated in the diagram.

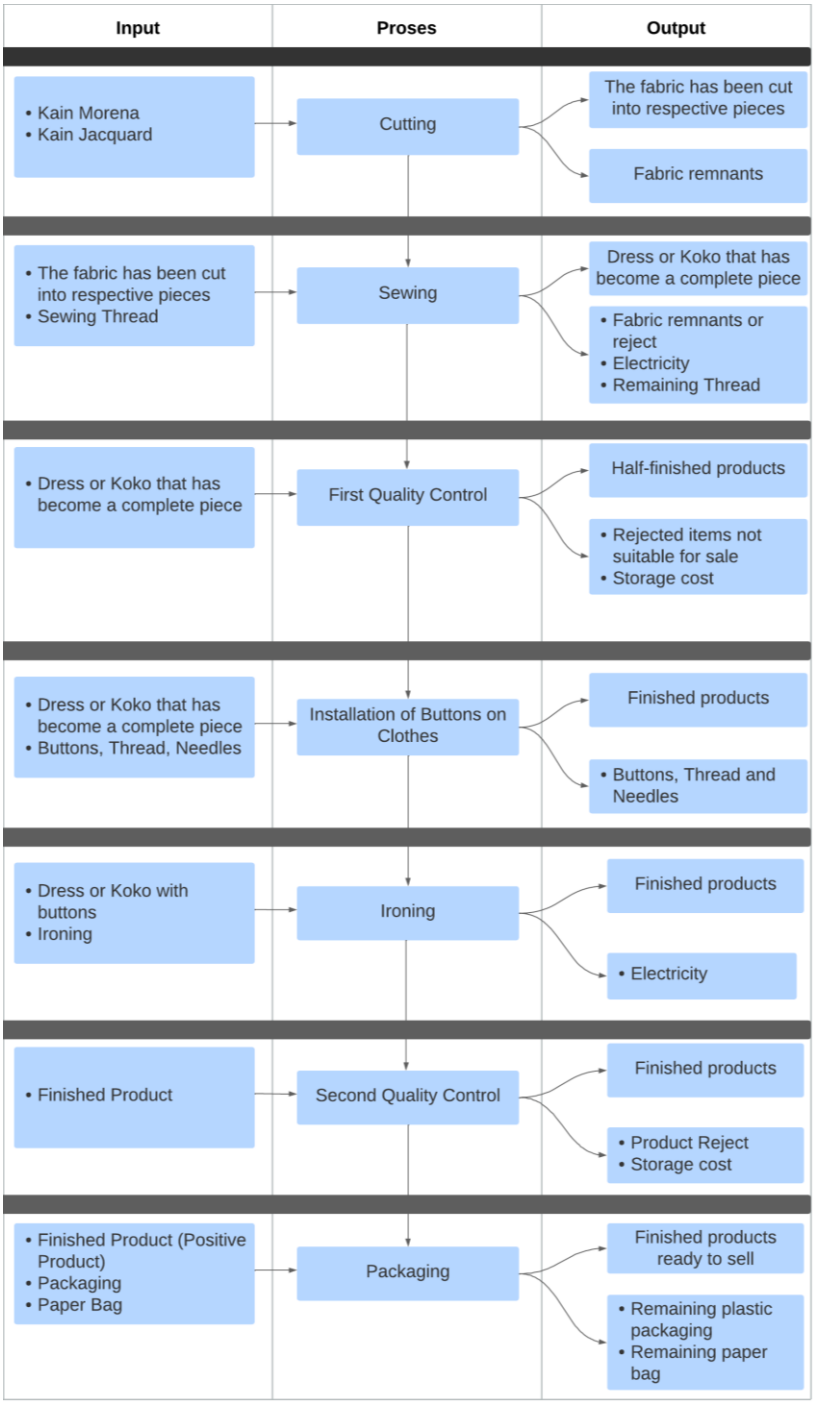

Figure 2. Production Process
Source: Processed by the author (2023)

4.2.1. Production Process in SMEs Y Reviewed from the Material Flow Cost Accounting (MFCA) Framework

4.2.1.1. Involving Management and Determining Roles and Responsibilities

After engaging in communication and obtaining commitment from various departments within the organization, the next step is to form an MFCA implementation team by establishing clear roles and responsibilities. In planning the implementation of MFCA, it is important to establish a clear

organizational structure so that roles and responsibilities can be determined accurately. The head of the production department at SMEs Y will serve as the chairperson of the MFCA implementation team. The reason for selecting the head of production as the team leader is to provide motivation for team members, as they feel supported by the leadership and production department in carrying out their tasks to the fullest extent.

Table 1. Role and Responsibilities of the MFCA Implementation Coordinator

No	Position	Amount Needed	Responsibilities
1	Head of Production	1	Overseeing the flow of material and energy during the production process
2	Quality Control	1	Checking finished products to ensure they meet the desired quality standards set by the company. Supervising the management of production waste and its disposal.
3	Head of Finance	1	Creating and calculating the production costs incurred at each production stage

Source: Processed data by author (2023)

4.2.1.2. Scope and Limitations of Process and Determination of Material Flow Modes

After determining the scope and boundaries of the production process in the design phase of MFCA implementation, the next step is to create a material flow model. In creating this model, the first step is to determine the quantity centers. Quantity centers are parts of the process where inputs and outputs are physically measured and represent the stages where raw materials are transformed. The production process of SMEs Y consists of 7 stages, but not all of them can be quantity centers. After conducting an analysis, it was found that there are 5 quantity centers in the production process of SMEs Y, namely cutting, sewing, button installation, ironing, and finishing. At each quantity center, there is processing of raw materials into products or waste materials, as well as measurable inputs and outputs.

1. Cutting Process

The cutting process is the first quantity center. In this stage, the types of fabric used are morena and jacquard. UMKM Y does not use any other materials besides these fabrics because their quality is already excellent. From November 2022 to April 2023, SMEs Y produced 66,144 pieces of sarimbit products, which translates to 84,045 yards of fabric. This includes 53,370 yards of morena fabric and 30,675 yards of jacquard fabric. Prior to production, SMEs Y usually purchases the fabrics in rolls so that they can be cut according to customer orders, reducing waste in each production run. Morena and jacquard fabrics often result in fabric scraps after the cutting process. Although some of the fabric scraps can be reused for future production, if their length is less than 3 yards, they generate negative outputs. SMEs Y produces an average of 0.1-2% negative outputs each month from the total processed raw materials. During the period from November 2022 to April 2023, SMEs Y generated approximately 60 rolls of fabric scraps out of the total 1,507 rolls of fabric processed. However, these fabric scraps can still be reused for future production. If the fabric is used to make products with the smallest size, less than 3 yards, the fabric scraps will be stored in SMEs Y's warehouse or disposed of as they cannot be reused.

2. Installation of Buttons

In this process, fabric that has passed the first stage of quality control is used. In this stage, 111,781 pieces of buttons and 12,715 pieces of acrylic are used as accessories. The focus of this process is on

attaching buttons and accessories to products that have passed the first stage of quality control, using sewing thread. In this process, there is still a possibility of waste materials, namely buttons and sewing thread, resulting in negative outputs.

3. Ironing

After the button attachment process, the next step is ironing to ensure that the products sent to customers are neat and free from loose threads. This process requires electrical energy and involves 5 workers.

4. Finishing and Packaging

This process is carried out when the finished products are ready to be packaged as sarimbit products. The focus of this process is on packaging and assessing the suitability of the products produced in the previous production process. In this finishing process, 50,000 pieces of plastic packaging are required, and it involves 8 workers. The negative output generated from this process is damaged packaging materials, such as plastic packaging or cardboard used for packaging. Packaging damage rarely occurs as the packaging needs to be ordered from a third party. However, occasional occurrences may be due to human error or stacking of other packaging, resulting in approximately 1% of the total packaging being unusable.

4.2.1.3. Cost Allocation

In this stage, cost allocation is performed. In MFCA, costs are classified into four categories: material cost, energy cost, labor cost, and disposal cost. To determine the material cost, the physical quantity of input raw materials at each quantity center is multiplied by their unit cost, and the material cost flow is tracked through each quantity center. Once the material cost is identified and allocated, the energy cost, system cost, and disposal cost for each quantity center are calculated.

1. Cutting Process

The cutting process is the first quantity center. In this stage, two types of fabric are used, namely morena and jacquard. From November 2022 to April 2023, SMEs Y produced a total of 30,671 pieces of sarimbit products, equivalent to 84,045 yards of fabric, divided into two categories: 53,370 yards for morena fabric and 30,675 yards for jacquard fabric. The unit price is Rp 20,000 for morena fabric and Rp 24,000 for jacquard fabric, resulting in a total raw material cost of Rp 1,803,606,000. The positive output in this stage is 47,629 yards for morena fabric and 29,958 yards for jacquard fabric. These figures are divided by the total input in this process, which is 53,370 yards for morena and 30,675 yards for jacquard fabric, and multiplied by the total raw material cost. Consequently, the cost allocation for positive output is Rp 952,580,352 for morena fabric and Rp 718,999,181 for jacquard fabric.

The negative output of raw materials in this production process is 5,741 yards of morena fabric. The estimated quantity of 5,741 yards of morena fabric is divided by the total input of 53,370 yards and multiplied by the total input cost of raw materials, resulting in a cost allocation of Rp 114,819,648 for the negative output in this process. The percentage of positive output in the allocation of raw materials in this process is obtained by dividing the quantity of morena fabric (47,629 yards) by the input of 53,370 yards and multiplying by 100%. The percentage of negative output in the allocation of raw materials in this process is obtained by dividing the quantity of morena fabric (5,741 yards) by the input of 53,370 yards and multiplying by 100%.

The negative output of raw materials in this production process is 717 yards of jacquard fabric. The estimated quantity of 717 yards of jacquard fabric is divided by the total input of 30,675 yards and multiplied by the total input cost of raw materials, resulting in a cost allocation of Rp 17,206,818 for the negative output in this process. The percentage of positive output in the allocation of raw materials in this process is obtained by dividing the quantity of jacquard fabric (717 yards) by the input of 30,675 yards and multiplying by 100%. The percentage of negative output in the allocation of raw materials in this process is obtained by dividing the quantity of morena fabric (717 yards) by the input

of 30,675 yards and multiplying by 100%. This process generates a positive output of raw materials amounting to 89% and a negative output of 11%. In this stage, there is also the input cost of sewing, which amounts to Rp 1,186,619,000 for the entire output of the cutting and sewing processes.

2. Button Installation

In this process, fabric that has passed the first stage of quality control is used. In this stage, 111,781 pieces of buttons and 12,715 pieces of acrylic are used as accessories, with prices of Rp 197.92 per piece for buttons and Rp 800 per piece for acrylic. The total cost incurred is Rp 22,123,333 for buttons and Rp 32,295,323 for acrylic. This production stage requires a total input of 25 workers, with one worker assigned to each machine. According to the information provided by SMEs Y, this process does not yield negative output because any leftovers can be reused in the subsequent production process

3. Ironing

After the buttons are attached, the next process is ironing to ensure that the products sent to customers are neat and free from loose threads. This process requires electrical energy and 10 workers. For the ironing process, one machine is needed for one worker. In this stage, there is also an input of energy, which is 2 kWh with a unit price of Rp 1,444.70. The production process takes 480 minutes multiplied by the packing time of 7 days. This process does not yield negative output as it does not generate waste.

4. Finishing and Packaging

This process is carried out when the finished products have been produced into sarimbit products. This process focuses on packaging and assessing the suitability of the products that have been made in the previous production process. In the finishing process, 36,700 pieces of plastic packaging and 8 workers are required. The negative output generated from this process is damaged packaging plastic or cardboard used for packaging. Packaging damage rarely occurs because the packaging needs to be ordered from a third party. Usually, it occurs due to human error or the accumulation of other packaging, resulting in approximately 1% of the total packaging being unusable. Therefore, there is a positive output of 36,333 pieces with a total cost of Rp 36,011,250 and a negative output of 367 pieces with a total cost of Rp 363,750.

After the calculation, these costs are presented as expenses during production, as shown in the following table:

Table 2. Cost allocation, Positive Output, Negative Output on SMEs Y's production raw materials.

Raw Material	**Cost Allocation**	**Allocation of positive output costs**	**Allocation of negative output costs**
Kain Morena	Rp 1.067.400.000	Rp 952.580.352	Rp 114.819.648
Kain Jacquard	Rp 736.206.000	Rp 718.999.182	Rp 17.206.818
Kancing	Rp 22.123.333	Rp 22.123.333	-
Acrylic	Rp 32.295.323	Rp 32.295.323	-
Plastik Packaging	Rp 36.375.000	Rp 36.011.250	Rp 363.750
Total	**Rp 1.894.399.656**	**Rp 1.762.009.440**	**Rp 132.390.216**
Percentage (%)		**93%**	**7%**

Source: Processed data by author (2023)

Table 3. Cost allocation, Positive Output, Negative Output on UMKM Y's production energy

Production Stages	**Energy**	**Energy Requirements**	**Unit**	**Unit Price**	**Cost Allocation**	**Positive output percentage**	**Positive output cost**	**Negative output percentage**	**Negative output cost**
Cutting	-	-	-	-	-	100%	-	0%	-
Sewing	-	-	-	-	-	100%	-	0%	-
Button Installation	-	-	-	-	-	100%	-	0%	-
Ironing	Listrik	4800	Kwh	Rp 1.444.70	Rp 6.934.560	100%	-	0%	-
Packaging	-	-	-	-	-	100%	-	0%	-
Total					Rp 6.934.560	100%	-	0%	

Source: Processed data by author (2023)

Table 4. Cost allocation, Positive Output, Negative Output on UMKM Y's production system

Production Stage	Number of Workers (Vendor/Individual)	Requirements (Pcs)	Wage/ Pcs	Cost Allocation	Positive output percentage	Positive output cost	Negative output percentage	Negative output cost
Cutting dan *Sewing*	5	6.134	Rp 30.000	Rp 920.130.000	89%	Rp 818.915.700	11%	Rp 101.214.300
Button Installation	25	30.671	Rp 301.90	Rp 231.489.000	100%	Rp 231.489.000	0%	-
Ironing	10	30.671	Rp 1.141	Rp 35.000.000	100%	Rp 35.000.000	0%	-
Packaging	8	30.671	Rp 114.11	Rp 28.000.000	99%	Rp 27.720.000	1%	Rp 280.000
Total				Rp 1.214.619.000	91.6%	Rp 1.113.124.700	8.4%	Rp 101.494.300

Source: Processed data by author (2023)

4.2.1.4. Interpreting and communicating the results of MFCA

The next step after calculating the cost allocation related to the production process is to interpret the results of MFCA using cost flow matrices. These costs can be categorized as part of the product or material losses.

Table 5. The Cost Flow Matrix for the Production Process in SMEs Y

Component	Raw Material Cost	Electricity Cost	System Cost	Waste Management Cost	Total
Product	Rp 1.762.009.440 93%	Rp 6.934.560 100%	Rp 1.113.124.700 91.6%	-	Rp 2.882.068.700 92.5%
Material Losses	Rp 132.390.216 7%	-	Rp 101.494.300 8.4%	-	Rp 233.884.516 7.5%
Total	Rp 1.894.399.656 100%	Rp 6.934.560 100%	Rp 1.214.619.000 100%	-	Rp 3.115.953.216 100%

Source: Processed data by author (2023)

Based on the sum of raw material costs, energy costs, and system costs, the total allocation of product costs and material loss costs can be calculated. In the cost flow matrix, it can be concluded that the company incurs a material loss of 7.5%. In fact, each production stage generates waste, and although the percentage of material loss may not always be significant, reducing this percentage can help the company improve cost efficiency in production.

4.2.1.5. Recommendations for Implementation Based on MFCA Results

By using MFCA, the management of UMKM Y can accurately assess data on material losses and the associated costs to identify opportunities for improving environmental and financial performance. The following steps can be taken to make improvements in the production process: material substitution, process modification, production line or product optimization, and enhancing R&D activities related to material and energy efficiency. Based on the MFCA analysis conducted at UMKM Y, the following alternative improvements or production process management can be considered:

a) Management of leftover fabric as raw material

Alternative management for morena and jacquard fabrics involves planning the material requirements from the beginning based on the sales and marketing team's estimates. It requires the use of more modern cutting tools to ensure accurate fabric cuts and minimize leftover pieces. The cutting process requires employees with high precision and discipline. Some of the leftover fabric pieces can be used for further production, but if the remaining fabric length is less than 3 yards, it will result in negative output. The discarded fabric can be reused to create handicrafts such as tablecloths, napkins, and other small items. By reusing the leftover fabric in the cutting process, it can increase savings in raw material and reduce the amount of leftover fabric, adding economic value. If it is possible to use the leftover fabric to create hijabs again, as it is still related to modest fashion and can be sold separately to retailers or other partners, it can turn the material loss into a profit for UMKM Y more quickly. This approach avoids wasting or storing the leftover fabric as raw material without processing it, compared to directly selling the fabric without further utilization.

b) Reducing the width of each pattern piece's edge

This solution is provided to reduce fabric waste that occurs after the sewing process. Its implementation requires the use of more modern cutting tools to ensure more accurate cuts, thus minimizing fabric remnants. The cutting process requires meticulous and disciplined employees. Narrowing the width of each pattern piece's edge (the smallest distance at which the fabric can be cut by the machine) can help reduce the amount of fabric being cut and can be implemented immediately after a new fabric design is ordered and new patterns are required.

c) The use of a new fabric cutting table

This solution is provided to reduce fabric waste during the cutting process. By comparing the current fabric cutting table size with a larger and longer cutting table size, effective pattern arrangement can be achieved before the cutting process. This can help minimize fabric waste after the cutting process is completed. Since the cutting process plays a crucial role in determining the amount of fabric waste that will be generated, implementing a larger and longer cutting table can contribute to better material utilization in subsequent processes.

4.2.2. Content Analysis

Based on the information obtained through interviews, it was processed using Nvivo 12 Pro/Plus software. This application was used for content analysis through features such as word frequency and text search. The word frequency feature was used to analyze the interview transcripts by identifying frequently repeated words spoken by the respondents. The criteria for filtering words through word frequency were a minimum length of 4 (six) letters and displaying the top 100 words to identify the focal points of the respondents' information. The following is the content analysis based on the word frequency feature.

Figure 3. Content Analysis
Source: Processd by Nvivo 12 Pro (2023)

Based on the analysis of word frequencies, it is evident that the most frequently mentioned word is “kain” (fabric) with a frequency of 109 times, accounting for 0.73% of the coverage. According to the Kamus Besar Bahasa Indonesia (Indonesian Dictionary) available at https://kbbi.kemdikbud.go.id/, “kain” is defined as “a fabric woven from cotton threads.” Therefore, it can be inferred that the focus of this research is related to the fabric, which serves as the main raw material in the production process of SMEs Y. The second most frequently mentioned word in the word frequency analysis is “produk” (product), mentioned 100 times. After conducting the research, it is found that this refers to the main focus of SMEs Y, which is the development and research related to products that generate 80% of the company's revenue. Therefore, the company will prioritize these products and focus on how they are produced. The third most frequently mentioned word in the word frequency analysis is “produksi” (production), mentioned 93 times with a coverage of 0.62%. After conducting the research, it is found that this refers to the main focus of the company at the moment, which is the production process. This is crucial in meeting the needs of partners/customers and is closely related to efficiency at SMEs Y.

The fourth most frequently mentioned word in the word frequency analysis is “sisa” (remainder), mentioned 67 times with a coverage of 0.45%. After conducting the research, it is found that this refers to the issues faced by UMKM Y in the production process. According to the Kamus Besar Bahasa Indonesia (Indonesian Dictionary) through https://kbbi.kemdikbud.go.id/, “sisa” means “what is left (after eating, taking, etc.); excess; leftovers.” In this context, it pertains to the remaining fabric raw materials used by the company. Further management is needed for these remnants in order to minimize the costs associated with the leftover fabric raw materials. The next word in terms of frequency mentioned by the respondents in the Nvivo 12 Pro analysis is “reject.” The word “reject” is mentioned 52 times with a coverage of 0.35%. This word is significant because it relates to the procurement of fabric materials and the sewing process, which can result in rejected items. The term “reject” can refer to the rejection or refusal of products or goods that do not meet the established quality standards or specifications.

5. Conclusion

5.1. Conclusion

The implementation of Material Flow Cost Accounting (MFCA) is crucial for companies, especially in the small and medium-sized enterprise (UMKM) industry, as it makes the production process more transparent through the material flow scheme. By implementing MFCA, businesses can assess the efficiency of material utilization in a production process by measuring the amount of waste generated. MFCA also enables businesses to allocate costs to raw materials, energy, and labor, which is beneficial for making efficient and profitable decisions.

In the case of SMEs Y, it is evident that material losses (negative outputs) from the cutting process reach 10%, and there is currently no systematic follow-up on the leftover fabric. This leads to the accumulation of fabric waste. The lack of workforce associated with roles and responsibilities also contributes to the neglect of material losses resulting from fabric waste. Therefore, the researcher proposes adding internal business processes to SMEs Y to address fabric waste and transform it into useful products in the future, while also preventing the occurrence of fabric leftovers.

5.2. Limitation

The limitation of access to and availability of the required data for material flow cost accounting calculations resulted in this research being limited to a period of six months, from November 2022 to April 2023. Production planning is carried out when there are orders from customers, which means that the production cost records for the entire year are not presented as a separate report. As a result, the researcher had to sort out the production costs from the overall annual cost reports of the company. UMKM Y does not yet have an integrated system and still relies on manual records for cost recording and production planning. In addition, this research employed a qualitative method through observation and interviews without using quantitative comparative data. Therefore, future studies can consider incorporating other methods for comparing research findings.

5.3. Suggestion

It is suggested by the researcher that for future studies, if the company does not have internal data related to material flow cost accounting, data can be collected through a longer period of observation. For example, observations can be conducted on the production process for one year. In cases where cost-related data is not available, benchmarking can be conducted with other batik industries or by considering market prices. The use of material flow cost accounting (MFCA) is recommended by the researcher as an environmental management accounting system so that negative outputs and hidden costs in the production process can be identified by the company, thus improving production process efficiency. Control measures can be implemented by the company through appropriate corrective actions, and the outcomes of those actions on negative outputs can also be monitored.

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