

# How Does the Value Stream Mapping Method Identify Waste and Improve the Coffee Bean Production Process of a Café?

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## Abstract

**Objective:** This study aims to identify waste and its causes in the production process and provide suggestions for improvement.

**Design/Methods/Approach:** The author uses a qualitative research method approach to obtain research data. The author identifies the waste that occurs using Value Stream Mapping (VSM). Identify waste in the coffee bean production process using structured question weighting and direct interviews with several parties related to the production process, including the café owner, production manager, head barista, and two baristas in the production section.

**Findings:** The waste causes that occur in the identified coffee production process are waiting time due to the first stage sorting process still using hands manually, the absence of tools, defects caused by the inevitable side effects of the roasting process, and unnecessary motion. After knowing the cause of the waste that occurred, the company was given a suggestion for improvement using 5W-1H tools, such as using a coffee sieve of a certain size for the first stage sorting process, making a new product in the form of ground coffee, processing defect coffee beans that always exist from the roasting results, and adding a fan and exhaust in the roasting room to reduce unnecessary movement during the process.

**Originality:** The paper contributes to the limited literature on lean production in the coffee processing business and disseminates this information to improve production efficiency.

**Keywords:** Waste Elimination, Production Improvement, Coffee Production Process, Value Stream Mapping, Value Stream Analysis Tools

**JEL Classification:** M11



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## I. Introduction

Coffee has become a drink that can be enjoyed by various groups in Indonesia. Initially, coffee was only enjoyed in coffee shops in the form of black coffee brewed with the brew method, namely pouring hot water into a glass containing black coffee powder. However, nowadays, a new phenomenon appears in the form of cafes that sell coffee with various variants and innovations, which changes the image of coffee to be more youthful, relaxed, and modern. This is also supported by changing trends in society to work more flexibly. These new habits caused café businesses have proliferated. Besides being tempted by the emergence of new markets, the promising profit potential also makes many people interested in starting a similar business. But sometimes, the lack of preparation, experience and a strong managerial base make many café businesses go out of business midway. The lack of preparation of a cafe can be seen in the concept, the quality of the menu sold, and the understanding of the coffee from the cafe. Experience in the coffee industry is no less important. When a business owner has minimal or little experience, the café will find it difficult to innovate, so competing with competitors with higher experience will be difficult. The experience in question is the experience of business owners regarding understanding from upstream to downstream of the coffee industry, starting from how to produce coffee beans to processing and brewing methods so that the café can adapt to a constantly changing environment and it'll be easier to innovate. There are three coffee brewing methods: brewing, filtering, and using a machine.

When a café grows and develops well, the café will begin to pay attention to a series of raw material processes, especially the upstream part of the coffee industry itself. Good managerial knowledge will make the café grow to be better and more efficient. A business owner with good management knowledge will be able to manage and understand the problem of raw material supply and consumer demand and the number of employees needed at the café. In addition, excessive production processes in cafes will make the process inefficient. To overcome this, one way is to implement the lean manufacturing concept to combat waste. Waste can be described as any human activity that absorbs a certain amount of resources but does not produce added value, such as errors that require correction, unwanted production results by users, unnecessary processes or processing, useless labor movements, and waiting for the final results of previous activities (Womack and Jones, 1996 in Formoso et al., 2002). Waste can also be interpreted as loss or loss of various resources, namely material, time (related to labor and equipment), and capital, caused by activities that require direct or indirect costs but do not add value to the final product for the user (Formoso et al., 2002). In his book *Toyota Production System: Beyond Large Scale Production*, which classifies waste into seven categories, Linker adds one type of waste to that seven waste types (Khannan & Haryono, 2015). The seven waste types are Waste of Overproduction, Waste of Overprocessing, Waste of Waiting, Waste of Defect, Waste of Motion, Waste of Transportation, and Waste of Inventory.

The term lean was first coined by John Krafcik (1988) and popularized by Womack (1990) in the book *The Machine That Changed the World*. Lean focuses on identifying and eliminating waste from a process (Ohno & Bodek, 1988). Bhasin and Burcher (2006) define lean as a philosophy that aims to eliminate non-value-added activities from the process and treat activities that do not add value required by customers as waste. The lean method can be used to find out the reasons and methods for eliminating waste or non-value-added activities. Lean production focuses on producing large amounts of output but with fewer resources (Kalsaas, 2002). Implementing lean production is to get lower production costs, but the resulting output is increasing, or it can be said that efficiency has been achieved. In the Lean Production concept, there are three types of operational activities: value-added activities, non-value-added activities, and activities that do not increase value but are still needed (necessary non-value added). The principle of Lean Production is waste treatment, process streamlining, quality control, and continuous improvement, and expected to reduce or eliminate non-value-added activities. Therefore, this requires a special method to produce a quality product at a more efficient cost and time (Hines & Rich, 2005).

This research focuses on a series of process flows for the roasted coffee bean production of a café, namely ByCoffee Indonesia. The production process flow starts from the first stage of sorting, roasting, cooling (resting), and the second stage of sorting and packaging. For example, the incomplete recording of warehouse inventory makes it prone to waste occurring in unnecessary inventory and activities that are still done traditionally or do not use tools. Thus, making the process longer and causing waste in waiting. In addition, unnecessary motion wastage is also very likely to occur because many workers still make excessive movements when working. Waste in the form of defects also occurs in this company due to poor raw material factors, resulting in roasted coffee beans that are not up to standard. The company always discards production results that do not fit these standards.

There were not many previous types of research examining the identification of waste in a coffee bean production process in a café using Value Stream Mapping with the Lean Thinking approach. Shah and Ganji (2017) investigated the impacts of lean production methods on the enhanced performance of service-based industries by studying a local baked foods supplier. Reis et al. (2018) developed a model to evaluate the integration of Lean and Green systems (Lean Green Synergy – LGS) by formulating a conceptual framework. The case study was carried out on specialty coffee-producing properties in Quindío, Colombia. Saini and Singh (2019) investigated the impingement of lean manufacturing practices (LMPs) in small and medium enterprises (SMEs) of Northern India and their relationship with firm performance. Kartika and Setiawan (2020) investigated the lean production implementation in coffee beans businesses in Surabaya to achieve

a competitive advantage in the production process to compete with other competitors. Kharub et al. (2021) used lean six sigma to improve the production rate and reduce the waste of a south Indian food processing company. To address these research gaps, we investigate how a coffee bean production process of a café could identify some waste by implementing an analysis tool of Value Stream Mapping and making some continuous improvements for efficiency based on the application of 5W – 1H principles.

Our research makes several contributions. First, by implementing an analysis tool of Value Stream Mapping on the coffee bean production process flow, it can be identified that some kinds of waste are to be eliminated. Secondly, this research investigated some causes and then some continuous improvements for efficiency based on the application of 5W – 1H principles. Last, we try to strengthen the lean thinking literature by showing how a coffee bean production process could identify some waste by implementing an analysis tool of Value Stream Mapping and making some continuous improvements for efficiency based on the application of 5W – 1H principles.

## 2. Literature Review

### 2.1. Lean Thinking

The term lean was first coined by John Krafcik (1988) and popularized by Womack (1990) in the book *The Machine That Changed the World*. Lean focuses on identifying and eliminating waste from a process (Ohno, 1988). Bhasin and Burcher (2006) define lean as a philosophy that aims to eliminate non-value-added activities from processes and treat activities that do not add value required by customers as waste. Another definition, according to APICS Dictionary (2005), "Lean" is a business philosophy based on minimizing the use of resources, including time, in various company activities. In principle, lean provides satisfactory quality for customers and, at the same time, minimizes non-value-added activities.

Lean is an effort to eliminate waste sustainably, add value to goods or services, and add value to customers (Kalsaas, 2002). It can be concluded that to find out the reasons and methods for eliminating waste or non-value-added activities. The lean method can be used. The principle of careful planning is to find a methodically effective and efficient process that will not interfere or get in the way. Lean thinking helps create processes with fewer materials, resources, and time while still achieving the same result. Lean thinking is more focused on creating effective and efficient processes. Lean has several stages (Hines & Taylor, 2000):

1. Recognizing the waste.
2. Defining a goal.
3. Knowing the Big Picture.
4. Understand Detailed Mapping.
5. Involving suppliers and customers.
6. Replanning the plans made.

A Toyota executive board named Taiichi Ohno was the first to spark seven kinds of waste. His book, *Toyota Production System: Beyond Large Scale Production*, classifies waste into seven categories. Then the Linker adds one type of waste to the seven types (Khannan & Haryono, 2015). The seven waste types are:

1. Waste of Overproduction  
Production of goods exceeds the customer's order quantity or quantity required. Then the activity of early producing goods that have not been ordered will cause 'stock' or increase the inventory of goods in the warehouse. This is a waste that can disrupt the production cycle and information flow.
2. Waste of Overprocessing  
A process that is redundant and does not provide added value to the goods to be produced, so the process causes waste.
3. Waste of Waiting  
Waste of waiting time caused by the cessation of ongoing production activities. This is caused by idle machines due to running out of raw materials, delays in the completion of previous production activities, and damaged machines, so there will be a bottleneck in production activities after waiting for the material to arrive and waiting for decisions/instructions.
4. Waste of Defects  
Defective goods or products produced below the quality standards set by the company so that the product cannot be used or sold will cause reworks that take more time, effort, and costs.
5. Waste of Motion  
A movement that does not need to be done nor should exist. This waste is related to the waste of defects because when a defective product occurs, there will be reworks movement, which should not have occurred if the product was not defective. Then an employee is busy looking for equipment that cannot be found because of no proper storage.
6. Waste of Transportation  
Transportation is the activity of moving materials, components, or products from one place to another. This transfer can use feet, transport belts, trolleys, and others, depending on the distance.

## 7. Waste of Inventory

The more inventory is stored, the more waste will occur. This waste is in the form of the idle value of inventory (unproductive), the value of space that must be provided for storage, administrative management burdens, workloads for receiving, storing, and issuing returns, goods damaged or expired during storage, and others.

Kilpatrick (2003) states that the benefits of implementing lean for companies include:

1. Reduction of lead time.
2. Productivity enhancement.
3. Reduction of work in process (WIP).
4. Product quality improvement.
5. Good utilization of space by reducing distance.

"Lean production is doing more and more with less and less" means that lean production focuses on producing large amounts of output but with fewer resources (Kalsaas, 2002). Implementing lean production is to get lower production costs, but the resulting output is increasing, or it can be said that efficiency has been achieved. In the Lean Production concept, there are three types of operational activities: value-added activities, non-value-added activities, and activities that do not increase value but are still needed (necessary non-value-added). Lean production is expected to reduce or eliminate non-value-added activities.

Studies involving lean thinking show the usefulness of this practice for operational efficiency in their processes and other improvements designed to combat waste (Table 1).

## 2.2. Value Stream Mapping

Value Stream Mapping is all value-added, non-value-added, and necessary non-value-added activities needed to produce products through the main production process (Womack & Jones, 2003). Value stream mapping explains product design, product flow, and information flow. Value stream mapping is one of the imaging methods used to map product and information flows (Nash et al., 2008). Value stream mapping is the first point to find waste and its causes. Value stream mapping is a visual process in which product flow mapping is performed to select the best and most suitable stream for future reference to meet performance and methodology (Gohane et al., 2014). Big Picture Mapping is another term for value stream mapping, a tool used to describe the entire system and all existing processes. This tool defines the information and materials flow in the value stream.

Nash and Poling (2008) divide Value Stream Mapping (VSM) into three main parts, namely:

1. Production process flow or material flow.  
This process or material flow lies between the information flow and the timeline. The process flow is depicted from left to right. Sub-tasks or sub-processes and parallel processes are drawn in the same form under the mainstream. The process flow makes it easy to see between processes that have sub-tasks and processes that are parallel to other processes.
2. The flow of communication or information.  
The flow of information in the value stream mapping is usually located at the top. With this flow of information, the company can see all types of information and communication, both formal and informal, that occur in the value stream mapping. With the flow of information, companies can also track information that is not necessary and becomes non-value-added communication that does not provide added value to the company itself.
3. Timeline or mileage.  
At the bottom of the VSM, a series of lines contain important information about the VSM, commonly called timelines. The two lines in this timeline are used to compare the improvements to be implemented. The first line at the top is called Production Lead Time (PLT) / Process Lead Time / Lead Time. This PLT is the time needed for the product to go through all processes from raw materials to customers' hands and is usually in units of days. The PLT under the break between these processes is added to the total PLT at the end. The second line at the bottom is the cycle time. This is called the total cycle time and is written under the total PLT. The last line under the timelines is the mileage which is the distance traveled by the product and the operator along the production process flow.

Table 1. Previous Empirical Studies

<b>Authors</b>	<b>Findings/Approach</b>	<b>Results achieved</b>
Shah & Naghi Ganji (2017)	Investigate lean production methods' impacts on service-based industries' enhanced performance by studying a local baked foods supplier.	60-66% of respondents believe that, to a large extent, productivity improvement, product, and service quality improvement, and also profitability improvement has a significant impact on implementing Lean production practice. 60% of respondents believe that, to a moderate extent, waste reduction, sales volume improvement, and set-up time reduction have a significant impact on implementing Lean production practices.
Verma & Sharma (2017)	Identify the problems faced by the Industry in terms of Non-Value Added time and propose Future State Value Stream Mapping, which can increase the value-added time and reduce non-value-added time.	The VSM is an effective tool for eliminating these wastes, and the study also suggested ways to reduce non-value-added times in a manufacturing process. Large reductions in time consumption can be achieved by reducing the waiting time of a job during the production process. The most important point is that in this improvement process, no new machines were purchased, nor were operators expected to work faster or harder; only procedures and layouts were changed to allow the product to flow more smoothly through the manufacturing process. And this activity reduced the manufacturing lead time intern increased the productivity of a small-scale industry.

Table 1. Previous Empirical Studies

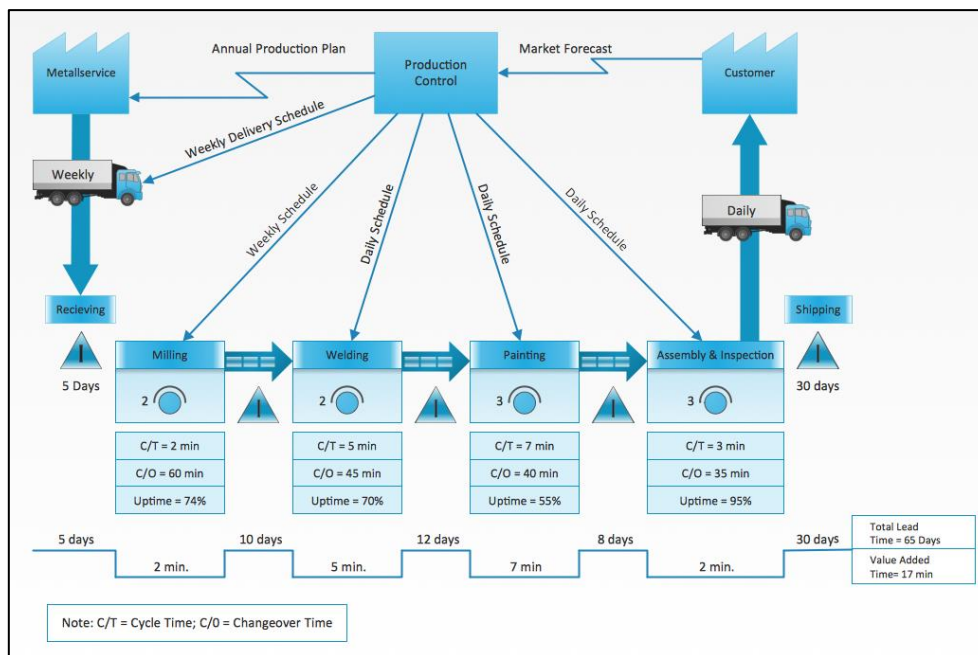
<b>Authors</b>	<b>Findings/Approach</b>	<b>Results achieved</b>
Reis et al. (2018)	Develop a model to evaluate the integration of Lean and Green systems (Lean Green Synergy – LGS) through the formulation of a conceptual framework. The case study was carried out on specialty coffee-producing properties in Quindío, Colombia.	The LGS model encourages the adoption of Lean and Green systems since it allows constant monitoring of the production process and identifies improvement points, facilitating integrated management. By selecting appropriate metrics, the LGS model allows applying the same calculation system and frames the organization into one of the five maturity levels through benchmarking between similar organizations.
Jimenez et al. (2019)	Diagnosis of the production process in the value chain of the processing and marketing of fish and Shellfish Companies as a case study. Also, improvement proposals were made under Lean Manufacturing tools to increase the performance in the value chain under study.	The results of this study allowed us to characterize the current state of the process, taking as a point of reference the line of fresh fish, to identify the tasks that do not add value to the process, which represent 37.7% of the processing time and correspond to inventories in processes, excess movements due to deficiencies in the distribution of plant and bottlenecks that begin during the filleting process. Improvement proposals were designed through lean tools, which can improve the organization of the plant and process times, with an impact on the decrease of complaints and returns of products and on the company's profit margins.

Table 1. Previous Empirical Studies

<b>Authors</b>	<b>Findings/Approach</b>	<b>Results achieved</b>
Saini & Singh (2020)	Investigate the impingement of lean manufacturing practices (LMFs) in small and medium enterprises (SMEs) of Northern India and their relationship with firm performance.	The total productive maintenance, supplier management, just-in-time, and five S practices enhance the firm performance. Other practices, such as plant management practices, operational and people practices found to a lesser extent than previous ones. From the correlation, it is revealed that lean practices have a strong relationship with firm performance.
Kartika & Setiawan (2020)	Implementing lean production in the coffee bean business in Surabaya city to achieve a competitive advantage in the production process to compete with other competitors.	There is a percentage reduction in the non-value-added activities from 30.7% to 15.4%. The percentage is reduced because cooling beans activities are carried out simultaneously with the inspection. Thus, it changes from non-value-added activities into necessary non-value-added activities, eliminating packaging preparation by moving tools to more accessible places.
Kharub et al. (2022)	Using lean six sigma to improve the production rate and reduce the waste of a south Indian food processing company.	Researchers used a known technique in the measure phase called VSM (Value Stream Mapping). In the VSM Diagram of this research, the complete information about the time it took for each process happens. The waiting time from the process was determined, and the non-value-added activities were identified. The study results suggested that waste can be reduced by up to 50%. Consequently, the profit increases by 7% if the firm acts on recommendations. Further, it was calculated that purchasing new equipment costs can be covered in 3 years.

According to Gaspersz (2007), there are four stages to creating a value stream mapping, including:

1. Identification of Consumer Needs  
Describe overall customer needs, including customer product requirements, the quantity of product required, delivery frequency, and packaging required.
2. Information Flow Addition  
Description of the flow of information from consumers to suppliers, including sections that predict and limit the information consumers obtain from suppliers, or explain what information is required from suppliers to consumers.
3. Material Flow Addition  
Describe the company's material flow, period, checking to time, operating time, moving time, and inventory points.
4. Linking Information and Material Flows  
The relationship between information flow and material flow with indicators that can provide information such as plans, outputs, where to send information and instructions, and also where and when problems usually occur.



Source: Gaspersz (2007)

Figure 1. Value Stream Mapping

Big Picture Mapping is another term for value stream mapping, a tool used to describe the entire system and all existing processes. This tool defines the information and materials flow in the value stream. Big Picture Mapping is a starting point to help management, engineers, suppliers, and consumers identify waste and its causes. By drawing all the information flows physically and the relationship between the two, the company's condition can fulfill consumer orders and find out the location of the cause of the long throughput time (Czarnecki & Loyd, 2001). Hines and Taylor (2000) said that this tool identifies waste locations and knows the relationship between information flow and physical flow.

1. Identify customer needs  
An overview of all customer needs containing the product requested by the customer, the number of products desired, the number of products delivered at a time, how often deliveries are made, and the needed packaging.
2. Add information flow across the process  
Description of the flow of information from customers to suppliers, including forecasting and information on supplier cancellations by customers, organizations, or departments that provide information to the company, how long the information appears to be processed, what information is conveyed to suppliers, and orders implied.
3. Added physical flow on the map  
Physical flows can come from outside the company, and those within the company must be added together. How long is the physical flow, at what points are inventory and process checks performed, defect rates, rework rounds, cycle times for each point, time to complete each operation, how many hours per day each workstation works, shift times, where inventory is held and how much inventory, as well as congestion



- points that occur.
4. Link physical and information flows  
Connect physical and information flows with arrows that can provide information on schedules used, work instructions generated, from and for what information and instructions are sent, and when and where problems usually occur in physical flows.
  5. Complete the flow map  
The final phase is completing the map with the information on lead time and value-adding time from the entire process. This information is placed at the bottom of the map.

### 2.3. Value Stream Analysis Tools

To assist researchers in identifying waste in a value stream and finding appropriate ways to eliminate or reduce it, Value Stream Analysis Tools can be used. The seven tools refer to the waste identified in the value stream. These tools were developed by Hines and Rich (1997) to map in detail the value stream that focuses on value-added processes or activities to make it easier to make improvements to the waste that occurs. The seven tools of value stream mapping tools consist of the following:

1. Process Activity Mapping (PAM)  
PAM is an analytical tool to identify the time and productivity cycle of information and material flows. This analysis tool is often used in activities in the production area. PAM is divided into five activities, namely:
  - O = Operation
  - T = Transportation
  - I = Inspection
  - D = Delay
  - S = Storage
 Then classify the groups into activities according to Value-Added (VA), Non-Value-Added (NVA), or Necessary Non-Value-Added (NNVA). The steps in PAM include the following:
  - a) Understand process flow.
  - b) Identify waste.
  - c) Consider the stages in the correct order and efficiently.
  - d) Consider different and more efficient flow stages and layouts.
  - e) Consider every stage of the process that is important and useful.
2. Supply Chain Response Matrix (SCRM)  
SCRM is a graph that maps the relationship between inventory and cycle time for each distribution activity so that inventory and cycle time for each activity that increases or decreases are discovered. Furthermore, the data is used as a consideration in determining inventory needs in a short time cycle. Improving or maintaining a good level of service as effectively and efficiently as possible is the aim of SCRM.
3. Production Variety Funnel (PVF)  
PVF is a method that describes the amount of variation in each production process flow. Identification of specific products is the function of this analysis tool. PVF can also indicate congestion points so that inventory improvement planning can be determined through raw materials, semi-finished products, or finished products.
4. Quality Filter Mapping  
Quality Filter Mapping is an analysis tool that identifies the location of quality defect problems in the supply chain. This analysis tool can map three types of quality defects, including:
  - a) Product Quality.  
Defective products that qualified for the selection stage.
  - b) Defect Quality.  
Production defects in the company area that successfully found during the inspection.
  - c) Service Quality.  
Defective service quality (time, quality, and service delivery).
5. Demand Amplification Mapping  
An overview of changes in demand across all supply chain activities. In the law of industrial dynamics, it is stated that demand passed on to all supply chain activities through a series of policies will experience an increase in variation in each movement, both upstream and downstream. With data from Demand Amplification Mapping, decision-making steps and deeper analysis can be carried out to manage demand fluctuations, anticipate demand changes, and supply policies.
6. Decision Point Analysis  
Decision Point Analysis shows several choices from different production systems, with a compromise on the cycle time of each choice with the level of inventory required during activities in a time cycle.
7. Physical Structure  
Physical Structure is an analysis tool that functions to understand supply chain conditions at the production level. By understanding the company's condition and operational form well, more attention can be directed

to more problematic areas.

Optimizing the solutions offered to improve a problem is the goal of the improvement stage. This improvement stage uses 5W-1H. 5W-1H is a method used to investigate and research problems that occur in the production process. 5W-1H consists of What, Where, When, Why, Who, and How. This method is a set of systematic steps aiming to collect the data needed for investigation or preparing a report on an existing problem.

In the production process, the application of 5W-1H is useful for gathering information and analyzing problems that occur so that appropriate solutions can be taken for these problems. The 5W-1H principles can be used to compile corrective steps for a problem in a company. 5W-1H consists of What (what is done for improvement), Why (why is it needed to be improved), When (when to make improvements), Where (where to make improvements), Who (who is responsible for making proposed improvements), and How (how to carry out the proposed improvements) (Hardiansyah 2018; Muzaki, 2011).

### **3. Method**

This research was conducted using a qualitative approach. This qualitative approach focuses on researchers' understanding, thoughts, and perceptions. Qualitative research is subjective because it is mostly done by collecting information, interviews with sources, and direct observation.

Primary data can be obtained through interviews with related parties or direct observation data in the field. The primary data in this study are the results of interviews and observations on the ByCoffee Indonesia side, which knows and masters the flow of the roasted coffee bean production process. Therefore, interviews will address café owners, production managers, head baristas, and baristas to obtain information related to the structured questions weighting of the seven wastes. Identification of waste in the coffee bean production process at the café uses structured question weighting and direct interviews with several parties related to the production process. The parties who participate in structured questions must have understood the technical production process carried out daily. Participants in the following structured questions included the café owner, production manager, head barista, and two baristas in the production section.

The secondary data used in this study are company documentation or records, government publications, industry analysis by the media, and journal articles that can be trusted and the truth accounted for as sources of data used.

### **4. Result and Discussion**

#### *4.1. Big Picture Mapping*

Big Picture Mapping is a method used to visualize the production activity process through flow chart mapping. Big-picture mapping can describe the entire process flow. Big picture mapping also helps visualize the flow, helps see the presence of waste, and shows the linkages between information flow and physical flow. The first stage to making a big picture mapping is that researchers seek information about the production process flow through interviews with the café owner. In the next stage, the researcher arranges information and physical flow through observation and interviews. Observations are made by observing the production process and collecting data in the form of the number of workers and the time required to complete each part of the production process. Big Picture Mapping can also be used to identify the value streams and lead times for each stage of the production process. Big Picture Mapping is very necessary to describe the overall physical flow and flow of information from the early stages of the production process, namely sorting raw coffee beans from farmers to finished products in the form of roasted coffee beans that are ready to be distributed. Big Picture Mapping can be useful to know the general company condition in the production process. The depiction is described in Figure 2.

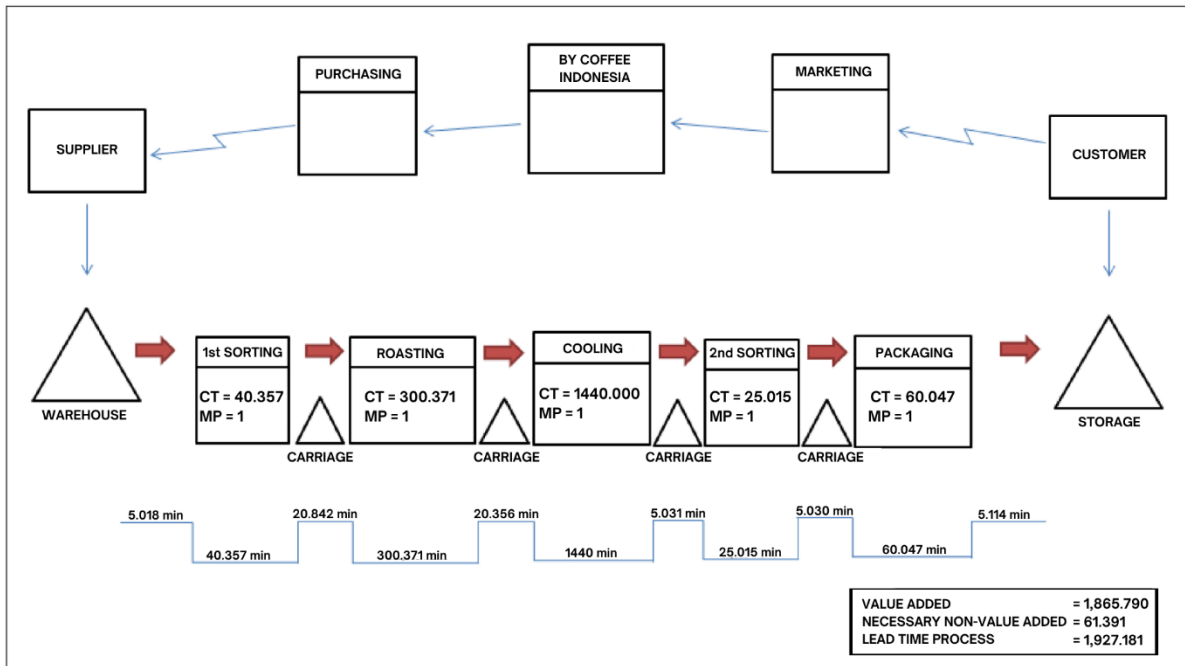


Figure 2. Big Picture Mapping of the Cafe

Figure 2 illustrates the value stream at the cafe, which consists of purchasing activities for raw materials from suppliers, after that the raw materials or raw coffee beans are stored in the warehouse, after which they enter the production process, which consists of the first stage of sorting, roasting, cooling, and packaging. After going through the packaging process, the product or roasted coffee beans are transported or stored in the storage. This sorting process requires manpower (MP) of 1 person and a cycle time (CT) of 120.3 minutes. After the sorting process is complete, transporting the results of the first sorting stage are carried out from the sorting place to the roasting place. This transport activity requires a CT time of 20.8 minutes. The next process is the roasting process. This process is the core process in the production of roasted coffee beans because, in this process, raw coffee beans are roasted with different techniques and temperature levels. So that they can become roasted coffee beans with different flavors and levels of maturity according to demand, this process requires one person of MP and 300.3 minutes of CT. After completing the roasting process, transportation activities are carried out from the roasting process to the cooling process. This transport activity requires CT for 20.3 minutes. The next stage is the cooling process for coffee beans that have just been roasted. This process aims to remove the gas present in the roasted coffee beans due to the roasting process so that the taste produced by the coffee beans does not contain gas. In this process, the chilled roasted coffee beans are also labeled to contain information on the coffee bean name, the coffee bean type, and the date of the roasted process. The cooling process requires MP for as much as one person and CT for 1440,7 minutes. After the cooling process, there is transportation activity from the cooling process to the sorting process for the second stage. In the second stage of the sorting process, roasted coffee beans with a dry and wrinkled surface or quaker will be discarded and considered a defective product. This second stage sorting process requires manpower (MP) of 1 person and a cycle time (CT) of 25.1 minutes. After the sorting process, there are transportation activities from the sorting process to the packaging process. This transport requires CT for 5 minutes. The next process is the packaging process, where the roasted coffee beans are packaged and ready to be distributed to consumers. This packaging process requires one person of MP and 60 minutes of CT. After the packaging process, there is an activity of transporting goods to storage or storage areas. The activity of transporting goods from the packaging process to the storage area requires CT for 5.1 minutes so that the total lead time process is 2,007,1 minutes, Value Added Activity (VA) is 1,945.7 minutes, and Necessary Non-Value-Added (NNVA) is 61.3 minutes.

4.2. Identify Waste Using VALSAT

This analysis is needed to identify the causes of waste. Identification of waste in the coffee bean production process at the café uses structured question weighting and direct interviews with several parties related to the production process. The parties who participate in structured questions must have understood the technical production process carried out daily. Participants in the following structured questions included the café owner, production manager, head barista, and two baristas in the production section.

In filling out the structured questions, the participants were first given directions to make filling out the structured questions easier. Giving directions to structured questions also aims to equate participants' perceptions of the content of structured questions with production activities within the company. The weighting of structured questions uses a

scale of 1-5 from small waste to waste that impacts the value stream generated by the company.

Based on the results of the waste weighting, the biggest waste is the waiting process activity at 3.17; Product Defect at 2.67; Unnecessary Motion at 2.33; Overproduction at 1.50; Movement of Goods at 1.33; Improper Processing at 1.17; and Unnecessary Inventory of 1.00. The types of waste that occur in the production process at the café, from the largest to the smallest, can be identified through the weighting results.

#### 4.3. Value Stream Analysis Tools (VALSAT) Weighting Results

After the weighting of the waste is known, the next step that needs to be done is to determine what tools from the Value Stream Analysis Tools (VALSAT) are most appropriate to map the value stream in detail to facilitate understanding of the existing value stream mapping analysis and take corrective actions. This determination is made by multiplying the average score of each waste by the value stream mapping tools suitability matrix. Based on the calculation results of Value Stream Analysis Tools (VALSAT), the tool with the greatest value is Process Activity Mapping (PAM) of 68.50. Therefore, Process Activity Mapping was chosen as a tool to make it easier to analyze and improve the value stream.

Process Activity Mapping aims to map the entire process flow in detail at each stage. Process Activity Mapping divides each stage into three groups, namely, Value Adding Activity (VA), Non-Value Adding Activity (NVA), and Necessary Non-Value Adding Activity (NNVA). These tools aim to identify lead time and productivity of information flow and physical flow in all production activities. Based on the results of the analysis using Process Activity Mapping (PAM), information was obtained that there were ten operating activities with a total time of 2015 minutes, five transportation activities with a total time of 55 minutes, one inspection activity with a total time of 5 minutes of activity, one storage activity with a total time of 5 minutes, and no activity delay. In addition, information is obtained that there are five Value-Added Activities, one Non-Value-Added Activity, and eleven Necessary Non-Value-Added Activities. The total time of the production process is 2080 minutes, and the total time of Value-Added Activity is 1946 minutes (93.56%).

#### 4.4. Proposed Improvement

The results of the data analysis show that the waste which most affects the lead time of the roasted coffee bean production process at the café is the waiting process. This is due to the first stage sorting process. Waste in the sorting process is caused by the raw coffee beans sorting process is still done manually using both hands of workers. This causes the first stage of the sorting process to take a long time, thus making the baristas who work on the next process or in the roasting process unable to work and have to wait until the sorting process is complete. In addition, this is also due to the absence of tools that facilitate the sorting process, so the processing time for this activity becomes longer.

Based on the waste analysis results that most influence the length of the lead time of the production process, namely the first stage sorting activity, which is done manually with both hands of workers or baristas, the proposed improvement uses the 5W-1H principle as follows:

Table 2. Proposed Improvement of *Waiting*

<b>What</b>	Using a coffee sieve that has a certain size
<b>Where</b>	First stage sorting room at ByCoffe Indonesia Café
<b>When</b>	During the first stage of the sorting process
<b>Who</b>	Barista
<b>Why</b>	Using a coffee sieve will speed up the first stage sorting process so that lead times are shorter.
<b>How</b>	Finance Section Invest by buying a coffee sieve for the first stage sorting process. Production Manager Section Monitor the work of the first stage sorting process. Barista Section Carry out the first stage sorting process using a coffee sieve.



Figure 3. The Coffee Sieve

Based on Table 2, it can be concluded that using a coffee sieve is very effective in accelerating the first stage

sorting process to the next process. But the coffee sieve must be utilized correctly and according to its capacity so it can be maximized.

Table 3. Proposed Improvement of Defect

<b>What</b>	Making new products in the form of ground coffee from processed defects
<b>Where</b>	Bycoffe indonesia café
<b>When</b>	After the second stage of the sorting process
<b>Who</b>	Production division
<b>Why</b>	By making a new product in the form of ground coffee, the company will eliminate defects that always exist in the roasting process result so that the company has the potential to benefit from the defective processed product, namely ground coffee.
<b>How</b>	<p>Finance section</p> <p>Invest by buying an economical coffee grinder or processing defective roasted coffee beans.</p> <p>Production manager section</p> <ul style="list-style-type: none"> <li>▪ Learn how to operate and maintain a coffee grinder.</li> <li>▪ Conducting a milling trial on defective roasted coffee beans due to the roasting process.</li> </ul> <p>Barista section</p> <ul style="list-style-type: none"> <li>▪ Learn how to operate and maintain a coffee grinder</li> <li>▪ Carry out the process of grinding defective roasted coffee beans</li> </ul>



Figure 4. Coffee grinder

Based on Table 3, it can be concluded that it is necessary to obtain a grinder machine to grind and grind the defective coffee beans to overcome product defects that arise from the roasting process. However, during the process of grinding defective coffee beans, a mixture of normal coffee beans is needed so that the results from the mill become a new product for the company that is worthy of sale and can be enjoyed by consumers. By processing and utilizing these defective products, the company has new products that can be sold and offered to consumers in the form of ground coffee.

Table 4. Proposed Improvement of Unnecessary Motion

<b>What</b>	Increasing air ventilation in the form of exhaust and wall fans
<b>Where</b>	Sorting room at bycoffe indonesia café
<b>When</b>	During the sorting process
<b>Who</b>	Production division
<b>Why</b>	By increasing ventilation facilities in the form of exhaust and wall fans, the roasting room will get good air circulation, thus making the roasting room not hot when the machine is working. This way, the baristas don't have to leave their workspace just to get fresh air. Baristas will also be more focused when working and evited negligence when roasting raw coffee beans because if the roasting is too long, it will make the roasted coffee beans too dark or burnt and eventually create new waste.
<b>How</b>	<p>Finance section</p> <p>Invest by buying an economical exhaust and fan.</p> <p>Production manager section</p> <p>Installing the exhaust and fan in the roasting room.</p> <p>Barista section</p> <p>Carry out the roasting activities.</p>



Figure 5. Fan



Figure 6. Exhaust

Table 4 shows that to minimize unnecessary motion at the roasting stage, adding several ventilation facilities, such as exhaust and fans in the workspace, is necessary. The workers do not need to leave their workspace to get fresh air. Increasing these facilities will make the roasting room normal or not hot. Thus, the hope is that workers will be more focused when working and evited negligence when roasting raw coffee beans, such as roasting for too long, which causes the coffee beans to become too dark or burnt. If negligence occurs, this will cause new waste such as product defects, time, costs, and wasted energy.

## 5. Conclusion

The implications identified through the results of this empirical research can be explained as follows. By using the value stream mapping method on the coffee bean production process flow, it can be identified that there is waste in the form of Waiting, Defect, and Unnecessary Motion. The waste weighting for each were sorted from the highest value Waste of Waiting (3.17), Waste of Defect (2.67), and Waste of Unnecessary Motion (2.33).

We find that the waste causes in the identified coffee production process include waiting, defects, and unnecessary motion. Regarding waiting time, this waste is caused by the waiting time between the first stage sorting process and the roasting process. This waiting time is due to the first stage sorting process still using hands manually and the absence of tools. Regarding defects, this waste is caused by the inevitable side effects of the roasting process. If one roasting process produces 100 grams of defects, it can be concluded that in one day, the company has produced 2 kilograms of product defects. Finally, unnecessary motion is caused because when the roaster operates, the temperature can reach 200 degrees Celsius, so the temperature around the roaster will also become hot. This is also due to the lack of ventilation in the roasting room.

The managerial implications obtained through the results of this study are in the form of a proposed improvement plan to find solutions to the problems of each wase. First, associated with the waste of waiting, the cafés should make improvements related to using a coffee sieve because it can speed up the first stage sorting process. This will speed up the process and reduce the waiting time for the next process. Second, to eliminate the waste of defects, the café should process defective roasted coffee beans mixed with quality roasted coffee beans by grinding them together and making them into a fine powder. So, defective products can become new products that can be sold, namely ground coffee. Last, associated with the waste of unnecessary motion, the café should improve by increasing ventilation facilities such as exhaust and fans in the roasting room. This will create a comfortable atmosphere where by adding these facilities, the roasting room will not be hot so that workers do not have to leave the workspace to get fresh air.

The results of this study are expected to enrich the uniqueness of the implementation of the value stream mapping analysis tool in a production process, especially for coffee beans. The limitation of this research is that the results cannot be generalized. It uniquely describes the value stream mapping of the café and investigates the waste. After identifying the waste, there are some proposed improvements to make the coffee bean production process efficient.

Future researchers are expected to be able to continue this research by studying value stream mapping in more depth and using more value stream analysis tools that can be applied to ByCoffee Indonesia's café. So, the production process will be more effective and efficient. If the company accepts the proposed improvement, the next researcher can validate the future state map after the improvement.

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## Author Contribution

Author 1: conceptualization, writing original draft, data curation, formal analysis, investigation, methodology.

Author 2: collecting data

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## Conflict of Interest

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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