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Identification Types of Waste in Panties Production At PT Indonesia Wacoal

Ajeng Putri Dewi Larasati[a)], Dino Rimantho[b)]
[a)] Department of Industrial Engineering, Pancasila University, Indonesia
[b)] Corresponding Author: dino.rimantho@univpancasila.ac.id

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ABSTRACT

PT Indonesia Wacoal is a garment company that produces underwear with several product variations: panties. Companies must always produce good quality products by maximizing production results and high productivity. However, *waste* becomes an obstacle to the company's performance in carrying out its production. The potential for the emergence of waste can occur in all company activities, where PT Indonesia Wacoal experienced the same thing. This study aims to identify and analyze waste that occurs in the production process of *panties*. The waste is defective products, transportation, excessive movement, and waiting time. The method used in this article is seven tools: the Pareto diagram and the fishbone diagram. The identification results indicate that the waste of defective products in Wolly yarn is about 211 seconds or 64.04%. In addition, there is a long process of transferring material from QC to the finished product warehouse of around 1188 seconds or 29.73%. Furthermore, excessive movement in the sewing process for 2340 seconds or 45.14% and waste due to the waiting time for the storage process to the next process is 4320 seconds or 42.40%. The identification results show several factors causing waste such as labor, machines, methods, materials and the environment.

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1. Introduction

The development of the industrial revolution era 4.0 is creating very tight competition in the industrial world. The competition is related to the company's achievement in facing market competition, where various factors are also considered so that the company can survive and occupy the peak of success. The Indonesian Ministry of Industry explained that the growth of the textile industry had decreased by around 5.41% in 2020. In addition, the Indonesian Ministry of Industry also said that in 2021 the industrial world would begin to rise again to 0.93. %. In addition, the Indonesian Ministry of Industry also said that in 2021 the industrial world began to rise again to 0.93 %. So we need factors such as optimization of raw materials, good quality, low prices, and efficiency and effectiveness. In contrast, delivering goods on time according to demand is also a step in maintaining consumer confidence so as not to switch to competing companies. Therefore, the production process needs to be improved continuously (continuous improvement) in order to eliminate activities that do not have added value (non-value added) that can cause waste (waste) so that good productivity is not achieved and the realization of efficient and effective costs (Gaspersz, 2007).

Companies are always required to produce good quality products by maximizing production results and high productivity. However, waste is one of the obstacles to the company's performance in carrying out its production. As stated by Gaspersz (2007), it is stated that waste is an activity that does not provide added value throughout the process flow from the input to the output stage. The wastage that occurs includes material resources and time to the capital spent, causing direct and indirect cost losses.

In general, waste in production includes overproduction, waiting time, excess transportation, inappropriate products, excess inventory (unnecessary inventory), excess movement (unnecessary motion), and product defects.

Research conducted by CV. Sogan Jaya Abadi, a manufacturing industry producing batik fabrics, experiences waste in the production process with activities that get great results; waiting time is 55.83% (Nuzula, 2019). Other research was also conducted on the CV. Tanara Textile, which made improvements to t-shirt fabric, experienced waste in the inventory of 28.571% due to accumulated raw materials, work in process (WIP), unused spare parts, and hoarding of finished goods. (Kusbiantoro & Nursanti, 2019). The potential for the emergence of waste can occur in all company activities, where PT Indonesia Wacoal experienced the same thing.

PT Indonesia Wacoal is a garment company that processes raw materials into underwear with several product variations established in 1981 in Citeureup, Bogor. The production of underwear is focused in Indonesia and Asian, European and American countries. PT Indonesia Wacoal focuses on underwear, including bras, panties, shorts, corsets to lingerie. In producing goods, especially panties, the materials used are lace, cotton, yarn, and rubber, which are continuously produced on the production floor. The quality specifications of the panties owned by PT Indonesia Wacoal can produce products that meet the needs of women in terms of fittings and functions. Besides that, Panties product specifications affect whether or not the amount of material is used. Thus, it can affect the level of efficiency and productivity of the company.

Methods that can be used in analyzing productivity include standard time setting(Azizan, 2017), profitability determination with POSPAC(Syarifuddin, Syukria, 2017), APC (Suliantoro et al., 2012), quality control(Suseno & Chyano, 2020).

Another method that can be used to analyze the work process in making underwear panties is seven tools. A study by Ayuk (2018) applied seven tools to improve the batik cloth production process. In addition, researchers also provide information on suggestions for improvement in reducing product defects. Seven tools are also used to analyze the waste of material transfer of 238.2 meters in the sewing area of shirt production and produce proposals in the form of a point of use storage (POUS) system and improvement of the layout of new facilities with the CRAFT algorithm to 93.6 meters. (Anggara et al., 2018). Based on previous studies regarding product quality improvement and methods, the seven tools are considered capable of good improvement. Applying the seven tools method can analyze the defects in the production process and describe the factors causing the product defects. In addition, the seven tools can also analyze the priority of solving product defect problems based on the number that often occurs(Astuti & Wahyudin, 2021).

Based on the previous description, the seven tools method has been widely applied to various manufacturing industries, but research on the application of the seven tools method to panties products has not been carried out. Therefore, this study aims to identify the types of waste that occur in the panties production process using the seven tools method to identify what factors cause a problem and the consequences of the problems that will be caused. The selection of this method is considered appropriate to determine the types and factors causing the waste that occurs in the production of panties so that it can reduce the waste that exists in the company.

2. Previous Research

Previous research serves to review whether the research conducted is in line with the research that has been done previously. Some of the journals used

Table 1. Application of the Seven Tools Method

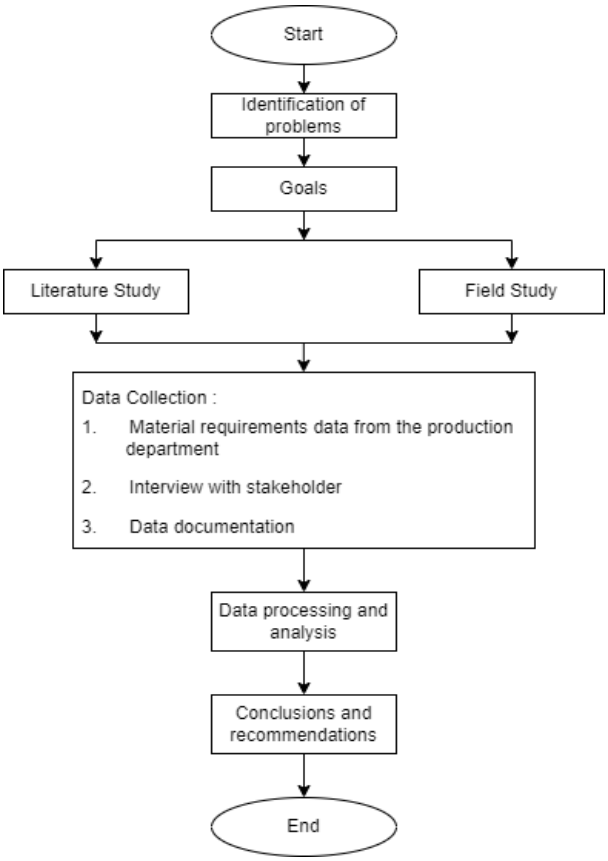
No	Name (Year)	Object of research	Summary
1	M. Mujiya Ulkhaq, et al (2018)	Community Machine	This study is to determine the application of the seven tools as a quality management tool in reducing product defects produced by community machines. A causal diagram shows four influencing factors: humans, machines, methods, and materials.
2	Andrianto Eko Saputra, et al (2021)	An 1000 Rings 20	This study identifies the cause of the tire ring 20 defect and analyzes whether the product defect is still within the control limits. The seven tools have four influencing factors: humans, machines, raw materials, environment, and methods.
3	Iswandi Idris, et al (2016)	Tempe Production	This study aims to determine the quality control of tempe products using the seven tools method. The results show that raw materials, manufacturing processes, and the environment significantly affect product quality.
4	Wibowo et al. (2019)	Glass Bottled Mineral Water	This research was conducted to identify the problem of damage to glass bottled mineral water products. The results show that there are defects caused by factors such as machines, raw materials, labor, environment, and methods
5	I Gusti Ayu (2019)	Arabica Coffee Production	This research was conducted to determine the company's optimal quality control. The results show that the quality of the process has not reached the optimal level caused by labor, machinery, and environmental factors, so improvements must be made.

Source: Data Collection

Based on the previous research above, the research will be conducted to identify the causes and consequences of product defects in the production of panties.

3. Method

The data used in this study are primary data and secondary data. Data collection is done by observation or direct observation, brainstorming, and company data. In general, the steps in this study are shown in Figure 1:



Picture 1. Research Flowchart
Source: Data collection

The identification results based on one of the seven tools methods will show the factors causing the waste.

3.1. Preliminary Study

The preliminary study was conducted by studying literature in the form of searches related to quality control and theories related to waste and the seven tools. In addition, field studies were conducted to observe the existence of the research object. The object of this research is the production of underwear panties at PT Indonesia Wacoal.

3.2. Problem Identification

After conducting a preliminary study, the next step is to identify the problems in the research object. The problem found during the production process for underwear panties is that there is waste that does not add value to the company. As a result, this waste results in losses for the company.

3.3. Problem Formulation

This study's problem is analyzing the production process of underwear panties to reduce waste using seven tools to increase company productivity.

3.4. Research Objectives

This study aims to identify the types of waste that occur in the panties production process and what factors cause waste to occur in the production of panties at PT Indonesia Wacoal.

3.5. Data Collection

After identifying the problem and determining the research objectives, the next step is to collect data. Data were collected by directly interviewing the production supervisor regarding the problems experienced during the production process. The interview technique is carried out in a structured manner by asking questions that have been prepared through dialogue with the resource person. In addition, data collection is also carried out by observation or direct observation of the object of research using all senses.

3.6. Data Processing

Data processing is done by the seven tools method to control the quality or quality of a product. Seven tools not only solve quality problems but the lost process time in production can also be solved with this method. The seven tools do not have to be used sequentially and entirely because the use is adjusted to research needs. Seven tools cannot stand alone because they are used for identification only, so a methodology is needed for problem-solving.

- Flowchart (Flowchart)
  A flow chart contains a process with interconnected boxes and lines. This tool is usually used to describe the steps in the presentation of a process (Armawan, 2018).
- Histogram
  Visualize a table in the form of a bar that determines the frequency distribution of data or tabulations by seeing how often the data appears differently in a group of data. With this tool, of course, you can see the variance in a data group. The histogram can be expected at the average value or asymmetrical, indicating that many data are not in the average value (Armawan, 2018).
- *Checksheet* (Check Sheet)
  Control sheets are usually used as a data collection tool before the data is analyzed. This check sheet contains things that are needed in the condition of the work area, whether it is following the criteria or not. With this check sheet, you can describe problems by separating opinions and facts on the ground (Armawan, 2018).
- Scatter Diagrams (Scatter Diagrams)
  A data interpretation tool is used to determine the relationship between two variables between a cause and the factors that influence it, whether it is a positive, negative, or no relationship (Armawan, 2018).
- Control Map (control chart)
  The control chart method is used to evaluate the process control being worked on over time. This control chart has the median as the mean, the upper control limit, and the lower control limit. In addition, it will show deviations from data but not indicate the cause. The benefits of this control chart include monitoring a process to keep it stable continuously, evaluating performance, and

determining product quality acceptance criteria before being marketed to consumers.

- Pareto chart
  Pareto diagrams are usually used to clarify the most dominant factor of several factors that can be traced to the problem. Furthermore, a Pareto chart is a form of bar and line graph. It also compares each problem with the whole before and after repair. Pareto diagrams can also represent some of the problems identified to be continued in manufacturing cause-and-effect diagrams.
- Fishbone Diagram (Cause and Effect Diagram)
  This cause-and-effect diagram is intended to investigate the root cause of the problem. Dr. Kaouru Ishikawa introduced this fishbone diagram which the quality control department originally intended as one of the seven quality tools (seven tools) to look for the causes of problems in the production process that involve many variations in a process. The primary function of making this diagram is to analyze the factors that cause a problem so that it causes some unwanted consequences. The parts in the fishbone salt include the head on the right to be the location of the problem or the result of a problem occurring, and the fishbone part, which are the factors causing an unwanted problem. This section is broken down into several structures depending on what factors affect the problem. The fishbone section includes machines, methods, people, materials, measurements, and the environment.

3.7. Analysis and Discussion

The data processing results are then analyzed and identified what improvements must be made from the analysis results. This analysis helps solve problems so that they are easy to understand.

3.8. Conclusions and Suggestions

The conclusion contains answers to the formulation of the problem consisting of the results of research carried out and what suggestions are proposed for the research object.

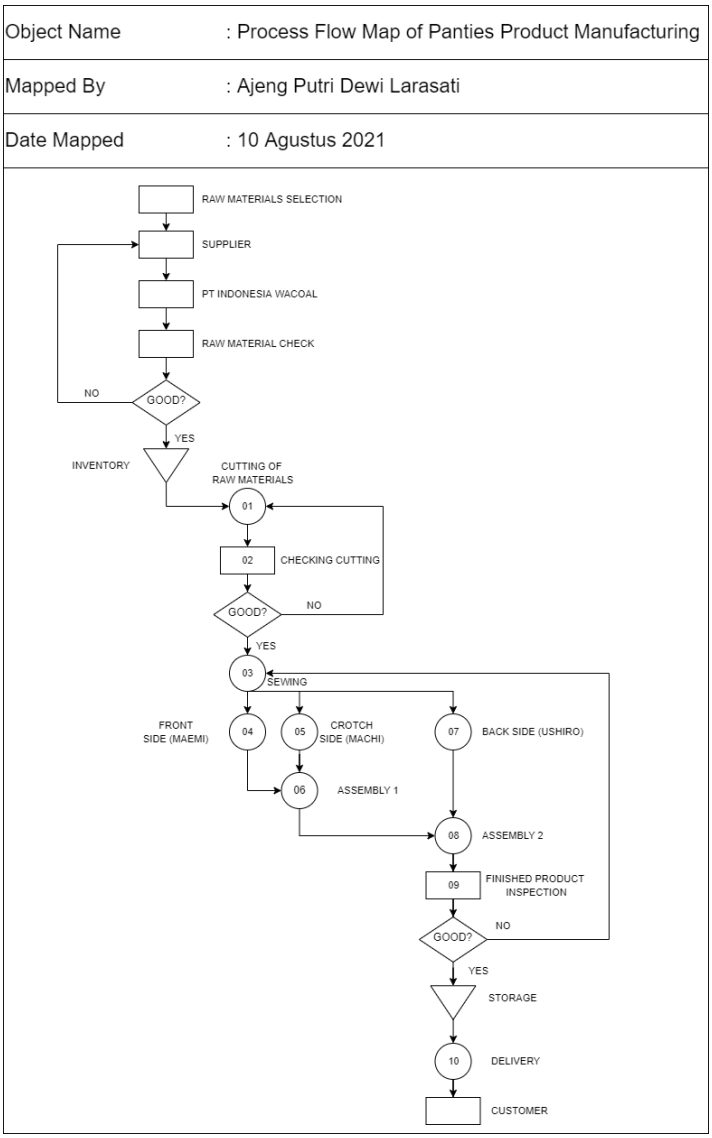
4. Results and Discussion

4.1. Identify the types of waste

The first step is to identify the type of waste, and it is necessary to identify the sources that cause waste in each production process. After doing this, identification, prevention, and minimization of waste can be made.

4.1.1. Production process

The process of making underwear panties is carried out in several stages by employees through several departments. The following is a flow map of the process of making panties products:



Picture 2. Process Flow Map of Panties Product Manufacturing
Source: Data Processing Results

4.1.2. Machines and tools

In the production of underwear panties, there are various kinds of machines and equipment used, such as:

1. *Knife band* to cut the pattern on the fabric.
2. *Sewing machine* to join the fabric pattern with the thread.
3. *Bursting Strength Tester*, testing machine to determine the tensile strength of the seam.
4. *Colour Fastness To Washing Tester*, to test the color resistance whether it quickly fades and shrinks or not.
5. *Washing machine* to see how quickly the material can clean and remove stains.
6. *Drying* to test the product's resistance to drying.
7. *Box Lamp Color Matching*, to see the difference in color before being tested for color fastness and after being tested, so that colour consistency is maintained.
8. *Testing the flexibility due to friction from one surface using the Rubble tool*
9. *They are tearing* a tool to test the strength of the material or the tensile strength of the material.
10. *Grammation Scales are a tool to test the material* to know the thickness or density of the material used.
11. *Lamp Test Color Fastness is a tool to test the color change when light exposure*.

4.1.3. Types of waste

1. Overproduction

This type of waste produces products that exceed consumer demand so that there is an accumulation of goods to be stored; producing goods before being asked by consumers is also included in overproduction. Continuous production is used to maximize production machines or avoid idle operators. So excess production makes it difficult for companies to identify which processes must be improved or maximized because of the continuous production process. The risk of the resulting product also does not necessarily follow what consumers need (Surijah et al., 2021).

In the production process, PT Indonesia Wacoal will make panties products according to orders that will be marketed. If there is no demand, the company will not make panties but produce other product variants such as bras and lingerie. Thus, waste due to excess production is not experienced by PT Indonesia Wacoal because the company produces according to the existing demand.

2. Inventory

Inventory can be considered waste even though it is not directly needed to meet current consumer demand. This inventory requires more space to put excess inventory, which requires high costs to pay for storage in the warehouse and additional employees to monitor the inventory. Inventories include raw materials, semi-finished goods, and finished products stored for the future. The high inventory results in the company being unable to see any problems such as material delays from suppliers or damaged products. In contrast to the case, if there is sufficient stock, the product is damaged, and the delay in stock from the supplier will be detected immediately (Surijah et al., 2021).

When the material comes to the inventory warehouse from the supplier, quality control will be carried out first to determine whether the material is following the requested specifications or not. So that when the raw material comes to PT Indonesia, Wacoal is still intact and ready to use. Similarly, semi-finished materials will be placed on the shelf before being used for the following process. Materials that come following orders that have been predicted by the previous company so that there is no excessive waste in inventory.

3. Defects

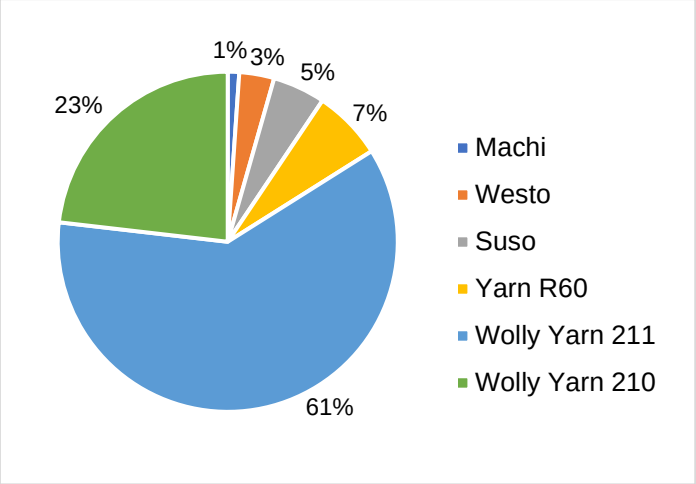
Defective products or not following specifications become a problem due to a lack of accuracy from humans and machines in making these products. Product defects occur because the finished goods that come into the hands of consumers are not as expected, so the process of returning goods to the company is accompanied by customer dissatisfaction. Inappropriate work processes or unused raw materials will cause waste if they cannot be appropriately reused. This waste is commonly referred to as a defect or scrap.

Although it has passed the test on the quality of the raw material before being produced, PT Indonesia Wacoal occasionally experiences defects in the form of stitches, pattern cuts, or final labeling. The defect results are distributed to the cooperative for sale or disposal. In addition, new pieces of fabric are also considered as defects. Moreover, there are estimated to be in the production process by 2-6%. Likewise, in the assembly process, the remaining unused pieces may become defects. To produce underwear panties, the materials used are fabrics for machi, weto, suso, R60 yarn, wolly 211 yarn, wolly 210 yarn in panties article 3200. The following is the material data that experienced waste in August-October 2021:

Table 2. Waste Activities PT Indonesia Wacoal Month 1

Category	Type	Waste Weight (meters)	Percentage (%)	Cumulative Presentation (%)
Thread	Wolly Yarn 211	25600.00	60.78	60.78
	Wolly Yarn 210	9760.00	23.17	83.95
	R60 . Yarn	2800.00	6.65	90.60
Fabric	Machi	458.46	1.09	1.09
	Westo	1397,00	3.32	4.40
	Suso	2106.50	5.00	9.41
	Total	**42121.96**	**100**	

Source: Data Processing Results

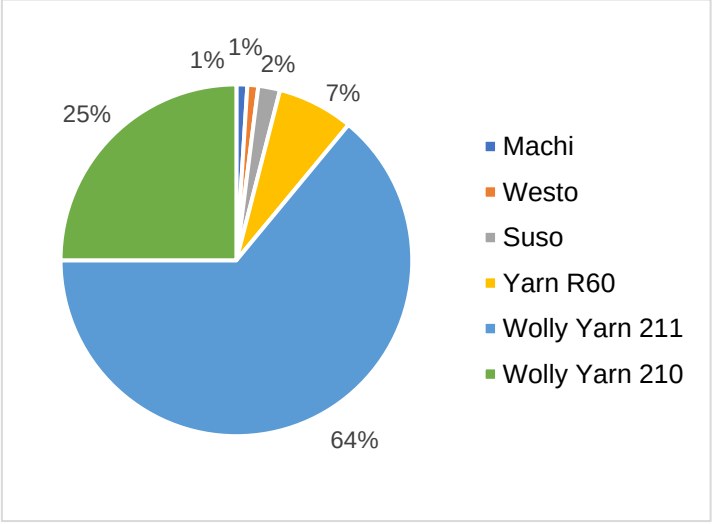


Picture 3. Waste Activities PT Indonesia Wacoal Month 1
Source: Data Processing Results

Table 3. Waste Activities PT Indonesia Wacoal Month 2

Category	Type	Waste Weight (meters)	Percentage (%)	Cumulative Presentation (%)
Thread	Wolly Yarn 211	27520.00	64.21	64.21
	Wolly Yarn 210	10560.00	24.64	88.85
	Yarn R60	3100.00	7.23	96.08
Fabric	Machi	862.40	2.01	98.09
	Westo	548,80	1.28	99.37
	Suso	267.72	0.63	100
Total		**42858,92**	**100**	

Source: Data Processing Results

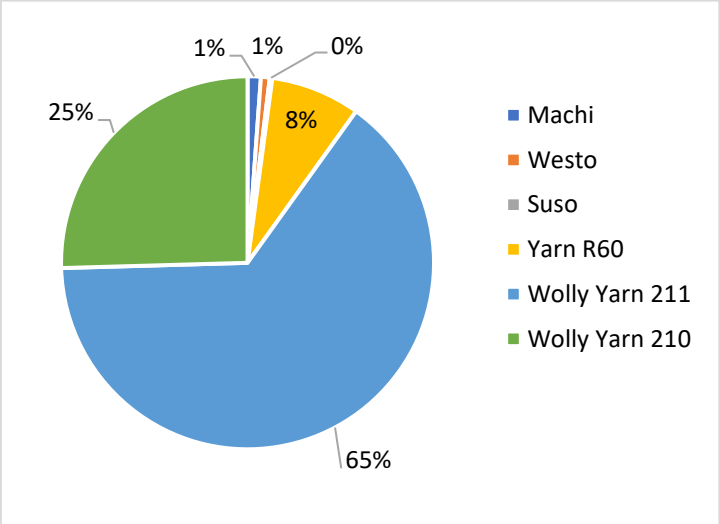


Picture 4. Waste Activities PT Indonesia Wacoal Month 2
Source: Data Processing Results

Table 4. Waste Activities PT Indonesia Wacoal Month 3

Category	Type	Waste Weight (meters)	Percentage (%)	Cumulative Presentation (%)
Thread	Wolly Yarn 211	138055,11	64.65	64.65
	Wolly Yarn 210	54353.78	25.45	90,10
	Yarn R60	16594.89	7.77	97.87
Fabric	Machi	2451,20	1.15	99.02
	Westo	1625,60	0.76	99.78
	Suso	478.74	0.22	100
Total		**213559.3**	**100**	

Source: Data Processing Results



Picture 5. Waste Activities PT Indonesia Wacoal Month 3
Source: Data Processing Results

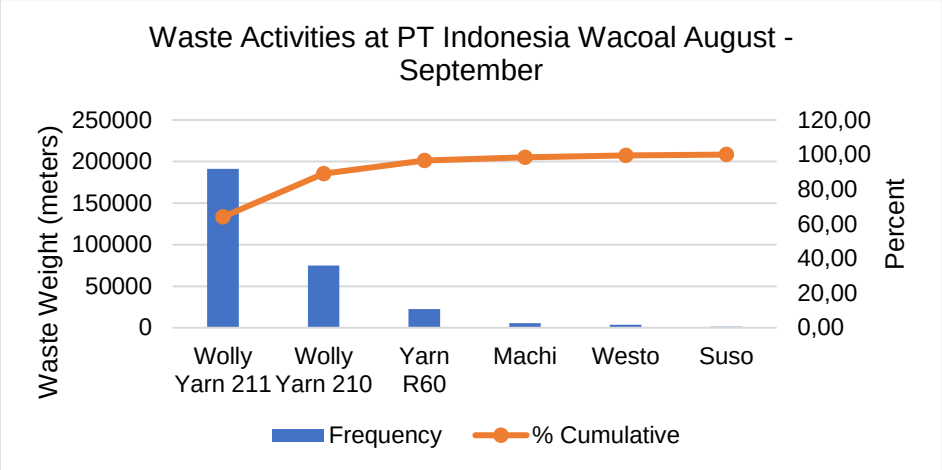
The following is the activity waste for August-September at PT Indonesia Wacoal.

Table 5. Waste Activities PT Indonesia Wacoal August-September

Category	Type	Waste Weight (meters)	Percentage (%)	Cumulative Presentation (%)
Thread	Wolly Yarn 211	191175	64.04	64.04
	Wolly Yarn 210	74674	25.01	89.05
	Yarn R60	22495	7.53	96.58
Fabric	Machi	5420	1.82	98.40
	Westo	3571	1.20	99.60
	Suso	1205	0.40	100
Total		**298540**	**100**	

Source: Data Processing Results

The following is a Pareto diagram of the waste rate of PT Indonesia Wacoal.



Picture 6. Pareto Diagram of PT Indonesia Wacoal's Activity Waste Rate
Source: Data Processing Results

The Pareto diagram above shows that the most effective activity waste rate is Wolly Yarn type 211 waste, which is 64.04%. The high percentage of the waste is because the yarn is used daily to manufacture company panties. The composition of the waste activities of PT Indonesia Wacoal is dominated by waste from Wolly 210 yarn by 25.01%, R60 yarn by 7.53%, suso fabric by 1.82%, westo fabric by 1.20%, and machi fabric by 0.40% of the total waste of PT Indonesia Wacoal.

4. Transportation

Waste in transportation use occurs due to excessive movement in the production process until the consumer receives the product. Excessive use of transportation such as moving goods from one location to another. The transfer of excess material can also be an obstacle because the layout of tools and machines has not been maximized, then the distance required from one location to the next takes a long time. Then the lack of planning that has not been maximized has resulted in employees having to do repetitive work or taking a long time, even though time and energy can be placed on other things.

Problems in material transfer also occur at PT Indonesia Wacoal, resulting in activities that do not provide added value. Inadvertent transfer processes and inadequate equipment such as forklifts result in material falling to the floor. This process causes the excessive activity to move the dropped item. The distance of material transfer can also be wasteful if it is too far because it requires excessive time to carry out the production process.

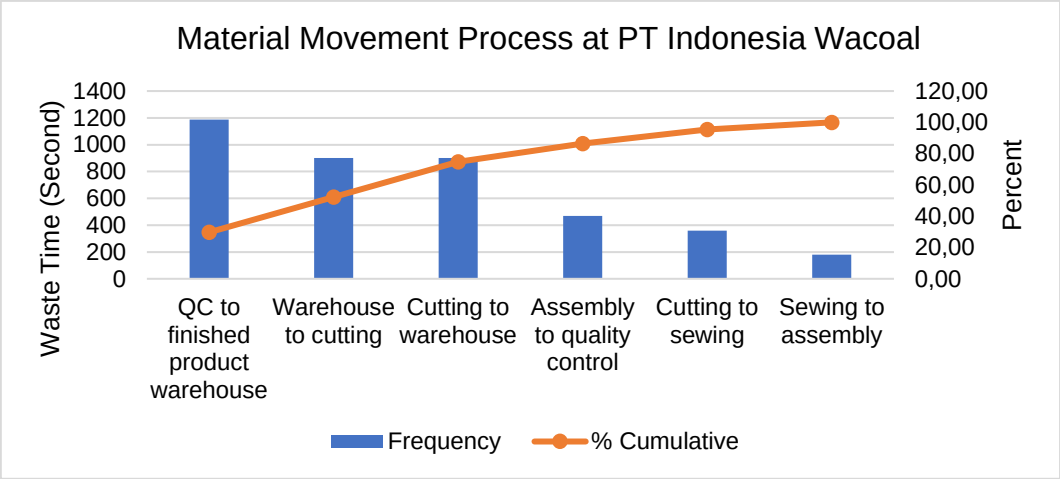
To produce underwear panties, the process of moving material from the raw material warehouse to the cutting process, and then to the sewing process. If it has not started to be sewn, the pieces will be stored in the storage warehouse first or in the setting place rack. After sewing, it goes to the assembly process to be put together and checked by quality control. After the underwear is finished, it will be stored in the finished product warehouse for further marketing to consumers. The following is the displacement data at PT Indonesia Wacoal:

Table 6. Material Transfer Process at PT Indonesia Wacoal

Category	Waste Time (second)	Percentage (%)	Cumulative Presentation (%)
QC to finished product warehouse	1188	29.73	29.73
Warehouse to cutting	900	22.52	52.25
Cutting to warehouse	900	22.52	74.77
Assembly to quality control	468	11.71	86.49
Cutting to sewing	360	9.01	95.50
Sewing to assembly	180	4.50	100
Total	**3996**	**100**	

Source: Data Processing Results

If made in the form of a Pareto diagram, it will look like this:



Picture 7. Pareto Diagram of Material Transfer Process at PT Indonesia Wacoal
Source: Data Processing Results

From the Pareto diagram above, it can be seen that the most extensive material transfer process is from quality control to the finished product warehouse, which is 44.44%. The high percentage of transfers is because the distance from the quality control room to the finished product warehouse is quite far, which takes 15.6 minutes or 936 seconds. Warehouses dominate material transfer at PT Indonesia Wacoal for cutting by 22.52%, cutting to warehouses by 22.52%, assembly to QC by 11.71%, cutting to sewing by 9.01%, and sewing to the assembly by 4.50% of the whole process of moving material PT Indonesia Wacoal.

5. Motion

The existence of excessive movements carried out by both operator and machine resources such as repetitive activities in producing, inspecting, and storing inventory. Movement can be characterized by the movement of the right hand and left hand and then evaluate which ones are needed in the work process. Excessive movement will undoubtedly increase the time for the following production process, which is closely related to the waiting process (delay). The working position also affects the operator in completing the work because if you are in an uncomfortable position or for too long in a static position, it will cause pain in specific parts so that the processing time will be longer(Wulandari et al., 2017).

In the panties production process, all the production is carried out by machines and operated by operators, such as cutting and sewing. However, several processes are carried out by the operator, namely during the strap grouping and packaging process, so that it allows for excessive movement if you ignore the map of the right hand and left hand when working.

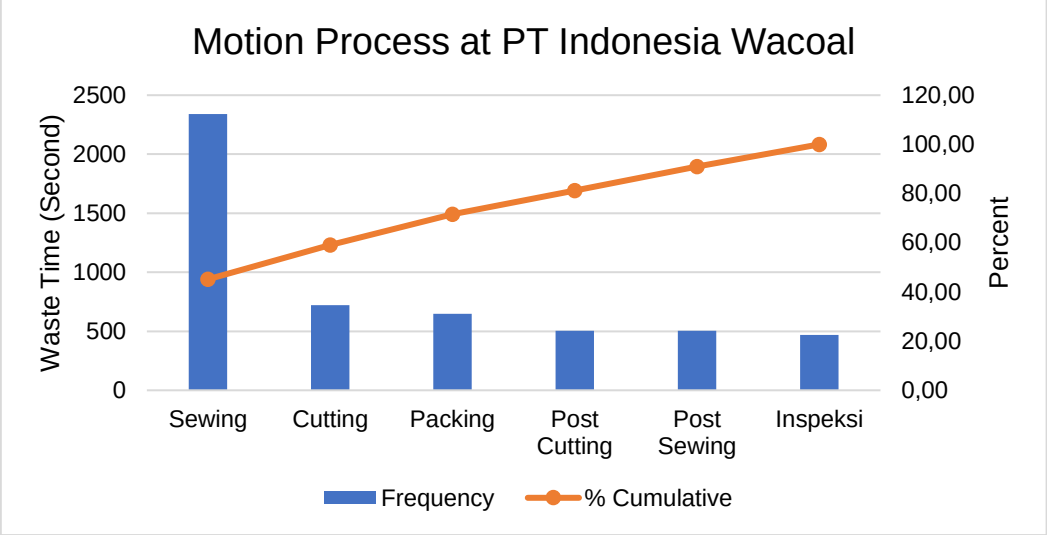
The process of movement occurs during sewing to produce panties. In addition, there are several processes such as post sewing (checking stitches), cutting (cutting pattern), post cutting (checking cutting results), packaging (packing) and carrying out inspections or quality control. The following is data on movements carried out at PT Indonesia Wacoal:

Table 7. Movement Process at PT Indonesia Wacoal

Category	Waste Time (Second)	Percentage (%)	Cumulative Presentation (%)
Sewing	2340	45.14	45.14
Cutting	720	13.89	59.03
Packing	648	12.50	71.53
Post Cutting	504	9.72	81.25
Post Sewing	504	9.72	90.97
Inspection	468	9.03	100
Total	**5184,00**	**100**	

Source: Data Processing Results

If made in the form of a Pareto diagram, it will look like this:



Picture 8. Pareto Diagram of Movement Process at PT Indonesia Wacoal
Source: Data Processing Results

The Pareto diagram above shows that the most considerable movement is during the sewing process, which is 45.14%. The high percentage of sewing movements is because when uniting several parts of the underwear, it is influenced by the operator's right and left-hand movements and age, which affects the operator's performance in optimally operating the sewing machine. In addition, sewing positions that are bent and sitting too long in a static position can increase the workload on the neck and shoulders. So that it affects the sewing process time of 39 minutes or 2340 seconds. The movement process at PT Indonesia Wacoal is dominated by cutting by 13.89%, packing by 12.50%, post cutting by 9.72%, post sewing by 9.72%, and inspection by 9.03% of the entire movement process at PT Indonesia Wacoal

6. Waiting

The existence of waiting time is caused by an imbalance in the allocation of resource use on the production line, so there is a delay in waiting time. A long waiting time is said to be a waste if it causes other operators to wait so they cannot carry out other activities, resulting in the delivery of goods to consumers will take a long time and result in increased operational time. This process will decrease the service level and lower consumer confidence in the company. Excessive waiting time is also caused by waiting for the previous process to be completed, which is closely related to excessive motion (unnecessary motion). In addition, there are several contributing factors such as engine damage and material displacement

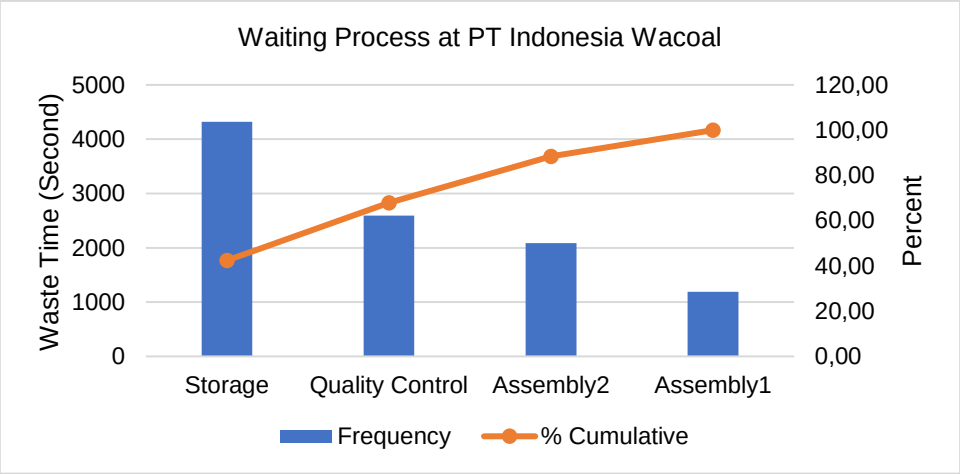
There are waiting activities in the storage warehouse because the material is still being cut and has not yet started the sewing process. Then during the assembly process, the maemi part waits for the machi part or vice versa to be put together or in the assembly. Furthermore, the following process is the assembly that combines Ushiro's parts. The last waiting process is during quality control, where all parts in assembly two will be checked for quality in quality control. The following is the waiting process data at PT Indonesia Wacoal:

Table 8. Waiting Process at PT Indonesia Wacoal

Category	Waste Time (Second)	Percentage (%)	Cumulative Presentation (%)
Storage	4320	42.40	42.40
Quality Control	2592	25.44	67.84
*Assembly*2	2088	20.49	88.34
*Assembly*1	1188	11.66	100
Total	**10188**	**100**	

Source: Data Processing Results

If made in the form of a Pareto diagram, it will look like this:



Picture 9. Pareto Diagram of the Waiting Process at PT Indonesia Wacoal
Source: Data Processing Results

7. *Overprocessing*

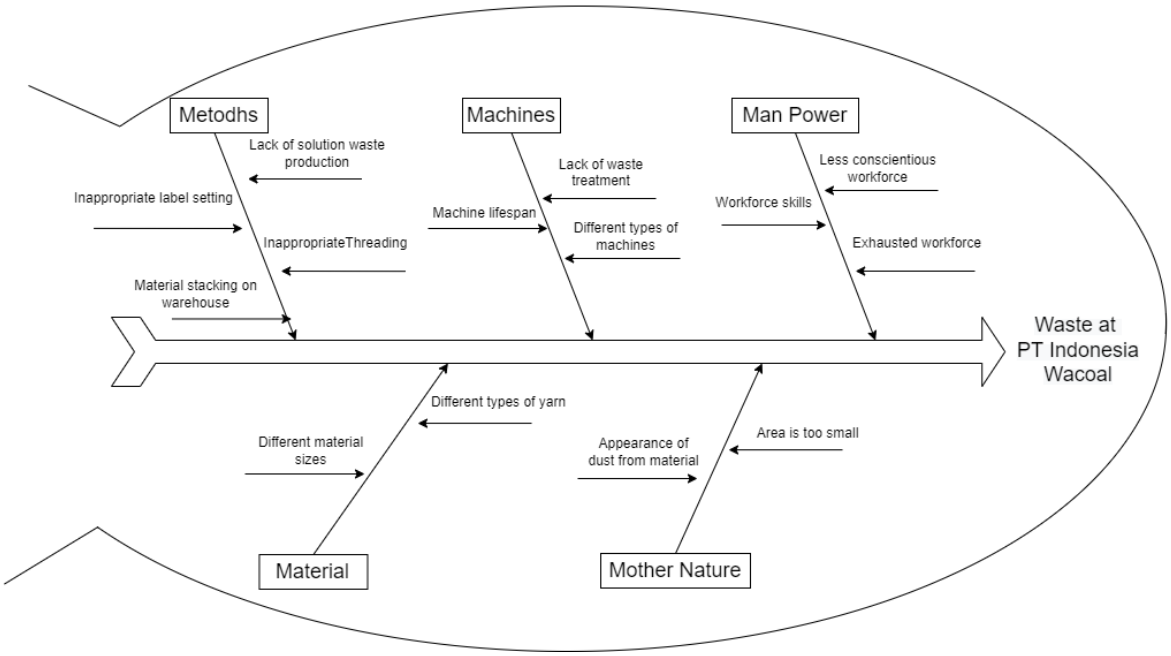
Waste, in this case, occurs due to processes that are not desired by consumers but are included in the production flow, so that time is wasted and lost in terms of time to costs for the company. Excessive processes occur because the company wants to place additional materials, employees, and work time that is not added value, even though these resources can be allocated for other needs and there is a repetition of processes that should be done simultaneously.

Because the production process is carried out by several operators in each production line, waste due to excessive processes at PT Indonesia Wacoal does not occur in the production of panties.

Based on the identification of the types of waste in defects using a Pareto diagram, it can be seen that the largest activity waste rate is Wolly Yarn waste type 211, which is 64.04%. The high percentage of the waste is because every day the yarn is used to manufacture panties at the company. In addition, the longest material transfer process of 44.4% is from the quality control location to the finished product warehouse where the location is quite far and takes 15.6 minutes (936 seconds) for the entire material transfer process. The presence of dominant excess movement also occurs in the sewing process by 45.14% where the process is influenced by several factors to unite several fabrics with threads with a time of 39 minutes or 2340 seconds of the total time of the entire moving process. The waiting time also occurs in companies where 42.40% is used from the storage warehouse to the next process, this is because after the fabric is cut and has not started to be sewn, the material will be stored in the warehouse or in a set place which takes a long time of 72 minutes or 4320 seconds of the total waiting time in the entire process of PT Indonesia Wacoal.

4.2. Identify Waste Factors

Based on the results of observations and interviews with production supervisors during practical work, the results of the identification of factors causing waste at PT Indonesia Wacoal which is described using a fishbone diagram as follows:



Picture 10. Fishbone Diagram of Waste Causing Factors at PT Indonesia Wacoal
Source: Data Processing Results

1. Man Power

In the process of making panties, workers must be careful in combining several materials into one. Because in this process several sizes of goods are needed that match the specifications because if they are not suitable, the sizes produced will also be different and the target for these sizes do not reach the desired demand.

Healthy stamina is also needed because in a day the manufacture of products in large quantities. So that workers are required to have sufficient rest so that accidents do not occur and minimize errors that occur. The process of making panties is also influenced by the skills of the workforce. Because people who have seen using a sewing machine compared to those who have just used it will produce a different amount of product. This lack of operator skill will slow down the production process at PT Indonesia Wacoal.

2. Machine

The machine is one of the factors causing waste in PT Indonesia Wacoal. This is because if the machine is not maintained it will have an impact on production results. At PT Indonesia Wacoal does not yet have a waste treatment machine. The remaining unused yarn and fabric will be immediately thrown away or burned. The waste processing machine is very important that should be owned by the company, especially if the remaining yarn and fabric is quite a lot per month so that there is no pollution. Having their waste processing machine can also reduce the costs required if the services of a second party are involved. The second factor is where the machine has an economic life that can work optimally until the machine's life runs out. Old machines will hinder the implementation of the production process, especially sewing machines. Therefore, periodic maintenance is needed so that the production process is produced optimally.

Another factor is the various types of machines. In the garment industry, of course, there are several machines, such as sewing machines, and overlock machines to support the production process. Different types of machines even though they are in the same brand but have different working mechanisms. This allows the thread installation to take a different amount of time for each type of machine. So it is very influential on the sewing process. Therefore, the various types of machines become one of the factors causing waste.

3. Method

The method is a way of solving used in a process. Some of the causes of the waste factor are the absence of completion of the rest of the production where the waste in the form of fabric that can still be used should be addressed so that the residue is not immediately disposed of or burned. The rest of

the fabric can be used to make accessories or souvenirs as a by-product so that it can minimize the waste generated and increase profits for the company.

Furthermore, the location of the labels on the shelf setting place still uses affixed paper, making it possible for the paper to be lost and fall so that the potential for items to be exchanged with other shelves is higher. This of course can cause delays in the production process. The installation of the thread in the sewing machine must also be precise and appropriate. Improper thread installation will cause the stitching process to be hampered and the thread to tangle. In addition, the resulting stitches are not neat, which triggers the occurrence of defective goods.

Material inventory is something that companies need to meet consumer needs. The number of goods ordered must also be appropriate or accurate with the predetermined amount because it will affect the existing inventory. If the inventory in the warehouse is running low or less than the minimum inventory limit, then the production process will be disrupted or hampered which causes the lead time to increase it can reduce the quality of service in a company. However, if there is excess inventory, there will be a buildup in the warehouse. Material buildup experienced by PT Indonesia Wacoal is accompanied by not placing it on a certain shelf so that the material is seen piling up on the warehouse floor.

4. Material

This material is used to support all the activities that occur. Some of the material factors in producing waste are various types of yarn and different sizes of materials. Yarn is an important material used in the production of panties. There are two types of yarn used which are of almost the same quality. The use of threads in the wrong direction and the installation of needles that do not fit cause the threads in the stitches to break during the production process. If the thread breaks then there is too much time to start a new stitch.

In addition, fabrics also vary for each product, even for one type of product, namely panties, which have different fabrics for each variant. It is adapted to the wearer ranging from children, and teenagers to adults. The existence of different sizes of the fabric causes different cutting patterns and sewing. Some of these cuts can be in large or small quantities at once, so this has the potential to be a waste of material if it is not cut properly. The sewing process is also adjusted to the size of the fabric.

5. Environment

The environment around the workplace is very influential on the production process and triggers the presence of waste. The area is very influential on the production process because the area determines the movement of people to move, carry or store materials. The area in the setting place is too small to place a large storage rack, besides the distance between the shelves is too close to each other so that the path for humans to place goods can only be passed by one to two people. This results in a hazard to work safety and it takes a long time in the process of taking goods so that humans do not fall under the goods. In addition, pieces of unused and scattered fabric residue can cause dust that can stick to the finished product, causing dirty fabric or items that do not meet specifications. Therefore, the cleanliness of the environment must be maintained. To minimize the occurrence of defects in the fabric.

5. Conclusion

Based on the results of the identification of the types of waste (waste) that occurred during the production process of panties at PT Indonesia Wacoal occurs due to defects (waste due to defective products), transportation (waste of material moving process), motion (waste due to excessive movement), waiting (waste due to waiting time). By using a fishbone diagram, it can be seen the factors that cause waste that occurs at PT Indonesia Wacoal comes from man (labor who is less thorough, tired at work, and skilled labor), machines (no waste processing machine, age of the machine), methods (there is no solution for production waste, the location of the label on the setting place is less efficient, thread installation during the production process, stockpiling of materials in the warehouse), materials (various yarn types, different material sizes), environment (the area is too small, the appearance of dust from the material). This research can be a starting point for further research, especially from the perspective of increasing productivity. The results of the research can be used as material for company evaluation in reducing waste for the panties production process at PT Indonesia Wacoal. It is necessary to do further research related to strategies to minimize waste to increase company productivity.

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