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ANALYSIS OF FACTORS AFFECTING WASTE USING VALUE STREAM MAPPING (VSM) ON KAOSBEBAS.ID

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Abstract: Lean manufacturing approach is a systematic approach which identifies and eliminates waste through continuous improvement: the flow of products that customers want to pursue the perfection. This study aims to determine the amount of waste in Kaosbebas.id and examine the causes of the waste by using Value Stream Mapping (VSM), value stream analysis tools, and fish-bone diagrams. At the beginning of the study, the description of the current state map was carried out for the analysis of the fulfilment of the physical flow and the flow of information on the production of Kaosbebas.id. After weighting the waste, the researchers distributed questionnaires to informants related to the custom T-shirt production process to obtain the results of identifying the locations of waste and what things made the waste occur during the production process. Furthermore, the researchers conducted an evaluation process so that this waste reduction is expected to increase production efficiency and improve company performance. In addition, this study also aims to provide suggestions for improvements to the manufacture of custom t-shirts during the production process. This study uses a qualitative approach with the methods of observation, interviews, and questionnaires.

Keywords: value stream mapping (VSM), value stream analysis tools, fish-bone diagrams, defects, waste

INTRODUCTION

In the recent development of industrial world, the competition is getting higher and higher and increasingly triggering the companies to increase their production. Companies that has competitive advantage will win the competition (Anshori, 2005). This leads to complex production planning and control systems, and it makes mass production of goods more difficult. Therefore, this kind of situation presents a big challenge for companies to find new tools and methods to keep growing in the changing market scenario (Anshori et al., 2020). One method that can be used for a company to answer this challenge is the lean manufacturing method. Lean manufacturing is a practice with the aim of producing an efficient system by making continuous improvement and eliminating all forms of waste by identifying and eliminating waste throughout the product value stream (Bhamu, 2014). According to El-Namrouty (2013), in the Toyota production system, there is a method that describes seven types of waste or commonly called the seven wastes which has been expanded by various lean manufacturing practitioners. The seven waste meth-

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ods include (1) Over-production, (2) Waiting, (3) Transporting, (4) Over-processing, (5) Inventory, (6) Motions, and (7) Defects. When waste can be reduced it means the profit of the company can be increased (Anshori et al., 2020).

Kaosbebas.id is a custom t-shirt vendor company with no minimum order in Sidoarjo, East Java. Kaosbebas.id comes with a different and innovative concept. Consumers only need to contact the Kaosbebas.id admin and explain in detail the desired t-shirt. Then, Kaosbebas.id will produce the T-shirts. Koasbebas.id has a fairly long series of production processes as presented in Figure 1.

Kaosbebas.id has working hours from 08.00 to 17.00 WIB. Besides that, Kaosbebas.id is also required to be able to carry out a series of production processes optimally so that the T-shirts can be sent to customers on time. However, the difference in ordering in terms of quantity and variety of clothes makes Kaosbebas.id inseparable from problems in the production process. This can be seen from the waste that exists in several stages of its production activities.

From these processes and demands, waste arises that occurs starting from Kaosbebas.id when providing t-shirts with a pre-order system which causes the stock of T-shirts to still be at the supplier's place. The number of T-shirt stock that will be taken from the supplier adjusts to the customer's request per day. Therefore, this creates waste that forces Kaosbebas.id to pay daily fees for the delivery of T-shirts from suppliers. This waste can be categorized as transportation waste, where the transfer of resources (materials) and the transfer do not add value to the product.

The problem above also causes other waste of time, namely waiting. This is because the process of preparing the T-shirts from the supplier of the T-shirts to Kaosbebas.id, takes a total of about 7 hours. The case like this often makes the performance of the production team neglected due to idle time waiting for the T-shirts that have been ordered from suppliers to arrive. After the T-shirts arrive, the phase of the new T-shirts Press can be done with the remaining working time of about 2 hours until 17.00 pm. This short time often causes some T-shirts that should have been pressed that day have to be pressed the next day because the work time has run out.

Not only waste problem, Kaosbebas.id is also experiencing over production. It is characterized by production that exceeds customer demand. This is done to anticipate design defects or defects at the T-shirt press stage. Errors in the production process of Kaosbebas.id

Figure 1 Production Process

Table 1 the Defects of Production 2019

No.	Month	Total Production	Production Defect				Total Defect
			Press Design	Color T-Shirt	T-Shirt Size	Sleeve	
1	May	207	2				2
2	June	210	2		1		3
3	July	285	1		4		5
4	August	320	3		14		17
5	September	304	4		4		8
6	October	512	19	3	4	2	28
7	November	870	19	2	13	10	44
8	December	911	17	7	11	12	47

also cause waste defects or defects. The occurrence of defects is caused by the high number of defective products that exist in several stages of Kaosbebas.id production activities caused by errors in the T-shirt design press, T-shirt color, T-shirt size, and sleeves. Table 1 shows the production defects at Kaosbebas.id in 2019.

In Table 1, it appears that the production defects in 2019 which showed the average defects that occurred exceeded 5% in each month. This will also happen in 2020. Table 2 depicts production defects in 2020.

The problem above makes Kaosbebas.id require additional production costs for the repair process and additional time to produce goods to suit customer requests. When producing T-shirts ordered by customers, the anticipation made by Kaosbebas.id could not be a solution to reduce waste, thus causing Kaosbebas.id to suffer losses when production inconsistencies occur. This is considered an unresolved problem.

Lean Manufacturing

Lean Manufacturing is a manufacturing system to identify and eliminate waste throughout the product value stream in a sustainable manner. Lean concept is the concept of downsizing or efficiency. This concept can be applied to both

Table 2 Production Defect in 2020

No.	Month	Total Production	Production Defect				Total Defect
			Press design	Color T-shirt	T-shirt size	Sleeve	
1	January	743	29	5	5	3	42
2	February	652	34		6		40
3	March	1031	39	7	6	3	55
4	April	1011	34	5	9	4	52
5	May	1002	33	8	9	8	58
6	June	877	32	3	5	5	45
7	July	764	38		1		39
8	August	760	22	7		2	31
9	September	774	13		9	11	33
10	October	589	38		9		47
11	November	937	33		18	2	53
12	Desember	807	17				17

Source: Kaosbebas.id

manufacturing and service companies, because basically the concept of efficiency will always be a target to be achieved by the company (Kumar, et al., 2022).This happens widely not only within the company, but also throughout its supply chain network (Shah, 2007). The goal of lean manufacturing itself is to produce an efficient system. By having an efficiency, the company can also get its competitiveness (Ding et al., 2021). Like Ding et al. (2021) and Qamar et al. (2020) also found in their study that lean manufacturing can lead to efficiency. It can also be referred the previous study by Zaheer et al., (2020) and Endang & Novita (2022) in which they argued as based on their findings, that in lean environment, the company has a focus on eliminating waste so that the company is more efficient in production process. Thus, lean manufacturing leads the company to be efficient and competitive.

The Seven Waste

According to El-Namrouty (2013) and Hemalatha et al. (2021), there are seven types of waste as part of the production system proposed by Toyota, such as the following:

- Over-production is producing an item that is not needed. Over-production is very detrimental to the company because it can block the smooth flow of materials and reduce quality and productivity.
- Waste waiting occurs when a waiting state occurs, then the next operation automatically waits. This can happen due to poor material flow, too long a production process, and too far between work centers.
- Waste transportation is defined as the transfer of products between processes that do not add value to the product.
- Over-processing is an unnecessary step to process components, due to inefficient processing due to poor tools and poor product design. In the end, this can cause unnecessary movement and produce defective goods.
- Waste inventory, namely everything related to excess inventory, excess material, work in process, or finished goods causing long lead times, expired goods, damaged goods, increased transportation and storage costs, and delays.
- Waste Motion is the unnecessary movement of employees or machines. For example, walking around the factory floor in search of tools, unnecessary physical movement, due to poor ergonomic design, slows down workers (Mekong Capital, 2004).
- Defects are products that do not conform to specifications that can cause rework, and cause damage.

Value Stream Mapping

Value Stream Mapping (VSM) is an important tool that helps managers to understand the current state of operations and helps identify improvement opportunities to improve operational performance. VSM uses language or symbols as a technique to analyze material and product flow information. The main focus in VSM is on identifying value added and non-value added processes (Jasti et al., 2014). According to Setiawan et al., (2021) value stream mapping is a method of mapping the flow of the production process or service and the overall flow of information to produce one type of product or service. Not only in each work area but at the overall level of production, as well as identifying value-added and non-value-added activities. This is in line with the research of Maulana (2019) and Setiawan (2021) which explain that VSM is very useful for determining waste in a production process line.

Process Activity Mapping

Process Activity Mapping is a tool that is used to create detailed mapping in the process of meeting the needs of the order fulfilment process. This map depiction is useful for knowing all value stream activities and trying to reduce activities that are less important, simplifying them, so as to reduce waste (Sundri, 2021). Process Activity Mapping (PAM) maps processes in detail of the step-by-step process of activity mapping aims to map the process in detail step-by-step, starting from the stages of operation, transportation, inspection, delay, and storage. Then, this process groups into the types of existing activities, namely value adding activities, necessary non value adding activities, and non value adding activities. Previous studies using the PAM methods to identify waste in the production line of automotive manufacturing companies have been successfully applied, such as in the studies of Jasti & Sharma (2014), Martha & Arvianto (2018), Isnain (2017) and Kasanah (2021).

Fishbone/Ishukawa Diagram

A Fishbone diagram is a cause-and-effect discovery tool that helps find out the reasons for defects, variations, or failures in a process. One of the more well-known uses of Fishbone diagrams is not only to find the cause of existing problems, but in the design stage to prevent problems. The Ishikawa diagram was first introduced by Kaoru Ishikawa and is included as one of the seven basic methods of quality control (Perera, 2016). Ishikawa diagram is a reactive risk management method by identifying the potential causes of a problem to find the root cause of the problem through a brainstorming session (Wong, 2011).

METHOD

This research is a quantitative research using an intrinsic case study approach which intends to describe the results of the study and try to find a comprehensive description about a situation. The data were obtained by distributing the questioners to Kaosbebas.id and interview to informants also at Kaosbebas.id.

The data were analysed using Value Stream Mapping (VSM), value stream analysis tools, and fish-bone diagrams. At the beginning of the study, the description of the current state map was carried out for the analysis of the fulfilment of the physical flow and the flow of information on the production of Kaosbebas.id.

After weighting the waste, the researchers distributed questionnaires and also interviews to informants related to the custom T-shirt production process to obtain the results of identifying the locations of waste and what things made the waste occur during the production process. Furthermore, the researchers conducted an evaluation process so that this waste reduction is expected to increase production efficiency and improve company performance.

The method must be clearly and appropriately conveyed and contain a research design, population, sample, data collection method, and data analysis method, written with Time New Roman 12 letter space 1.15. Conceptual articles/literature studies do not need to write research methods.

RESULT

Description of the Current State Map

The current state map describes the flow of information and the physical flow of the custom T-shirt production process. At this stage, the flow of information and the physical flow

that occurs in the production process can be identified. The current state map can also be used to find out the lead time and value adding time information from the entire process needed to describe the system as a whole and the value stream. With The current state map, waste can be identified and the correlation of information flow and physical flow that occurs in the production process can be identified. The current state map depicted below is a timed cycle per day with an average demand of 50 shirts. This is in accordance with the results of interviews conducted by the researchers as follows:

It's just a reasonable estimate of demand, Right? Because we also have it sometimes it is achieved, sometimes it is not and if the expected estimation such as 50 for meals per week. (You know) Sunday is closed. So, the total is 5×6, then in a month it is 1,200 .." (Key Informant 1)

"... Our estimate of demand goes up and down. It means that, sometimes, it is achieved, sometimes it is not and when the estimate is 50 per day."

Analysis of Process Activity Mapping

Based on the results of the process activity mapping in the appendix, it is stated that the number of activity stages in the Kaosbebas.id production process is 1 activity. The activity is divided into 6 operations, 2 transports, 1 storage, and 2 delays. The whole activity takes 1970 Minimal 10 Seconds.

Based on the results of activities, the most carried out are operational activities, namely 6 activities with a percentage of 54.5%. The total time for operation activities occupies the second position, as the activity with the most time with a total time of 710 minutes and a percentage of 36%. All operating activities are value

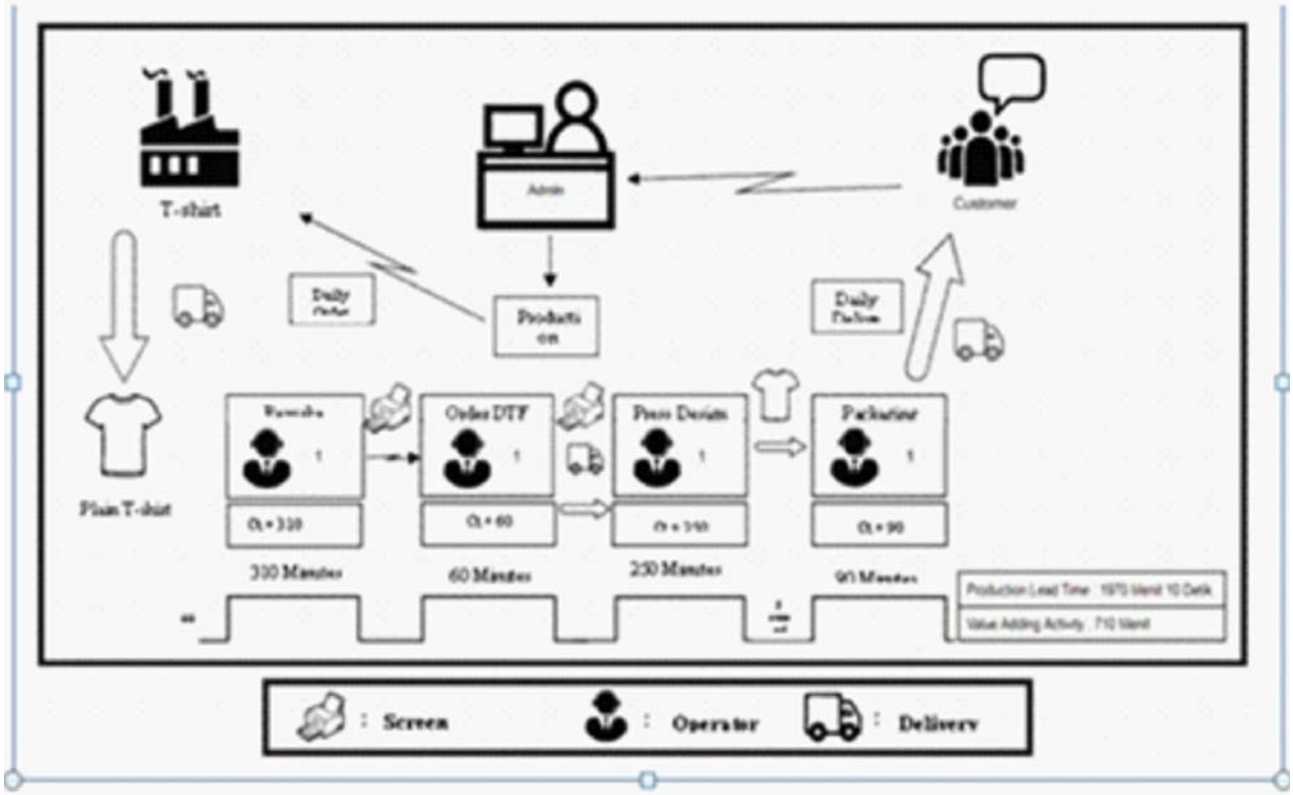

Figure 2 The Current State Map

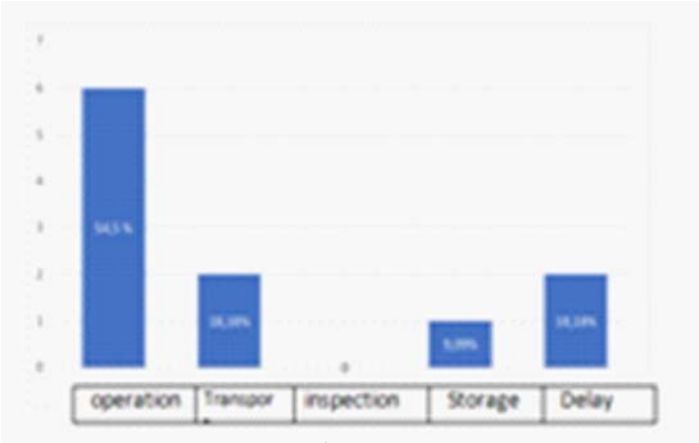

Figure 3 Percentage of Activity Mapping Process
Source: Processed Data

adding activities, so the more you do, the better the results. However, it is with a note that during the operation, there were no errors.

If measured from the number of activities, the delay and transport have the same rank that is the second rank and transport which is as many as 2 activities with a percentage of 18.18%. However, if it is measured from the amount of time, the delay activity is far more than that, thus, it ranks first as the activity with the most time, namely 1260 minutes with a percentage of 64%. Delay is included in the non-value adding activity, in which, when the non-value adding activity increases, it will be detrimental to the company.

Transport has a total of 2 activities with a percentage of 18.18% with a total time of 10 seconds. In this case, transportation is included in the non value adding activity. Kaosbebas.id carries out this activity to transfer between production processes, with a total time of 10 seconds, because each production process is carried out in one house, namely Koasbebas.id itself. However, this does not include moving processes outside the company such as suppliers. The fourth activity ranked the most carried out is storage, which is 1 activity with a percentage of 9.09%. Storage is included in the necessary non value adding activity, where this activity needs to be done but has no added value. This activity creates storage for Kaosbebas.id because T-shirts that have been packed and ready to be shipped must be stockpiled until they are picked up by the courier at an uncertain time.

Table 3 Total Time of PAM Work

Activity Type	Amount of Time (Minutes)	Percentage
Operation	710 minutes	36%
Delay	1260 minutes	64%
Transport	10 second	0,05
Inspection	-	-
Storage	-	-

Source: Processed Data

The Wasting of Seven Waste

Based on the results of interviews with informants, the seven wastes occurred in free t-shirts, whether it had a significant effect or not, it was stated that the most dominating cause of the waste was human error on company employees and suppliers.

> ".... The human resources in the press machine have been thorough; it has been running according to the instructions earlier. Well, if the instruction is wrong, it means it's from the head of production like that. So, when the instruction is wrong, for example it should be L to XL...." (Key Informant 1)

> "the most visible thing is miscommunication or negligence from the employees, Mas. I don't know whether the press process was wrong, the remake design was wrong, and finally there was a production error. Or, sometimes the customer is slow to respond. Seriously, sir! Then there was a change of order, like changing the design because of the design complaint of one size and another. Well, this problem then can also lead to other problems, Mas, for example, waste of time, waste of energy. Another example, the original T-shirt was finished for today, but in fact it hasn't been finished yet. Yes, I think it shouldn't take twice the job." (Key Informant 2)

> "... if it's in the pressing process, it might be the negligence of the workforce, for example it's oblique or other thing that is wrong...." (Key Informant 3)

Human error among employees is generally caused by miscommunication, inaccuracy, and carelessness, for example, in the wrong printing of T-shirts or remakes of designs. Providing information on orders from customers that is unclear and slow in response also triggers the occurrence of waste, namely production processing becomes delayed and cannot be done immediately. Another cause of waste mentioned by the resource person is the supplier.

> "... Yes, the biggest problem is due to such as this, if the supplier of the shirts doesn't want to go down to get involved, and that is the problem...." (Key Informant 1)

> "... but the problem is when we are a bit to relent because the supplier who has something to do with it (the order) also sends it late, yes, so we are late too when it is for the T-shirt supplier ...." (Key Informant 1)

> ".... I don't know if it's related to suppliers or not, but if we have more investment, of course, we can stock our own T-shirts and machines. It can definitely be cut down on production time." (Key Informant 3)

The problem related to this supplier can be concluded, that regulation related to stock and delivery and production cycle times applied by suppliers force Kaosbebas.id to relent and follow the regulation. Therefore, the production process is very dependent on the condition of the supplier. Based on the discussion and statement above, all seven wastes can be expected to occur

Table 4 Result of Seven Waste Weighting

No.	Type of Waste	Average	Ranking
1	Overproduction	1	4
2	Waiting	5	1
3	Transporting	0	6
4	Overprocessing	1	4
5	Inventory	0,6	5
6	Motions	3,3	3
7	Defects	4	2

Source: Processed Data

Tabel 5 VALSAT Calculation

No.	Type of Waste	Average	PAM	SCRM	PVF	QFM	DAM	DPA	PS
1	Overproduction	1	1	3		1	3	3	
2	Waiting	5	45	45	5		15	15	
3	Transporting	0	0						0
4	Overprocessing	1	9		3	1		1	
5	Inventory	0,6	1,8	5,4	1,8		5,4	1,8	0,6
6	Motions	3,3	29,7	3,3					
7	Defects	4	4			36			
Total			90,5	56,7	9,8	38	23,4	20,8	0,6
Ranking			1	2	6	3	4	5	7

Source: Processed Data

in Kaosbebas.id, where this seven waste is the method used by researchers as the method used to classify waste. Therefore, they need to do waste weighting by distributing questionnaires to follow up on the waste.

Based on the results of the weighting of seven wastes on Kaosbebas.id, it can be seen that the waste with the highest average value of 5 points is waiting, and then, the next sequence is followed by waste defects, motion over processing, over production and inventory.

VALSAT Calculation

After getting the waste weighting results, the next step is to choose the VSM tools that match the waste weighting results using the VALSAT method.

Process Activity Mapping (PAM)

Was chosen as a tool to analyze the waste produced by Kaosbebas.id because it has the highest score in the VALSAT calculation weighting process with a score of 90.

Analysis of Waste Causes Using Fishbone Diagram

The selection of this waste is based on the results of the analysis on the current state map and process activity mapping (PAM). Therefore, the waste to be analyzed is waiting (waiting), defects (defects). These two wastes cause 36% 54.5% 9% Value Adding Activity Non Value Adding Activity Necessary Non Value Adding Activity 58 Kaosbebas.id production performance becomes less effective and efficient. These two wastes have the highest number of activities in time and percentage. This will be analyzed further using a Fishbone diagram with the aim of knowing the causes of waste and providing suggestions for improvements to improve previous performance

Waiting

Figure 4 describes an identification of the causes of waste waiting using a fishbone diagram.

The result of the analysis using the fishbone diagram is based on the results of interviews between researchers and informants.

> "...But, if you look at it from inside the production itself, the waiting process is only at the supplier. It should be, if we already have all the items ready, the machines are already here, so there's no need to wait for tomorrow again." (Key Informant 1)

> "..There is a time gap between the production processes, when sending a design to a

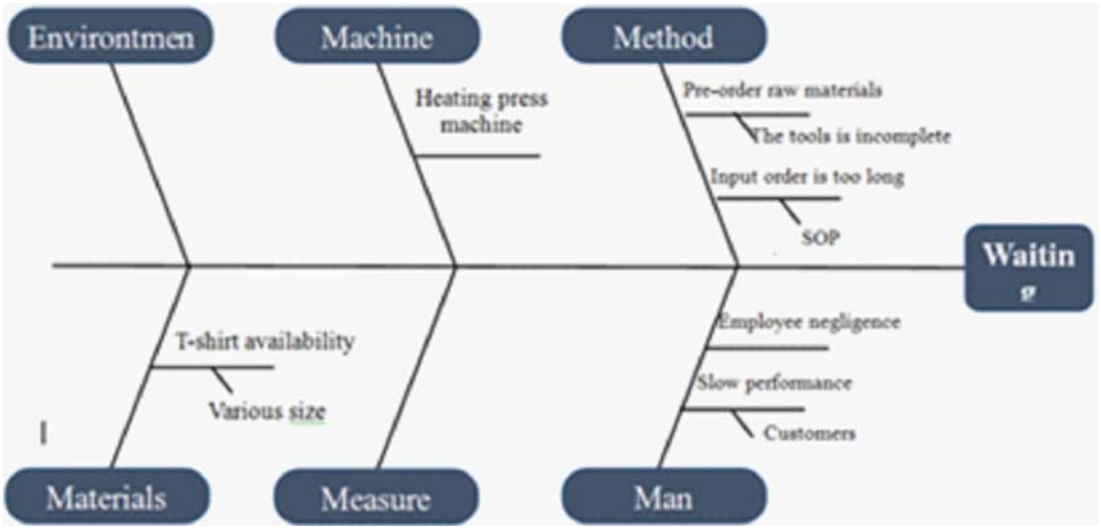

Figure 4 Fishbone Diagram of Waiting
Source: Processed Data

DTF ink supplier and then sending it back here, it takes a day. So, it can be said that the gap occurs only on the design sender, let me send the design to this supplier, Mas..” (Key Informant 2) “.. This is because we do the job based on request, according to his request and pre order too.” Key Informant 3)

The resource person explained that waiting occurs due to several things, for example the raw material procurement system is still pre-ordered from suppliers every day, because the equipment owned by the company is not complete. Late input of order data from the administrative division also often delays the work time of the production division. This is because customers often place orders halfway, for example, the customer has already paid for the shirt. However, the new design was sent to Kaosbebas.id a week later for various reasons, such as the customer’s own design which was not yet finished. As a result, Kaosbebas.id is forced to wait for customers as a form of service. This was also explained in the interview:

“..Well, if you wait for each other, it’s usually related to the customer. There must be production. Yes, if you check, it’s only a few minutes. Let’s just start the engine, wait until it’s hot for a few minutes. Until he’s ready to operate, it’s about 5 minutes anyway. What makes it long is waiting for the data, data approved on the production computer sometimes there are still changes, sometimes sending late or all kinds of things…” (Key Informant 1) 60

“..So, when you want to order, the customer likes some of it, “Mas, I want to order now, the picture will be sent in a week, yes, my picture is still being processed by my designer”. Yes, he has paid now, but he sent the picture in a week, so that’s it.” (Key Informant 1)

All of these actions are considered by Kaosbebas.id as a form of service to customers. However, this actually causes Kaosbebas.id to experience waste waiting. The causes mentioned above are the causes of waste from the method sector. The second cause of waste waiting is from the human sector or people involved in processes such as negligence of employees and

late performance. Both of the above happened because of several factors including discipline and other factors such as miscommunication or complaints from customers. This causes the production division to have to wait for definite information from the customer regarding the desired order.

The problem above also makes time to produce other orders that is to be neglected. The third cause of waste waiting is from the machine sector, the machine here is the press machine. The press machine needs to be pre-heated for about 5–10 minutes, causing waiting time to start the screen printing process on the shirt. The material sector also takes part as a cause of waste waiting, orders that vary by type, and an erratic amount causes the availability of t-shirts from suppliers to be erratic, sometimes the t-shirts needed by Kaosbebas.id are not available, causing Kaosbebas.id to have to wait until the T-shirts are available. Orders from customers who change are also the cause of waste waiting. Kaosbebas.id must check and recap the orders that will be ordered to the supplier.

Defect

Figure 5 is an identification of the causes of waste defects with a fishbone diagram.

The result of the analysis using the Fishbone Diagram is based on the result of the researcher's interview with the informants. The first is the human or HR sector which occurs most often. The informant said that the defects occurred because of employee errors, either from the administration or the production department.

> "....Well, those mistakes are the writing of the T-shirt listing that is lacking. But, now for screen printing, for the screen printing order, it's usually still in our human resources who are not very careful." (Key Informant 1)

> ".... What is the most obvious is miscommunication, or being careless from a colleague worker," Mas, whether the press was wrong, the remake design was wrong, then there was a production error...." (Key Informant 2)

> ".... Employees, it looks like wrong information, technical error. If it's like that, it will automatically repeat or repair...." (Key Informant 3)

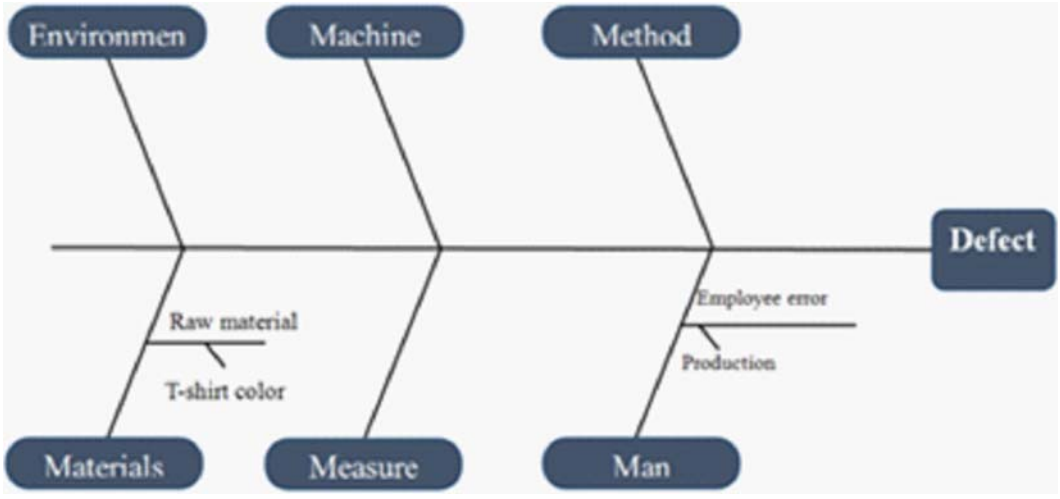

Figure 5 Diagram of Fishbone Defect
Source: Processed Data

Defects caused by the administration section occur when there is an error in inputting order data, such as an error in size, color or even design. This automatically causes the production division to experience errors in the production process. The defects that are purely caused by the production division are inaccuracies and errors in remake designs and press designs on t-shirts. The resource person also explained that the errors that occurred in the remake design had a significant negative impact compared to the t-shirt press. For example, when a customer asks for an A4 paper design size, but it is printed with an A4 ratio size, and the result is a 2cm decrease in size. The second sector is materials. These defects occur when the color of the shirt that the customer wants does not match the t-shirt inventory owned by the supplier. For example, green, green is not just one type, there are army green, light green, dark green, turquoise green, etc.

The customer wants a dark green color, but the green color that the supplier has is only army green and light green. The two things above often cause complaints from customers, causing the re-making of T-shirts as a form of service from Kaosbebas.id, which automatically creates waste for Kaosbebas.id.

Proposal for Improvement

Proposal for Improvement of Waiting

1. Supplier.
2. The results of the discussion of the fishbone diagram show those activities that take time or cause waiting, one of which is activities related to suppliers. According to Widyanesti (2012), in assessing supplier criteria, companies need to look at several categories that exist in suppliers including quality, price, delivery, and warranty. & claim policies.
3. Therefore, Kaosbebas.id needs to negotiate with suppliers regarding the estimated delivery time of raw materials with certainty. Kaosbebas.id also needs to find a new supplier because Kaosbebas.id only holds 1 supplier for each raw material that needs to be supplied, namely plain t-shirts and DTF ink screen printing. This needs to be done as a form of anticipation in case of problems with the main supplier.
4. Providing Inventory and Machine

While negotiating with suppliers, Kaosbebas.id should start planning the procurement of inventory or machinery slowly and gradually. The inventory needed by Kaosbebas.id is such as plain t-shirts that are sizing and sewing themselves as well as a DTF ink screen printing machine which incidentally is still ordering from suppliers. This is because the pre-order system at the supplier is proven to be the cause of waste waiting. Thus, the solution given to realize the procurement of inventory and machinery is in the form of making the right business plan, because with a business plan, Kaosbebas.id will easily determine how much capital is needed and allocated for the procurement of inventory and machinery.

To get a source of capital, there are many ways that can be obtained, starting from internal parties, namely own capital and loans from business partners. Then, from external parties, namely it is through financial institutions such as banks and non-financial institutions such as cooperatives and pawnshops (Suparwo et al., 2018).

Proposal for Improving the Defect

Making policy and regulations

Human resources (HR) are the second factor that causes waste waiting and defects at

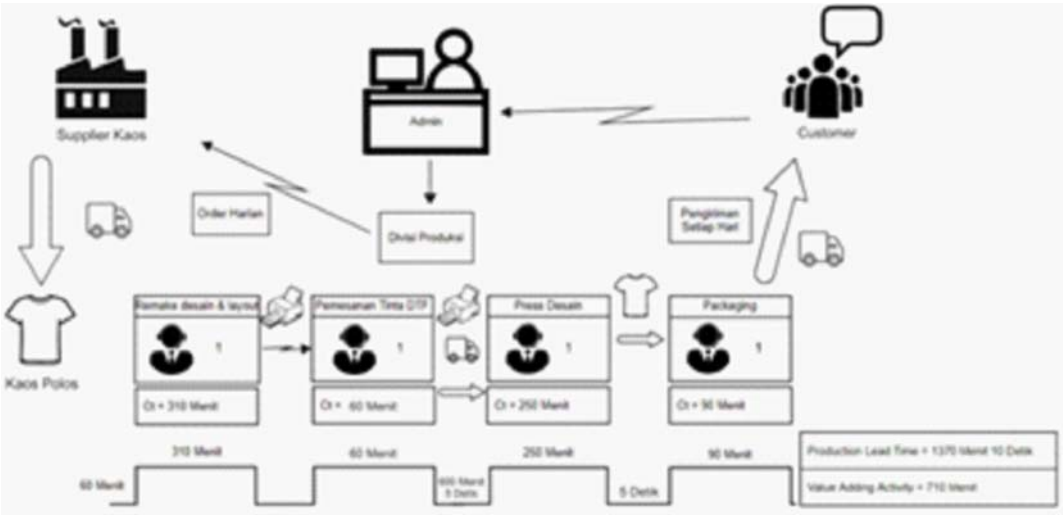

Figure 6 The Future State Map

Kaosbebas.id. Based on the results of the discussion on the activity fishbone diagram, what causes waste waiting is human error or negligence and human error. Kaosbebas.id needs to reduce these human errors by providing briefings or training for employees to operate work equipment properly and improve work discipline. Discipline is an employee driving tool so that each job can run smoothly; it must be strived for good discipline. Technically, Kaosbebas.id should make company regulations and sanctions such as the following:

1. Sanction of hard-discipline
   a. Postponing the compensation that had previously been designed as with other workers.
   b. A one-time wage reduction which is usually given daily, weekly or monthly.
   c. Postponing the promotion program for the workforce concerned in a higher position.
2. Sanction of light-discipline
   a. Verbal warning to the worker concerned.
   b. Written warning.
   c. Statement of dissatisfaction in writing, verbal or written reprimand to the employee concerned in order to minimize performance errors that cause waste waiting and defects.

Recommendation for Process Activity Mapping

The improvement proposal given above is then made in the process activity mapping (PAM) to find out in more detail which activities will change the cycle time. The changes made are in the delay activity because it is considered having no cycle time problems in the operation, transport, inspection, and storage activities. Table 6 is the PAM table before and after repairs.

Drawing the Future State Map

Based on the recommendation of Process Activity Mapping (PAM), the future state map can be described. The future state map describes a view of the value obtained from the improvement activities that have been carried out. The focus in making the future state map is to identify opportunities to design a more efficient operating system as well as serve as a comparison picture between the current state of the company and the future state that has been designed with proposed improvements.

Table 6 PAM after Improvement

Before		
Activity Type	**Number of Activities**	**Time**
T-shirt delivery time interval from the supplier	1	60 Minutes
Time lapse waiting for DTF screen printing ink from the supplier	1	1200 Minutes
Total	2	1260 Minutes

For example, it is a proposal to minimize waste and optimize value-added activities. The results of the depiction of the future state map in this study change the production lead time (PLT). PLT (Production Lead Time) is the time it takes a product to go through all processes from raw materials to the hands of customers.

The faster the PLT, the more effective the company's production process in meeting customer demands. In the results of previous research, the current state map has PLT with a total time of 1970 Min 10 Seconds, then after repairs, the total PLT at Kaosbebas.id decreased by 600 Minutes. In practice, this 600 Minute reduction is in the processing stage of the screen printing delivery from the supplier to Kaosbebas.id, so the PLT described for the future state map is 1370 Minutes 10 Seconds. The results of the depiction of the future state map do not change or add activities, but only reduce the amount of time in delay activities, where this delay activity is classified as a non-value adding activity, so it must be minimized. In practice, the reduced activity delay on the future state map for Kaosbebas.id is waiting for the delivery of DTF screen printing ink from the supplier. As for the value adding activity, there is no change and the total amount of time is still the same, namely 710 minutes. The results of the future state map can is presented in Figure 6.

DISCUSSION

Based on the results and discussion, the researchers provide some conclusions as the following.

1. Based on the results of the weighting of seven wastes on Kaosbebas.id, it can be seen

Table 7 PAM after Improvement

After		
Activity Type	**Number of Activities**	**Time**
T-shirt delivery time interval from the supplier	1	60 Minutes
Time lapse waiting for DTF screen printing ink from the supplier	1	600 Minutes
Total	2	660 Minutes

that the waste with the highest average value of 5 points is waiting, defects ranks second with 4 points, Motions ranks 3rd with 3.3 points, over processing and overproduction ranks 4th with 1 point, Inventory ranks 5th with 0.6 points, transporting lasts with 0 points.

2. In this case study, the value stream analysis tools (VALSAT) used is process activity mapping (PAM) with a total value of tool selection recapitulation of 90.5. This tool will map and classify all production activities in detail.
3. In the proposed improvement, it is recommended that PAM can clearly state that the total number of activities remains the same, namely 11 activities. However, there is a reduction in cycle time from the activity delay which was originally 1260 minutes to 660 minutes. From this description, it can also be concluded that the total processing time is 10 hours shorter than the total processing time for 1970 minutes 10 seconds 660 minutes 10 seconds.

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