Research Article

An Analysis of Quality Control on Defective Products at PT. Signore

Veronica, Yulianti Keke*, Vera Putrianto, Muhammad Basyar Azzuhri, Erni Pratiwi Perwitasari, Yuliantini

Trisakti Institute of Transportation and Logistics, Jakarta, Indonesia

Abstract.

This research aimed to analyze the damaged products at PT. SIGNORE, Tangerang, Indonesia. A Fish Bone Diagram was drawn to determine the factor that causes defective products. Then, an action plan including the concept of the Five M checklist, 5W + 1H (What, Why, Where, When, Who, How) and seven new tools of the corrective action plan, labor, machinery, materials, methods and environment were developed. The purpose of this study was to analyze the damage to a product because the quality of a product greatly determines customers' shopping experience and customer satisfaction with the quality standards of the product. The results of this study indicated that defective products usually occur due to poor quality control processes.

Keywords: Quality control, customer satisfaction, cause and effect

Corresponding Author: Yulianti Keke; email: yuliakeke@gmail.com

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1. INTRODUCTION

Along with the development of technology, people's lifestyles have turned their needs into desires. This has caused the development of the business world to become more rapid from time to time, especially in the fashion business. The competition in the fashion business is also getting tougher and more challenging. Therefore, in order to continue competing, PT. SIGNORE must prepare some strategies and make some major improvements in order to survive among other creative and innovative competitors. In business, when a customer makes a continuous purchase of a product, it means that they are satisfied with the product.

The affective feeling, especially for apparel products, may have an important influence on consumers' perceptions of the quality product and the shopping experience. This is used by companies to maintain product quality standards to match what consumers want. The purpose of this study is to analyze the causes of product defects produced

by PT. SIGNORE. This is due to the fact that customer satisfaction and customer loyalty to a brand are also determined by the quality of the clothes produced by PT. SIGNORE.

2. LITERATURE REVIEW

2.1. Quality

In manufacturing, product quality is a measure of excellence or a state of being free from defects, deficiencies and significant variations. It is brought about by strict and consistent commitment to certain standards that achieve uniformity of a product in order to satisfy specific customer or user requirements. In the other way quality may be defined as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs."[1]

Meanwhile, according to [2], product quality is the ability of a product to perform its functions, this includes overall durability, reliability, accuracy, ease of operation, and product repair, as well as other product attributes. Good or bad a quality depends on with the company's capabilities and standards able to meet consumer perceptions continuously [3]. Quality is the customer's expectation of the reality received by the customer [4]. Quality can affect customers to commit to the products or services offered by the company so that it will lead to increased sales of a product or service. The influence of quality is very crucial in maintaining customer loyalty in the long term. [5] found that product quality has a positive and significant effect on customer satisfaction. The customer's decision to make a purchase is influenced by the quality of a product [6].

2.2. Quality Control

According to quality experts Montgomery, DC "Quality control is an engineering and management activity, with which we measure product quality characteristics, compare with specifications or requirements and take 30 corrective actions. appropriate when there is a difference in appearance which is actually standard."

Quality control is currently a factor for consumer decisions in buying a product and service. As a result, quality control is a key factor that leads to the success of the company's product results, business growth and increased competitive position. Quality control plays an important role in knowing the extent of the process [7].

In the garment industry, quality control is practiced from the very beginning, from the procurement of raw materials to the stage of making finished garments. For textile and apparel industry products, quality is calculated in terms of quality and standards of fiber, yarn, fabric construction, color fastness, surface finished garment design and products.

2.3. Quality control tool

Quality management is a strategic system that involves all stakeholders using qualitative and quantitative methods to improve processes within the organization for the purpose of increasing customer needs. According to [8], total quality management is the company's commitment to provide the best and continuous improvements for its customers. Improving the quality of production and services can be done with various tools. 7 tools are statistical tools that are easy to use to solve a problem. According to Kaoru Ishikawa, 7 tools can be used to solve 95% of problems [9]. Seven old quality control tools are a set of the QC tools that can be used for improving the performance of the production processes, from the first step of producing a product or service to the last stage of production [10]. The method is originated in Japan after the second world war. 7 tools are tools for processing data and for improving quality. These seven tools are fishbone, histogram, scatter, Pareto, control chart, check sheet, and flowchart diagram.

2.4. Fishbone Diagram

Fishbone is often also referred to as a cause-and-effect diagram. A fishbone diagram is a graphical tool for illustrating the various causes of a certain event or phenomena. It is also known as an Ishikawa diagram or a cause-and-effect diagram [11]. Fishbone diagram is a visual list that is structured in a structured way [12]. This diagram illustrates the various causes that affect the process by separating and connecting one cause to another. Fishbone diagrams are used when a company or team needs to identify and explore the causes of a problem or look for factors that could lead to an improvement or improvement.

The use of this causal diagram has the benefits of being a self-study process, a guide for discussion, finding the causes of problems, collecting data, determining the level of technology, using it in various ways, and handling complex problems. A suitable method

for finding causative factors is, for example, brainstorming. After statistical analysis of factors and their verification, they will be added to the cause-and-effect diagram.

The significance of the diagram in the area of quality lies in its function to improve the quality system. The diagram is shaped like a fishbone and the main axis is quality management. The backbone has bones that are placed individually diagonally, and these bones represent the axes of the main components that contribute to the final quality of the company's products and services.
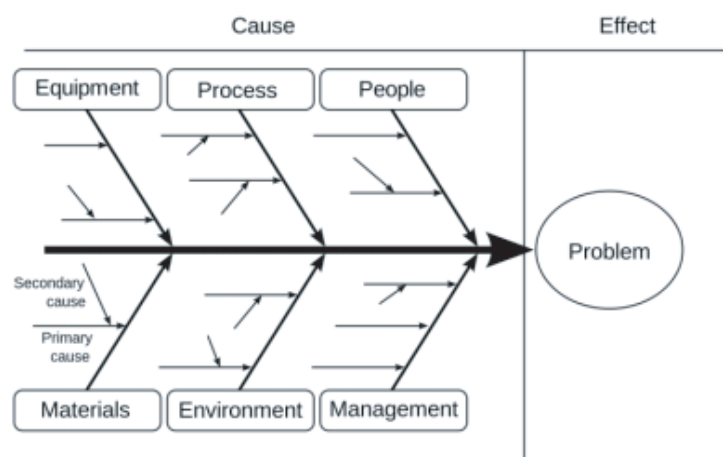

Figure 1: Example Diagram Cause and Effects.

2.5. Product Defect

Product defects have been divided into design defects, manufacturing defects, lack of warnings and instructions defects in foreign countries [13]. Defective products are products that are produced in the production process, where the products produced are not in accordance with the quality standards set, but economically the product can be repaired by incurring certain costs, where the costs incurred to repair lower than the selling value after the product is repaired [14]. Determination of product defects obtained from the results of measurement of quality control stations. Products that are declared defect will not continue with the production process and product defects stored in the warehouse [15]. Defective parts and products have a negative effect on manufacturers' sustainability performance

Product defects cause raw materials, time, effort and money spent on these products to be evaluated as waste later. Worse still, if these defective products get into the hands

of customers, the company will lose its own image. The causes of a defective product can be divided into three possibilities [16], namely:

1. Production errors

Production errors are divided into 2 different parts, namely the first part whose faults include production failures, product installations, failures in inspection facilities, and whether the errors are caused by operator negligence or machine mismatches. The second part is when a product that does not comply with the design and specifications made by the manufacturer but is proven to be unsafe in normal use.

1. Product Defects

Defects that occur at the product readiness level. It is divided into design, composition and also construction.

1. Insufficient information

Information that is not related to the marketing of a product, where the safety of a product is determined by information provided to users such as product labels, how to use the product, and warnings for risks or other things, so that manufacturers can provide such guarantees that the products created can be used as it should be.

3. METHOD

The data analysis technique used in this paper is descriptive method. Descriptive method is a method used to describe or analyze a research result but is not used to make broader conclusions. This can be done by collecting data from the field through interviews with relevant stakeholders, then by brainstorming with the stakeholders and the manager in the production department of PT Signore to find out the causes of product defects using a cause & effect diagram approach, Five M Checklist, Repair plan with 5W+1H, and analyze the relationship between the causes of defective products. After that relation chart, affinity chart and tree diagram were administered for analysis. *Relations diagram* is a tool for finding solution to problems that have complex casual relationships. It helps to straighten out and find the logical relations among the causes and effects and allows for multidirectional thinking rather than linear thinking. *Affinity diagram* collects large amount of disorganized and confused verbal data and groups

based on natural relationship. It is a creative process and not a logical process. Affinity diagram is used where participants have no past experience, situation is complex, need to find a pattern among thoughts and when there is a need to arrive at a consensus and no unity exists. *Tree diagram* is a technique for mapping out full range of paths and tasks for identifying the primary goals and related sub-goals. It is similar to an organization chart and helps to understand the sequence of tasks that need to be completed [17].

4. RESULT AND DISCUSSION

Phase 1. Interview Data.

1. Interviewees: Production Manager, Sewing Operator, Purchasing Division, Cutting Operator & Border Operator

Source: Processed Data

Phase 2. The Analysis of the Shirt Production Flow Chart

The shirt production process at PT Signore occurs for 5 days a week. This manufacturing process is based on predetermined batches. In a year PT Signore does not only produce the same model. Designs made in several periods have different styles and models. In the identification process, the production starts from selecting materials, making designs, cutting materials, doing borders, sewing, and then finishing. The following is the flowchart and explanation of each stage of the production process:
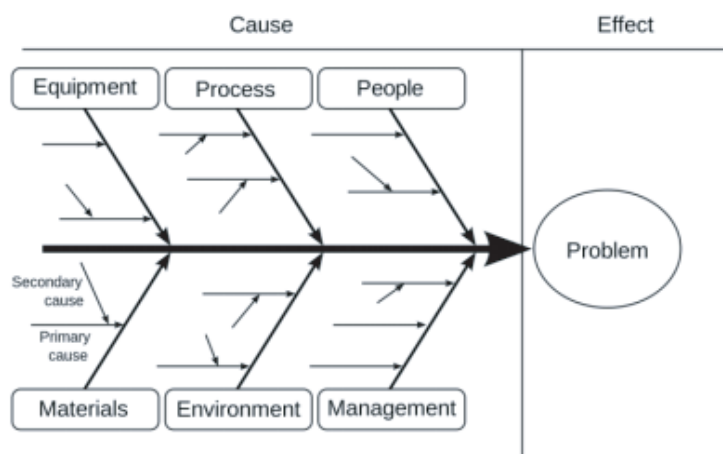

Figure 2: Shirt Production Process Flowchart.

1. Choosing Fabric

TABLE 1: Interviews Data.

No	Questions	Answers
	How is the Shirt Production Flow at PT Signore?	The manufacturing flow starts with the raw materials that we choose based on a batch/model of a certain theme. Then we create a design pattern using a computer and cut the fabric based on the design. After that, we make a line/border for a certain part and combine the pattern by sewing. Lastly, we do production check.
	Does the Sewing Operator check before sewing the provided pattern?	By naked eye, if there are certain parts that look disproportionate according to the part, they will be reported to superiors, but no detailed checks are carried out.
	What is the consideration in determining the material to be selected?	Materials are purchased based on the model/type of request in accordance with the production theme, besides that price is still the benchmark for purchasing and as much as possible getting raw materials at the lowest price.
4.	Is the machine that is used routinely repaired?	In the field we cannot schedule machine repairs because if there is a shortage of machines, it will slow down the production process. Repairs are carried out if there is damage that makes shirt production stop.
5.	How does the production operator work?	Work is carried out flexibly according to demand, operators are only given daily and monthly targets for production for 5 days / week.
6.	How is the production operator recruitment scheme?	We empower local communities to become production operators to reduce the unemployment rate in our neighborhood. Experience as well as education level is not a benchmark in recruitment.

This first stage is the basic stage for carrying out the production process. The material considered in this process is to adjust to the needs of production, the production needs of each period vary according to the theme of that period.

2. Creating Design

Design is the thing that becomes a reference for the continuity of product sales. The designs are created using tools on the computer to make patterns and designs.

3. Cutting Materials

In the cutting process, the pattern is made first to adjust the size of each product. After the pattern is finished, it is then cut using a special cutting tool.

4. Doing Borders

The next step is to do the border by using a special border machine. The purpose of doing this border is to strengthen the material so it doesn't get damaged quickly. This border is also the part of the model for making shirts that are produced.

5. Sewing

After carrying out the stages from material selection to border making, then the raw material is stitched. At this stage, the installation of buttons and certain parts for sewing are also carried out, such as the ends of the hands, the pockets on the chest of the shirt.

6. Finishing

The last stage is finishing, at this stage all parts of the shirt that have been produced will be checked for items such as the level of neatness of the stitches, the location of the pockets and buttons, and also the cleanliness of the thread at the time of the completion of the stitches.

Phase 3. Analysis the number of defect products using a check sheet tools

Problem solving can be started by using a check sheet tool, which is to calculate the number of defective products during the production process. The purpose of making this check sheet is to facilitate the sorting of data into different categories for causes and problems that occur during the production process. The following are the results of data on defective products during the December 2020 period until May 2021.

TABLE 2: Check sheet of Shirt Production for the Period December 2019 - June 2019.

No.	Periods	Quantity (pcs)	Defects (pcs)				Amount (pcs)	Percentage
			Sewing	Button	Fabric	Pattern		
1	December '20	2000	7	5	3	2	17	0.9%
2	January '21	1000	5	2	5	5	17	1.7%
3	February '21	1000	3	3	15	13	34	3.4%
4	March '21	1000	5	3	8	7	23	2.3%
5	April '21	1000	15	0	29	5	49	4.9%
6	May '21	2000	9	3	13	3	28	1.4%

Source: Processed Data

Phase 4. Creating Causes & Effect Diagram

A suitable method for finding causal factors is, for example, brainstorming. After statistical analysis of the factors and their verification, they will be added to the cause-and-effect diagram (Simanová & Gejdovs, 2015).
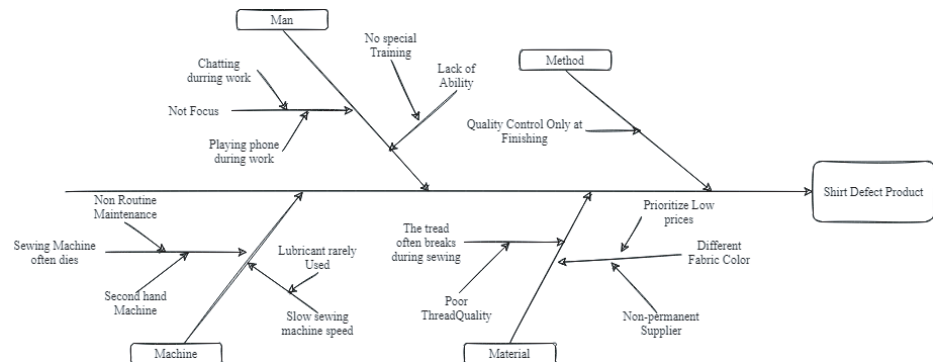

Figure 3: Diagram Cause and Effect Product Defect.

Phase 5. Improvement

These are the analysis using Five-M Checklist delivering problems of each factor and the effects to generate prevention action

1. An Analysis of the Problem Using Five M-Checklist

Source: Processed Data

1. Defining repair with 5W+1H Tools

Source: Processed Data

Phase 6. The analysis of the causes of product defect using relation chart, affinity chart and tree diagram.

1. Relation chart

The analysis of the causes of defective products:

1. A sense of irresponsibility to the given job desk.

2. Lack of education or training on the importance of a quality or the quality of a product.

3. The age of workers who are not in their productive age anymore.

4. Checking a product that is too fast and not thorough.

TABLE 3: Troubleshooting Priority Problems in the Production Process.

Factor	Problem	Effect	Prevention
Human	Not Focus	Sewing Not Straight	Educate Employee
	Lack of expertise	Slow & Imperfect Sewing	Special Training
	Age of workers	Unproductive workers	Limiting the age of workers
	Lack of Workers	Less Allocated Inspection Time	Allocating proper schedule for inspection from workers
Method	Quality control only once	The occurrence of product nonconformities in the early stages of production	Setting up a special division for Quality Control in the pre-sewing and post-sewing phases
Material	Low quality of raw material	Thread breaks during sewing	Creating special standards for raw materials
	Different Fabric tint	Inappropriate design	Creating contract with supplier
Machine	Engine Dynamo often Dies	Delayed production process	Performing Routine Maintenance
	Slow sewing machine rotation	Sewing pattern is not straight due to slow machine speed	Using new Machines as additional Assets

TABLE 4: 5W + 1H Production Process Method.

Analysis 5W +1H	Question & Answer
What	What is the Target of Improvement?
	Maintain customer satisfaction to continue to provide the best quality shirts
Why	Why is this plan needed?
	For implementing the company's mission of continuous improvement on the production side.
Where	Where is the plan implemented?
	In the production process of making shirts, in the process of selecting materials, and also in sewing.
Who	Who carried out the plan?
	Production team and stakeholders.
When	When was the plan implemented?
	The implementation is returned to stakeholders to make decisions whether the resources owned by the company are capable.
How	How to implement the plan?
	By following the sequence of the production process, starting with the purchase of raw materials, to solve the source of problems that originate from upstream production to downstream production.

The analysis of the consequences of defective products: The number of defects in the products produced are still relatively high. This shows that quality control was not conducted properly as per company's standard that may generate a high number of defective products.

The analysis of the relationship between causes and other causes:

1. (a) i. A. **A sense of irresponsibility to the given job desk**: this is caused by lack of direction and control over employee performance

B. **Lack of education or training about the importance of a quality or the quality of a product**: this causes comes as a consequences of lack of worker expertise and the absence of optimum training. Workers need to be get training to make sure they can do their job properly. Nevertheless, the workers also need to be reminded about the importance of producing a high quality products. This knowledge is significant since there is a lack of understanding given to workers regarding the importance of maintaining product quality.

C. **The age of workers who are not in the productive age**: This causes related to workers who tend to get tired quickly (especially the eyes and back).The concentration of workers who are no longer productive tends to decrease so that they often don't concentrate and make many mistakes at work. Since this causes can be prevented, we suggest to implement the limitation of ages policy.

D. **Checking a product that is too fast and not thorough**: this cases related to the time allotted for inspection or checking of goods is less than the maximum. The number of items that must be inspected is not comparable to the workers who inspect the product. We suggest the company to allocate proper schedule for inspection.

1. (a) Affinity Chart

Affinity Chart can be an essential first step in defining what the issue really is, whereas a cause and effect diagram assumes that the issue is already well defined [19]. Affinity diagrams can be used before other tools such as tree diagrams. This study comprised problem analysis results as follows:

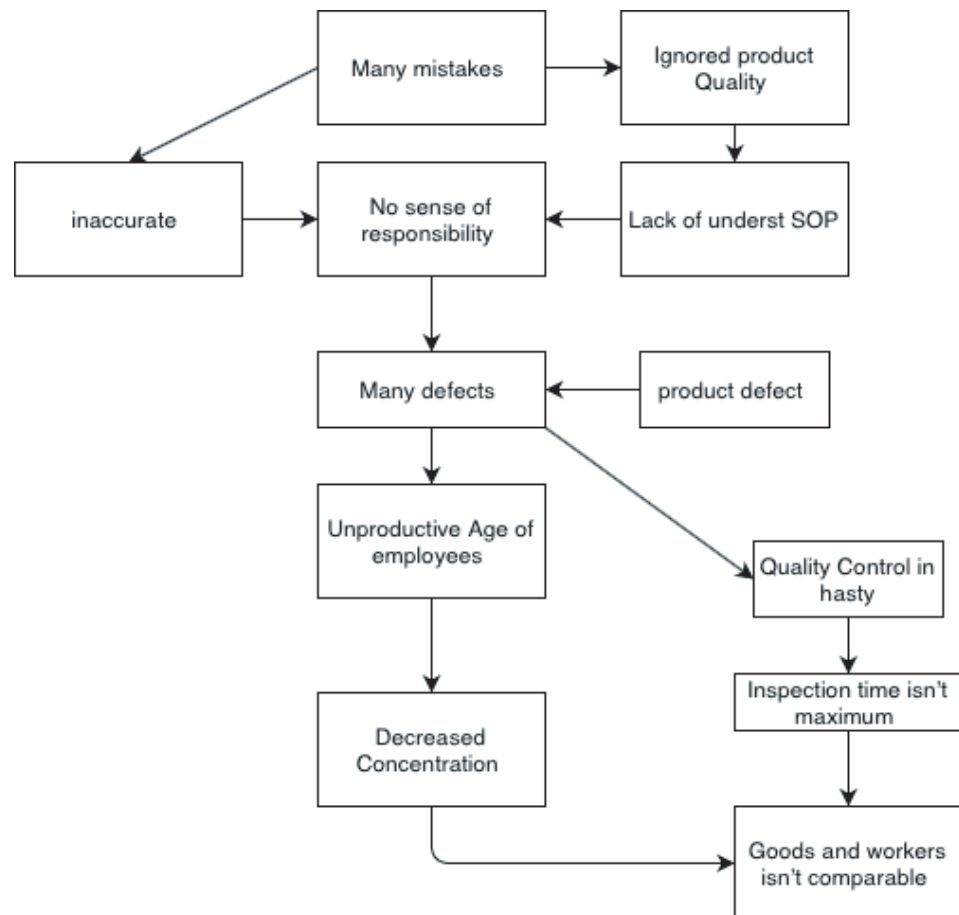1. Formulation of goals: to reduce the number of defective products

Figure 4: Diagram Relation.

2. Formulation of the current condition: The average level of product record is still quite high.

3. Main problem formulation:

4. The studs installed are not parallel to the others.

5. Slanted stitching.

1. (a) Tree Diagram Method

The method used to map a task that is carried out to overcome a problem. It is a technique for mapping out full range of paths and tasks for indicating the primary goals and related sub-goals.
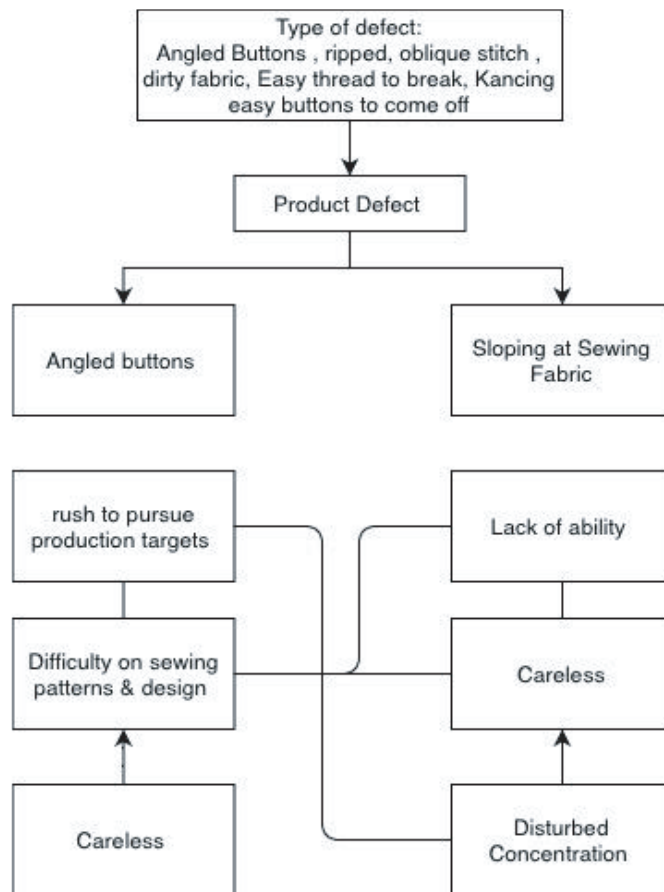
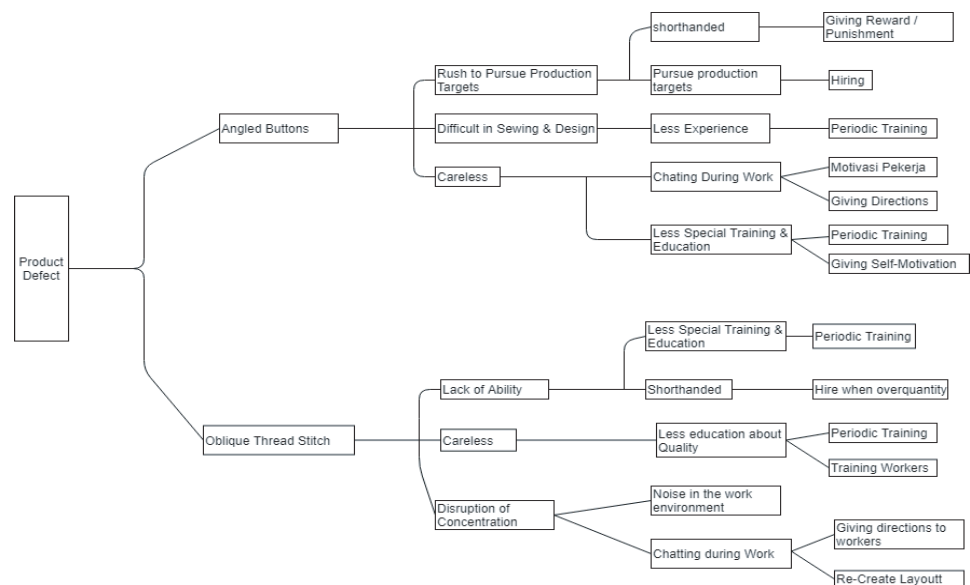**Figure** 5: Affinity Diagram .

Figure 6: Diagram Tree.

5. CONCLUSION

The results show that there are four factors that cause shirt defects, namely human factors, material factors, method factors and machine factors. In the flowchart of the production process, there are problems in the material selection area and the sewing area. The human factor is the priority to be resolved because it is the most critical factor for the production process. Based on the analysis of the new seven tools, there are still high defective products caused by human factors and material factors using the Five M checklist and 5W and 1H approach.

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