



## Analysis of Safety Shoes Product Quality Control at PT. BINA USAHA SEJAHTERA With Statistical Quality Control (SQC) Method Case Study of PT Bina Usaha Sejahtera (BINUSA)

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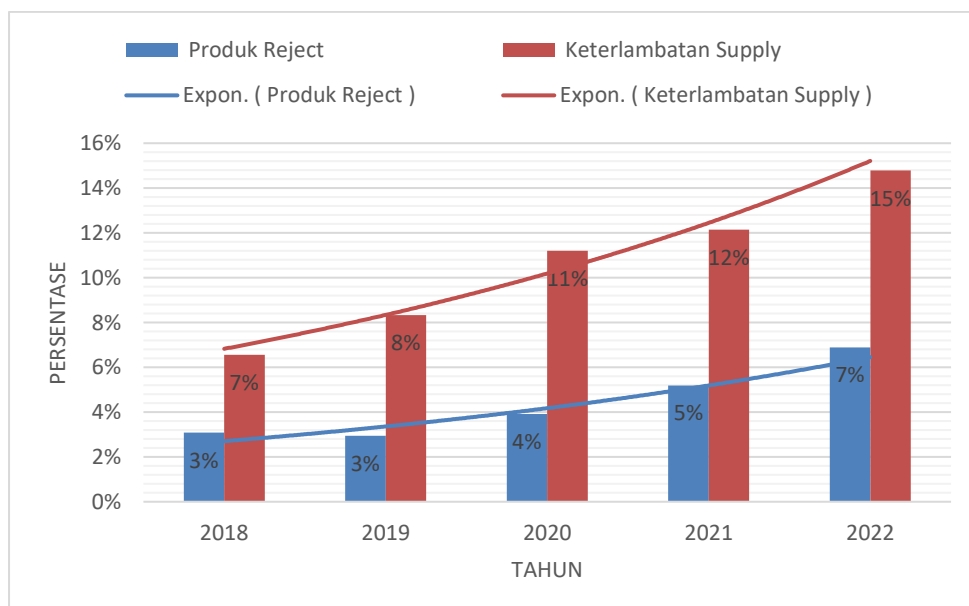
### ABSTRACT

PT. Bina Usaha Sejahtera faces several problems that often occur, especially in increasing the number of Reject goods. The purpose of this study is to analyze the main causes of rejected goods in the production of Safety Shoes and to evaluate and analyze the application of the Statistical Quality Control (SQC) method and 7 quality control tools in overcoming the lack of rejected goods. In addition, this study also aims to propose corrective actions and improve the quality of Safety Shoes products at PT Binusa using the 5W + 1H method. The sample population of this study is the result of data collection using check sheets for Safety Shoes during 2023, starting from January to October 2023. The requirement for the percentage of defective products in one year is less than 5% of the total production of the Binusa company. The sample used for research type BRG 0701 S1P amounted to 1,596 pcs. SQC has succeeded in reducing the deviation rate from 6% to 1%. PT Bina Usaha Sejahtera has committed to encouraging a culture of quality excellence by streamlining the production process, providing regular training, and managing the production process in a structured manner.

## INTRODUCTION

The Government of Indonesia sets a focus on Occupational Safety and Health (K3) through Law 1 of 1970 and Ministerial Regulation 5 of 2018. Safety shoes have a crucial role in various industrial sectors, such as manufacturing, construction, mining, transportation, and agriculture. The function of this shoe includes protection against the risk of injury, both from heavy objects, machinery, chemicals, and hazardous work environments (Nabila et al., 2022)PT. Bina Usaha Sejahtera, as a manufacturer of Safety Shoes, faces challenges such as an increase in Reject goods and shipping delays. A thorough evaluation of production processes, quality control, and inventory and delivery management is necessary to address these issues.(Arief & Nusraningrum , 2021)

To overcome this problem, PT. Bina Usaha Sejahtera requires comprehensive corrective measures. This involves improvements in quality control during the production process, improvements in inventory management, and optimization of delivery systems. By making these improvements, the company can ensure that every Safety Shoe manufactured meets the established quality standards, and can be delivered on time to customers. Success in overcoming these challenges will not only increase customer satisfaction, but also strengthen the reputation of PT. Bina Usaha Sejahtera in the growing Safety Shoes market. In the span of the last five years, PT. Bina Usaha Sejahtera experienced serious challenges related to the percentage of Rejects and delays in the delivery of Safety Shoes products. In 2018, about 3% of total shoe production did not meet established quality standards, while about 7% of total Purchase Orders experienced delays in delivery. Although the percentage of Rejects remained consistent at 3% in 2019, the company faced an increase in delays that reached 8%. In 2020, the percentage of Rejects increased to 4%, reflecting the greater challenge of maintaining quality standards. 2021 has been a more challenging year, with the percentage of Rejects reaching 5% and shipping delays reaching 12%. 2022 recorded the highest reject and delay rates, at 7% and 15% respectively.



This introduction identifies some of the main problems faced by PT Bina Usaha Sejahtera related to the production of Safety Shoes, including high levels of rejected goods, variability in product quality, lack of understanding of the factors causing rejected goods, and limitations in quality control. These issues create challenges in achieving consistent quality standards and meeting customer satisfaction. (Wardah et al., 2022a)

The problem formulation asks critical questions related to the causes of rejected goods, the application of quality control with the Statistical Quality Control (SQC) method and 7 quality control tools, as well as proposed corrective actions with the 5W + 1H method. The purpose of the study was formulated to analyze the causes of rejected goods, evaluate the application of the SQC method, and propose corrective actions to improve the quality of Safety Shoes products. Research contributions are highlighted in two main aspects, namely contributions to quality control practices at PT. Bina Usaha Sejahtera by providing specific guidance and recommendations, as well as contributing to knowledge and understanding of SQC methods in the context of the Safety Shoes industry. Through the implementation of SQC and case study modeling, this research is expected to improve the effectiveness of product quality control and provide new insights in the understanding of SQC (Mahira & Hidayat, 2022).

## **THEORETICAL REVIEW**

It is undeniable that quality is a very important attribute for an organization or company to maintain its survival. There are various approaches that can be used to achieve this, one of which is through the application of Quality Control. One of the methods used in quality control is Statistical Quality Control (SQC), which aims to measure and analyze variations that occur during the production process in order to achieve the desired quality (Wardah Et Al. , 2022b)

### ***Operations Management***

Operational Management according to Assuari (*Maghfur A., 2020*) is a hierarchical movement in supervising and considering the use of its assets seriously and capably in order to have the choice to create items and provide additions to the items made. Meanwhile, according to Render and Haizer (*Maghfur A., 2020*) Operational Management is a series of activities that create value in the form of goods and services by converting inputs into results. Operational management involves managing and monitoring the activities involved in converting inputs (such as human resources, raw materials, and machines) into valuable outcomes, both in the form of goods and services. The purpose of operational management is to achieve efficiency and effectiveness in company operations, so as to achieve the goals that have been set.

### ***Defective Products***

A product is an entity that has value in the market and is able to provide benefits that meet consumer needs. The product must have a value that can

satisfy consumer needs in accordance with what they want. Defective products refer to goods that do not meet the quality standards set by the company. The item requires additional costs to repair to meet the desired qualifications. Usually, repairs are made financially so that the defective product can become a superior item.(Shiyamy et al., 2021)(Arief & Nusraningrum, 2021)

### ***Quality Control***

Deming emphasized the vital role of management in improving quality by defining quality as an ongoing effort to improve stable systems. Its focus on statistical stability and constant efforts to improve the system by reducing variation aim to better meet customer needs. His philosophy is embodied in 14 points, among others, emphasizing the creation of firm goals, adoption of new programs, stopping dependence on inspections, improving production systems in a sustainable manner, providing on-the-job training, encouraging institutional leadership, removing barriers between departments, and supporting lifelong education. Deming emphasized the need for management to focus on long-term quality improvement, resist reliance on mass inspections, and encourage changes in systems and statistical approaches to achieve better quality(Fachrurrozi Adi et al., 2022). (Loomba & Karsten , 2019).

### ***Safety Shoes***

Safety shoes are specially designed shoes with protection on the front, made of steel or other materials such as polymers and carbon. Its main function is to protect the feet from physical hazards in the work environment, such as falling objects, sharp objects, extreme temperatures, slippery surfaces, and exposure to hazardous chemicals. The types of safety shoes vary depending on the potential hazards in the work environment and the type of work performed. There are several types based on silhouette shape and protection, such as Safety-Toed, Metal-Instep, Steel-Insole, Metatarsal, Electric-Hazard, and Heat-Resistance, each of which is designed to protect against a specific type of hazard. For example, Electric-Hazard is designed to protect against electric shock, while Heat-Resistance protects against extreme heat, as is often faced by firefighters or workers in the mineral mining industry( Gem Goddess & Nusraningrum , 2020).



Source: Sayyaf Muhammad N, 2020

### ***Quality Control with Seven Tools***

The Seven Tools tool for quality management includes a variety of methods that can improve process improvement capabilities. Here's a brief summary for each tool:( Arief & Nusraningrum , 2021)

1. Data Stratification: The attempt to group data with similar characteristics. Useful for finding quality causal factors and supporting the creation of Scatter Diagrams. Allows a thorough understanding of the problem.
2. Check Sheet: Used for operational data collection at the beginning of the repair process. A simple form helps to systematically record data, allowing analysis of the frequency of events over a certain period.
3. Histogram: Visual bar charts show the variability of a product or process. It is useful for checking the fulfillment of specifications and identifying the distribution of variables by measures of central tendency such as mean, mode, and mean.
4. Pareto Chart: The distribution of frequency or data attributes organized by category. Quickly identify the most common types of defects, although it does not automatically identify the most affected.
5. Cause and Effect Diagram: Useful for analysis of potential problems after identification of defects or errors. Involves team building, problem definition, and identification of potential causes. Help determine the extent of the problem for the remedial step.
6. Scatter Diagram: A powerful tool for illustrating the distribution of information in two dimensions. Helps detect and analyze relationships between quality and compliance variables. It often shows the degree and direction of the relationship between two variables.
7. Control Charts: Illustrate the amount and nature of variations in a process over time. It is important to monitor the process, prevent defects, and provide a statistical understanding of the status of the process. It was developed by Walter A. Shewhart as a technical form for quality management. (Juran and (Godfrey, 1998).

### **METHODOLOGY**

This research is a descriptive research with a quantitative approach, aiming to gain an in-depth understanding of a phenomenon through communication interactions between researchers and research subjects. This study uses a descriptive research design to describe symptoms, events, and events that occur today. The variables in this study include the independent variable and the dependent variable.

#### ***Data Collection Techniques***

*Sugiyono (2019)* also explained that primary data is a source of data obtained directly from research subjects. Primary data were obtained through interviews with research subjects and through direct observation in the field. Using appropriate data collection techniques, such as observation, interviews, and documentation studies, the study will obtain relevant and accurate primary

data. This primary data will provide deep insight into the problem under study and support the validity of the research.

### *Research Variables*

Variable	Dimension	Indicators
Product Quality	1 Fragility or cracking	Visual
Safety Shoes (Y)	2 Errors in the installation of components or accessories	Dimensional
	3 Surface defects and color accuracy	
	4 Design and comfort Shoes	
	5 The degree of accuracy of the size and quality of construction	Mechanical
	6 Physical endurance	
	7 Foot stability and protection	
	Human (X)	1 Compliance with procedures
2 Lack of competence due to lack of training and development		
Engine (X)	1 <i>Roll</i> shifting take up machine	Extruder
	2 <i>Improper graphite</i> tube position	
Environment (X)	1 Rough floor surface	<i>Testing Area</i>
	2 Preparation for <i>the final test</i> is risky.	
Method (X)	1 Incorrect suturing process	SOUP
	2 <i>Improper loading/Unloading</i>	
Material (X)	1 <i>Skin</i> on raw materials Damaged	Raw materials
	2 Poor material	

#### a) Observation

According to Sugiyono (2019), observation involves direct observation of conditions in the field. By making observations, researchers can see directly the phenomenon or event being

observed. This allows the researcher to gain a deeper understanding of the situation or circumstances under study.

b) Interview

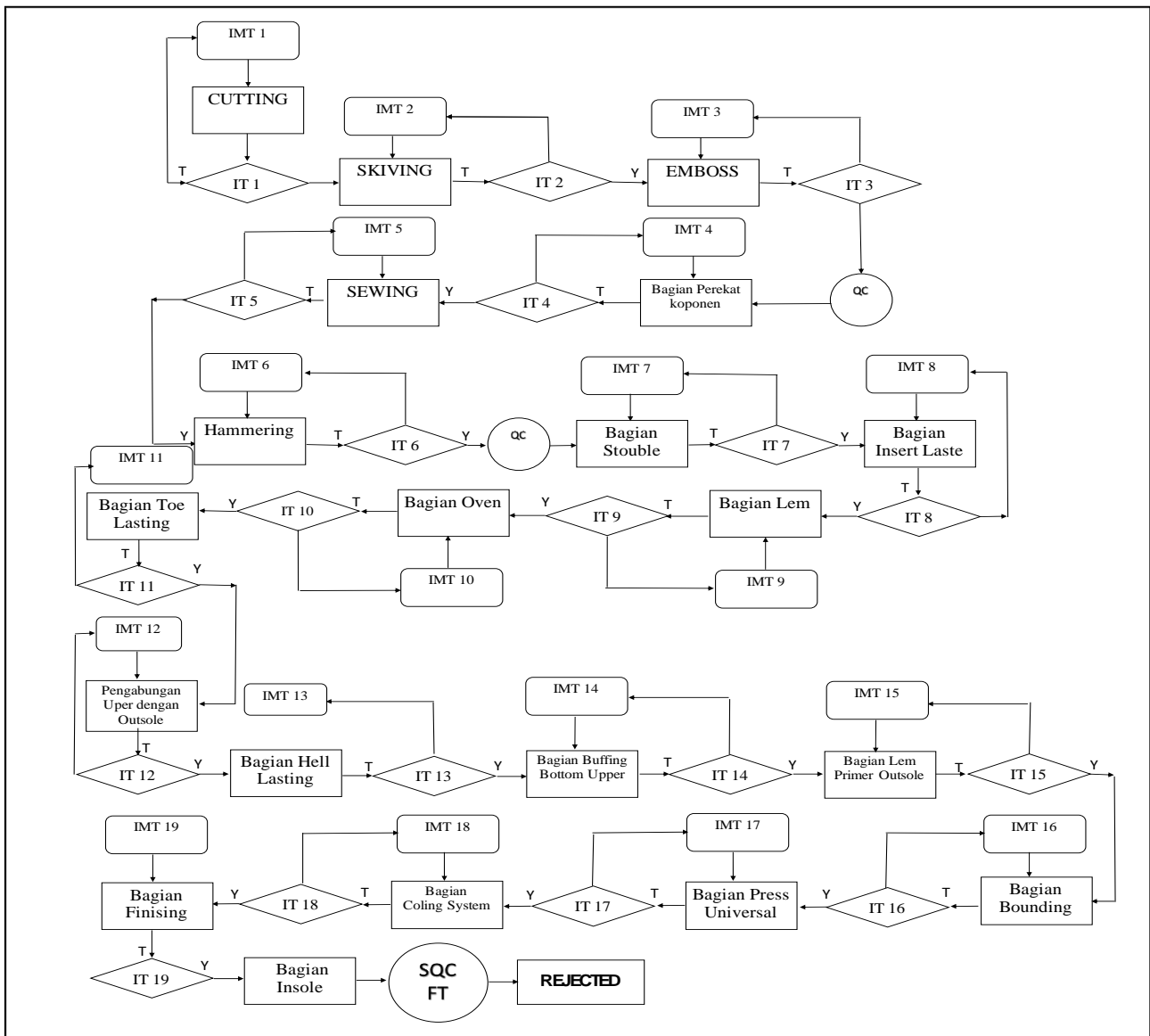
Sugiyono (2020) explained that interviews involve meetings between two individuals who interact with each other to ask and answer, and form meanings related to the topic being discussed. In the context of research, interviews provide an opportunity for researchers to dig deeper into the necessary information from respondents directly. Through structured dialogue, researchers can ask relevant questions and gain deeper insight into respondents' experiences, opinions, attitudes, and views related to the problems studied.

Population is a generalized area that includes subjects or objects with certain characteristics set by researchers, according to Sugiyono (2022). In this study, the sample population is the type of Safety Shoes products produced by PT Binusa, especially the BRG 0701 S1P variant. The sample taken amounted to 1,596 pcs of rejected goods from the product, which will be the object of analysis in the study. The sampling technique used in this study is a saturated sampling technique, according to Sugiyono (2019). Saturated sampling is a technique in which the entire population is used as a sample. Thus, all rejected goods from the BRG 0701 S1P product variant from PT Binusa will be samples taken for this study.

## **RESULTS AND DISCUSSION**

### **Quality Control Flow with**

To describe the series of quality control processes that will be carried out on BRG 0701 type Safety Shoes products, a production process flow is made.



Description : BMI : *Incoming Material Test*

IT : *Intermediate Test*

FT : *Final Test*

**Quality Control with Check Sheet**

In carrying out statistical quality control, the step that will be taken is to make a *check sheet*.

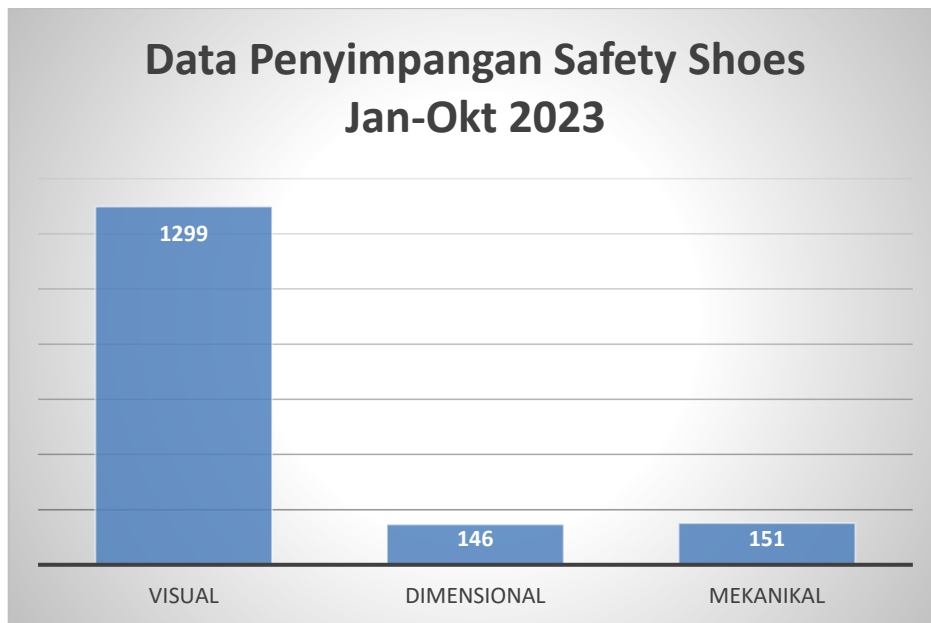
**Number of Safety Shoes deviations in 2023**

No	Moon	Year	Sum Production (PS)	Types Of Deviations			Sum Deviation (PS)	Percentag e Deviation %
				Visual	Dimensional	Mekanikal		
1	January	2023	3471	120	9	9	138	9%
2	February	2023	4503	156	12	12	180	11%
3	March	2023	4794	120	11	8	139	9%
4	April	2023	851	96	5	3	104	7%
5	May	2023	1354	89	12	32	133	8%
6	June	2023	2301	123	8	9	140	9%
7	July	2023	1497	170	12	8	190	12%
8	August	2023	1974	178	23	7	208	13%
9	Septembe r	2023	1963	124	46	9	179	11%
10	October	2023	2078	123	8	54	185	12%
	<b>Total</b>		24786	1299	146	151	1596	6%

To meet company standards, the percentage of defective products in one year must be less than 5% of the total production of Safety Shoes in Binusa. However, in the analysis of deviations, it was revealed that the highest type of deviation occurred in the visual aspect, where there were a total of 1596 cases of visual defects out of a total production of 24, 784 PCS.

***Histogram Item Reject Safety Shoes BRG 0701***

The next step is to create a histogram to determine the most visual aberrations.



**BRG 0701 S1P Safety Shoes deviation data for 2023 Jan-2023 Oct**

Based on the histogram analysis in Figure , it can be concluded that the most dominant type of BRG 0701 S1P Safety Shoes deviation is visual deviation, with the amount reaching 1,596 PS in August. Furthermore, there will be a significant increase in the type of mechanical deviation in May 2023.

**Safety Shoes Control Map**

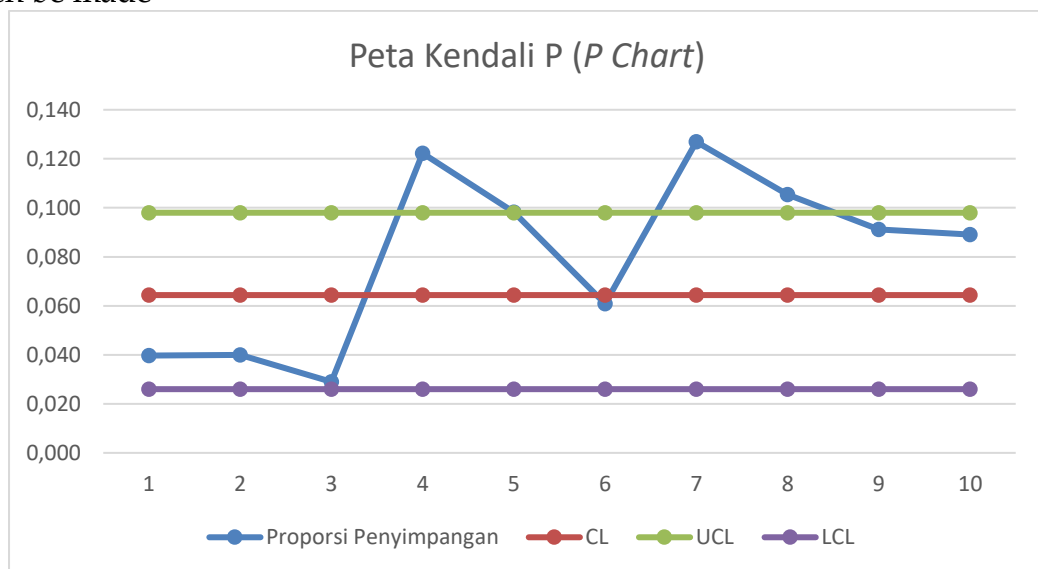
A control map is a graphical tool for statistically monitoring quality control by showing how data has changed over time. While it does not provide direct information about the causes of deviations, control maps provide a visual picture that helps identify patterns and anomalies. The steps of creating a control map involve goal setting, data collection, control limit calculation, graphing, pattern identification, analysis of the causes of deviations, and implementation of improvements. By utilizing control maps, organizations can effectively manage processes and improve the quality of products or services on an ongoing basis.

If the value of the *Lower Control Limit* (LCL) is negative, then the LCL is considered 0. For the complete calculation results of the control map p can be seen in Table below:

**Table of the Number of *Safety Shoes* Deviations in 2023**

Sub Group	Month	Total Production (PCS)	Number of deviations (PCS)	Proportion of deviations	CL	UCL	LCL
1	January	3.471	138	0,040	0,064	0,098	0,026
2	February	4.503	180	0,040	0,064	0,098	0,026
3	March	4.794	139	0,029	0,064	0,098	0,026
4	April	851	104	0,122	0,064	0,098	0,026
5	May	1.354	133	0,098	0,064	0,098	0,026
6	June	2.301	140	0,061	0,064	0,098	0,026
7	July	1.497	190	0,127	0,064	0,098	0,026
8	August	1.974	208	0,105	0,064	0,098	0,026
9	September	1.963	179	0,091	0,064	0,098	0,026
10	October	2.078	185	0,089	0,064	0,098	0,026
	<b>Total</b>	24.786	1596				

This process is then repeated for the following months., then a map can then be made

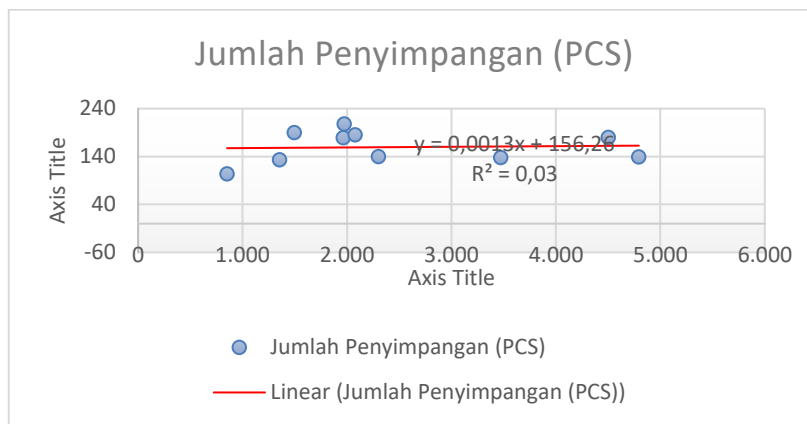


**P Chart of product deviations**

Based on the image on the control map p above, it can be seen that there is data that is outside the control limit, namely at points 4 and 7. By referring to the Table, it can be seen that points number 4 and 7, which are outside the limits of UCL's control, occur in August 2023 with the amount of production as much as PS and has the number of

### Scatter Diagram

A scatter chart is used to determine the strength of the relationship between two variables. Its main function is to find out if there is a relationship between two variables. In the study, the variable tested was the number of deviations from January 2023 to October 2023, while the variable observed was the amount of product production. Safety Shoes January 2023 to October 2023. The results of the variable test can be seen in the picture



**Scatter diagram of the amount of deviation of Safety Shoes products**

Source: Data processed, 2023

The above statement indicates that there is a correlation of 3% between the number of deviations from Safety Shoes products and the amount of production of Safety Shoes products. However, this does not apply to Safety Shoes products, where no correlation is found between the number of deviations from Safety Shoes products and the amount of production of Safety Shoes products. Therefore, it is advisable to look for other factors that can be the cause of visual deviations in the BRG 0701 S1P Safety Shoes product.

### Conducting Interviews

The results of the interview regarding the causes of visual deviations in Safety Shoes products below. In an effort to identify the cause of visual deviations in Safety Shoes products, we conducted interviews with five employees who have important roles in various areas of production. The following are the results of interviews with the resource persons listed in Table 4.4: First, Indra S, Warehouse Leader, provides insight into the conditions in the warehouse, highlighting potential errors that may occur in material handling and storage. Rina, Cutting Leader, emphasized critical aspects related to the material cutting process that can affect the quality of the final Safety Shoes product. Aldi S, Warehouse Helper, provides a perspective from an operational

point of view in the Warehouse, focusing on material placement and process handling.

No	Human Causative Factors
1	Non-compliance with standard operating procedures.
2	Lack of special training to handle production equipment.
3	Incapacity or lack of resources
4	Lack of Supervision or supervision
5	Incompetent operators

No	Material Causative Factors
1	Lack of Picking and Packing Efficiency
2	Contamination of the Material with foreign bodies.
3	Non-conformity of material with standards

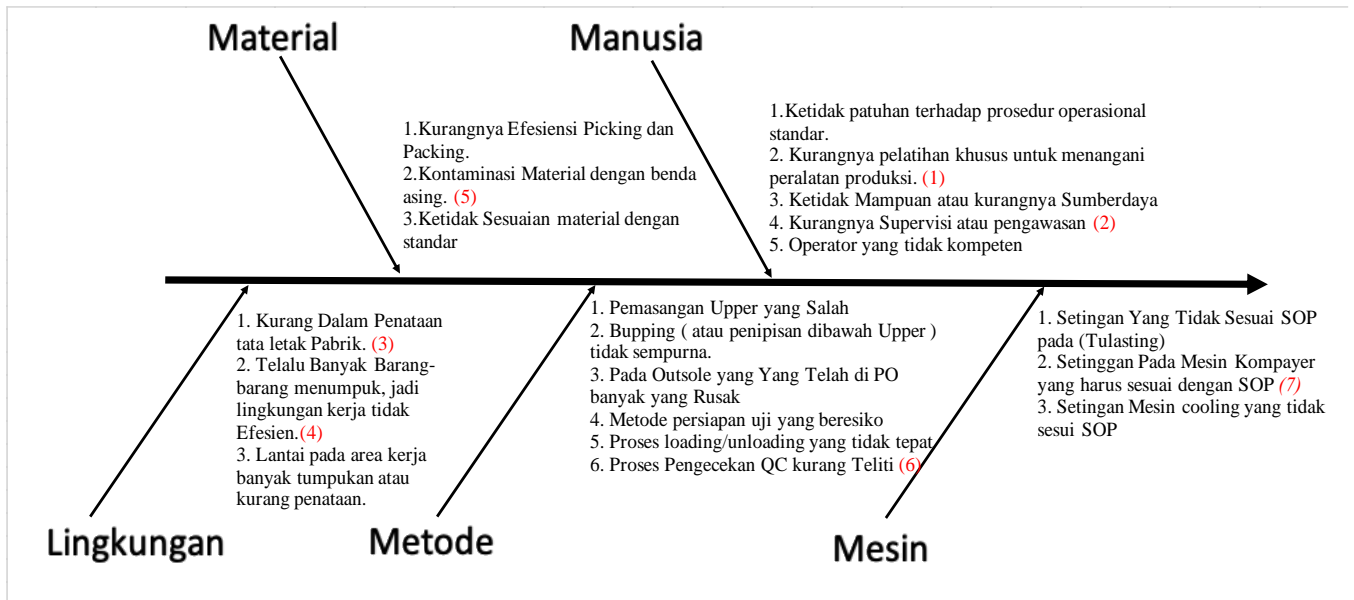
No	Causative Factors of the Method
1	Incorrect Upper Installation
2	Bupping (or thinning below the upper) is not perfect.
3	On the Outsole That Has Been in PO Many Are Damaged
4	Risky test preparation methods
5	Improper loading/unloading process
6	QC Checking Process is Less Thorough

No	Factors Causing the Machine
1	Settings That Do Not Comply with SOP on (Tulasting)
2	<i>Setting Up on a Thirsty Compayer Machine in accordance with SOP</i>
3	Cooling machine settings that do not comply with SOP

No	Environmental Causative Factors
1	Lacking in factory layout arrangement.
2	Too many things accumulate, so the work environment is not efficient.
3	The floor in the work area has many piles or lacks arrangement

### Create a Fishbone Diagram of Interview Results

The basic principle used in making Fishbone diagrams is through the results of a discussion session (Brainstorming). Based on the context of the problem, the main cause was visual deviation in 1,596 cases, accounting for 90% of the total deviation. Below is an overview of the cause-and-effect diagram for such cases of visual deviation.



### Fishbone Diagram

Based on the results of the analysis of the cause and effect diagram (*Fishbone salted*) by conducting discussions through Brainstorming, it can be seen in the Figure that there are 7 factors that cause problems that cause visual deviations in *Safety Shoes products*, namely:

- a. Lack of special training to handle production equipment.
- b. Lack of Supervision or supervision .
- c. Lacking in factory layout arrangement.
- d. Too many things accumulate, so the work environment is not efficient.
- e. Contamination of the Material with foreign bodies.
- f. The QC Checking Process is not Thorough.
- g. Setting on the Compayer Machine that must be in accordance with the SOP.

- 1) **Safety Shoes Specific Training:** Lack of training on the use of Safety Shoes and assembling machines can hamper operator efficiency. The solution is to provide comprehensive training covering the use of Safety Shoes, machine operation, maintenance, and emergency handling.
- 2) **Monitoring by PIC:** Lack of supervision can result in failure in production. The proposed solution is regular monitoring by the Person in Charge of Production (PIC) to ensure quality and smooth production.

- 3) **Factory Layout Changes:** Factory rearrangements are planned to improve efficiency and performance. This is expected to create a more optimal work environment and support increased productivity.
- 4) **Warehouse Arrangement:** To avoid annoying piles of goods, warehouse arrangement needs to be rearranged. This step will improve the efficiency, safety and accessibility of the material.
- 5) **Material Arrangement in Warehouse:** The risk of material contamination needs to be avoided with careful structuring. Warehouse employees are responsible for maintaining material integrity so that the final product meets quality standards.
- 6) **Improved QC Accuracy:** Meticulous checking is required to maintain product quality. Training and briefings for QC teams are proposed to increase rigor and identification of potential problems.
- 7) **Kompactor Machine Level:** The right machine level is important for the success of the production process. Comprehensive training for operators is proposed to ensure a solid understanding of the procedures and products produced.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the analysis and discussion in the previous chapter, conclusions were obtained to answer the problem formulation, including

- 1) The main cause of rejected goods in the production of Safety Shoes at PT Bina Usaha Sejahtera is the result of a number of factors found through the Fishbone Diagram. Such factors involve expanding specialized training, increased supervision, evaluating factory layout, more regular goods management, improved material control, more thorough QC inspection, and maintenance of machines according to SOPs. Comprehensively, the results of the discussion describe seven main factors that cause visual deviations in Safety Shoes products. First, the lack of specialized training in handling production equipment creates a knowledge gap that can result in visual errors. Second, lack of supervision or supervision becomes an important aspect that contributes to the occurrence of deviations. Furthermore, the inefficient arrangement of the factory layout aggravates conditions, followed by excessive accumulation of goods, hampering the efficiency of the work environment.
- 2) In overcoming the lack of rejected goods, PT Bina Usaha Sejahtera applies the Statistical Quality Control (SQC) method and uses 7 quality control tools. These tools, such as flowcharts, checksheets, histograms, Pareto diagrams, control maps, scatter diagrams, and cause and effect diagrams, are used to monitor, analyze, and understand patterns and causes of production deviations Safety Shoes. is a very relevant step in an effort to overcome visual deviations in products, especially in BRG 0107 type Safety Shoes. This approach has proven effective because it is able to detect variations in the

spread of visual aberration levels that exceed predefined control limits. Thus, PT BINUSATbk. can proactively take preventive measures against irregularities that occur.

3) The proposed improvements are based on a cause-and-effect diagram analysis, which identifies seven dominant factors that are the root cause of visual aberrations in Safety Shoes products. Through the 5W+1H (What, Why, Where, How, When, Who, How Much) approach, improvements are made with the aim of responding to every critical aspect that affects product quality.

### **FURTHER STUDY**

Future research can develop a more comprehensive methodology by considering other factors that affect product quality. The development of more specific performance indicators can facilitate the evaluation of the results of operational changes. Further collaboration with industry experts or quality consultants can bring additional perspectives and innovative solutions. Finally, sustainability studies involving continuous monitoring and evaluation can provide deeper insight into the long-term impact of operational change. By taking into account these suggestions and directions, it is hoped that future research can make a greater contribution to understanding and improvement in the context of Safety Shoe production.

### **ACKNOWLEDGMENT**

Suggestions for This Study:

This research provides in-depth insight into the causes and improvements in the production of Safety Shoes at PT Bina Usaha Sejahtera. Nonetheless, some suggestions can be given for improving the quality and relevance of this research. First, the expansion of analysis into economic and social aspects can provide a more comprehensive view of the impact of operational change. A more in-depth economic evaluation related to redesigning production flows can also be a valuable addition. In addition, research may involve long-term monitoring to evaluate the effectiveness of training programs on operator skills and product quality.

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