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IMPLEMENTATION OF STATISTIC PROCESS CONTROL IN FLAT SHOES AND HIGH HEELS PRODUCTION PROCESS

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Abstract---*The company implements quality control in order to improve the quality of products or services, increase productivity by reducing defective products, anticipate mismatches in the production process so that the products produced are still in accordance with the standards and specifications set by the company. The purpose of this study is to identify factors, constraints that affect the process of controlling the quality of flat shoes and high heels products that are carried out by the company. The research method uses descriptive analysis through Pareto diagrams, causal diagrams, control maps p and map controls c. The results of data processing indicate that the company has made several efforts to suppress the defective products produced. Analysis using Control Chart makes it easier to see the most dominant factors and constraints, and will get the results that must be done by the company to suppress improper production processes.*

Keywords---*Pareto diagram, causal diagram, control p-chart, control c-chart.*

I. INRODUCTION

Along with the times and economic development, the characteristics of the business world today are rapidly marked in all fields that require management expertise or business owners to control quality, and quality control itself has begun to be applied by various companies in the world, including Indonesia. The company carries out quality control, it will benefit, as the company can improve the quality of products or services, increase productivity by reducing defective products, anticipate mismatches in the production process so that the products produced are still in accordance with the standards and specifications determined by the company.

Well-run Quality Control will have an impact on the quality of well-produced products which will have an impact on the quality of products produced by the company. Quality standards including raw materials, production processes and finished products. Therefore quality control activities can be carried out starting from raw materials, during the process, and until the finished product has been adjusted to the standards set.

In the business world whether it is the nature of production or service, a quality program is the main program because business progress is determined by quality according to demand. In line with that, the quality of products provided must always be improved. Statistical quality control is used as a problem solving technique to monitor, control, analyze, manage, and improve products and processes using statistical process control methods. Problems that occur in the company still produce damaged women's shoes, including:

1. The problem of lack of employee knowledge about production

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2. There are still implementations of SOPs by employees
3. There are still a number of skilled employees

II. LITERATURE REVIEW

Quality is a feature and overall characteristics of a product or service that is able to satisfy the needs seen or disguised. The definition of the quality of a product is a relative term that is very dependent on the situation in terms of the views of consumers, people who are subjective say quality is something that is in accordance with the fit , suitability to use. Quality dimensions are measurement factors used to assess quality. Eight dimensions of quality are Performance, Durability, Conformity, Perception Quality, Features, Aesthetics, Reliability, Serviceability. Three reasons for the importance of quality for companies to continue to survive in the market, namely Corporate Reputation, Product Reliability, Global Engagement.

Quality control is a technique and operational activities used to meet quality requirements. To obtain effective quality control results, quality control of a product can be implemented using quality control techniques, because not all production products are in accordance with the standards set. There are several quality standards that can be determined by the company in an effort to maintain the output of goods produced including:

1. Quality standards for raw materials used
2. Quality standards of the production process (machines and labor that carry it out)
3. Standard quality of semi-finished goods
4. Standard quality of finished goods
5. Standard administration, packaging and shipping of final products to consumers.

In general, control or quality control in manufacturing companies is carried out in stages including:

1. Inspector and quality control of raw materials (raw materials, auxiliary raw materials and so on), quality of materials in the process and quality of finished products. Similarly, the number and composition of standards.
2. Product inspectors as a result of the manufacturing process. This applies to finished goods and finished goods. The inspection carried out illustrates whether the production process runs as determined or not.
3. Check ways of packaging and shipping goods to consumers. Perform a fact analysis to determine possible irregularities.

Labor machines and other facilities used in the production process must also be monitored in accordance with the standards of need. If there is a deviation, correction must be made to ensure that the product meets the planned standards.

Operation tasks in determining the critical point to focus attention on the production process, so that the quality of production can be fulfilled. Achieving quality targets will benefit the company in placing its position in the market (market position). Thus the quality is beneficial to the company in determining the company's reputation, product liability, global implications.

Statistical process control is a statistical technique that is widely used to ensure that the process meets the standards. In other words, Statistical Process Control is a process used to monitor standards, take measurements and take corrective actions when a product or service is produced. Statistical quality control using SPC (Statistical Processing Control) has 7 tools that are very useful in measuring and controlling quality, including:

1. Flow Chart
2. Pareto diagram (Pareto analysis)
3. Check the Sheet

4. Causal diagram

5. Bar chart (Histogram)

6. Spread Diagram

7. Control chart

Disabilities in a product are classified into 3 categories:

1. Critical defects, a form of defect in which assessment and experience indicate that a defective product will produce dangerous or unsafe conditions for people who use, store or depend on the product, and make the product unable to perform well.

2. Essential defects, a form of defect that is not critical but can result in failure or material will reduce the level of use of the product unit. Essential defects can result in serious consequences or lawsuits, so this type of disability must be monitored and controlled carefully.

3. Minor defects, defects that do not significantly reduce the use of a product, or have an important impact on the effectiveness of the use or operation of the product. This type of defect can cause customer dissatisfaction.

III. RESEARCH METHOD

The methodology of this research is using qualitative data analysis and quantitative data analysis. Analysis of qualitative data using fishbone diagrams (to see factors causing failure in more detail that have an effect and have a big impact on factors) and pareto diagrams, create employee descriptions.

While in conducting quantitative data analysis, the authors use some measuring tools commonly used in quality control research that is by using control diagrams, such as:

1. Control *P-chart* is used to analyze the number of product defects.

Calculates the percentage of data disability data

$$\bar{p} = \sum_{i=1}^{n} np \qquad \text{Eq. (1)}$$

where :

$\bar{p}$ = proportioneach sample

x = number of defective products in each sample

n = number of samples taken in inspection

Calculates center line (CL) which is the average of product defect

$$CL = \bar{p} = \frac{\sum_{i=1}^{n} np}{n} \qquad \text{Eq. (2)}$$

Calculates the upper limit (UCL) and lower limit (LCL)

$$UCL = \bar{p} + 3\sqrt{\frac{\bar{p}\,(1-\bar{p})}{n}} \qquad \text{Eq. (3)}$$

$$LCL = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \qquad \text{Eq. (4)}$$

If the data obtained is not entirely within the prescribed control limit, then in this case the data taken not yet uniform. It states that the quality control that is done still requires improvement. This can be seen if there is a point that still suffers irregularities.Therefore, it is necessary to create a new control limit on the data studied in order to obtain uniformity of data. This can be done by eliminating data that is smaller than the lower control limit (LCL) and the data is greater than the upper control limit (UCL) for each sample.

2. Control *C-chart* marks "count" or arithmetic defects. In a sempel how many defects are encountered regardless of the type of defect. All defects are in accordance with the prescribed limitations that occur on each product.

$$\bar{c}=\frac{\sum c}{k} \quad \text{Eq. (5)}$$

$$\text{UCL} = \bar{c} + 3\sqrt{\bar{C}} \quad \text{Eq. (6)}$$

$$\text{LCL} = \bar{c} - 3\sqrt{\bar{C}} \quad \text{Eq. (7)}$$

Plot the data of the number of defects of each subgroup checked and observed whether the data is in control or out of control (Yu et al., 2019).

IV. RESULT AND DISCUSSION

The production process for the January to December 2015 data is taken and the products studied are High Heels and Flatshoes. Factors that Affect the process of quality control of products that occur in the company include labor (male sex of all age between 24-35 years and junior high school or senior high school), raw materials (the company uses raw materials in the form of special cloth shoes, special leather shoes and shoe soles), machinery and equipment (the company has three sewing machines, three machinessisit, and two press machines and equipment such as glue, latex, soles, scissors, hammer, thread, and knives), working methods (raw material selection → pattern making → shoe face making → sol → finishing), work environment (work hours 9am-5pm with the number of employees 5 people).

The first control obtained from High Processes shows that the central line at 0.006, UCL at 0.016 and LCL at 0. From the first production process High Heels in January, July and October the number of defects exceeds the control UCL limits so that the revision process and CL value are 0.004. The Second High Heels production process shows that the central line at 0.007, UCL at 0.018 and LCL at 0. From the second production process the number of defects exceeds the UCL control limits so that the revision process and obtained the value of CL for 0.006. Third Production Process High Heels found that the central line of 0013 with UCL of 0025 and LCL of 0. The fourth production process of High Heels found that the central line of 0011 with UCL of 0028 and LCL of 0.

First Flatshoes production process found that the central line of 0006 with UCL of 0016 and LCL of 0. From the first production process Flatshoes in August the number of defects exceeds the control limit UCL so that the process revision and CL value of 0.002 is obtained. Second production process Flat shoes found that the central line of 0.012 with UCL of 0.019 and LCL of 0.005. From the secondproduction process of Flatshoes in May and December the number of defects exceeds the control limits UCL so that the process revision and CL value is 0:01. Third production process Flat shoes found that the central line of 0.012 with UCL of 0.019 and LCL of 0.005. From the third production process Flatshoes in May the UCL control limit limit so that the process revision and CL value is 0.008. Fourth production process Flatshoes found that the central line of 0.001 with UCL of 0.017 and LCL of 0.003. From the fourth production, the number of defects exceeds the UCL control limit so that the process revision and CL value is 0.009.

By using the control c-chart obtained by the production process of the High Heels with a central line of 0.5, UCL of 2.621 and LCL of 0. While for the production process Flatshoes are obtained from the central line of 0.4 with UCL of 2.297 and LCL of 0.

Based on the use of Pareto diagram, the cause of the High Heels shoes failure was 35% due to loose threads, 30% hole shoes due to sutures, 20% due to improper gluing, 15% due to wrong stitching pattern.While Flat shoes' failure factor is

9.38% due to wrong stitching pattern, 35.93% due to improper pattern, 26.56% due to loose thread, 28.13% of shoe holes because of stitches.

Based on causal diagrams, the first cause of failure is caused by the pattern not suitable because of human factors (negligence in doing the task), equipment (equipment not well maintained). The second factor is due to improper gluing process, equipment (the glue used is not the match material used), the raw material (the misuse of raw material not in accordance with SOP). The third factor is because the thread is sagging. This is the engine factor (the engine experiences constraints when used), humans (employees do not understand the maintenance of the machine). The fourth factor is the shoe because of the caused by human factors (the employees are not the following pattern), the machine (the machine is jammed so that when employees do re-sneak shoes will be hollow), raw materials (used t oo easy to damage raw materials).

V. CONCLUSION

The company has carried out quality control to support the company's product quality standards starting from raw materials, production processes to finished goods. The company controls the production process from each process so that it can be seen which processes are experiencing problems or problems. The company also controls the quality of finished products by identifying which products are suitable for marketing and which products are not marketable. The use of a control map in the form of a control chart p and a control map c in controlling the product quality of shoes heels and flatshoes can identify the quality of products of shoes heels and flatshoes that are still outside the control limits that must be used.

Based on the Pareto diagram, the repair priority that needs to be done from the production process is the production process at the stage of making shoe faces and the stage of making shoe soles where in this process the shoe face with soles is put together using glue. Based on the analysis of cause and effect, it can be seen that the main cause of disability factors is human error. The company has been doing business in handling products related to the production process by improving machinery, methods, raw materials and awards.

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