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# Application of Six Sigma and FMEA Methods for Defect Reduction in Woven Bag Production

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Abstract— This study aims to reduce the number of defects in the production of woven bags, which experiences product defects ranging from 4.1% to 5.4%. The method used is Six Sigma with the DMAIC (Define, Measure, Analyze, Improve, Control) approach to improve product quality. Root cause analysis was carried out using fishbone diagrams and Failure Mode and Effect Analysis (FMEA) which identified four main factors causing defects, namely humans, machines, materials, and methods. The results showed that the defects that had the most effect on the production process were perforated weaving, stretched weaving, and miss print. From the data analyzed for the period January to December 2024, a Defects Per Million Opportunities (DPMO) value of 6,746,655 and a sigma level of 3.97 were obtained, which shows that even though the production process is good enough, there is still room for improvement. Improvement recommendations include increased quality supervision and regular calibration of machines to achieve better quality targets. With the application of the Six Sigma method, it is hoped that the company can achieve a significant reduction in the defect rate and improve overall production performance.

Keywords— DMAIC, FMEA, Product quality, Six Sigma, Woven bag

## I. Introduction

The manufacturing industry in Indonesia continues to experience rapid growth, in line with the increasing need of the domestic and international markets for various types of products [1]. In the face of increasingly fierce competition, every manufacturing company is required to continue to improve the quality of the products produced to meet the standards set by customers and maintain a reputation in the market [2]. PT XYZ is a company engaged in the plastic weaving industry with a main focus on the production of woven bags or plastic sacks that are widely used in various sectors, such as the food, agriculture, and chemical industries. The company produces various types of woven bags ranging from 25 kg, 50 kg, and 100 kg sizes. The production process of 25 kg woven bags at PT XYZ has a percentage of defective products, which is around 4.1 – 5.4% of the total production. This condition shows that the quality control system implemented still needs to be improved to minimize the number of products that do not meet standards and avoid potential losses due to products that must be repaired or discarded. This still exceeds the limit allowed by the company of 3% and still has not reached zero defects as an effort towards perfection [3]. If effective corrective actions are not taken immediately in the form of a quality control system, the existence of these defects can hinder the company's productivity, increase the number of products that must undergo repair (rework), and contribute to the high level of waste in the production process [4].

One way to produce quality in accordance with predetermined standards or specifications is to implement an appropriate and appropriate quality control system so that it can help companies improve product quality [5]. To overcome these problems, this study aims to reduce the number of defects in the production of woven bags at PT XYZ by applying the Six Sigma method as a data-based quality improvement strategy. Six Sigma is a quality management method that focuses on reducing variations in the production process to improve the efficiency and quality of the products produced [6]. By applying the Six Sigma method, the company is expected to identify the root of the problem more systematically, significantly reduce the defect rate, and improve overall production performance. Therefore, this research has several stages to improve the quality of six sigma, namely Define, Measure, Analyze, Improve, and Control (DMAIC. In the Analyze stage, the Failure Mode and Effect Analysis (FMEA) method is used.

## II. RELATED WORKS

### A. Quality

Quality is very important and must be considered in the manufacture of a product. Good or poor quality of the product will affect the number of demand and the level of safety of the product. Therefore, the quality of existing products needs to be controlled and controlled to suit the desires and demands of the market [7]. Every company has advantages that are claimed to be a guarantee of the quality of its products. In addition to being important for consumers, quality is also important for business actors. The sustainability of his business is determined by the quality of the products he produces. With quality products, consumers will be interested in buying their products [8].

### B. Quality Control

Quality control is an important factor related to the production process, where each activity includes inspection or testing of the quality characteristics of the products produced [9]. Quality control is a series of activities to try to make the finished goods from the production process right in accordance with subscription needs and on time and on target [10]. Quality control is a process in which products are thoroughly inspected and evaluated, compared to the needs of the customers. [11].

### C. Product Defects

In the explanation [12] Regarding defective products, it is a good or service that is made in the production process but has shortcomings that cause the quality value to be less good or less than perfect. The occurrence of these defective products can actually be reduced or prevented by the company from producing properly from the beginning. With the creation of these defective products, companies or entrepreneurs will suffer losses. This is because defective products are not suitable to be sold with the standards that have been determined by the company beforehand. [5]**.**

### D. Six Sigma

Six Sigma is defined as a business process improvement method that aims to identify and reduce factors that cause defects and losses, reduce operating time and costs, increase productivity, meet customer needs more effectively, achieve maximum asset utilization levels, and obtain better investment returns in terms of production and service [13]. Six Sigma as a measurement system uses Defect Per Million Opportunities (DPMO) as a measurement. DPMO is a good measure of the quality of a product or process, because DPMO is directly correlated with defects, costs and wasted time [14]. DPMO is a measure of failure in a Six Sigma quality improvement program, which shows failures per million times. Motorola's Six Sigma quality control target of 3.4 [15]. SPC (*Statistical*

*Process Control*) is a method for data collection and analysis to be completed by the Practical Quality method [16].

**E. Stages - Quality Control Stages with Six Sigma**

The stages of implementing quality improvement with six sigma consist of five (5) as follows:

***1) Define***

Define aims to identify products or processes to be improved [17].

***2) Measure***

At the measure stage, the mean value is calculated, the Lower Critical Limits (LCL) and Upper Critical Limits (UCL) values are calculated, the Defect Per Unit (DPU) value is determined, the Defect per Million Opportunity (DPMO) value is determined, and the DPMO value is converted into a six sigma value [18].

***3) Analyze***

At the stage *analyze* This is an analysis of the stability of the process to find out whether product defects during the process are in a controllable state or not [19].

***4) Improve***

Stages *improve* is a stage that aims to provide improvement recommendations to improve product quality, reduce defective products so that there is an increase in sigma value [8].

***5) Control***

The control phase is to ensure that process implementation, performance measurement, and results can run smoothly and efficiently, as well as to prevent the need to adapt process activities to changing customer needs [20].

**F. Failure Mode and Effect Analysis (FMEA)**

The FMEA method is one of the most well-known and widely used proactive risk assessment methods in the industry. Failure Mode is the failure of a product or process according to its function or cause of failure while Effect Analysis is analyzing the possible consequences of each failure [21]. With FMEA analysis, each root of the problem is searched for its RPN value (*Risk Priority Number*). The highest RPN value is the main cause of the problems faced [22]. From the FMEA process, there will be several stages carried out, from the process of the stages to complete the FMEA, a score will be obtained to be used as a proposed improvement [23].

## III. METHOD

**A. Stages of Data Collection**

***1) Identification and Definition of Operational Variables***

The identification of variables in this study was carried out to determine the variables measured based on data from PT XYZ. These variables are bound variables and independent variables.

a. *Independent Variables*
   1. Data on the production of 25 kg woven bags from January 2024 – December 2024.
   2. Data on the types of defects of perforated weaves, stretched weaves, and miss prints in woven bag production.

b. *Bound Variables*

   The variables tied to this study are the production quality of defect woven bags including the percentage of defective products, DPMO value, sigma level.

***2) Data Collection Techniques***

a. Field Studies

Conducting direct field studies to observe the production process of making woven bags.

b. Studi Literature
   Data collection and study and seek information about risks and related issues.
c. Interview
   carried out by researchers in each *woven bag production process* with workers and managers to find out the order of the production process, the type of *defect* produced and the cause of the defective product.

## B. Research Flowchart

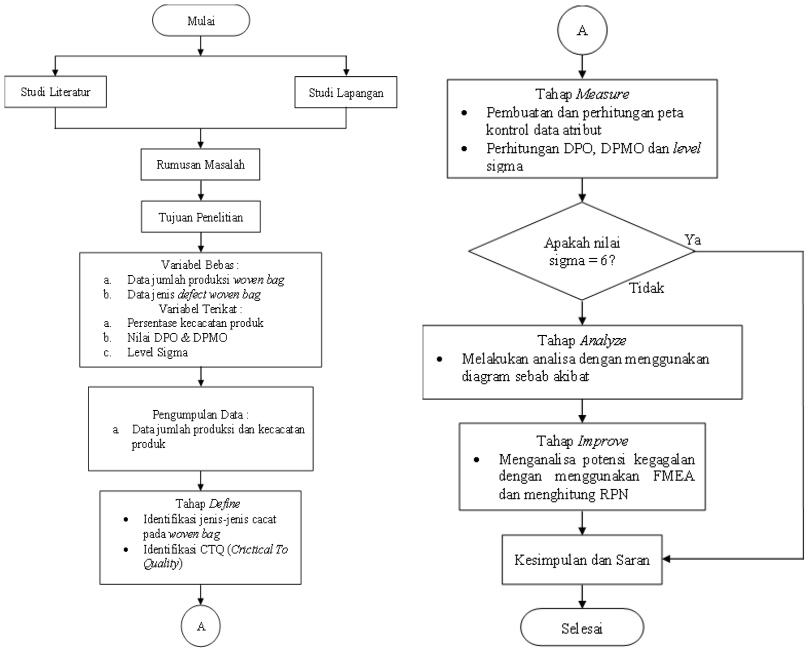


Figure 1. Flowchart

Research Flowchart This figure presents the overall research flow, outlining the systematic steps taken in this study. The process begins with identifying problems in the woven bag production process at PT XYZ, followed by the application of the DMAIC method, Define, Measure, Analyze, Improve, and Control. Each stage is aligned with Six Sigma principles to ensure quality enhancement. The flowchart also integrates data collection techniques such as observation, interviews, and literature reviews, leading to root cause analysis and formulation of corrective actions through FMEA. This structured framework ensures that every decision in the research is grounded in empirical data and quality improvement logic.

# IV. RESULT AND DISCUSSION

## A. Data on Production Quantity and Product Defects

After data collection, it can be found that the number of production and defects of woven bag products in January 2024 – December 2024.

Table 1.
Data on Production Quantity and Defects of Woven Bag Products January 2024 – December 2024

| Month Production | Production Quantity (Kg) | Product Defect Type (kg) | | | Number of Defective Products (Kg) | Percentage (%) |
|---|---|---|---|---|---|---|
| | | Perforated Webbing | Weaving Stretchy | Miss Print | | |
| January | 262.183 | 5.245 | 5.443 | 4.943 | 15.631 | 5,6% |
| February | 276.930 | 5.546 | 5.638 | 5.438 | 16.622 | 5,7% |
| March | 336.030 | 7.221 | 6.520 | 6.625 | 20.366 | 5,7% |

| Month Production | Production Quantity (Kg) | Product Defect Type (kg) | | | Number of Defective Products (Kg) | Percentage (%) |
|---|---|---|---|---|---|---|
| | | Perforated Webbing | Weaving Stretchy | Miss Print | | |
| April | 261.693 | 5.334 | 5.633 | 5.233 | 16.200 | 5,8% |
| May | 281.641 | 5.833 | 5.732 | 5.532 | 17.097 | 5,7% |
| June | 250.628 | 4.713 | 5.512 | 4.912 | 15.137 | 5,7% |
| July | 331.362 | 6.727 | 6.555 | 6.627 | 19.909 | 5,7% |
| August | 363.085 | 7.362 | 7.361 | 7.361 | 22.084 | 5,7% |
| September | 248.342 | 5.167 | 5.066 | 5.316 | 15.549 | 5,9% |
| October | 266.626 | 5.833 | 5.532 | 5.232 | 16.597 | 5,9% |
| November | 210.206 | 4.304 | 4.304 | 3.804 | 12.412 | 5,6% |
| December | 216.945 | 4.539 | 4.339 | 4.238 | 13.116 | 5,7% |
| Sum | 3.305.671 | 67.824 | 67.635 | 65.261 | 200.720 | |

**B. Stages - Quality Control Stages with Six Sigma**

The stages of implementing quality improvement with six sigma consist of five (5) cycles, namely the DMAIC cycle (Define, Measure, Analyze, Improve, Control) which is as follows:

***1) Define***

Sourced from data from PT. Yanaprima Hastapersada, Tbk, the following is the percentage of product defects that have been displayed in the table below:

Table 2.
Percentage of Defects and Cumulative Defects

| Recapitulation of Types of Defects | | | |
|---|---|---|---|
| **Jenis *Defect*** | **Jumlah *Defect*** | **Persentase *Defect*** | **Cumulative Percentages** |
| Perforated Webbing | 67,824 | 34% | 34% |
| Loose Woven | 67,635 | 34% | 67% |
| *Miss Print* | 65,261 | 33% | 100% |

***2) Measure***

The first step in the measure stage is to process data on the quality control of statistical processes.

**a. Perforated Weave Control Map**

Table 3.
2024 Results of Calculation of Proportion of Defects, CL, UCL, and LCL Defects of Perforated Weaving January 2024 - December 2024

| Moon | Production Quantity | Perforated Webbing | P | CL | UCL | LCL |
|---|---|---|---|---|---|---|
| January | 262183 | 5245 | 0.0200 | 0.0205 | 0.0213 | 0.0197 |
| February | 276930 | 5546 | 0.0200 | 0.0205 | 0.0213 | 0.0197 |
| March | 336030 | 7221 | 0.0215 | 0.0205 | 0.0213 | 0.0198 |
| April | 261693 | 5334 | 0.0204 | 0.0205 | 0.0213 | 0.0197 |
| May | 281641 | 5833 | 0.0207 | 0.0205 | 0.0213 | 0.0197 |
| June | 250628 | 4713 | 0.0188 | 0.0205 | 0.0214 | 0.0197 |
| July | 331362 | 6727 | 0.0203 | 0.0205 | 0.0213 | 0.0198 |
| August | 363085 | 7362 | 0.0203 | 0.0205 | 0.0212 | 0.0198 |
| September | 248342 | 5167 | 0.0208 | 0.0205 | 0.0214 | 0.0197 |
| October | 266626 | 5833 | 0.0219 | 0.0205 | 0.0213 | 0.0197 |

| Moon | Production Quantity | Perforated Webbing | P | CL | UCL | LCL |
|---|---|---|---|---|---|---|
| November | 210206 | 4304 | 0.0205 | 0.0205 | 0.0214 | 0.0196 |
| December | 216945 | 4539 | 0.0209 | 0.0205 | 0.0214 | 0.0196 |
| Total | 3305671 | 67824 | | | | |

Control map p for the type of perforated woven defect can be seen in the image below:

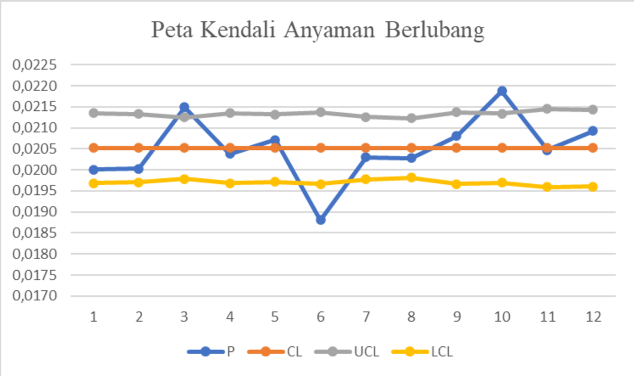


Figure 2. Control Map P On Perforated Woven Defect

This figure illustrates the control chart for perforated woven defects from January to December 2024. Most of the points fall within the control limits, indicating that the process is statistically under control, although variations in monthly proportions exist.

**b. Loose Webbing Control Map**

Table 4.
Results of Calculation of Proportion of Defects, CL, UCL, and LCL Defects of Loose Weaving January 2024 - Desember 2024

| Mountain | Production Quantity | Loose Woven | P | CL | UCL | LCL |
|---|---|---|---|---|---|---|
| January | 262183 | 5443 | 0.0208 | 0.0205 | 0.0213 | 0.0196 |
| February | 276930 | 5638 | 0.0204 | 0.0205 | 0.0213 | 0.0197 |
| March | 336030 | 6520 | 0.0194 | 0.0205 | 0.0212 | 0.0197 |
| April | 261693 | 5633 | 0.0215 | 0.0205 | 0.0213 | 0.0196 |
| May | 281641 | 5732 | 0.0204 | 0.0205 | 0.0213 | 0.0197 |
| June | 250628 | 5512 | 0.0220 | 0.0205 | 0.0213 | 0.0196 |
| July | 331362 | 6555 | 0.0198 | 0.0205 | 0.0212 | 0.0197 |
| August | 363085 | 7361 | 0.0203 | 0.0205 | 0.0212 | 0.0198 |
| September | 248342 | 5066 | 0.0204 | 0.0205 | 0.0213 | 0.0196 |
| October | 266626 | 5532 | 0.0207 | 0.0205 | 0.0213 | 0.0196 |
| November | 210206 | 4304 | 0.0205 | 0.0205 | 0.0214 | 0.0195 |
| December | 216945 | 4339 | 0.0200 | 0.0205 | 0.0214 | 0.0195 |
| Total | 3305671 | 67635 | | | | |

Control map p for the type of loose woven defect can be seen in the image below:

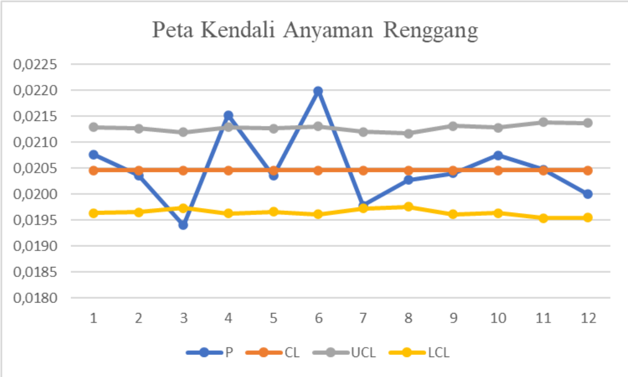


Figure 3. Control Map P On Loose Weaving Defect

The chart shows the defect proportions for loose weaving. The control limits demonstrate that the process remains stable, but some data trends indicate areas for potential improvement.

## c. Miss Print Control Map

Table 5.
Results of Calculation of Defect Proportions, CL, UCL, and LCL Defect Miss Print January 2024 - December 2024

| Moon | Production Quantity | Miss Print | P | CL | UCL | LCL |
|---|---|---|---|---|---|---|
| January | 262183 | 4943 | 0.0189 | 0.0197 | 0.0206 | 0.0189 |
| February | 276930 | 5438 | 0.0196 | 0.0197 | 0.0205 | 0.0189 |
| March | 336030 | 6625 | 0.0197 | 0.0197 | 0.0205 | 0.0190 |
| April | 261693 | 5233 | 0.0200 | 0.0197 | 0.0206 | 0.0189 |
| May | 281641 | 5532 | 0.0196 | 0.0197 | 0.0205 | 0.0190 |
| June | 250628 | 4912 | 0.0196 | 0.0197 | 0.0206 | 0.0189 |
| July | 331362 | 6627 | 0.0200 | 0.0197 | 0.0205 | 0.0190 |
| August | 363085 | 7361 | 0.0203 | 0.0197 | 0.0204 | 0.0190 |
| September | 248342 | 5316 | 0.0214 | 0.0197 | 0.0206 | 0.0189 |
| October | 266626 | 5232 | 0.0196 | 0.0197 | 0.0206 | 0.0189 |
| November | 210206 | 3804 | 0.0181 | 0.0197 | 0.0207 | 0.0188 |
| December | 216945 | 4238 | 0.0195 | 0.0197 | 0.0206 | 0.0188 |
| Total | 3305671 | 65261 | | | | |

Control map p for the type of perforated woven defect can be seen in the picture below:

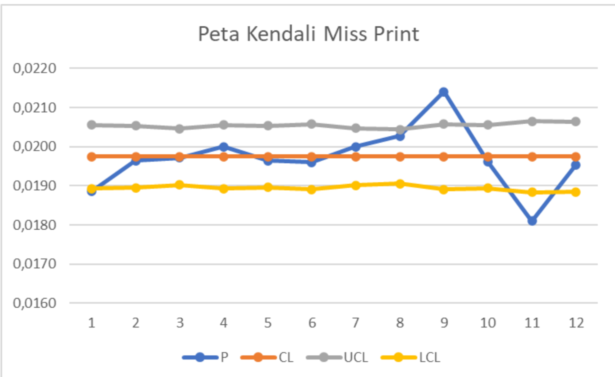


Figure 4. Control Map P on Defect Miss Print

This diagram visualizes the control chart for miss print defects, showing that defect rates are largely within acceptable bounds, signaling process capability, yet pointing to improvement areas.

***3) Analysis***

This stage is the third operational step in the DMAIC cycle, where at this stage the results of measurements that have been carried out in the previous stage are analyzed, and the root cause of each CTQ is also determined using a fishbone diagram.

a. Fishbone diagram *defect* perforated webbing

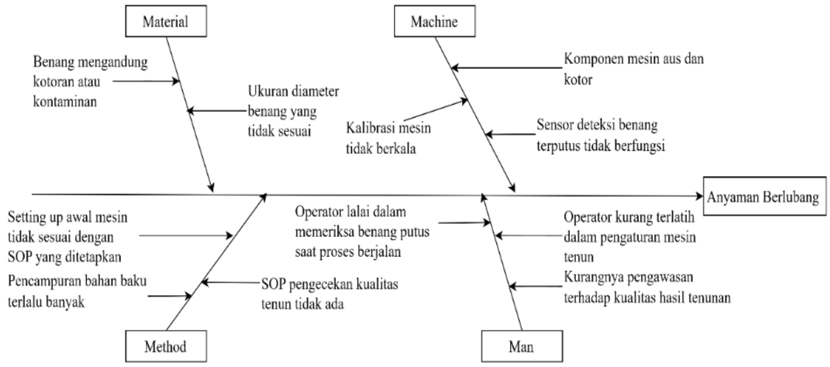


Figure 5. Fishbone diagram root of *the problem of* perforated weaving defects

This diagram identifies the root causes for perforated weaving defects, emphasizing issues in material cleanliness, machine calibration, and operator practices.

b. Fishbone diagram *defect of* stretched weaving

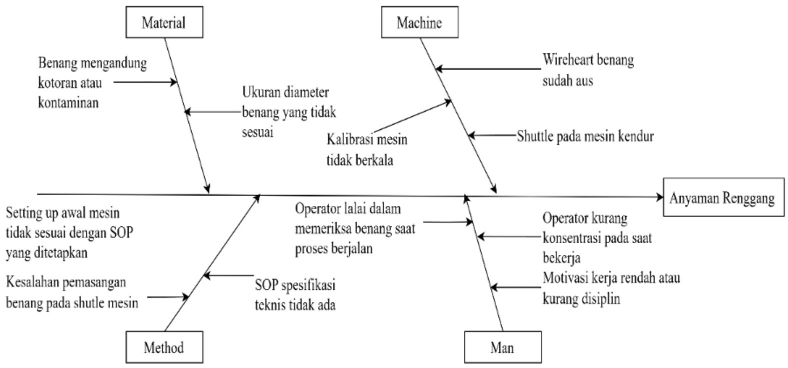


Figure 6. Fishbone diagram root of the problem *of* stretched weaving defects

The fishbone diagram highlights factors contributing to stretched weaving defects, such as improper machine settings, thread installation, and lack of operator focus.

c. Fishbone diagram *defect miss print*

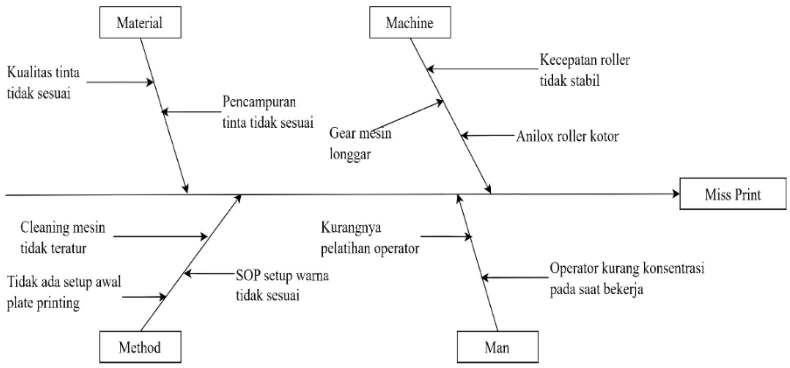


Figure 7. Diagram of fishbone root defect miss print problem

This fishbone chart outlines potential causes of miss print defects, focusing on ink quality, roller conditions, and procedural adherence by operators.

### *4) Improve*

In improve, several ideas will be proposed to make improvements to various kinds of defects that occur. The technique used at the improve stage is Failure Mode And Effect Analysis (FMEA). The application of FMEA in this improve stage is used to evaluate failures that occur and known failures that cause the greatest impact of product defect problems at PT XYZ.

### a. FMEA Defect Analysis of Perforated Weave

Table 6.
FMEA Defect Analysis of Perforated Weave

| No | Potential Causes | Effects of Failure | Value | | | | Recommended Improvements |
|---|---|---|---|---|---|---|---|
| | | | S | Or | D | RPN | |
| 1 | Yarn contains dirt/contaminants | Decreased weaving strength and product rejection | 8 | 6 | 5 | 240 | Thread quality inspection before production (Incoming Quality Control). |
| 2 | The size of the thread diameter does not match | Product durability decreases, structural defects | 8 | 5 | 6 | 240 | Test the dimensions of the thread diameter by periodic sampling. |
| 3 | Periodic machine calibration | Imprecise machine, broken thread, product defects | 9 | 5 | 7 | 315 | Preventive Maintenance program and monthly tool calibration. |
| 4 | Worn and dirty engine components | Inconsistent weaving results, repeated defects | 7 | 6 | 6 | 252 | Regular replacement of spare parts, strict cleaning SOPs. |
| 5 | Thread detection sensor not working | Thread break is not detected, large defect | 8 | 5 | 7 | 280 | Daily sensor function inspection before production. |
| 6 | Initial setting up of the machine is not in accordance with SOP | Threads are easy to break | 7 | 6 | 6 | 252 | Machine setup training and setting checklist before production start. |
| 7 | Mixing raw materials too much | Increased thread quality variation, defects | 7 | 5 | 5 | 175 | Standardization and control of mixing of raw materials. |
| 8 | Operator defaults on checking for broken threads | Thread breaks undetected, production output defective | 7 | 6 | 5 | 210 | Intensive supervision and visual alarm for thread break detection. |
| 9 | SOP for weaving quality check is not present | New defects detected at the end of production | 8 | 5 | 7 | 280 | Make SOPs for woven quality inspection in the middle of the process (in-process inspection). |
| 10 | Operators are poorly trained in machine settings | Setting is not optimal, thread breaks | 7 | 6 | 6 | 252 | Circular loom machine setting certification training |
| 11 | Lack of oversight of the quality of the results | Mass defects pass production | 9 | 5 | 7 | 315 | Routine quality in the production area, the implementation of QC sampling is stricter. |

### b. FMEA Defect Analysis of Stretched Weave

Table 7.
FMEA Defect Analysis of Stretched Weave

| No | Potential Causes | Effects of Failure | Value | | | | Recommended Improvements |
|---|---|---|---|---|---|---|---|
| | | | S | Or | D | RPN | |
| 1 | The yarn contains dirt or contaminants | The weave is not tight, the strength of the product drops | 8 | 5 | 5 | 200 | Tighten the QC of the yarn raw material, do cleaning before production. |
| 2 | The size of the thread diameter does not match | Variations in the thickness of the weaving, stretchy | 8 | 5 | 6 | 240 | Standardization of thread specifications and periodic dimensional inspections. |

| No | Potential Causes | Effects of Failure | Value | | | | Recommended Improvements |
|---|---|---|---|---|---|---|---|
| | | | S | Or | D | RPN | |
| 3 | Periodic machine calibration | Imprecise thread tension setting | 8 | 5 | 7 | 280 | Routine machine calibration schedule and audit of calibration results. |
| 4 | Wireheart thread is worn out | The yarn is not perfectly bonded, stretchy | 7 | 6 | 6 | 252 | Wireheart replacement schedule based on machine working hours. |
| 5 | Shuttle Meme Famous | Shuttle pressure reduced, weaving stretched | 8 | 5 | 6 | 240 | Shuttle tension inspection before production, shuttle tightening SOPs. |
| 6 | Setting up the machine is not in accordance with the SOP | Wrong Tension Setting, Tension Weaving | 7 | 6 | 6 | 252 | SOP-based machine setup training and production pre-start checklist. |
| 7 | Thread installation error on the shuttle | Unstable thread pull, stretching | 8 | 5 | 5 | 200 | Simulation and retraining of thread installation to operators. |
| 8 | SOP technical specifications are not present | Standard variations of thread mounting | 7 | 5 | 6 | 210 | Make and socialize SOP for installation technical specifications. |
| 9 | The operator defaults to checking the thread during the process | Loose thread undetected, loose | 8 | 5 | 5 | 200 | Strict supervision and visual indicators for thread detection. |
| 10 | Operator lacks concentration while working | Imprecise setting, loose weaving | 7 | 6 | 5 | 210 | Programs to increase operator awareness and work rotation. |
| 11 | Low work motivation / lack of discipline | Negligence of machine setting, degraded quality | 8 | 5 | 6 | 240 | Reward and punishment system based on quality of work. |

### c. Analisa FMEA Defect Miss Print

Table 8.
Analisa FMEA Defect Miss Print

| No | Potential Causes | Effects of Failure | Value | | | | Recommended Improvements |
|---|---|---|---|---|---|---|---|
| | | | S | Or | D | RPN | |
| 1 | Ink quality is not suitable | Inconsistent print colors, blurry images | 8 | 5 | 5 | 200 | Standardization of ink quality from suppliers and inspection of incoming materials. |
| 2 | Ink mixing is not suitable | Uneven color gradation | 7 | 5 | 6 | 210 | Ink mixing training and color mixing standard formulation. |
| 3 | Loose machine gear | The print position shifts, the print is not precise | 8 | 4 | 5 | 160 | Preventive maintenance of machine gears and periodic tightening. |
| 4 | Unstable roller speed | Mold intensity differences | 8 | 5 | 6 | 240 | Roller speed monitoring using automatic sensors and periodic calibration. |
| 5 | Anilox roller kotor | Uneven ink, striped print | 7 | 5 | 7 | 245 | Daily anilox roller cleaning schedule and inspection before production. |
| 6 | Irregular cleaning of the machine | The rest of the ink stains the next print | 7 | 5 | 6 | 210 | Daily cleaning SOPs and printing machine hygiene audits. |
| 7 | No initial setup plate printing | Inaccurate mold alignment | 8 | 4 | 7 | 224 | The initial plate setup SOP must be carried out before the start of production. |
| 8 | SOP setup color does not match | Differences in color tone between products | 7 | 4 | 6 | 168 | Update and training SOP color setup that is adjusted to production standards. |

| No | Potential Causes | Effects of Failure | Value | | | | Recommended Improvements |
|---|---|---|---|---|---|---|---|
| | | | S | Or | D | RPN | |
| 9 | Lack of operator training | Setup and print check errors | 8 | 5 | 5 | 200 | A competency-based printing operator training program and an internal certification test. |
| 10 | Operator lacks concentration while working | Forgot to check the color/plate, wrong print | 7 | 5 | 6 | 210 | Work rotation system and supervisor monitoring per shift to maintain concentration. |

### *5) Control*

This stage, the company has a process control system, both controlling the standard specifications and to control the work instructions so that each process can be controlled, the failure of the data attributes that occur can be reduced by the company and the target of six sigma quality improvement can be achieved. However, in this study, there is no *control*, the implementation of control is carried out by the Company and the *improvement* stage is only limited to proposals to PT XYZ.

## V. CONCLUSION

The results showed that the three most influential types of defects in the production process were perforated weaves, stretched weaves, and miss prints, which had a direct impact on the quality of the final product and became the main focus of improvement. CTQ for perforated webbing is a whole webbing structure without holes; for stretched weaving is a uniform weave density in the direction of shuttle and creel; As for the miss print, it is a clean, neat, and even print. Through data analysis using the Six Sigma method for the January-December 2024 period at PT XYZ, an average DPO value of 0.00674 and DPMO of 6,746,655 was obtained, which shows that out of one million opportunities there are around 6,746 defects, with a sigma value of 3.97—indicating that the production process is quite good but still needs improvement. To reduce the number of defects and increase sigma levels, a root cause analysis of each CTQ was carried out using fishbone and FMEA diagrams. From fishbone, four main factors were found to cause defects, namely humans, machines, materials, and methods. The FMEA results identified causes with high RPN, such as lack of product quality supervision and non-routine machine calibration (315 RPNs each). Based on these results, improvement recommendations were prepared to support the improvement of the quality of woven bag products.

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