



Analysis of the Causes of Multifilament Thread Defects in PT X Using Seven Tools

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Abstract

PT X, a leading plastic packaging manufacturer in Indonesia, faces the problem of high defect rates in the production of multifilament yarns that hinder output optimization. This research aims to analyze and improve product quality using the Seven Tools method. Data for the May-October 2025 period shows a total production of 214,045.5 kg with an accumulated defect of 5,029 kg. The results of the Pareto analysis identified two main defects (vital few), namely brittle yarn (38%) and easily broken yarn (31%). Analysis via the control map (p-chart) showed the process was in an uncontrolled condition, especially in August which exceeded the upper control limit (UCL 0.0242). Based on the fishbone diagram, the root cause of the problem comes from the instability of the engine temperature (godet), operator negligence, non-standard SOP, and variations in material quality. To overcome this, it is recommended that companies carry out routine machine maintenance (PPM), install automatic temperature monitoring systems, standardize SOP, and hold periodic training for operators to create process stability and minimize defects on an ongoing basis.

Keywords: Multifilament Yarn, Seven Tools, Quality Control, Flawed Products, SQC

1. Introduction

PT X is a leading plastic packaging manufacturing company in Indonesia which was established in 1981, the products of PT include woven bags, jumbo bags, adstars, and multifilament yarns. The company has been internationally recognized, even becoming the largest manufacturer of block bottom bags in Southeast Asia. Multifilament yarns are faced with the main problem of a high rate of repeated product defects (rejects), which significantly hinders optimal production. These defects include threads that break easily (decreased tensile strength), sticky threads, fuzzy/hairy threads, and danier inconsistencies. The root causes of this problem include the use of poor quality replacement materials (Material), engine interference such as inaccurate vibration and heating temperature (Machine), inaccuracy of the winding process (Method), and operator negligence (Man). To address quality problems, achieve the goal of reducing costs and defective products, this study proposes the Seven Tools method. The application of this data-driven statistical method will be used to collect data, prioritize defects (Pareto Diagram), trace the root cause of problems (Cause-and-Effect Diagram), and monitor process stability (Control Map), in order to stabilize and improve the quality of multifilament threads on an ongoing basis.

2. Research Methodology

2.1. Manufacturing Industry

Industry is all forms of economic activity that process raw materials and/or utilize industrial resources so as to produce goods that have added value or higher benefits, including industrial services. The manufacturing industry converts raw materials into finished goods that have a selling value and can be consumed or used by consumers. Industry can also create and expand employment opportunities, thereby indirectly improving welfare and reducing poverty. The second result of the expansion of the industrial sector in particular and the economy as a whole is an increase in tax revenues for the country, which also helps to improve the balance of payments or foreign exchange reserves [1], [2].

2.2. Quality

Quality is all the characteristics and features of a good and service that produces a product used to meet consumer needs. Quality can determine the success of a product in the face of market competition. Quality is the standard of something that is measured against other

similar things, the level of excellence of something. So what determines quality are the standards set by the company, not the consumers who use them. Values-based approach is quality in terms of value and price. Taking into account the trade-off between performance and price, quality is defined as "affordable excellence". Quality in this perspective is relative, so the product that has the highest quality is not necessarily the most valuable product. However, the most valuable product or service is the best-buy [3], [4], [5].

2.3. Quality Supervision

Supervision is an inspection and control activity for activities that are late and are being carried out, so that these activities can be in accordance with what is expected. Quality control is a way to maintain the quality and the goods produced to have conformity with predetermined product specifications following the discretion of a company to maintain the market. Quality control is broadly divided into two, namely supervision during the production process and supervision of the final product [6], [7], [8].

2.4. Quality Control

Quality control is developing, designing, producing and providing quality product services and always satisfying the results. The purpose of quality control is to satisfy consumers when buying products. Factors that affect quality control are the function of goods, the outer shape and cost of goods because cost and price can determine the quality of the goods. Quality control and supervision are activities carried out to ensure that production activities and operations are carried out in accordance with what is planned and if deviations occur, then the deviations can be corrected so that what is expected can be achieved [4], [9], [10], [11].

2.5. Definition of Statistical Quality Control

Statistical quality control can also be said to be one of the quality control tools using statistical methods that aim to control, analyze, and improve from the initial process of a production to the finished product with predetermined quality standards. The purpose of statistical quality control is to find out the cause of errors in the data analysis process, so that it can quickly make improvements so that mistakes that have already occurred do not recur [9], [12].

2.6. Defective Products

Defective products are units of products that due to their physical condition cannot be treated as final products, but can be repaired to be sold in the form of final products. Defective products are products that do not comply with the set quality standards and incur costs for the repair process. To control and reduce these defects, the manufacturing industry effectively utilizes seven tools of quality (7 QC tools). This method begins with structured data collection using a check sheet, followed by prioritizing the most impactful issues through a pareto chart. Once the main problem is identified, a cause-and-effect diagram (fishbone) is used to dig up and organize all the possible root causes. On an ongoing basis, control maps and histograms are used to monitor process stability [13], [14], [15].

2.7. PP and Multifilament Yarn

Polypropylene (PP) is a good choice of plastic material for food packaging. Polypropylene or PP plastic is one of the most commonly used plastics due to its characteristics. This multifilament thread serves as the main sewing thread or reinforcing thread. These threads are generally made of synthetic materials such as polypropylene (PP) and have important characteristics of tensile strength and durability to ensure the integrity and safety of the sack seam when accommodating and withstanding heavy loads [16].

2.8. TQM

One of the approaches used to improve quality is Total Quality Management (TQM). TQM is a company quality management process that aims to increase the company's competitiveness through quality control [17].

2.9. Seven Tools

One of the simplest tools or techniques in performing quality control is with seven tools. The seven tools method has seven stages, including check sheets, histograms, pareto diagrams, fishbone diagrams, scatter diagrams, flowcharts, and control charts. A check sheet is a data collection tool used to simplify a recording or analysis to become information. Scatter Diagram is a tool for identifying relationships between two variables. Fishbone or causal diagram is a diagram used to show the causal factors (causes) and quality characteristics (consequences) caused by the causative factors of an effect or problem. Stratification is an attempt to unravel or classify problems into smaller groups or similar groups or into single elements of the problem. A histogram is a bar chart used to show the presence of data dispersion and frequency distribution. A pareto chart is a tool or image that sorts data from highest to lowest and starts from left to right. A control chart is a map used to study how the process changes over time. The data is plotted in chronological order. Upper control limit (UCL), a line above the center line indicates the upper control limit. Lower control limit (LCL), a line below the center line indicates the lower control limit [4], [18], [19], [20]. Here is the formula:

$$P = \frac{D_i}{n_i} \quad (1)$$

$$CL = \frac{\sum D_i}{\sum \text{Jumlah Produksi}} \quad (2)$$

$$LCL = P - 3 \sqrt{\frac{p(1-p)}{n}} \quad (3)$$

$$UCL = P + 3 \sqrt{\frac{p(1-p)}{n}} \quad (4)$$

This process diagram or flowchart is quite simple, but it is an excellent tool for trying to understand a process or explain the steps of a process [21].

2.10. Flowchart

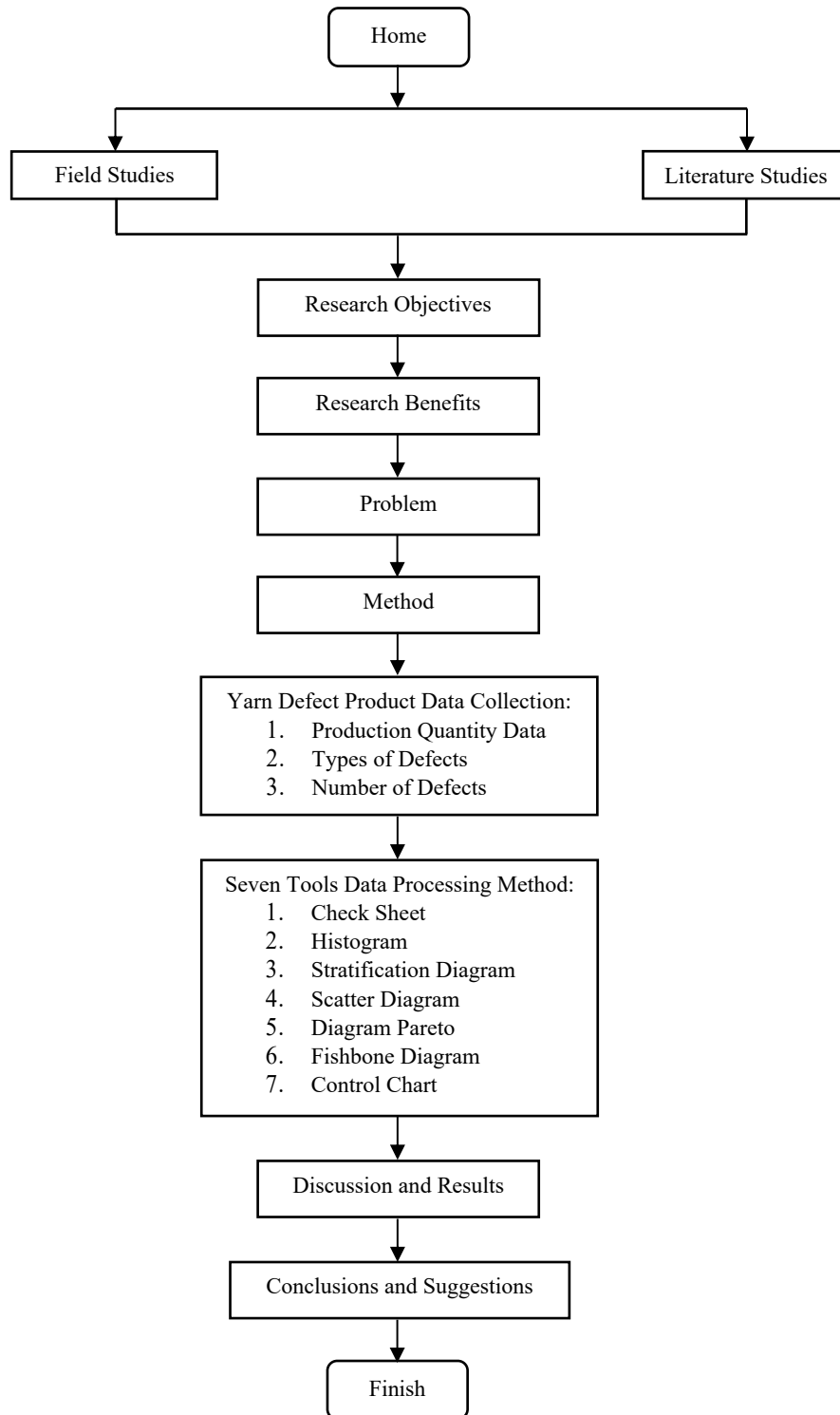


Fig. 1: Flowchart

3. Results and Discussion

The results and discussion on data processing used Seven Tools to analyze the defects of multifilament yarn products for the period May to October 2025.

3.1. Check Sheet

A check sheet is used to calculate the percentage of defects in multifilament yarn products.

Table 1: Multifilament Yarn Production Data From May - October 2025

Date	Yarn Production (Nett.W'T)						Number of defects
	Production Quantity		Type of Defect (Unit)				
	Kg	Roll	Fluffy Yarn	Sticky Thread	Threads Break Easily	Danier	
1/5/2025	1122,7	198	12,75	6,375	10,625	4,25	34
10/5/2025	1012,9	192	7,125	3,5625	5,9375	2,375	19
20/5/2025	1052,8	186	12,375	6,1875	10,3125	4,125	33
30/5/2025	975,1	176	11,25	5,625	9,375	3,75	30
1/6/2025	1120,7	222	8,625	4,3125	7,1875	2,875	23
10/6/2025	1017,2	182	12,375	6,1875	10,3125	4,125	33
20/6/2025	1070,3	190	7,875	3,9375	6,5625	2,625	21
30/6/2025	1106,6	218	8,25	4,125	6,875	2,75	22
1/7/2025	895,2	158	7,125	3,5625	5,9375	2,375	19
10/7/2025	767,4	140	6,375	3,1875	5,3125	2,125	17
20/7/2025	1057,3	186	10,125	5,0625	8,4375	3,375	27
30/7/2025	957,8	172	9	4,5	7,5	3	24
1/8/2025	905,2	160	6,375	3,1875	5,3125	2,125	17
10/8/2025	735,2	132	9,375	4,6875	7,8125	3,125	25
20/8/2025	1145,6	202	9	4,5	7,5	3	24
30/8/2025	1160,7	208	10,125	5,0625	8,4375	3,375	27
1/9/2025	1149,9	204	8,25	4,125	6,875	2,75	22
10/9/2025	949,5	170	9	4,5	7,5	3	24
20/9/2025	1132,3	200	10,125	5,0625	8,4375	3,375	27
30/9/2025	1135,7	202	9	4,5	7,5	3	24
1/10/2025	892,7	158	6,375	3,1875	5,3125	2,125	17
10/10/2025	733,5	130	6,75	3,375	5,625	2,25	18
20/10/2025	1116,5	196	9	4,5	7,5	3	24
30/10/2025	2234,6	404	22,5	11,25	18,75	7,5	60
Quantity	214045,5	38572	1885,875	942,9375	1571,5625	628,625	5029

Based on the observation check sheet for six months, from May to October 2025, the total production data of multifilament yarn reached 214,045.5 kg, with a measured accumulation of defective products (reject) of 5,029 kg. The type of disability in May was 726 units of the total disability. Then in June, it was 740 units of total disabilities. In July, it was 727 units of total defects. Furthermore, in August, it was 743 units of total disabilities. In August, it was 743 units of total defects. Furthermore, in September, it was 723 units of total defects. And the last one in October was 1370 units of the total defects. Based on the data in the table, it can be said that in the October period, the highest number of defects occurred than in other periods, the number of defects was 1,370 units.

3.2. Stratification Diagram

The stratification diagram is one of the seven tools used to group or divide disability data into certain categories or groups.

Table 2: Multifilament Yarn Production Data From May - October 2025

Stratification								
Yes	Types of Defects	May	June	July	August	Bulan September	October	Quantity (Unit)
1	Fluffy Yarn	272,25	277,5	272,625	278,625	271,125	513,75	1885,875
2	Sticky Thread	136,125	138,75	136,3125	139,3125	135,5625	256,875	942,9375

Stratification								
Yes	Types of Defects	May	June	July	August	Bulan September	October	Quantity (Unit)
3	Threads Break Easily	226,875	231,25	227,1875	232,1875	225,9375	428,125	1571,563
4	Danier	90,75	92,5	90,875	92,875	90,375	171,25	628,625
	Total	726	740	727	743	723	1370	

Based on the total number and type of defects from May to October 2025, multifilament yarn products can be classified into smaller similar group data to make the data clear. The stratification of multifilament yarn products is based on four types of defects, with the lowest defect being the type of non-uniformity defect which is 628,625 units. The highest defect is fluffy yarn which is 1885,875 units. Then in the defect of sticky thread, which is 942.9375 units. And in the easily broken yarn, defects were obtained, which was 1571,563 units.

3.3. Histogram

The histogram diagram of the number of defects in multifilament yarn products shows the presence of uneven data.

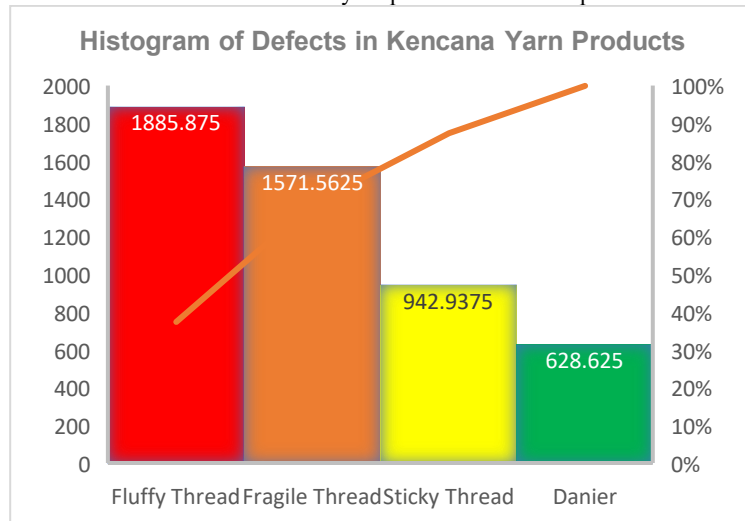


Fig. 2: Histogram of the Number of Defects of Multifilament Yarn Products

Fluffy yarn was recorded as the highest type of defect with a total of 1,885,875 units, making it the highest quality problem. Then the yarn is easily broken with a total of 1,571.5625 units. Then the sticky thread was 942.9375 units and the danier inconsistency was 628.625 units. Both of these values indicate a much lower frequency.

3.4. Scatter Diagram

The Scatter Diagram is used to determine the correlation between two variables, namely cause and effect, thus identifying the points that have the largest percentage of defects.

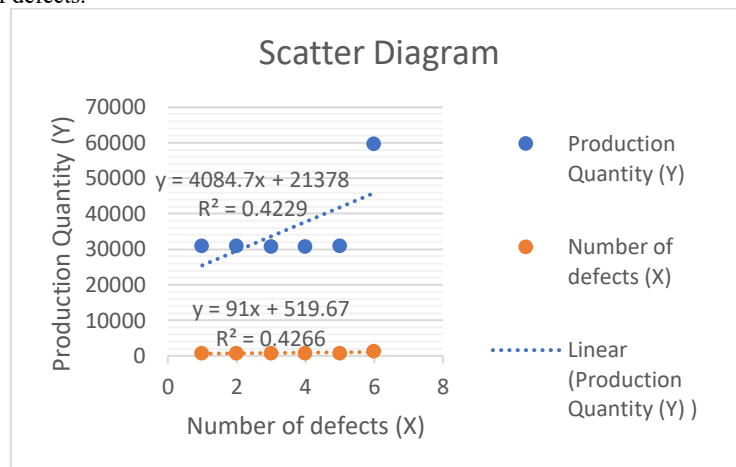


Fig. 3: Scatter Diagram of the Percentage of Defects in Multifilament Yarn Products

Based on the scatter diagram image, it shows that there is a correlation between two variables x and y. The goal is to determine whether the relationship is positive, negative, or no correlation at all. The Scatter Diagram presents a linear regression analysis that shows the relationship between the number of defects (x) on the horizontal axis and the number of production (y) (blue dots) on the vertical axis. Based on regression analysis for production data, it was found that there was a positive relationship represented by the trend line equation

$y = 4084.7x + 21378$. This equation indicates that statistically, each one unit increase in the number of defects correlates with an increase in production of about 4084.7 units. The strength of this linear relationship is classified as a coefficient of determination R^2 which is 0.4229, or about 42.29% of the variation in the amount of production can be explained by the variation in the number of defects through this linear model. The chart also displays data for the number of defects (orange dots) with the trend line $y = 91x + 519.67$ and R^2 which is 0.4266. Based on the data presented, there is a very weak positive linear relationship between the number of defects and the number of production. A low R^2 determination coefficient of about 0.42 indicates that the number of defects is half the percentage of the total production.

3.5. Pareto Diagram

Pareto diagrams are used to determine the order of the types of defects that occur based on the order of the number of events that occur in multifilament yarn products. The following are the results of processing using the Pareto diagram:

Table 3: Percentage of Product Defects of Multifilament Yarn

No	Types of Defects	Quantity (Units)	Percentage of Defects (%)	Cumulative Percentage (%)
1	Fluffy Yarn	1885,875	38%	38%
2	Sticky Thread	942,9375	19%	56%
3	Threads Break Easily	1571,5625	31%	88%
4	Danier	628,625	13%	100%
	Total	5029	100%	

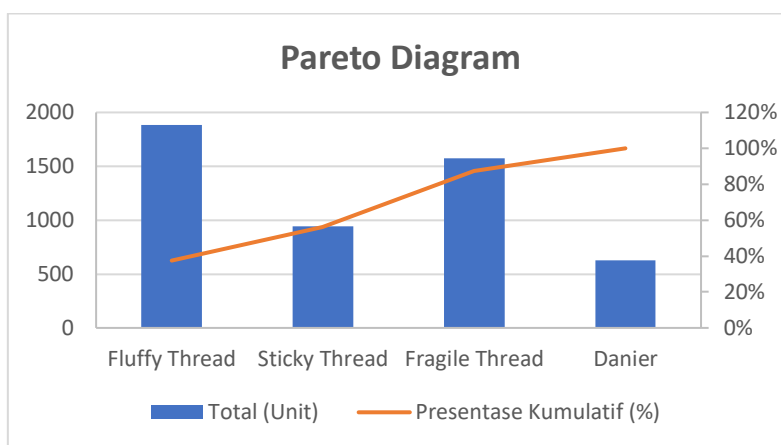


Fig. 4: Pareto Diagram of Multifilament Yarn Products

Based on the defects of multifilament yarn products with a total of 5,029 units, it can be concluded that the largest defect is the fluffy yarn with a total of 1,885,875 units, the percentage of defects is 38% of the total defects. Furthermore, 1,571.5625 pieces of easily broken yarn and the percentage of defects was 31% and the percentage of sticky threads was 942.9375 units and the percentage of defects was 19%. The smallest defect was the uniformity of the danier of 628,625 units and the percentage of defect of 13%. Based on the table, the highest to lowest cumulative percentage was obtained in bristly yarn at 38%, then sticky yarn at 56%, then in easily broken yarn at 88% and in danier inuniformity which was 100%. Hairy yarn and easily broken yarn are included in the category of vital few. Other types of defects, namely in sticky threads and inuniformity of the danier, are classified as trivial many or "trivial many". The cumulative percentage of sticky thread defects is 88% and the percentage of defects in danier inuniformity is 100%. Then it can give priority to repairs must be directed to the fluffy yarn and the yarn is easily broken.

3.6. Cause and Effect Diagram

Based on the data processing that has been carried out, it is found that improvements must be directed to hairy threads and threads that break easily. is the most dominant type of defect that occurs.

Fishbone Diagram Thread Breaks with Ease

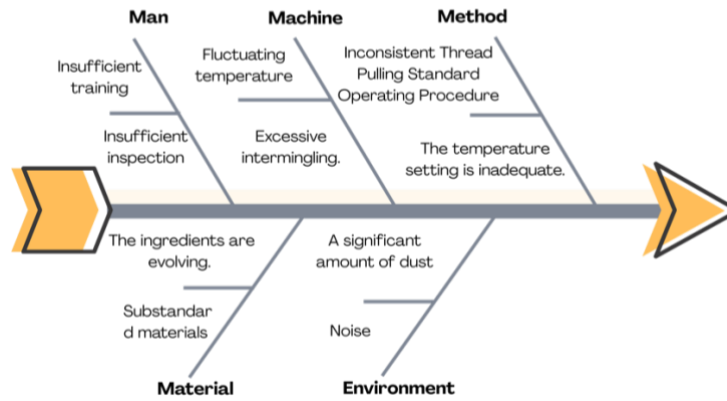


Fig. 5: Fishbone Threads Break Easily Diagram
Fishbone Diagram of Feathered Thread

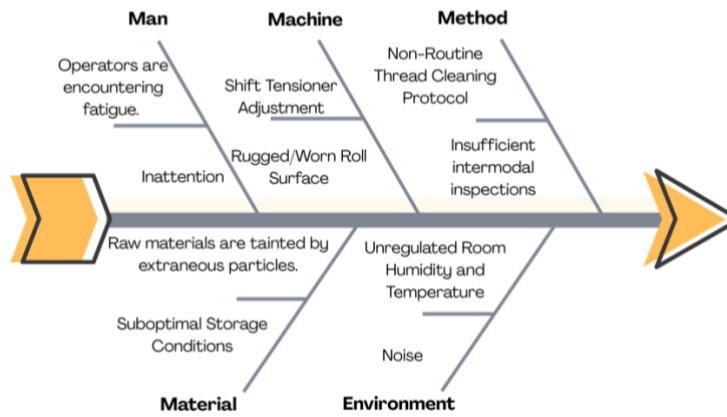


Fig. 6: Fishbone Fluffy Yarn Diagram

Fishbone Diagram Discussion Thread

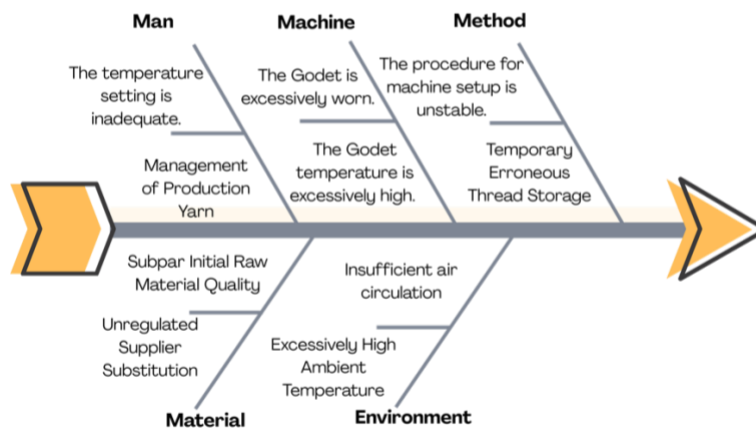


Fig. 7: Fishbone Sticky Thread Diagram

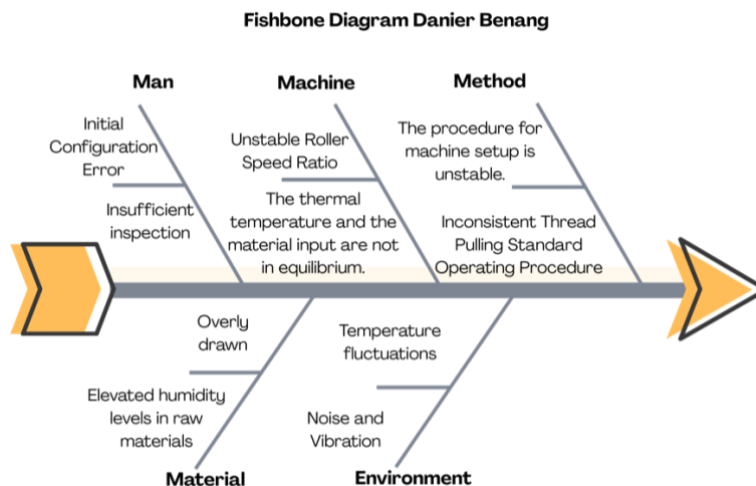


Fig. 8: Fishbone Danier's Inconsistency Diagram

The analysis of the root of the problem in multifilament thread defects shows that four types of defects, namely easily broken threads, bristled threads, sticky threads, and danier inconsistencies caused by several factors, including man, machine, method, material, and environment factors. The machine factor is caused by direct technicalities such as overheating boiler temperature, shifting tensioner calibration, unstable roller speed ratio, and worn engine components (such as windings or boilers). The man factor is caused by initial setting errors, lack of inspection, inappropriate temperature settings, and operator fatigue or lack of concentration. The Method is caused by inconsistent thread pulling SOP, unstable machine setup procedures, and lack of thread area cleaning routines. In materials caused by low quality of the initial raw materials, exposure to contamination of other objects, and poor storage conditions (such as high humidity). In the environment, it is caused by uncontrolled room temperature and humidity and the presence of noise or vibration that affects the stability of the process. For problem analysis in the defects of multifilament threads easily break, brittle threads, sticky threads, and danier inuniformity are as follows:

Table 4: Proposed Improvements to Threads Break Easily

Categories	The Root of the Problem	Proposed Improvements
Man	Less training	Conduct training and ongoing, Implement operator certification system.
	Lack of inspection	Appoint specialized QC personnel, Implement daily inspection check-sheets that are mandatory to review.
Machine (Machine)	Unstable temperature / Improper temperature setting	Routine calibration of temperature sensors, Installing automatic temperature control system/ alarm, Preventive maintenance schedule.
	Intermindel too much	Optimizing thread flow to reduce friction, Fixing machine parts that cause excessive friction.
Method	Inconsistent Thread Withdrawal SOP	Develop and standardize clear SOP, Ensure operator compliance, Review SOP periodically.
Material (Material)	The material is changed	Standardizing raw material specifications, Cooperating with consistent suppliers, Testing incoming raw materials.
	Poor material quality	Tighten supplier selection criteria, Use materials from trusted suppliers, Return non-standard materials.
Environment	A lot of dust	Improved ventilation and dust extraction systems, Regular cleaning schedules, Use of engine covers/air filters.
	Noise	Conducting noise audits, Installing sound dampers or providing ear protection.

Table 5: Proposed Improvements to Fluffy Yarn

Categories	The Root of the Problem	Proposed Improvements
Man	Operator experience fatigue & Lack of concentration	Implement regular rest schedules, Analysis of workload & ergonomic work positions, Healthy lifestyle education.
	Lack of intermindel inspection	Assign special QC personnel or additional operators for routine inspections, Create mandatory inspection check-sheets.
Machine (Machine)	Calibration of Shifter Tensioner	Perform routine calibration on all sensors and tensioners, Implement a strict preventive maintenance schedule.
	Rough/Wear Roll Surface	Check and replace worn coils/components regularly, Make sure the surface in contact with the threads is smooth.
Method	Thread Area Cleaning Procedure Not Routine	Create and implement routine and scheduled SOP for cleaning thread areas, including air ducts and around the machine.
Material (Material)	Lack of intermindel inspection	Incorporate the intermindel inspection steps into the operator's daily work SOP.
	Raw Materials are contaminated by other particles & Poor Storage Conditions	Apply strict raw material storage standards, Conduct random raw material testing, Selection of reliable suppliers.
Environment	Uncontrolled Humidity and Room Temperature	Install an automated climate control (HVAC) system to keep humidity and room temperature stable.
	Noise	Perform a noise audit to identify the main source, Install a sound absorber or provide ear protection.

Table 6: Proposed Improvements to Sticky Thread

Categories	The Root of the Problem	Proposed Improvements
Man	Temperature settings don't match Handling of Production Yarn	In-depth training on how to set the temperature according to the standard, Apply the initial shift temperature verification check-sheet. Create and socialize the correct SOP for thread handling after production.
Machine (Machine)	Godet is too worn The temperature of the boiler is too hot	Schedule preventive maintenance & regular inspections, Replace worn components immediately. Install automatic temperature monitoring system with alarm, Regular calibration of temperature sensor & ensure optimal cooling system.
Method	Unstable Machine Setup Procedure Wrong Temporary Thread Storage	Develop detailed & standardized machine setup SOP, Make sure all operators follow them strictly. Apply clear temporary storage standards (cool, dry, heat/chemical-free).
Material (Material)	Low Initial Raw Material Quality Uncontrolled Supplier Replacement	Tighten the specifications of raw material acceptance, Perform random sample quality testing, Return non-standard materials. Standardization of the process of selection & approval of new suppliers, Use verified suppliers.
Environment	Lack of air circulation	Improve ventilation and air circulation systems in the production area.

Table 7: Proposed Improvements to Danier's inconsistency

Categories	The Root of the Problem	Proposed Improvements
Man	Initial Setting Errors Lack of inspection	In-depth training of correct setting procedures, Apply initial setup verification check-sheets. Assign special QC personnel/instruct operators for routine inspections, Implement reporting system.
Machine (Machine)	Unstable Roller Speed Ratio The temperature is hot and the input material is unbalanced	Regular audit & maintenance of speed control system, Calibration of periodic speed sensors, Improvement of control technology. Install automatic temperature monitoring system with alarm, Optimize the raw material dosing system.
Method	Unstable Machine Setup Procedure Inconsistent Thread Withdrawal SOP	Develop detailed, documented, & standardized machine setup SOP, Perform compliance audits. Revision & standardization of thread pulling SOP (optimal voltage & speed), Train operators thoroughly.
Material (Material)	Too drawn High humidity in raw materials	Adjust the machine settings (roller & tensioner speed ratio) to optimize the withdrawal rate. Apply strict raw material storage standards (humidity control), Perform moisture testing when received.
Environment	Temperature changes	Install an automatic climate control (HVAC) system or an additional exhaust fan to keep the room temperature stable.

3.7. Control Map

The following is data processing using the P control map (defect proportion) that 100% inspection is carried out, so that the number of n matches the amount of production per day.

Known:

Defective proportions?

Center Control Line (CL)?

Lower Control Line (LCL)?

Upper Control Line (UCL)?

Then the following calculation is made:

Proportion of Defects

Calculations in the first data:

$$P = \frac{D_i}{n_i} \quad (5)$$

$$P = 0.02 \frac{726}{31019}$$

Center Control Line (CL)

Calculations in the first data:

$$CL = \frac{\sum D_i}{\sum \text{Jumlah Produksi}} \quad (6)$$

$$CL = 0.02 \frac{5029}{214046}$$

Lower Control Line (LCL)

Calculations in the first data:

$$LCL = P - 3 \sqrt{\frac{p(1-p)}{n}} \quad (7)$$

$$LCL = 0.02 - 3 \sqrt{\frac{0,0235(1-0,0235)}{726}}$$

Upper Control Line (UCL)

Calculations in the first data:

$$UCL = P + 3 \sqrt{\frac{p(1-p)}{n}} \quad (8)$$

$$UCL = 0.020 + 3 \sqrt{\frac{0,0235(1-0,0235)}{726}}$$

Table 8: Control Map P (Defect Proportions)

Moon	Yarn Production (Nett.WT)						
	Production Quantity		Percentage	Proportions	CL	UCL	LCL
	Kg	Number of defects					
May	31019,6	726	2%	0,0234	0,0235	0,0239	0,0209
June	31019,6	740	2%	0,0239	0,0235	0,0239	0,0209
July	30702	727	2%	0,0237	0,0235	0,0239	0,0209
August	30703,5	743	2%	0,0242	0,0235	0,0239	0,0209
September	30942,5	723	2%	0,0234	0,0235	0,0239	0,0209
October	59658,3	1370	2%	0,0230	0,0235	0,0238	0,0216
Total	214045,5	5029					
P	0,023495						
1-P	0,976505						

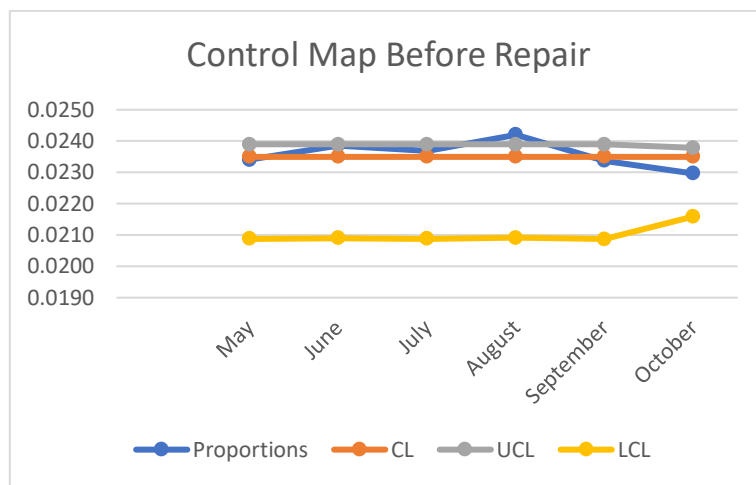


Fig. 9: Multifilament Yarn Product Control Map Diagram Before Repair

Table 9: Control Map P (Defect Proportions)

Moon	Yarn Production (Nett.WT)						
	Production Quantity		Percentage	Proportions	CL	UCL	LCL
	Kg	Number of defects					
May	31019,6	726	2%	0,0234	0,0235	0,0239	0,0209
June	31019,6	740	2%	0,0239	0,0235	0,0239	0,0209
July	30702	727	2%	0,0237	0,0235	0,0239	0,0209
September	30942,5	723	2%	0,0234	0,0235	0,0239	0,0209
October	59658,3	1370	2%	0,0230	0,0235	0,0238	0,0216
Total	183342	4286					
P	0,023377						
1-P	0,976623						

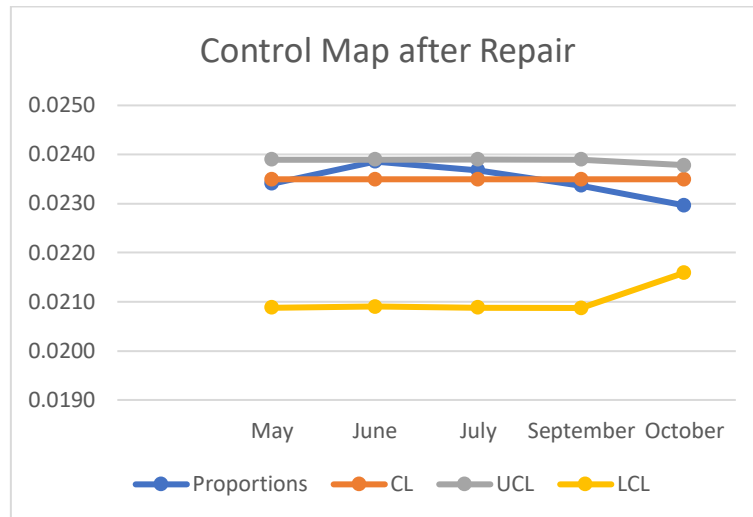


Fig. 9: Product Control Map Diagram Multifilament Yarn After Repair

Based on the control map (P-chart) the proportion shows that there is a proportion that is out of statistical control. Although most data points were between the upper control limit (UCL) and the lower control limit (LCL), the proportion in August pointed out of the upper control limit or UCL of 0.0242. The proportion that goes out of the limits of statistical control is caused by several factors at the time of production of multifilament threads. Then the lower control limit (LCL) showed a decline in October of 0.0230. So that from the graph, solutions can be found so that in the future defective products can be controlled properly. Then the next stage is to remove data that is beyond the control limit, therefore it is necessary to revise the final P control map graph. Based on the control map after the improvement it shows that the proportion is within statistical control, as all the May, June, July, September, and October data points are located between the upper and lower control limits. Although October showed the lowest proportion of defects at 0.0230, it is still under the control of UCL and LCL. Therefore, after improvements to the control map, it can be said that the proportion of statistical control is more stable between the upper limit of control and at the lower limit of control.

4. Conclusion and Suggestion

Based on the research that has been conducted, the following conclusions are obtained:

1. The priority of quality problems identified through pareto analysis and data stratification, namely in the analysis of defect data during the period from May to October 2025, showed that the total accumulated defective products reached 5,029 kg. Through data stratification and the application of pareto diagrams, the most significant quality issues have been specifically identified. Two types of defects stand out as "vital few" that require immediate attention: bristled threads which are 1,885,875 units or 38% of the total defects and easily broken threads which are 1,571,5625 units or 31% of the total defects. These two defects suffer the most defects among other defects that occur in the quality of multifilament threads. Based on the check sheet, it shows an increase in the number of defective units in October, which is 1,370 units, so it can be said that defects in the multifilament thread production process need to be stabilized so that the output of multifilament yarn gets optimal results.
2. The root cause of the problem comes from several production factors, including man, machine, method, and material. After conducting research using a fishbone diagram, it was possible to decipher the root causes of the four main types of defects. The problem does not only come from one source but also from other factors. In the engine factor, uncontrolled temperature and shifting tensioner calibration occur. In the human factor, there is an initial setting error and a lack of operator concentration. In addition, inconsistent working methods, such as non-standardized SOP, and varying quality of raw materials can increase defects in multifilament yarn products. This relationship is reinforced by the scatter diagram, which shows a positive and weak correlation between the number of defects and a low R2 coefficient of determination of about 0.42 indicating that the number of defects is half the percentage of the total production.
3. The production process is not completely stable and requires continuous statistical control. The control map (p-chart) shows that the multifilament yarn production process is statistically out of control. The existence of a data point that exceeded the upper control limit (UCL) in August of 0.0242 indicates a significant non-random variation or special cause variation, and requires improvement in that period. Then after improvements to the control map show stability after the removal of data that is beyond the control limits, an overall high proportion of defects are expected to be carried out regularly and continuously. The goal is to implement stable statistical control, so that defects in multifilament threads can be effectively minimized in the future.

Then there is a research suggestion for companies that can improve maintenance routinely by making improvements to the machine factor by applying a PPM schedule for tensioner calibration and replacement of wear components (gutters and coils). In addition, companies are advised to install an automatic temperature monitoring system on the bucket to prevent overheating that causes the threads to become sticky and break easily. Standardization of procedures and training to improve and standardize machine setup SOP and thread pull SOP to be consistent across all shifts. It is recommended to conduct periodic training (refresher training) for operators on correct initial setting procedures and provide adequate work rotations to reduce fatigue and improve concentration. Environmental and material control to improve control of environmental factors by installing an automatic control system for room temperature and humidity in the production area. In addition, the inspection of raw material quality and storage conditions should be tightened to prevent contamination and deterioration of material quality.

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