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Analysis of Software Quality Tools Batik Textile Manufacturing Company Recall Case

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ABSTRACT: This study was conducted on a Batik Textile Manufacturing Company. It was established in year 1973; its head office is at Gumpang, kartasura, Sukoharjo, Indonesia. The resulting product is yarn clothes, grey cotton, cambric (bleaching, mercerized, Sulfurized). To respond with the often discovery of defective fabric products therefore it is necessary to control the quality of the existing products so that later can reduce defective products. This company went through several defects identification process including:

- Unwoven weft weaving is a type of defect in which there is no pitch thread woven perfectly due to several reasons.
- Double wrap is a type of defect in which yarn that goes double numbering resulting in woven wicker is not perfect.
- Wrap breaking out is a type of defect in which there are broken threads in woven wicker resulting imperfect.
- An ugly edge where the defect type on the edge of the fabric is not woven well.
- Karat is a type of defect in which there are rust stains on the fabric, this is due to rust obtained from the engine when the fabric weaving process.

The company also has a quality policy for orientation in its business activities. The seven tools that include: flowchart, check sheet, histogram, scatter diagram combined with control charts, Pareto diagrams and fishbone diagrams.

KEYWORDS: Histogram, Ishikawa, Control Chart, Checklist, Pareto, Run Chart, Scatter Diagram

I. INTRODUCTION

The growing global market introducing a competition between companies in providing high quality products in accordance with the wishes of the consumer. This company is engaged in textiles also experienced defective products. Products produced by this company are yarn clothes, grey cotton and Batik fabric (fabric for batik material). To respond with the often discovery of defective fabric products therefore it is necessary to control the quality of the existing products so that later can reduce defective products. One basic way in quality control of products is to make corrections to the elements concerned with the production and evaluation of the results. One of the tools that can be used is quality control system using simple implementation of seven tools. From the above purposes, for reducing and preventing of defects, researchers will conduct research on quality control in textile product in Company.

II. HISTOGRAM

A histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable (quantitative variable) and was first introduced by Karl Pearson. It is a kind of bar graph. To construct a histogram, the first step is to "bin" the range of values-that is, divide the entire range of values into a series of intervals-and then count how many values fall into each interval. When Histogram is used in “Plan Quality”, serves as a preventive approach to improve processes where historical data is used to identify categories of causes effecting most. Histogram is used in “Control Quality” to identify causes of poor performance in process and work product.

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Histogram - Monthly Defects of Karat

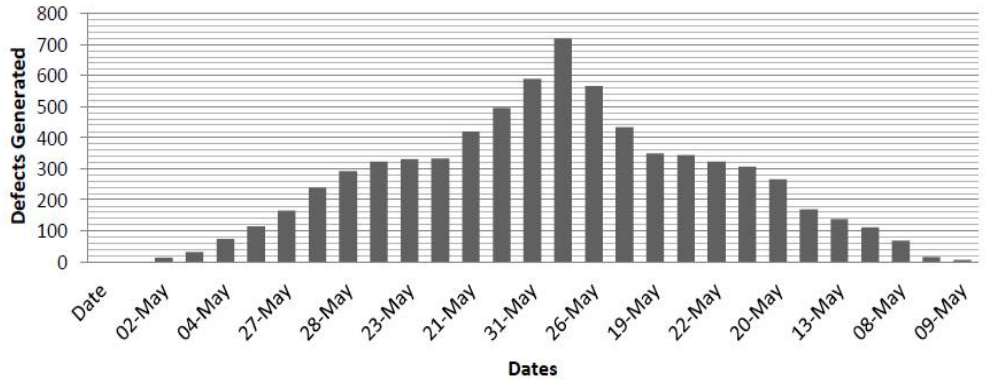

Fig.1. Monthly Defects of Karat

Histogram - Monthly Defects of Ugly Edge

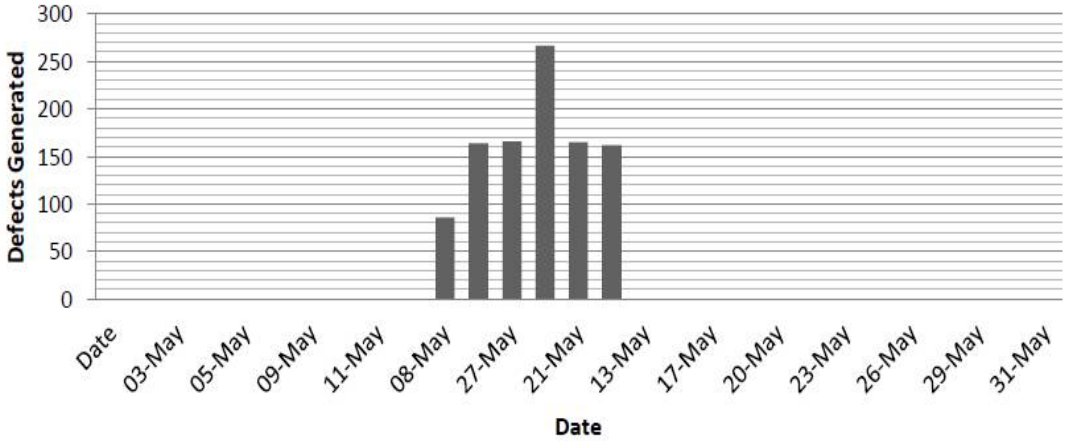

Fig.2. Monthly Defects of Ugly Edge

Histogram - Monthly Defects of Unwoven weft

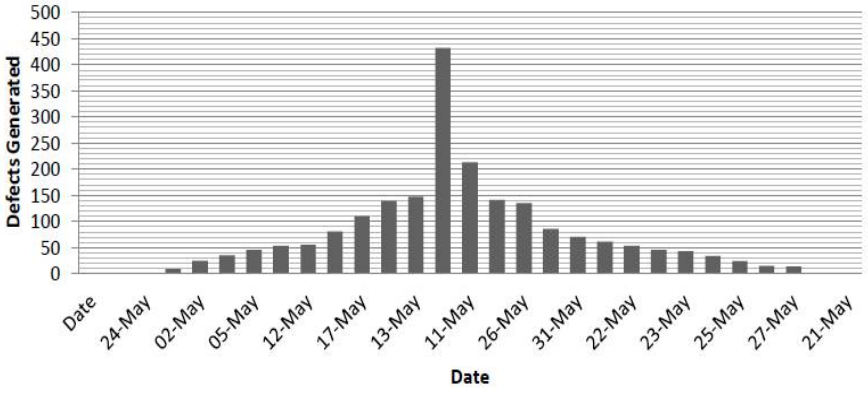

Fig.3. Monthly Defects of Unwoven weft

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Histogram - Monthly Defects of Wrap breaking

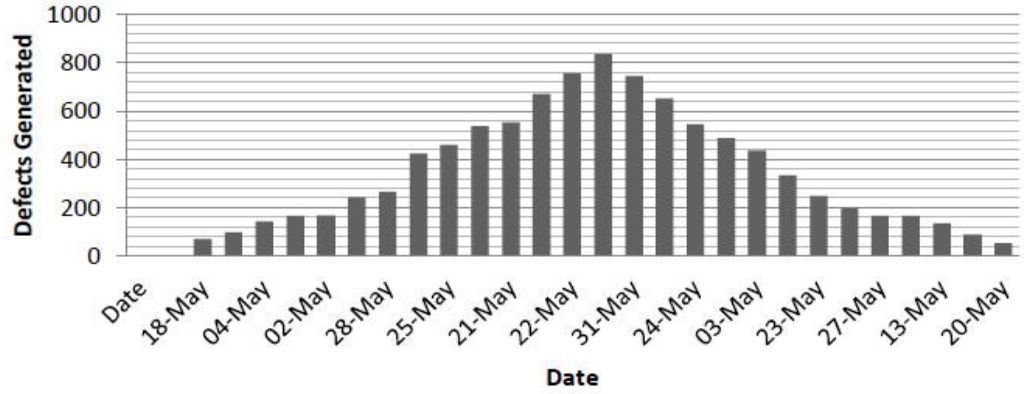

Fig.4. Monthly Defects of Wrap breaking

Histogram - Monthly Defects of Double Wrap

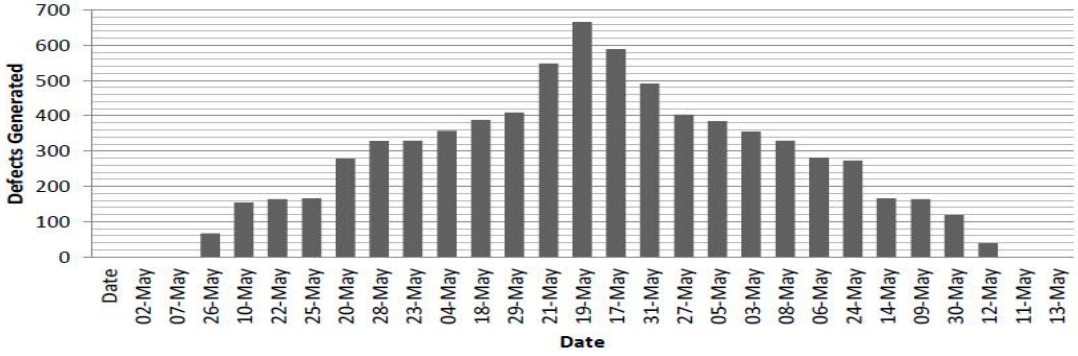

Fig.5. Monthly Defects of Double Wrap

III. RUN CHART

Run chart one effective method for defining a process. Flow chart is a simple drawing of a process. It could be said processing from start to finish the process in a system.

Weekly Defect Run Chart for karat

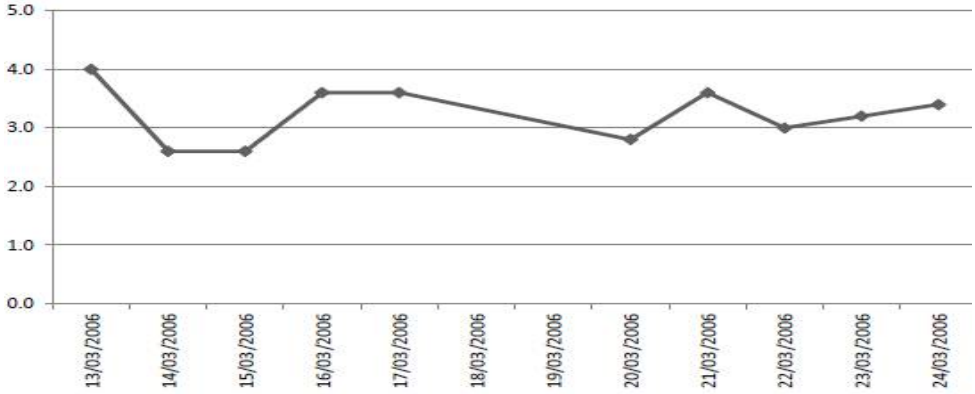

Fig.6. Weekly Defect Run Chart for karat

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Weekly Defect Run Chart for ugly edge

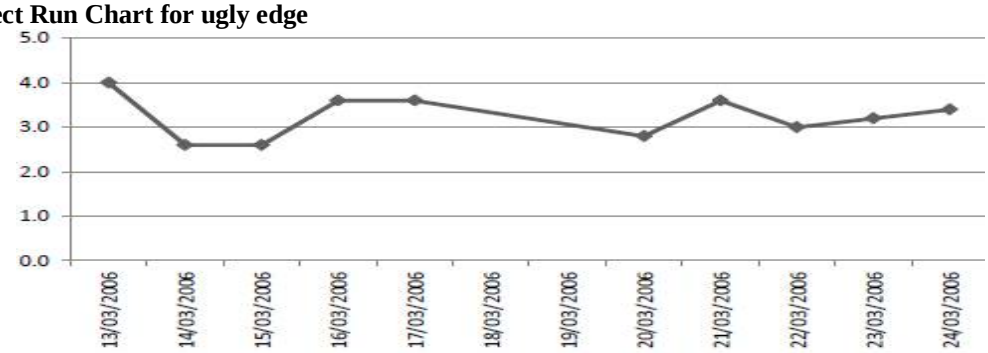

Fig.7. Defect Run Chart for ugly edge

Weekly Defect Run Chart Unwoven Weft

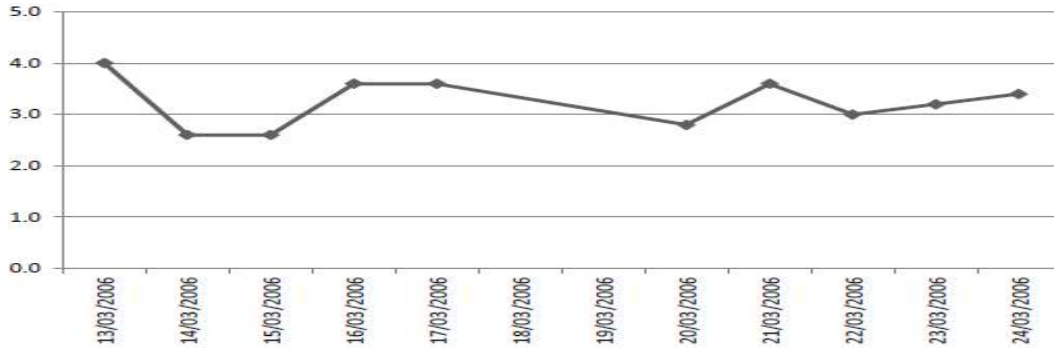

Fig.8. Defect Run Chart Unwoven Weft

Weekly Defect Run Chart Wrap Breaking

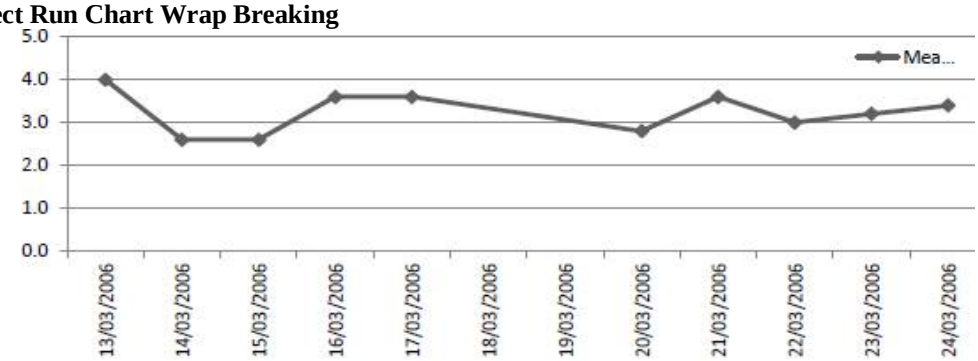

Fig.9. Defect Run Chart Wrap Breaking

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Weekly Defect Run Chart for Double Wrap

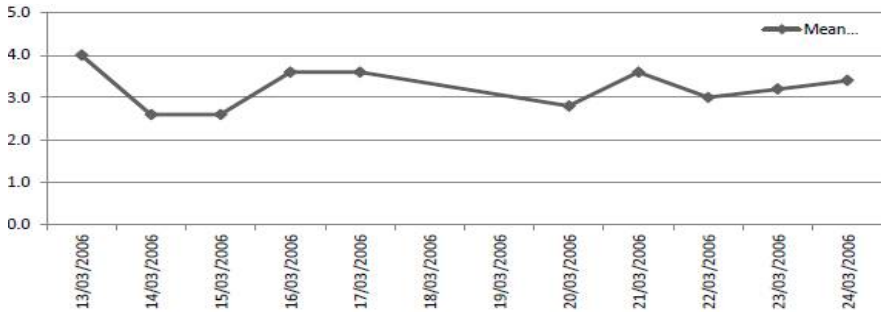

Fig.10. Defect Run Chart for Double Wrap

IV. PARETO CHART

Charts Pareto is used to classify problems according to cause and symptoms. Problems were depicted by priority or importance, using a bar graph format, where 100% indicates a total loss. The underlying principle of this diagram is the '80 -20 rule 'which states that "80% of the trouble comes from 20% of the problems'.

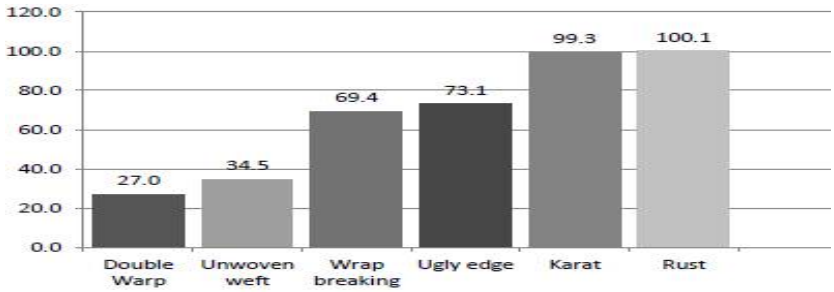

Fig.11. PARETO CHART BAR

Contributor	# of Defects	% Cum
Double Warp	7447.23	27.0
Unwoven weft	2071.08	34.5
Wrap breaking	9631.46	69.4
Ugly edge	1008.36	73.1
Karat	7220.16	99.3
Rust	211.49	100.1

Table No. 1. PARETO CHART DATA

V. SCATTER DIAGRAM

Scatter diagram is a useful tool to clarify whether there is a relationship between two variables, and whether the relationship is positive or negative. Also called: scatter plot, X–Y graph. The scatter diagram graphs pairs of numerical data, with one variable on each axis, to look for a relationship between them. If the variables are correlated, the points will fall along a line or curve. The better the correlation, the tighter the points will hug the line.

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Scatter diagram for karat

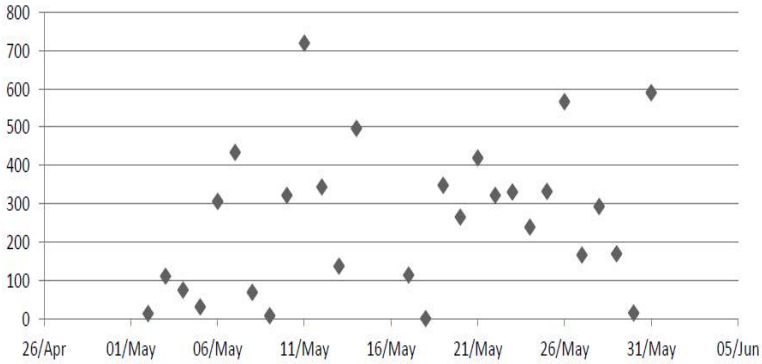

Fig.12. Scatter diagram for karat

Scatter diagram for ugly edge

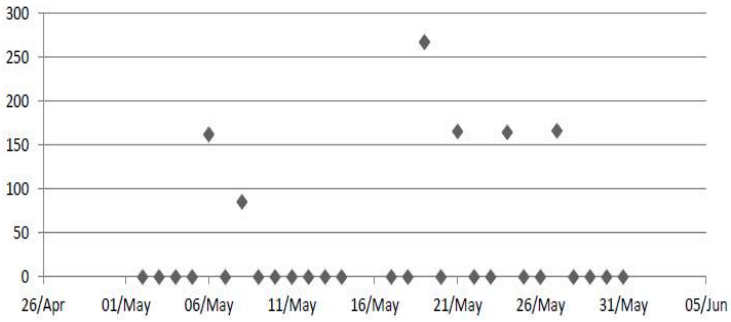

Fig.13. Scatter diagram for ugly edge

Scatter for Wrap Breaking

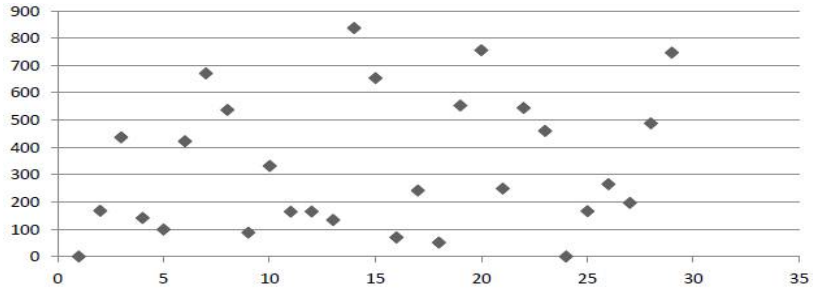

Fig.14. Scatter for Wrap Breaking Scatter for Double Wrap

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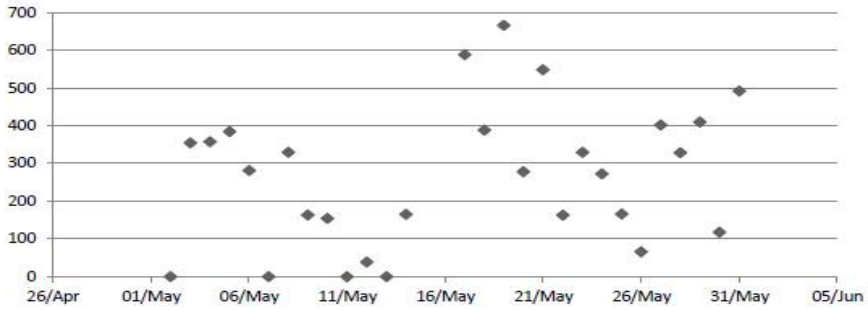

Fig.15. Scatter for Double Wrap

VI. CHECKSHEET

A QC checksheet would likely prevent the dimensional issues in the keychain example used earlier, since a checksheet typically provides dimensional tolerances and specifies measuring methods.

1. Outlining quality standards and product requirements the supplier is expected to meet and
2. Providing objective criteria for inspecting the product to ensure the customer's expectations are being met.

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Day Numbe		Defect Type					
	Length produced	Unwoven weft	Double wrap	Wrap breaking	Ugly ed	Karat	Rust
1	6669	25.11	0	166.73	0		0
2	4984	141.21	354.55	436.16	0	111.24	0
3	6236	8.84	357.34	141.37	0	73.91	0
4	4948	45.16	384.51	98.96	0	30.69	0
5	5491	80.7	281.2	422.08	161.5	306.54	73.09
6	6458	53.36	0	671.46	0	434.08	0
7	4700	139.3	329.18	537.54	85.35	68.39	0
8	5391	45.38	163.36	87.52	0	6.85	0
9	6149	0	154.32	332.38	0	321.89	0
10	5341	213.74	0	164.91	0	719.21	0
11	6116	55.24	38.77	164.21	0	343.46	0
12	6188	147.16	0	133.76	0	136.36	0
13	5128	86.22	165.42	836.45	0	496.26	0
14	6377	110.66	589.11	654.05	0	113.28	0
15	3990	34.47	388.87	69.84	0	0	0
16	7326	432.45	666	241.73	266.68	348.62	0
17	4411	34.84	278.03	51.05	0	265.57	0
18	6267	0	548.15	553.42	164.92	419.55	0
19	6046	53.08	163.41	755.01	0	322.72	0
20	5105	43.13	329.35	248.46	0	330.94	0
21	5739	0	272.55	544.07	163.97	238.69	0
22	6154	23.9	166.32	460.13	0	332.65	0
23	6278	135.7	66.28	0	0	566.99	0
24	5310	14.43	402.55	165.94	165.94	165.94	0
25	5910	61.68	328.33	265.04	0	292.76	138.4
26	7273	14.76	409.79	195.8	0	169.24	0
27	4559	0	117.87	487.08	0	14.97	0
28	5677	70.56	491.97	746.31	0	589.36	0

I. **Table no.2.** Data for **Checksheet**

Control Chart

The control chart is a graph used to study how a process changes over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit. These lines are determined from historical data.

Ishikawa (Fish Bone Diagram)

Fishbone diagram (fishbone diagram - because it is shaped like a fish bone) is often called Cause-and-Effect Diagram. Fishbone diagrams are used to identify and analyse a process or situation and find possible causes of an issue / problem that .In essence this diagram can be used for the needs of the following:

- Helps identify the root cause of a problem.
- Helps generate ideas for solutions to problems.

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- Assist in the investigation or fat-finding further.

VII. FISH BONE DIAGRAM FOR KARAT

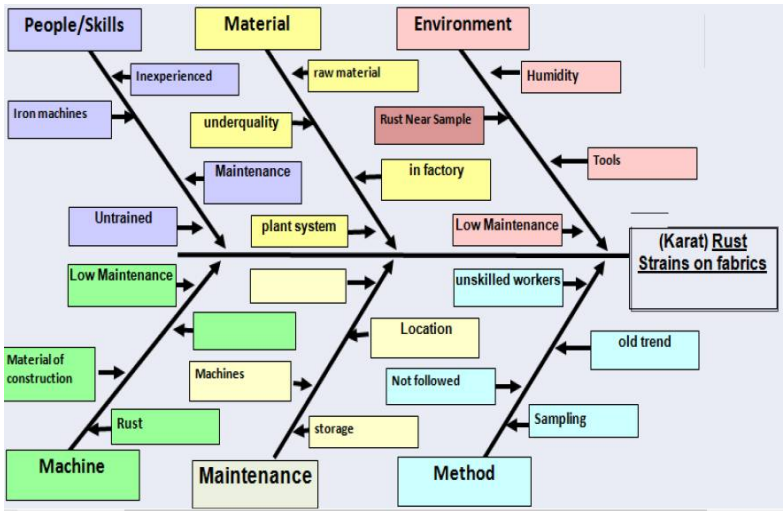

Fig.16. FISH BONE DIAGRAM FOR KARAT

Fish Bone Diagram for Ugly edge

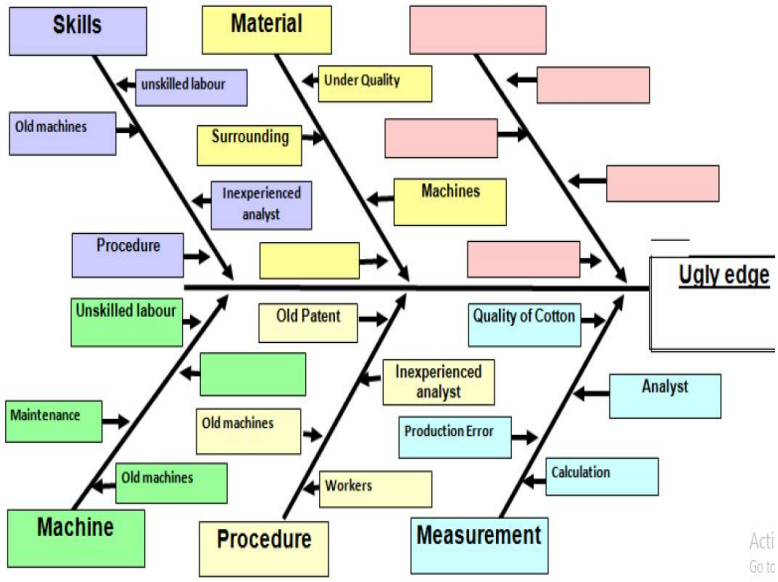

Fig.17. Fish Bone Diagram for Ugly edge

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Fish Bone Diagram for Wrap Breaking

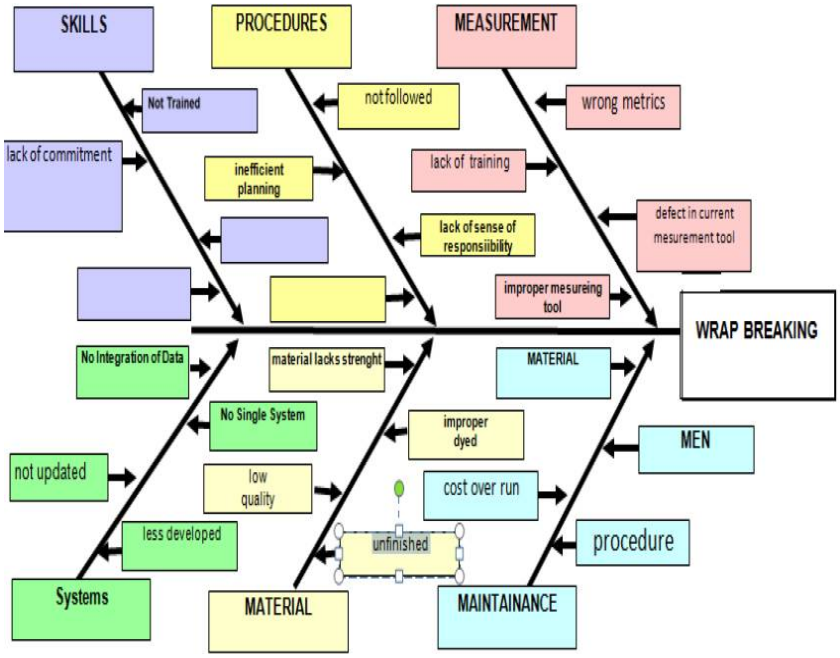

Fig.18. Fish Bone Diagram for Wrap Breaking

Fish Bone Diagram for Double wrap

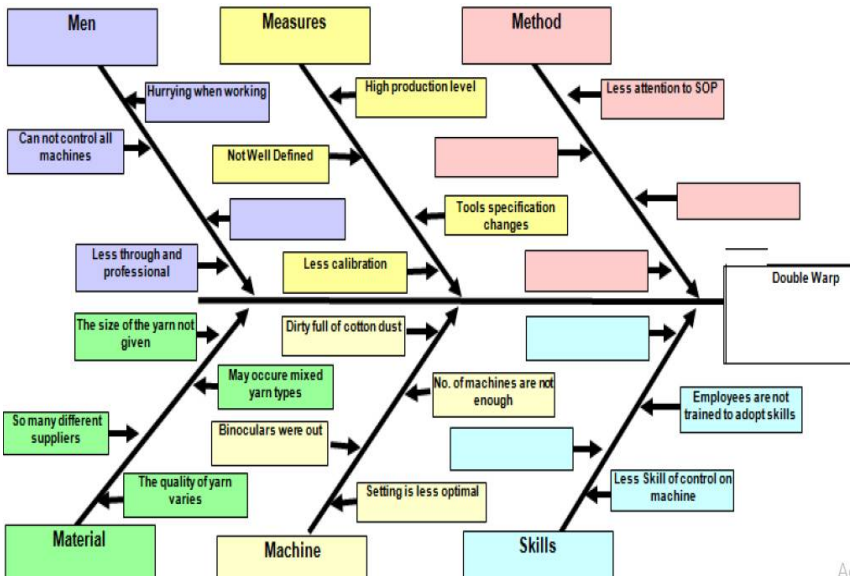

Fig.19. Fish Bone Diagram for Double wrap

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Fish Bone Diagram for Unwoven weft Weaving

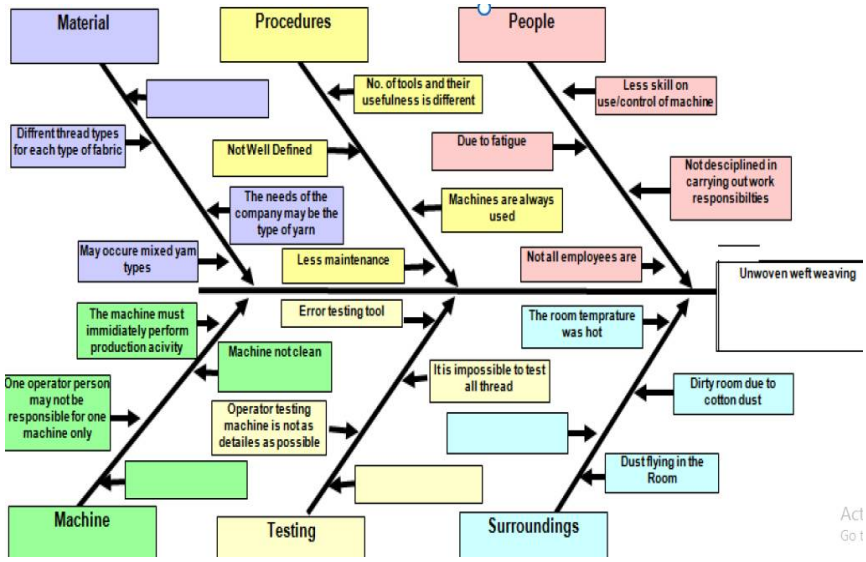

Fig.20. Fish Bone Diagram for Unwoven weft Weaving

VIII. 5 WHY: ROOT CAUSE ANALYSIS TECHNIQUE

The 5 Whys technique is one of the most effective tools for root cause analysis. The 5 Whys strategy is a simple, effective tool for uncovering the root of a problem. You can use it in troubleshooting, problem solving and quality improvement initiatives. Start with a problem and ask "why" it is occurring. Make sure that answer is grounded in fact, then ask "why" again.The 5 Whys method is part of the Toyota Production System. Developed by Sakichi Toyoda, a Japanese inventor and industrialist, the technique became an integral part of the Lean philosophy.

As per the Ishikawa root cause analysis it can be said that the main causes of all the defects are unskilled labour, machinery problem and the procedural & system defects.

5 why in case of the defects generated by the people (labour):

1. Why labours were unable to produce defect less material?
2. Why labours were having lack of control on machine?
3. Why labours having lack of skills?
4. Why labours were not skilled?
5. Why the training was not conducted?

5 why in case of the machinery problems:

1. Why labours were not being able to generate more material?
2. Why the machines were not enough?
3. Why the new machines were not provided by management?
4. Why the budget provided by the finance department was not enough?
5. Why the company was not being able generate revenue?

5 why in the case of why the procedure/system defects are happening

1. Why the measurements are not being calculated properly?
2. Why the metrics are wrong for calculation?
3. Why the procedure is not well defined?
4. Why the setting is less optimal?
5. Why the system maintenance is not been done up to date?

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After answering all these questions, the root cause was found out and batik textile would work on it to avoid similar problems in future.

IX. TAKT TIME

Takt time was originally used for to design of the operator's work content. The term "Takt Time" is derived from the German word "Takt", which refers to the rhythm and time bar in a piece of music. In production it refers to the speed at which products are produced .It is the overall available production time in a chosen time interval divided by the overall forecasted customer demand for the time interval.

$$Takt\ time = \frac{\text{Total Available Production Time}}{\text{Average Customer Demand}}$$

In the case of Batik Textile Manufacturing Company, the formula will be:

$$Takt\ time = \frac{\text{Number of working days in a month}}{\text{Average no. of defects in 1month}}$$

i.e. Takt time =25/4

$$Takt\ time = 6.25$$

Therefore, the frequency of defective fabric products was approximately 6.25 time in 1 month.

X. POKA YOKE

Poka Yoke is a quality management concept developed by a Matsushita manufacturing engineer named Shigeo Shingo to prevent human errors from occurring in the production line.
The main objective of poke yoke is to achieve zero defects. Poka Yoke is more of a concept than a procedure. Thus, its implementation is governed by what people think they can do to prevent errors in their workplace, and not by a set of step-by-step instructions on how they should do their job.
Poka Yoke in the case of Batik Textile Manufacturing Company:

- Hiring the skilled labour and train them for an optimum task.
- Quality check report of the yarn must be provided by the vendor.
- The company must not change the vendors frequently for the same quality of the yarn.
- The old machinery should be removed and more new (up-to-date) machinery should be installed having latest measurement techniques & procedures.
- The testing of every batch of yarn must be done before production.
- Clear the machines & the surroundings on the regular basis to prevent the cotton dust from flying in the room & ruining the material.

Notify users to not use their phones if the battery is over used and passes the heating temperature threshold.

XI. CONCLUSIONS

- The types of defects that occur in grey cloth warp xyz is not woven, warp double, dropping out of warp, weft double, empty warp, warp tenuous, ugly edges, thick fodder, and rust. And of the various types of disabilities that are categorized by the company, the most common defect is a defect warp doubles the percentage value of 44%.
- Based on the analysis of the fishbone diagram above, it can be seen that there are several factors causing the defect types that double warp material, human, machine, and environment management. Hence there is need for improvement and evaluation of the company.
- Efforts need to be made by the company in order to reduce defects in the fabric of gray xyz types are:
  - In terms of the company's material should be tightened and more thoroughly in attention and choose the quality of the raw material fabric
  - In terms of human or workers in the company will have to give directions or training to them in order to improve performance and improve the regulation and strict supervision over again so that the workers could work properly

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- In terms of engine actions that must be done is to improve the care and cleaning of the machine regularly
- In terms of its working methods should be the elements of the company's more obedient again and adhere to the SOP that has been applied
- In terms of the measurement of the company should be more attention to measurement of the testing equipment so as to meet the standards in the company so as to produce a desired output quality
- In terms of the environment the company should further improve the implementation of 5S workplace culture that covers everything about the company's environmental condition.

XII. RECOMMENDATIONS

- The result shown that the seven tools could be effectively used in this company, and therefore, seven tools could be implemented in other garment industry and duplicated the same method.
- Companies should improve the quality of raw materials according to the standard specified.
- Companies should improve control over the performance of its employees in order to avoid deterioration in performance and negligence at work.
- Perform routine engine maintenance, and pay attention to cleanliness of the engine so that the engine is not damaged or distractions while walking.
- Follow standard operating procedures that have been defined.
- Calibration routine within 6 months-12 months.
- Evaluate the working environment such as lighting and 5s for workplace.

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