QUALITY IMPROVEMENT USING SIX SIGMA METHOD TO REDUCE DEFECTS OF OFFICE PARTITION PRODUCTS AT PT. INSPIRA MULTI KARYA

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Abstract.
Quality improvement carried out at PT. Inspira Multi Karya on partition products is still not effective, as evidenced by the presence of defective products such as scratches, dents, cracks, and edge defects. Based on these problems, the authors are interested in analyzing the quality improvement of Office Partitions products using the Six Sigma method and improving processes with the DMAIC approach (Define, Measure, Analyze, Improve, Control) to reduce the level of product defects, as well as with the help of analytical tools in the form of Pareto Diagrams. , Fishbone Diagram, FMEA after doing all the analysis, the results obtained are the factors that cause defects in office partition products at PT. Inspira Multi Karya namely Human, Environment, and Method. The results of the calculation of the value of Defects Per Million Opportunity (DPMO) are used to determine the level of defects per million opportunities. From the calculation results obtained a sigma value of 3.0502 with an average value of Defect Per Million Opportunity (DPMO) of 61405 per one million opportunity, Defect per Opportunity (DPO) or the possibility of the Office Partition product experiencing defects to meet the company standards of PT. Inspira Multi Karya of 0.061405. Proposed improvements that need to be made to reduce the level of defects in Office Partition products are Making good and appropriate SOPs, Cartons for packing must be given Styrofoam, Cutting materials according to size standard dimensions, Checking raw materials before processing, Employees must work carefully and focus , Conduct training for the operator concerned.

Keywords: *Six Sigma, DMAIC, Pareto Charts, Fishbone Diagrams, Defects Per Million Opportunity, Quality Control*

Introduction

Quality is very important for companies, in this case quality is the most important benchmark for consumers' views of the products/services that will be selected for use. According to Hendy Tanady (2015: 3) quality is an effort from producers to meet customer satisfaction by providing what is the need, and even the expectations of the customer, where these efforts are visible and measurable from the final product produced. In other words, quality is one of the guarantees that the company must provide and fulfill to customers. PT. Inspira Multi Karya is a company engaged in the manufacturing of office furniture and office partitions. Office Partition Products is one type of product produced at PT. Inspira Multi Karya, this is a desk partition product between employees, apart from being a barrier, the office partition also serves to provide privacy space for each staff so that they can work more optimally, designed with uniqueness and technology that will provide comfort in working. but the quality improvement carried out at PT. Inspira Multi Karya on partition products has not been effective, as evidenced by the presence of defective products such as scratches, dents, cracks, and edge defects.

Based on these problems, the authors are interested in analyzing the quality improvement of Office Partitions products using the Six Sigma method and improving processes with the DMAIC approach (Define, Measure, Analyze, Improve, Control) to reduce the level of product defects, as well as with the help of analytical tools in the form of Pareto Diagrams. , Fishbone Diagram, FMEA .Six Sigma is a strategy, science, and tool to achieve and support business success. Six Sigma focuses on increasing customer satisfaction, the success of Six Sigma depends on the ability to solve problems and quality programs, thus Six Sigma can be used as a measure of industrial system performance targets on how well a product transaction process between suppliers and customers is. the higher the sigma target achieved, the better the industrial system performance will be. This method is also very flexible to run a business easily. The drawback of this method is the need for perseverance in carrying out business strategies because in order to get a good product, special and regular monitoring must be carried out.

Literature Review

A. Quality

Quality is the totality of features and characteristics possessed by a product that is able to satisfy consumer needs. Quality in general means that the characteristics of a productor service are determined by the user or customer and obtained through process measurement and through continuous improvement. While the notion of quality in the context of the production process is the conformity of the specifications of the product design that has been

determined by the company / manufacturer.

B. Six Sigma

Six Sigma is a comprehensive and flexible system for achieving, sustaining, and maximizing business success. Six Sigma is uniquely driven by a strong understanding ofcustomer needs, disciplined use of facts, data, and statistical analysis, and careful attention to managing, improving, and re-embedding business processes.

Table 1. Simple Sigma Conversion Table

Yield = percentage of items without defect	*Defect Per Million Opputinities*	Sigma Level
30.9	690.000	1
69.2	308.000	2
93.3	66.800	3
99.4	6.210	4
99.98	320	5
999.997	3	6

Research Method

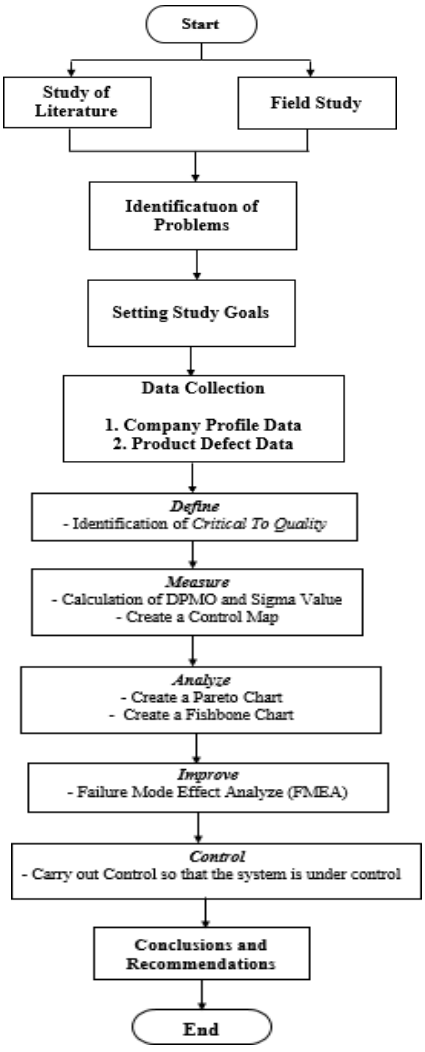

Figure 1. Research Flow Chart

Results And Disscusion

A. Define

In this define stage, the office partition product at PT. Inspira Multi Karya contains 4Critical to Quality (CTQ) which are determined based on the type of defect, namely scratches, dents, cracks, and edge defects. Of the 4 CTQs, there is 1 type of defect withthe highest percentage of defects, namely the type of scratches defect.

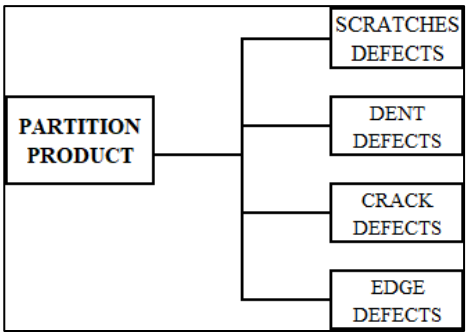

Figure 2. *Critical to quality on partition products*

B. Measure

Table 2. *DPMO value and sigma value*

Month	Production Total	Defects Total	CTQ	DPU	TOP	DPO	DPMO	SIGMA VALUE
September	30	7	4	0,2333	120	0,0583	58333,3333	3,0689
	25	7	4	0,2800	100	0,0700	70000,0000	2,9758
	45	10	4	0,2222	180	0,0556	55555,5556	3,0932
	40	10	4	0,2500	160	0,0625	62500,0000	3,0341
Oktober	20	7	4	0,3500	80	0,0875	87500,0000	2,8563
	35	6	4	0,1714	140	0,0429	42857,1429	3,2185
	30	8	4	0,2667	120	0,0667	66666,6667	3,0011
	40	10	4	0,2500	160	0,0625	62500,0000	3,0341
November	50	13	4	0,2600	200	0,0650	65000,0000	3,0141
	25	6	4	0,2400	100	0,0600	60000,0000	3,0548
	30	5	4	0,1667	120	0,0417	41666,6667	3,2317
	35	9	4	0,2571	140	0,0643	64285,7143	3,0198
TOTAL	**405**	**98**		**2,94746**	**1620**	**0,7369**	**61405,4233**	**3,0502**

The results of the calculation of the value of Defects Per Million Opportunity (DPMO)are used to determine the level of defects per million opportunities. From the calculationresults obtained a sigma value of 3.0502 with an average value of Defect Per Million Opportunity (DPMO) of 61405 per one million opportunity, Defect per Opportunity (DPO) or the possibility of the Office Partition product experiencing defects to meet thecompany standards of PT. Inspira Multi Karya of 0.061405.

Table 3. *Calculation of P. control map*

bulan	*Total Input* (Unit)	*Good Product* (Unit)	Cacat (Unit)	% Cacat (P)	$3\sigma = 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	UCL (P bar + 3 STDV)	LCL (P bar - 3 STDV)	P bar
September	30	23	7	0.233	0.48809	0.73371	-0.24247	0.246
	25	18	7	0.280	0.48809	0.73371	-0.24247	0.246
	45	35	10	0.222	0.40837	0.65399	-0.16274	0.246
	40	30	10	0.250	0.40837	0.65399	-0.16274	0.246
Oktober	20	13	7	0.350	0.48809	0.73371	-0.24247	0.246
	35	29	6	0.171	0.52720	0.77282	-0.28158	0.246
	30	22	8	0.267	0.45657	0.70219	-0.21094	0.246
	40	30	10	0.250	0.40837	0.65399	-0.16274	0.246
November	50	37	13	0.260	0.35816	0.60378	-0.11254	0.246
	25	19	6	0.240	0.52720	0.77282	-0.28158	0.246
	30	25	5	0.167	0.57752	0.82314	-0.33189	0.246
	35	26	9	0.257	0.43046	0.67608	-0.18483	0.246
Total	**405**	**307**	**98**	**2.947**	**5.56646**			

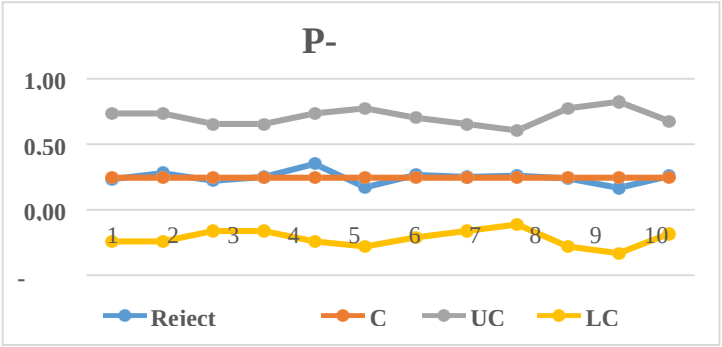

Figure 3. *Chart of P control map*

The graph above shows that the data generated on the P control chart does not pass through UCL and LCL. And the result is a control chart P whose data is still within the control limits.

C. Analyze

At this stage an analysis of the problems that occur in the Office Partition products atPT. Inspira Multi Karya, which previously did the calculations at the measure stage. At this stage, the biggest defects in Office Partition products will be known and the factors that cause these defects to occur.

This stage uses 2 tools, namely Pareto diagrams and fishbone diagrams. The Pareto diagram is used to determine the types of defects that most appear in Office Partition products so that the repairs that will be carried out focus on these types of defects. After knowing the type of defect that has the most number of defects, the next step is to use fishbone diagram tools (Fishbone Diagram) to find out the causes of the most common defects.

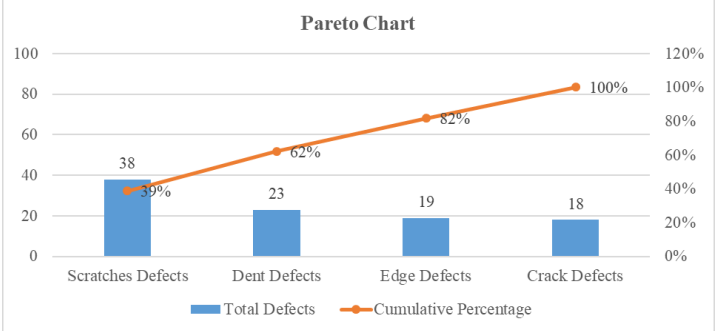

Figure 4. *Pareto chart of product defects*

The results obtained after finding the types of defects in office partition products on the Pareto diagram, the percentage of the highest types of defects reached 39%, namely scratches defects, 23% dent defects, 19% edge defects, 18% cracked defects.

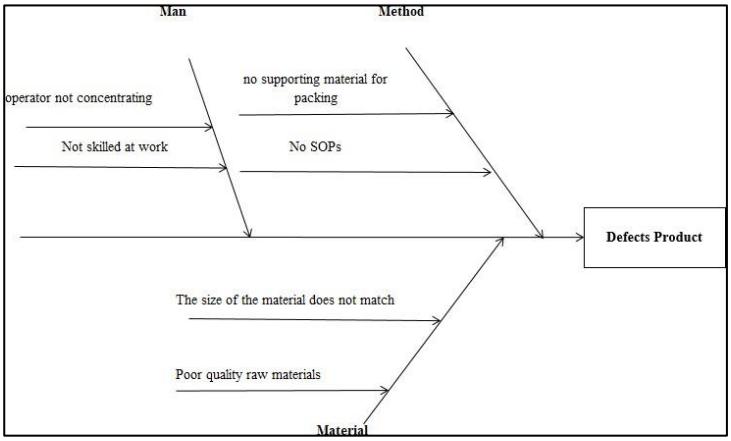

Figure 4. *Pareto chart of product defects*

Method

This factor is caused by the poor packing process and the absence of supporting materials for the packer, then the Standard Operation Procedure (SOP) or work instructions do not exist, resulting in irregular work procedures that must be carried out and ultimately causing the defect problem.

Material

This factor is caused by a discrepancy in the size of the material pieces that have beenstandardized, and also not checking the raw materials before processing, resulting in defects in the finished product.

Man

This factor is caused by the operator's lack of concentration so that in carrying out theirduties the operators are not focused, this also occurs because they are not experts in doingtheir work and there are mistakes that make the product defective.

D. Improve

The process carried out at this stage is to make various efforts to minimize various causes of product defects. The tools used at this stage are Failure Mode Effect Analysis (FMEA) and provide input on actions to reduce this with the Action planning for failuremodes tools.

Table 4. Failure mode

Modus of failure	*Cause of failure*	*Effect of failure*	*Severity Rating*	*Occurance Rating*	*Detection Rating*	*Risk Priority Number*	*Ranking of RPN*
Defects Product	No SOPs	Work is not according to the rules	6	5	5	150	1
	no supporting material for packing	Many products are damaged during shipping	5	6	4	120	2
	The size of the material does not match	Difficulty in assembling	5	4	3	60	4
	Poor quality raw materials	Product quality standards are decreasing	4	3	4	48	5
	operator not concentrating	Operators are not working optimally	5	4	4	80	3
	Not skilled at work	There were some errors at work	5	3	3	45	6

Failure Mode and Effects Analysis (FMEA) is useful for determining the priority of problems causing defects. Using FMEA by means of the highest Risk Priority Number (RPN) value obtained from the Severity (Severity), Occurance (Frequency) and Detectability (Detective Level) values indicate that the reason for the highest Risk PriorityNumber (RPN) value can be corrected to reduce defects. Calculate the RPN value by multiplying each of these factors S x O x D which is given a scale of 1 - 10 to get the RPN rating. based on the biggest problem seen from the results of the FMEA, the highestscore is the absence of SOP, so the author wants to make suggestions for improvements by designing the proposed Standard Operational Procedure (SOP).

Table 5. Action planning for failure modes

Expected product	*Cause of failure*	*Effect of failure*	*Design Action*	*Design Validation*
Partition products are not defective and are in accordance with company regulationspe rusahaan	No SOPs	Work is not according to the rules	Suggest making SOP	Make a good and appropriate SOP
	no supporting material for packing	Many products are damaged during shipping	Need additional material to do packing	Cartons for packing must be styrofoam
	The size of the material does not match	Difficulty in assembling	Adjust the size of the pieces to fit the standard	Cut the material according to the standard dimensions of the size
	Poor quality raw materials	Product quality standards are decreasing	Pay attention to the quality of raw materials	Checking raw materials before processing
	operator not concentrating	Operators are not working optimally	Improve accuracy, focus, and skills	Employees must work carefully and focus
	Not skilled at work	There were some errors at work	Improve operator skills	Conducting training for the operator concerned

In the table, it is intended that the solutions specified can lead directly to the cause of failure. The determined solution is made effectively and realistically possible by considering several inputs from the company.

E . Control

1. Making SOPs and reviewing it better.
2. Checking on the Quality Control section, every Quality Control process must be carried out at every stage of the ongoing production process so that errors can be detected early.
3. Carry out periodic control or supervision of operators, raw materials and productionprocesses so that the products produced can have good quality.
4. The workers pay attention and carry out their duties according to the right rules.
5. Tidy up the production floor by properly arranging the finished goods, tools or products in place.
6. It is necessary to conduct regular training and evaluation of workers.
7. Create a work assistant team tasked with overseeing employee performance on the production process in order to reduce errors made by operators.

Conclusion

Standard Operation Procedure (SOP) proposal

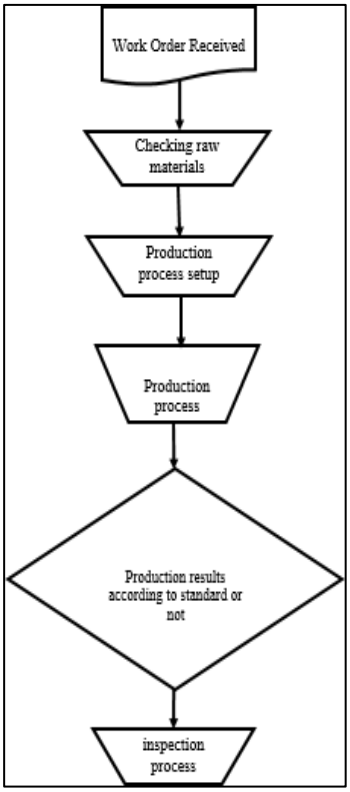

Figure 6. *Standard operation procedure (SOP)*

Production Department receives Work Order Document(SPK)

1. The SPK document that has been given will be signed, and the party who signed it must be responsible for the contents and information of the SPK document.
2. Prepare raw materials from the warehouse to be immediately processed into production.
3. After the material has been prepared, then theproduction process is carried out.
4. During the production process, only the main director, the head of the production division, the head of the production division and staff are allowed to enter the production area
5. If anyone with an interest wants to enter the productionarea, they must have a clear permit and reason.
6. Each operator works according to their responsibilities in terms of supervising the machine and its production process
7. Stages of the Production Process
8. The finished product will be inspected

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