

Conference Paper

Quality Control Analysis of Steel Plates Products at PT. ABC Using Seven Tools and Kaizen Method

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*Corresponding author: E-mail:	ABSTRACT
sumiatiroyanawati04982@gmail.com	Quality is the overall set of characteristics of a product or service in satisfying part or all of the needs of consumers. Consumers as product users always compare in choosing or using products so this situation results in the role of quality being increasingly important. The problems faced by PT. ABC is the defect rate that occurs in the production of High Strength Steel Plates, namely in January - September 2017 the defect rate of the High Strength Steel Plates type is 3.28%. This of course greatly affects the efforts of PT. ABC to increase production results or at least reduce the level of defects that occur. The purpose of this research is to find out the factors that cause defects, analyze product defects and analyze the causes for continuous improvement. This can be done using the Kaizen method. This technique uses the basic tools of Seven Tools. The results showed that based on data processing using Seven Tools, it can be seen that the number of defects from the type of defect on the steel plate High Strength Steel Plates during 9 months was wavy defects with a percentage of 26.36%, wrong cut with a percentage of 27.61%, not symmetrical with a percentage of 25.62%, and deep scale with a percentage of 20.39%. The results of the analysis that the cause of wrong cutting defects are caused by human factors that are not careful, lack of concentration, and lack of skill. To overcome this problem, Kaizen or 5S analysis was made. Improvements have been made to the production of High Strength Steel Plates for a period of 9 months, from 3.28% to 2.60% there was a decrease in defects or 0.68%.
	Keywords: Quality, defect, seven tools and kaizen

Introduction

Product quality and productivity are the keys to success for any production system as well as to generating profits. Quality control in production activities is very important to be carried out by an industrial company to reduce the risk of damaged or defective products (Latifah et al., 2022). Quality control is very much needed by the company to maintain market share or even increase the existing market share, so that market share still exists (Alfadilah et al., 2022). One way to control the quality of product quality control is to improve the quality of the production process which must be run continuously and analyzed in formulating the causes of product defects (Pramono et al., 2018), to obtain a reduction in defective products that can minimize losses (Qothrunnada et al., 2022).

PT. ABC operates in the production of steel plates. The company's products are used in shipbuilding, heavy equipment, and construction. PT. ABC is a company engaged in the steel plate industry, the production process here runs continuously. Various quality control programs are carried out by the company so that it can produce good products following established quality standards. The company is still not able to minimize the level of defects in steel plate products,

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several types of defects occur in steel plates, namely corrugated steel, wrong cuts, asymmetry, and deep scale (dirt that sticks to the plate). In the wrong type of cut, defects were found with a total of 111 units or about 0.27% which resulted in producing results that were not optimal. In quality control problem analysis, the number of damaged or defective products can be analyzed using seven tools, and quality improvement from raw materials, operators, and machines can be done using the Kaizen-5S method.

Literature Review

Seven tools

Analyzing data to solve problems, can be obtained using basic integrated quality control techniques called 7 tools (seven integrated quality control tools), namely: Check Sheet, Histogram, Pareto Diagram, Cause effect diagram, Stratification, Scatter Diagram (scatter diagram), Control Chart (control map) (Neyestani, 2017).

The tools of quality control which are often called the seven tools are used to solve problems based on correct and accountable data.

a. Check Sheet

The check sheet is a data collection tool. Check sheets can be used for a variety of purposes.

b. Histogram

The histogram is a type of bar graph in which the amount of data is grouped into several classes at certain intervals.

c. Pareto Charts

Pareto diagrams are made to find out the problem or cause which is the key to solving the problem or comparison to the whole.

d. Cause and Effect Diagram

This diagram is useful for analyzing and finding factors that have a significant influence on determining the quality characteristics of work output (Saifuddin et al., 2021).

e. Stratification

Stratification is an attempt to group data into groups that have the same characteristics.

f. Scatter Diagram

The scatter diagram is a tool for identifying potential relationships (but not causal relationships) between two variables. The shape of the scatter diagram often identifies the type of relationship that may exist between two variables.

g. Control Chart

The control chart is a statistical tool to set control limits based on existing plots based on the kinds of changes or deviations that occur in the production process (Abdel-Hamid & Abdel-haleem, 2019).

Kaizen

Japanese work culture is known as kaizen. Kaizen according to Imai (2008) is "continuous progress and improvement in social life and work life". The word kaizen is used to describe a management process and business culture means continuous improvement with the active participation and commitment of all employees in any form carried out by the company (Shania et al., 2022). Successful work is rooted in the values that are owned and behavior that becomes a habit. These values stem from customs, religion, norms, and rules that become beliefs that become habits in work or organizational behavior. The values that have become habits are called culture. Because culture is associated with the quality or quality of work (Bordin et al., 2018).

Work Culture is a philosophy based on a view of life as values that become the nature, habits, and driving forces, entrenched in the life of a community group or organization which is reflected from attitudes into behaviors, beliefs, ideals, opinions, and actions that are realized as work (Imai, 2008). Kaizen or continuous improvement is "continuous process improvement to always improve the quality and productivity of output" (Gupta & Gupta, 2017).

Material and Methods

This research started with a literature study and field study during the research, then obtained the formulation of the problem, and continued with determining the research objectives, after that the identification of variables in this study was carried out, then data collection was carried out namely data on types of defects and data on the number of defects. Followed by data processing with check sheets, grouping product defect data with stratification, analyzing product defects with histograms, analyzing product defects using Pareto diagrams, analyzing P control charts for defects in the production process, and identifying the causes of problems with fishbone diagrams. After the data is processed, the proposed improvements are made to Improve using the Kaizen Five-M checklist and Kaizen 5-S. And then the results are obtained and a discussion is carried out, then conclusions can be made, giving suggestions and finished.

Results and Discussion

Data processing using seven tools

Check sheet

From the check sheet above, it is known the number of defects from the type of defect in the process of making High Strength Steel Plates.

	Number of Defects (units)						_				
Type of defect	January	February	March	April	Мау	June	July	August	September	$\sum x$	\overline{X}
Wavy defects	13	11	11	9	10	9	22	10	11	106	0,26
Wrong cut	9	12	14	11	13	10	18	12	12	111	0,27
Not symmetrical	11	8	13	12	12	8	15	13	11	103	0,25
Deep scale	8	7	10	8	10	7	14	10	8	82	0,20
Total	41	39	48	40	45	34	69	44	42	402	99,98

Table 1. Checksheet

Source: Data processed

From the check sheet above, it is known the number of defects from the type of defect in the process of making High Strength Steel Plates.

Pareto chart

Table 2. Pareto chart

Type of defect	Number of Defects (units)	Percentage (%)	Total Cumulative	Cumulative (%)
Wavy defects	106	$\frac{105}{402}$ x 100% = 26,36 %	106	26,36
Wrong cut	111	$\frac{111}{402}$ x 100% = 27,61%	217	53,97
Not symmetrical	103	$\frac{103}{402}$ x 100% = 25,62%	320	79,59
Deep scale	82	$\frac{82}{402}$ x 100% = 20,39%	402	99,98
Total	402	100 %	-	-

Source: Data processed



Figure 1. Pareto diagram of steel plate

From Figure 1 above, it can be seen that the type of defect that is prioritized for repairs in the manufacture of steel plates for this type of the wrong cut with a percentage of 27.61%.

Histogram

From Figure 2, it can be seen that the defects in High Strength Steel Plates products from January-September 2017 were mostly in the 10-12 interval with a frequency of 17, 7-9 with a frequency of 10, 13-15 with a frequency of 7. While the lowest defects are in intervals 16-18, 45-52 with a frequency of 1, and 22-24 with a frequency of 0.



Figure 2. Pareto diagram of steel plate





Figure 3. Scatter diagram between the number of defects and types of defects wrong cut

From Figure 3 above, it can be seen from the scatter diagram that the spread of the level of disability that occurs is in line with the level of the wrong cut, where both have a positive form of correlation. From the calculation, the correlation value is 0.9244.

Control chart



Figure 4. P-Control chart

Figure 5. Comparison of the defect before and after reduction

Based on the P control chart in Figure 4 above, it can be seen that the data obtained are out of control limits, 4 points are out of control limits, namely no. 6, 13, 19, and 27, so it can be said that the process is not under control. This means that quality control at PT. ABC needs improvement because there are very high and irregular fluctuation points which indicate that the production process is still deviant. From Figure 5, it can be seen that the average initial defect in January - September 2017 was 3.28% to 2.60%, there was a decrease in the number of defects by 0.68%.

Cause and effect diagram

From the causal diagram, it is known that 5 factors affect the process of the occurrence of wavy defects in the product. The human factor is less focus or concentration and not being careful. For the engine factor that affects is the wrong temperature setting and the temperature is not suitable. Material factors that affect it is unstable material quality. The method factor is that the applied procedure is not carried out properly. Environmental factors that influence is less lighting and stuffy air.



Figure 6. Cause and effect diagram

Recommendations Improvement

The improvement plan describes the allocation of resources and alternative priorities in implementing the improvement plan. The tools used in determining the priority of the

improvement plan are implementing Kaizen using the Kaizen-M checklist method and the Kaizen five-step plan.

No	CTQ	Factor	Problem	Problem Solution		
	Wavy	Man	Not careful, Lack of con-	The head of production provides even tighter		
	defects		centration	supervision of his employees, Optimizing rest time		
1.		Material	Unstable material quality	Take control at the time of selecting raw materials		
		Environment	Less lighting, stuffy air	Added lighting, Evaluation of the comfort of the		
				work area.		
		Machine	Wrong temperature	Checking the machine setting up during the		
			setting	production process		
		Method	The procedures applied	The head of production gives direction to his		
			are not carried out	employees before the production process starts		
			properly			
		Man	Less Skilled	Must increase creativity at work		
2		Environment	Low lighting, The process	Added lighting, Conduct an evaluation of the		
	Wrong cut	Maabiaa	area is not clean	comfort of the entire work area		
		Machine	measuring instruments	in order for the tool to comply with the standard,		
			Indiated De Camprated,	it is checked repeatedly		
		Method	Less instructions in the	The head of production gives direction to his		
		Methou	nroduction process	employees before the production process starts		
		Man	Less Skilled	Must increase creativity at work		
		Environment	Low lighting. The process	Added lighting. Evaluation of the comfort of the		
			area is not clean	work area.		
	Not	Machine	Pay attention to the	Carry out the process according to the specified		
3	symmetrical		position of the machine	standards, Checked repeatedly		
			that has been			
			standardized, Checking			
			the location on the plate			
		Method	Less instructions in the	The head of production gives direction to his		
			production process	employees before the production process starts		
		Man	Lack of focus or	Optimizing rest time		
		Machino	Owngen entering the	Charlend before the process takes place Setting the		
		Machine	furnace Spray pressure	tool according to the plate		
4			on the plate	tool according to the plate		
		Environment	Low lighting	Adding lighting. Evaluation of the comfort of the		
	Deep Scale			entire work area		
	1	Material	Carbon content is too	Checked at the time of selection of raw materials		
			high			
		Method	The established	The head of production gives direction to his		
			procedure is not	employees before the production process starts		
			executed properly			

Table 3. Problem analysis with five-M checklist

No.	Kaizen Five Step Plan / 5S	The consequences	Implementation
1.	Seiri (Sort)	a. Workers find it difficult to take raw	a. Separating raw materials that have been
		h Wests of work time to take mined row	cut and uncut.
		b. Waste of work time to take mixed raw materials.	b. Classify raw materials that have been cut and uncut.
		c. The work movement is disrupted due to	c. Throw away unnecessary items so as not
		scattered garbage.	to interfere with the process.
2	Seiton	a. To find the raw materials needed for the	a. Arranging the layout of raw materials in
	(Straighten)	next production process takes a long time,	accordance with the production process so
		resulting in a waste of work time and wasting	as not to waste time and waste employee
		employee energy.	energy.
		b. Productive preparation time is not	b. Putting the raw materials that have been
		effective, people or	determined so that there is no wastage of
		the related department is waiting as a result	time for the production process.
		the production does not run normally	
3.	Seiso (Shine)	a. The work environment becomes	a. Remove all the remaining pieces of steel
		dangerous.	plate so as not to disturb the workers.
		b. Cause work accidents.	b. Warn all workers who are in the process
		c. Reduce work productivity.	of cutting the steel plate to be able to
			immediately dispose of the remaining pieces
			of the steel plate.
			c. Get into the habit of taking time to clean up
			the pieces of steel plate.
4.	Seiketsu	a. The setting time is not appropriate and the	a. Provide direction when running the
	(Standardize)	use of the machine is not good.	machine.
		b. The machine is sometimes unstable in the	b. Provide maintenance on machine parts
		process.	c. Make SOP rules on the machine
		c. Machine settings are not correct.	
5.	Shitsuke	a. Employees or workers find it difficult to	a. Provide time for training on the working
	(Sustain)	understand the theory or practice that exists	process of the machine.
		in their field of work.	b. Conduct training for workers so that
		b. Less careful in operating the machine.	mistakes do not occur while working.
		c. Production results are not appropriate	c. Check and pay attention when the process
		because the process is not by the procedure.	is running.

Table 4. Recommendations for improvement to kaizen five step plan / 5s on steel plate products

Conclusion

- The conclusions of this study are as follows:
- 1. From the results of the analysis that occurred at PT. ABC can be concluded that the defects of steel plate products at PT. ABC, which initially was 3.28% to 2.60%, there was a decrease in defects of 0.68%, with the highest number of defects, namely in wrong cutting defects and there were 111 defects that were prioritized to be carried out in the manufacture of steel plates because the type of defect was wrong. cut that is with a percentage of 0.27%. By calculating check sheets, Pareto diagrams, histograms, and P control charts.
- 2. The proposed improvement based on the Kaizen or 5S method is to achieve the target of zero defects, the company must propose improvements based on the kaizen implementation tools to improve product quality. Therefore, it is necessary to increase supervision and control in terms of giving directions to employees to be more careful at work, arranging raw materials, tools, and machines according to their type and function,

and maintaining tools and machines regularly so that they are not damaged, maintaining the cleanliness of the entire work area, regular evaluation of comfort at work, getting used to form an attitude of obeying the rules and carrying out work by SOPs in the company.

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