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Quality Control Analysis of The Risk of Paving Product Damage Using Six Sigma and Kaizen Methods

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ABSTRACT

Objective: *PT Varia Usaha Beton experienced various problems, including product defects allegedly due to lack of quality control in the production process, and the purpose of this study is to determine the causes of paving product failure and determine the risk reduction strategy for damage to paving products.* ***Method:*** *To conduct this research using six sigma and kaizen methods.* ***Results:*** *January-December 2023, the company standard for product defects was 0.1% of production each month, in January the defect was 0.3%, February the defect was 0.2%, March the defect was 0.5%, April the defect was 0.4%, May the defect was 0.2%, June the defect was 0.3%, July the defect was 0.4%, August the defect was 0.3%, September the defect was 0.4%, October the defect was 0.2%, November the defect was 0.4%, and December the defect was 0.2%, results showed the highest defect was in March 4859 out of 984275 and the lowest was in October 985 out of 552177, and types of defects: crack 9250, gupil 10040, porous 9961, with production improvement analysis using Kaizen Five M Checklist focusing on supervision, machine maintenance, material, SOP, and environment.* ***Novelty:*** *Further research is needed on factors that contribute to product defects.*

INTRODUCTION

PT. Varia Usaha Beton is constantly experiencing various problems. One of these problems is the occurrence of product defects in the production process that occur due to the application of less than optimal quality control. Problems Which happen on PT. Miscellany Business Concrete is Lots occurrence disabled product in process production due to lack of supervision in terms of quality control. From January to December In 2023, the company produced 9,022,481 paving blocks. Problems at PT. Varia Usaha Beton is that many product defects occur in the production process, allegedly due to a lack of attention to this matter. control quality. Production on January as much as 801,731 unit, February 743,700 unit, month March 984,375 units, April 476,237 units, May 767,483 units, June 711,499 units, July 726,900 units, August 892,796 units, September 781,360 units, October 552,177 units, November 801,369 units units, December 782,954 units. The company's standard for product defects is 0.1% of production in every month. On month January obtained disability as big as 0.3%, month February obtained disability as big as 0.2%, month March obtained disability as big as 0.5%, month April obtained disability as big as 0.4%, month In May, the defect rate was 0.2%, in June the defect rate was 0.3%, in July... defects of 0.4%, in August defects of 0.3% were found, in September defects were found by 0.4%, in October the defect was found to be 0.2%, in November the defect was found to be 0.4%, And month December obtained disability as big as 0.2%.

Production activities are very important for companies. Various problems exist. in production activities can cause both material and non-material losses. Quality management must meet company quality standards to reduce product defects, improve quality and customer satisfaction [1]. Quality that is level Good And the bad thing is, level quality Which relate with product, man or power workers and an environment that satisfies customers [2]. Quality control is the most important function for companies to compete in the industrial world. Quality control activities are designed to help companies improve product quality and control product defect rates to zero defect rates [3]. Risk management namely facing the uncertainty that may arise, a strategy is needed to manage this uncertainty and minimize risk with strengthening human resources through mitigation risk [4].

Some previous studies used to support this research include Hairiyah's research [5] Which discuss about control quality use method six sigma And kaizen focus in reduce amount disabled product bread And increase quality product the on PT UD CJ Bakery Which Where must make continuous improvements to the problem. Research from Susetyo [6] discusses identification disabled product use method six sigma And kaizen in do identification disabled product Which happen in the process manufacturing plastic tube.

The objectives of the research based on the existing problem formulation are as follows: (1) to determine the evaluation reason failure product paving. (2) Determine strategy risk reduction damage on product paving.

Six Sigma

Six Sigma is a disciplined approach to data-driven activities to reduce or eliminate errors. in all production processes [7]. Six sigma is the determination of the level of product defects to determine the occurrence of defects. product defects [8]. Six sigma can improve product quality by taking steps that can reduce risk failure defective product [9]. Principle six sigma that is all activity Which important for quality And Things that cause delays in any process are good opportunities to make improvements. [10]. The goal of six sigma is to improve performance, achieve high quality levels, eliminate root causes causes of defects, and minimize process and product variation [11]. DMAIC is a process of continuous improvement. continuous to achieve the six sigma target. DMAIC is carried out systematically based on science and fact, DMAIC covering define, measure, analyze, improve, control [12].

Kaizen

Kaizen is a continuous process of continuously improving quality and productivity to achieve results. Which significant from time to time [13]. Objective kaizen is For create ability internal in company [14]. Kaizen is designed to regulate all company activities, providing beneficial progress that encompasses the kaizen process [15]. Kaizen is useful for determining suggestions for improvement after a company's data processed with six sigma [6].

RESEARCH METHOD

A. Time And Place Study

This research was conducted at PT. Varia Usaha Beton, located in Tambak Oso, Jl. H. Anwar Hamzah Block F02- F03, Village New, Tambakoso, District Waru, Sidoarjo, Java East. Study This implemented during 6 month, from month October of the year 2023 up to you month March of the year 2024.

B. Retrieval Data

In study This done collection data with a number of method For finish studies case Which carried out at PT. Varia Usaha Beton, there are two types of data used, namely primary data and secondary data. The primary data needed to obtain information that is the problem in this research is Observations are carried out by paying attention to every action carried out in the production and quality control, recording data from these observations, and identifying the objects that are the focus of the research for obtain the necessary information, including production data and the types of defects that occur in each product. Through observation on defects the, so the goal is For identify factors Which causing defects in the product. Next, an interview was conducted with the owner partners and employees who are tasked with quality control. The selection of sources in the interview process is those who are directly involved in the problems that are the focus of this research. Interviews were conducted with presenting a number of questions, and the information obtained from the interviews is recorded as relevant data. Data results interview covers information about production as well as type disabled Which happen from beginning process production until product become product So. After That There is data secondary Which required in study This is review general company data, production quantity data, product defect quantity data and product defect type data obtained from company.

C. Channel Study

Diagram flow study Which show stages in study Which done, following This is a diagram research flow Which can be seen in the Figure 1.

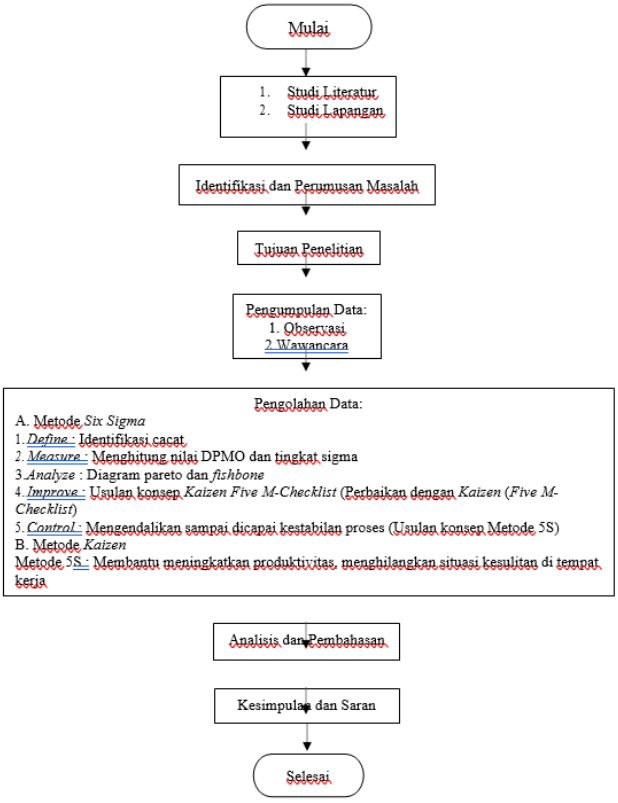

Figure 1. Research Flowchart.

In study This, use two type method, namely qualitative And quantitative. Method qualitative done through observation field with observe activity Which done by part production. Furthermore, data results observations are recorded and research objects are identified for the collection of production data and types of defects in each product. In addition, an interview was conducted with the head of the production department, with a number of questions that The results are recorded as part of the data collection. Meanwhile, the quantitative method uses the six-point method. sigma with kaizen.

A. Six Sigma

Six sigma is a systematic approach to identifying and eliminating wasteful activities through continuous fundamental improvement to achieve 6 sigma [16]. Six sigma includes strategic focus on increased satisfaction consumers. The following is steps used method six sigma, namely:

1. Define

At the define stage, quality problems experienced during the production process are identified. At this stage, product Which experience disability will searching for know root reason disability with based on on problem Which There is [17]. If matter the known, step furthermore is describe characteristics CTQ quality, to describe customer needs for the product. Critical to Quality is the size of a product that must meet performance standards or specification limits to satisfy customers [18].

2. Measure

Measure stage will measure the problems that have been set to be solved and will create an effective matrix to help monitor progress against the objectives identified in

step previously. Stage This done collection data For measure characteristics And ability For determine the steps taken for improvement [2]. The following are the measurement stages must done:

a. Map Control P

P control charts are used to monitor attributes related to product characteristics, especially focus on the quantity of events that are accepted or rejected as a result of the production procedure, the diagram This can be compiled by taking the population and samples [17]. In addition, there are special components which form the control chart, namely UCL (Upper Central Line), CL (Central Line), and LCL (Lower Central Line) Line). Following is formula For look for map control is as following:

1) Presentation Problem or Disabled

$$p = \frac{np}{n}$$

Source: [17]

Information:
n = amount sample
np = amount disability
p = average proportion disability

2) Calculation line CL aims to evaluate average amount error or problem

$$CL = \frac{\Sigma X}{\Sigma N}$$

Source: [17]

Information:
ΣX = Amount total
Which damaged ΣN =
Amount total Which
checked

3) Calculation limit control on Upper Central Line (UCL) used evaluate whether data is at in condition control or No.

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

Source: [17]

Information:
p = Average disability
product n = Amount
production

4) Calculation limit control lower (LCL) used For evaluate whether data is at in condition control or not.

$$UCL = P - 3\frac{\sqrt{P(1-P)}}{n}$$

Source: [17]

Information:
p = Average product
defects n = Amount
production

b. Stage analysis DPMO and Level Sigma,

To carry out DPMO analysis and determine the sigma value level, you can do the following: The steps in the DPMO analysis table and sigma levels. The following is the formula for calculate the value DPMO:

1) Defect Measurement per Opportunities (DPO)

DPO is measurement error Which show amount error per One opportunity with use formula that is:

$$DPO = \frac{Total\ Defect}{Total\ Produk \times CTQ}$$

Source: [18]

2) Calculation Defect per Million Opportunities (DPMO)

DPMO is performance quality as level damage per One million opportunity, Which stated as following:

$$DPMO = DPO \times 1{,}000{,}000$$

Source: [18]

3) Calculation Sigma Level

Calculation sigma level use Microsoft Excel with formula as following:

$$NORMSINV\ ((1000000\text{-}DPMO)/10000000)+1.5$$

Source: [18]

3. Analyze

The analysis stage involves the use of a fishbone diagram to identify factors and causes. Cause and effect serves as a tool to analyze defects in a company. By utilizing fishbone diagram, can effectively display the factors and causes of defects, conduct a comprehensive analysis until root reason the problem determined [17].

4. Improve

Stage improve is phase improvement quality six sigma through consideration opportunity, lack, ability, repair, analysis, And action For repair more continued [17].

5. Control

control stage is the final step in the quality improvement stage by ensuring the desired level of performance. in accordance with standards, which are then recorded and implemented and are useful as corrective steps for complete the process furthermore [17].

B. Kaizen

Following is steps finish problem use method kaizen delivery other that is:

1. Five M-Checklist, focuses on five elements in the process, namely man (operator), milleu (environment), method (method), machine, and material. Improvements are made by examining various aspects of the process [19].

2. Five Step Plan, this five step plan is a method used by Japanese companies to implement repair. Step This often called 5- S Which includes:
   a. Seiri (sorting), sorting And grouping goods according to function And its type, For know Which needed And Which one is No.
   b. Seiso (arrangement), organize And put material or goods on place Which in accordance so that easy found And reachable When needed.
   c. Seiton (cleanliness), clean all over equipment in environment Work And throw away rubbish on the place.
   d. Seiketsu (maintenance), that is activity guard cleanliness self so that all over hold on on three levels as mentioned in on (seiri, seiton, Seiko).
   e. Shitsuke (habituation), meaning develop attitude so that obey regulation Which has set as well as discipline about cleanliness And neatness on facility at work [19].

RESULTS AND DISCUSSION

Results

A. Collection Data

Data Which used is summary product disabled from product paving in One year that is from month January 2023 until December 2023. Information This encompassing production goods And Also product Which fail production (reject) based on direct observations at PT. Varia Usaha Beton during the research period. Data details can be seen in table 1.

Table 1. Defective Data And Amount Production.

No	Month	Amount Production	Type Product *Reject*			
			Cracked	Gupil	Porous	Total
1	January	801731	831	982	982	2795
2	February	743700	521	912	265	1698
3	March	984275	1050	1851	1958	4859
4	April	476237	608	591	786	1985
5	May	767483	871	307	461	1639
6	June	711499	863	549	563	1975
7	July	726900	950	861	980	2791
8	August	892796	760	1231	921	2912
9	September	781360	1051	891	909	2851
10	October	552177	381	294	310	985
11	November	801369	699	981	1219	2899
12	December	782954	665	590	607	1862
	Total	9022481	9250	10040	9961	29251

On Table 1 there is that month January company own amount production paving as much as 801731 with total defects amounted to 2795. In February the company had a total paving production of 743700 with a total of 1698 defects. In March the company had a paving production volume of 984275 with total disability as big as 4859. On month April

company own amount production paving as much as 476237 with total disability as big as 1985. On month May company own amount production paving as much as 767483 with total disability as big as 1639. On month June company own amount production paving as much as 711499 with a total of 1975 defects. In July the company had a paving production volume of 726900 with a total defect of 2791. In August the company had a production volume of paving as many as 892796 with a total of defects of 2912. In September the company had a production volume of paving as many as 781360 with a total of 2851 defects. In October the company had a total of paving production was 552,177 with a total of 985 defects. In November the company had The total production of paving blocks was 801,369 with a total of 2,899 defects. In December, the company own amount production paving as many as 782954 with a total disability of 1862.

B. Category Product Reject

Reject product category, it includes an explanation of paving products that have a reject product category. There is in PT. Miscellany Concrete Business which is becoming problems in production, can seen on Table 2.

Table 2. Category Product Reject.

No	Category	Explanation
1	Paving Cracked	Paving product defects include lines that cause paving easy split or cracked. Matter the Can caused by Because dose material hardener Which not enough from provision size.
2	Paving Gupil	Disability product paving experience damage on part Wrong Onehis side.
3	Paving Porous	Imperfection product paving own surface Which No average. Due to Because sand which is used too much rough.

C. Processing Data Use Six Sigma

After process collection data Already complete, next that is process processing data For identify problems that occur in the production process. By using the six sigma method, it can provide an overview of the types of product defects and their causes. There are 5 (five) stages of six sigma, namely define, measure, analyze, improve, And control. Following processing data using method six sigma.

1. Define

Define stage is the company's core process which includes functions that provide added value. like product consumer, service, support And information [20]. In activity production in PT. Miscellany Business Concrete, often time experience disabled product. By Because That, required repair For reduce disabled Which happen. On In this define stage, the type of product defect is identified using Critical to Quality (CTQ). The following table is used. Critical to Quality paving products that is:

Table 3. Critical to Product Quality Paving

No	Critical to Quality	Reason
1	Paving experienced rift	Cracked paving usually occurs during the drying process, due to... when the paving is piled up too much or it could even be because of the employees not enough be careful on moment lift paving the, so that condition paving become cracked.
2	Form paving gupil	Form paving No perfect because Can happen on moment machine pressingNo cleaned moreover formerly before used Can Also Because mold Still not yet in position right.
3	Paving porous	This porous paving is one of the defects that occurs in production results. PT. Varia Usaha Beton. This porous paving usually occurs due to a lack of cement, or even because when pressing it was not pressed enough so that paving have cavity inside it Which result in form paving become porous.

2. Measure

Measure stage is a measurement that aims to measure aspects such as performance, processes, and activity, the measurement phase is P-Chart and six sigma level and DPMO [20]. In carrying out control statistically, the first step to be taken is to create a check sheet. Check sheet or check sheet collection data can used For help analyze problem, control process, And develop plan [21]. Following data production during January until December 2023.

Table 4. Data Production Paving And Data Disabled Product Paving.

Month	Amount Production	Amount Product Disabled	Type Defective Product			
			Disabled Cracked	Disabled Gupil	Disabled Porous	Presentation Disabled Product
January	801731	2795	831	982	982	0.3%
February	743700	1698	521	912	265	0.2%
March	984275	4859	1050	1851	1958	0.5%
April	476237	1985	608	591	786	0.4%
May	767483	1639	871	307	461	0.2%
June	711499	1975	863	549	563	0.3%
July	726900	2791	950	861	980	0.4%
August	892796	2912	760	1231	921	0.3%
September	781360	2851	1051	891	909	0.4%
October	552177	985	381	294	310	0.2%
November	801369	2899	699	981	1219	0.4%
December	782954	1862	665	590	607	0.2%
Total	9022481	29251	9250	10040	9961	3.8

In measure stage, measurement divided become two stage that is:

Map Control Chart

Map control is tool Which used in control quality statistics For monitor And evaluate activity or process in a way graphic For overcome problem And increase quality [22]. Making The control chart in this study was conducted with the aim of identifying variables that indicate consistency and unpredictable variables, which can produce outputs that are influenced by causes because problem Which complex. For make things easier process calculation in manufacturing map control P, used help Microsoft Excel. Example calculation map control on month January can seen on calculation in lower This:

Calculation Proportion Disabled January:

$$P = \frac{np}{n}$$

$$P = \frac{2795}{801731}$$

$$P = 0{,}003486$$

Calculation *Center Line* (CL) January:

$$CL = \frac{\Sigma np}{\Sigma n}$$

$$CL = \frac{29251}{9022481}$$

CL = 0,003242

Calculation *Upper Center Limit* (UCL) month January:

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

$$UCL = 0{,}003242 + 3\sqrt{\left[\frac{0{,}003242(1 - 0{,}003242)}{801731}\right]}$$

$$UCL = 0{,}003242 + 3\sqrt{\left[\frac{0{,}003242(0{,}996758)}{801731}\right]}$$

$$UCL = 0{,}003242 + 3\sqrt{\left[\frac{0{,}003231}{801731}\right]}$$

$$UCL = 0{,}003242 + 3\sqrt{0{,}0000000040}$$

$$UCL = 0{,}003242 + 3\,(0{,}00006348)$$

$$UCL = 0{,}003242 + 0{,}000190$$

$$UCL = 0{,}003432$$

Calculation *Lower Center Limit* (LCL) month January:

$$LCL = P - 3\sqrt{\left[\frac{P(1-P)}{n}\right]}$$

$$LCL = 0{,}003242 - 3\sqrt{\left[\frac{0{,}003242(1 - 0{,}003242)}{801731}\right]}$$

$$LCL = 0{,}003242 - 3\sqrt{\left[\frac{0{,}003242(0{,}996758)}{801731}\right]}$$

$$LCL = 0{,}003242 - 3\sqrt{\left[\frac{0{,}003231}{801731}\right]}$$

$$LCL = 0{,}003242 - 3\sqrt{0{,}0000000040}$$

$$LCL = 0{,}003242 - 3(0{,}000063)$$

$$LCL = 0{,}003242 - 0{,}000190$$

LCL = 0,003052

After done calculation in a way complete on every month, data results from processing map control the can seen in the table 5.

Table 5. Results Map Calculation Control

Month	Amount Production	Amount Product Disabled	Proporti on	UCL	CL	LCL
January	801731	2795	0.003486	0.003432	0.003242	0.003052
February	743700	1698	0.002283	0.003440	0.003242	0.003044
March	984275	4859	0.004937	0.003414	0.003242	0.003070
April	476237	1985	0.004168	0.003489	0.003242	0.002995
May	767483	1639	0.002136	0.003437	0.003242	0.003047
June	711499	1975	0.002776	0.003444	0.003242	0.003040
July	726900	2791	0.003840	0.003442	0.003242	0.003042
August	892796	2912	0.003262	0.003423	0.003242	0.003062
September	781360	2851	0.003649	0.003435	0.003242	0.003049
October	552177	985	0.001784	0.003472	0.003242	0.003013
November	801369	2899	0.003618	0.003433	0.003242	0.003052
December	782954	1862	0.002378	0.003435	0.003242	0.003049
Total	9022481	29251				

After analyze data Which obtained from company, map control (P-Chart) has arranged And can seen in Figure 2.

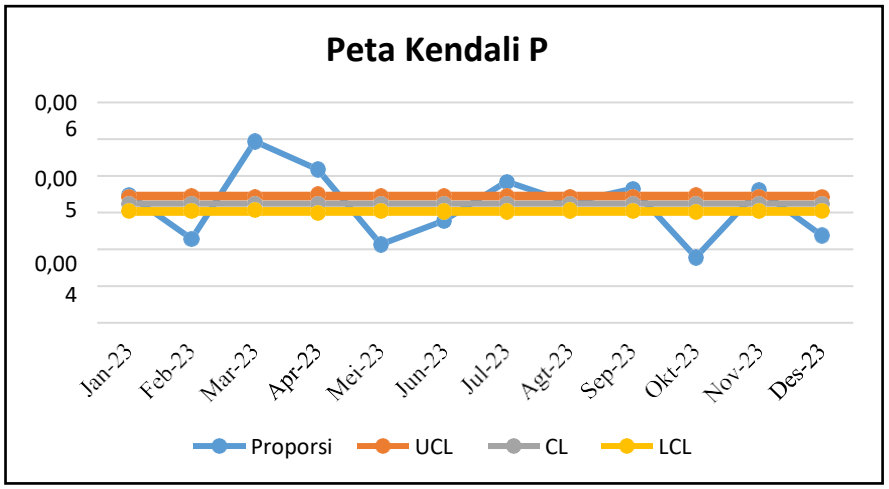

Figure 2. Map Control

From map control P on obtained results that There is 4 (four) month Which is at on cancel control that is month March is at on number 0.004937, month July is at on number 0.003840, on month September is at on number 0.003649, and November was at 0.003618, which is an effort to make improvements in a systematic way. continuously it can be seen that there is a significant change in the P control chart graph, where the P value Still exceed mark UCL is at on number 0.003422 And mark LCL is at on number 0.003062 And There is Which exceeding the UCL and LCL lines. Therefore, the process capability in the January-December 2023 period is running smoothly. good because a number of proportion disability exceed on limit control.

Stage measurement level six Sigma and Defect Per Million Opportunities (DPMO)

Calculate DPMO (Defect Per Million Opportunities), then convert the calculation results with six sigma table to obtain sigma values, Example of DPMO calculation in September can be seen on calculation in lower This :

a. Count mark DPO

$$\text{DPO} = \frac{\text{Total Defect}}{\text{Total Produk} \times \text{CTQ}}$$

$$\text{DPO} = \frac{2851}{781360 \times 3}$$

$$\text{DPO} = 0{,}001216$$

b. Calculating DPMO (*Defects Per Million Opportunities)*

DPMO = DPO × 1.000.000
DPMO = 0,001216 × 1.000.000
DPMO = 1216,255

c. Determine mark sigma

Calculation This conversion mark sigma from DPMO (*Difect Per Million Opportunities*) become mark sigma with using *Microsoft Excel* with the formula = NORMSINV ((1000000-DPMO)/10000000)+1.5. Then the value DPMO 1216 is sigma 4.53. After a complete calculation is carried out for each month, the resulting data from calculation DPMO and mark the sigma seen on Table 6.

Table 6. Calculation Mark Sigma And DPMO

Month	Amount Production	Amount Product Disabled	CTQ	Mark DPO	DPMO	Mark Sigma
January	801731	2795	3	0.001162	1162,069	4.545345
February	743700	1698	3	0.000761	761,0596	4,670433
March	984275	4859	3	0.001646	1645,543	4.439155
April	476237	1985	3	0.001389	1389,364	4.491212
May	767483	1639	3	0.000712	711,8507	4.689802
June	711499	1975	3	0.000925	925,2765	4.613224
July	726900	2791	3	0.00128	1279,864	4,516190
August	892796	2912	3	0.001087	1087,221	4,565310
September	781360	2851	3	0.001216	1216,255	4.531613
October	552177	985	3	0.000595	594,6161	4,741450
November	801369	2899	3	0.001206	1205,853	4,534205
December	782954	1862	3	0.000793	792,7243	4.658571

Total	9022481	29251	36	0.012772	12771.7	54.99650956
Average	751873.4167	2437,583333	3	0.001064	1064,308	4.583042463

It can be concluded that the average DPMO value is 1,064.308 per month, which means that the process has a chance of success. produce defects as much as 1,064,308 so that it is obtained mark sigma of 4.58.

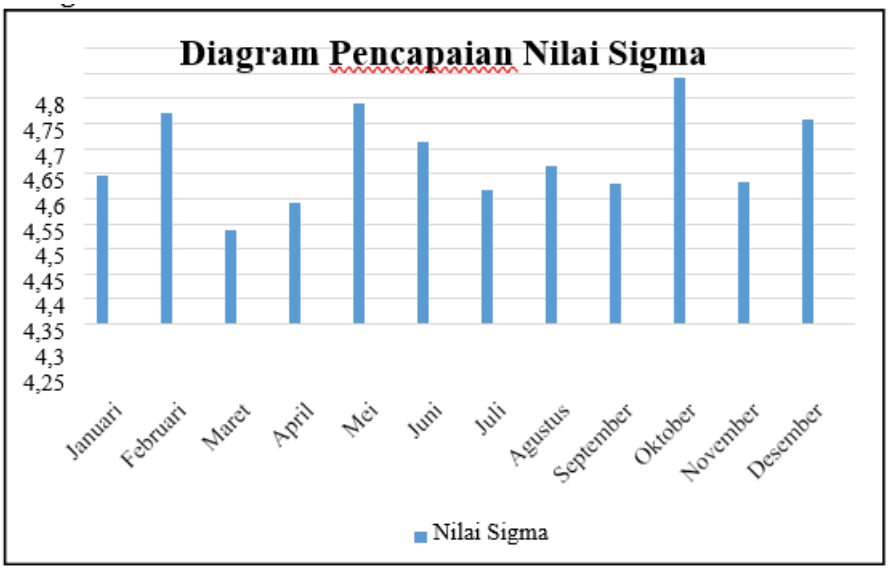

Figure 3. Diagram Achievement Sigma.

The image above is the result of the sigma achievement level, showing that the higher the DPMO produced, the better. the sigma value is getting lower. Therefore, corrections must be made to reduce the DPMO value and increasing the sigma value until it reaches zero damage. In March 2023, production reached the sigma level the lowest amount of 4.439155 compared to month other.

3. Analyze

The analysis stage uses Pareto diagrams and cause - effect diagrams using fishbone diagram for know What just a factor Which influence existence disability product.

Diagram Pareto

A Pareto diagram is a diagram that shows a level of failure factors that can be influence condition based on principle Pareto. in analyze possibility reason occurrence production failure shrimp crisp fish, so he did calculation data presentation product disabled on paving.

Table 7. Data Presentation Product defects Paving

Type disabled	Amount Disability	Frequency Cumulative	Percentage (%)	Cumulative (%)
Cracked	9250	9250	32%	32%
Gupil	10040	19290	34%	66%
Porous	9961	29251	34%	100%
	29251		100%	

Based on table 7 above, it can be seen that the percentage of cracked products is 32%. And presentation cumulative as big as 32%, product Which experience gupil own percentage as big as 34% And presentation cumulative percentage of 66%, porous

products have a percentage of 34% and a cumulative percentage of 100%. Based on from data on Table 7 so can arranged A diagram Pareto Which can seen on Figure 4.

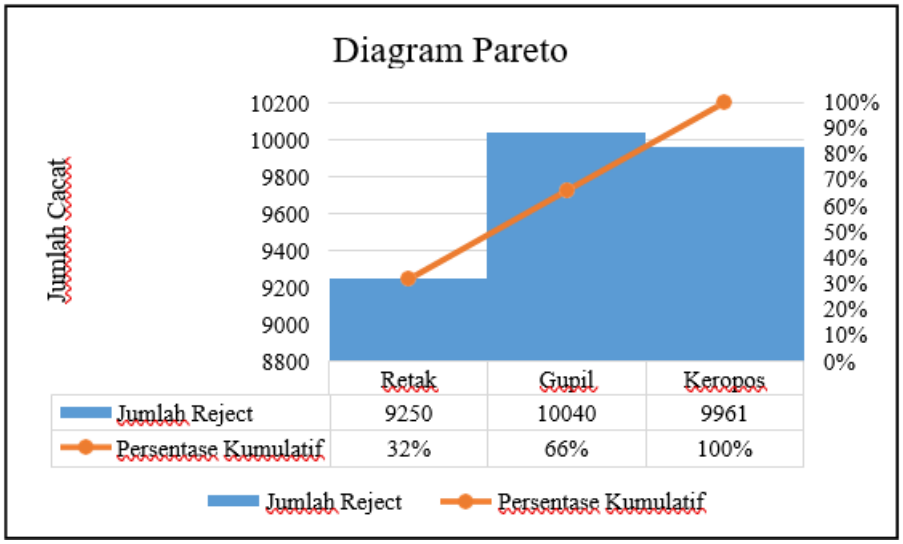

Figure 4. Diagram Pareto.

Based on Figure 4 above, it can be concluded that the largest type of paving product defect is period January - December 2023 is gupil with amount disabled as big as 10040 product And percentage disabled as big as 66%.

Fishbone Diagram

Diagram This, Also known as diagram bone fish or diagram Ishikawa, can used For analyze And identify root reason something problem or results certain. Diagram help connect factors reason Which Possible influence situation or problem Which happen. Influenced by a number of category, includes: man (man), that is all person Which involved in process manufacturing, method (method), to describe instruction For do procedure And conditions Which must fulfilled, materials, namely needs and equipment or requirements, machines equipment that needed referring to on all over equipment Which used in process production [22].

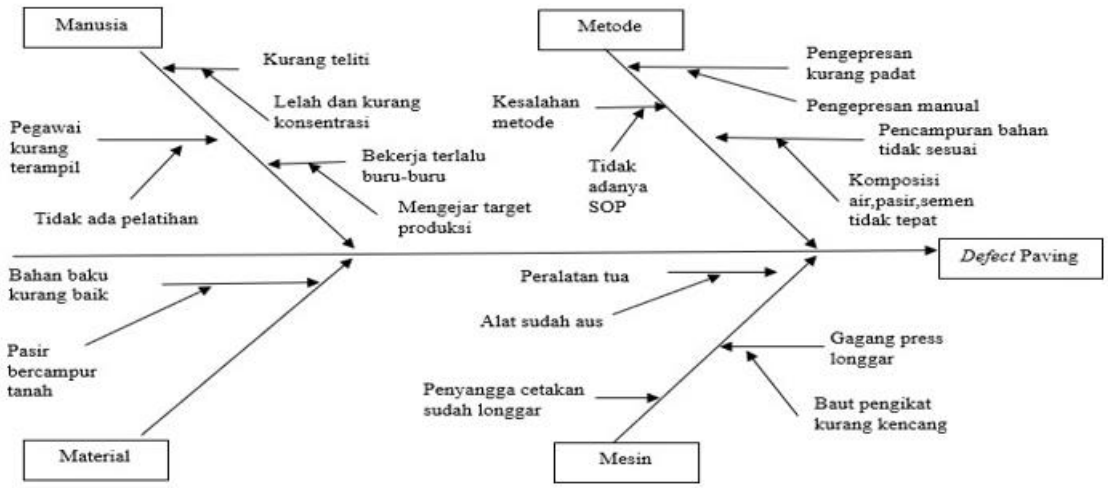

Figure 5. Fishbone Diagram.

From figure 5, can in analysis root product defects happen Because a number of factor between other is:

a. Man (Human) human factor, product defects occur due to lack of worker skills due to the absence of training, lack of accuracy caused by fatigue and lack of concentration, and working too quickly hurry, this matter caused by by chase production targets Which tall.
b. Material (Raw Material) from material factors, product defects occur due to insufficient raw materials. both caused by poor selection of raw materials and also inadequate storage of raw materials good so influential on quality material standard.
c. Machine (Machine) from factor machine, equipment Already old Which caused by tool Already worn out, buffer mold Already Loose due to too frequent use can interfere with work and thus affect product quality, and handle press Already loose Because bolt binder not enough tight.
d. Method (Method) from factor method, occurrence error method Which caused by Because No existence soup on companies so that workers do not work using general standards, pressing is not dense enough due to Still use manual, And mixing material No in accordance caused by by composition material not exactly.

4. Improve

After identifying and knowing the dominant cause of the defective product, the next step is create an improvement plan. The improvement plan is carried out through the implementation of the Kaizen Five M-Checklist. Kaizen Five – M Checklist is A tool Which focus on five element key in every process, that is man, method, machines, materials, and the environment. The benefit of implementing 5S is reducing the level of defects. happen Because existence decline productivity production, increase moral worker And simplify environment Work [19].

Table 8. Analysis Repair Using Kaizen Five – M Checklist

No	Factor	Problem	Reason	Solution Problem (Proposal Repair)
1	Man	Lack of skills Work too in a hurry hurry Lack of accuracy	Not enough experience Chasing the target production Which too Lots 1. Tired and lacking concentration 2. Lack of supervision	The need for implementation training And introduction in a way periodically to employees Required additive HR when target production too many More Lots supervision Which enforced to employee moment they

				currently Work
2	Machine	Equipment Already old	Tool Already wear out	Check the condition of the equipment before used production And perform regular maintenance Do inspection to buffer mold is at incondition Good on moment will done printing
		Buffer mold Alreadyloose	Because too often used	
		Handle press loose	Bolt binder not enoughtight	Check if the handle or screw pressing Already truly tight And in condition Good (No saggy) And make sure results pressing truly sturdy
3	Material	Material standard not enough Good	Sand mixed land	Make sure sand Which accepted or the sand used is notcontains a mixture of soil
4	Method	Error method	No existence SOUP	Create SOPs on discipline employees, materials, tools, machines, and carry out SOUP in a way sustainable
		Pressing not enough congested	Still usemanual pressing	If allows company buy tool press automatic so that minimize paving experience *defect*
		Mixing material Noin accordance	Composition water, sand,cement no appropriate	Ensure material Which mixed according to what has been determined company

Based on the data in table 8, the application of the kaizen five-m checklist allows for a comprehensive evaluation of the four element For identify fields Which need repair And apply steps appropriate improvements. This approach encourages continuous improvement by improving efficiency, productivity, And quality in aspects man, method, machine, And material. Through approach This, company can reach purpose in general more effective And maintain Power competition higher in market.

5. Control

At this control stage, the focus is on ongoing improvements. These improvements use proposed solutions. The Kaizen Five Step Plan/ 5S concept will be continuously

implemented by various parties by creating or determine process standard operational Which Which will used in supervision in process production against the occurrence of failure so that failure can be minimized and can improve productivity Work.

Table 9. Proposed Improvements Using Kaizen Five Step Plan

No	*Five Step Plan*	Solution Problem
1	*Seiri* / Short (Sorting)	1. Grouping material standard Which can used And No canused. 2. Grouping And keep goods Which Norequired, including: - Machine or equipment Work Which experience damage. - Machine or equipment Work Which No used in a way active. - Factor Which No associated with work.
2	*Seiton* / Neat (Arrang ement)	1. Save equipment with regular in location storage Which hasset. 2. Keep equipment or material based on how much often toolor materials the used.
3	*Seiso* / Clean (Cleanlin ess)	1. Clean area Work before And after work done, ensure the environment Work still comfortable And clean. 2. Clean equipment Which has used after process production finished.
4	*Seiketsu* /Care (Maintenan ce)	1. Marking equipment according to its function, type and size, compile procedure operational standard For operator, as well as provide instructions on the storage location of equipment, materials, and goods during And after process production. 2. Create instructions regarding tool storage locations, create SOUP about places, machines, and tools; putting up posters 5S.
5	*Shitsuke* /Diligent (Habit)	1. Operate draft 5S in a way continuous And without exception,with employee And owner partners become supervisor, aim Forcreate environment Work Which more regular And give responsibility Which more personal to each individual. 2. Carry out practice *seiri, seiton, Seiko, seiketsu,* And *shitsuke* in a wayconsistent without exception, aim so that operator And management company Keep going continuously create environment Work Which more conducive.

From table 9, the implementation of the kaizen five step plan is expected to increase efficiency, quality and improvement. in production paving. Repair on aspects the expected can produce product Which more Good, reduce defects in paving production,

and increase productivity. Implementation of the kaizen five-step plan (seiri, seiton, seiso, seiketsu, and shitsuke) also encourage discipline, responsibility, and awareness of cleanliness, order, and maintenance of an optimal work environment. By implementing these steps consistently Consistently, the production of women's bags is expected to become more regular, efficient and of higher quality, as well as encourage an increase sustainable in management quality production paving.

CONCLUSION

Fundamental Finding : The study concludes that product defects in the production process of PT. Varia Usaha Beton arise from human errors (limited skills, experience, accuracy, supervision, and worker fatigue), material problems (improper selection and storage), machine issues (poor condition and blunt needles due to insufficient maintenance), lack of operational standards among partners, and environmental factors such as excessive heat and cramped workspaces, with the highest defects recorded in March and the lowest in October. **Implication :** These issues indicate weaknesses across human, material, mechanical, procedural, and environmental aspects, reducing overall production quality and consistency. **Limitation :** The study relies on observational analysis without deeper quantitative measurement, cost evaluation, or comparison with industry benchmarks. **Future Research :** Future studies should determine the statistical impact of each factor, assess the effectiveness and cost–benefit of the Kaizen Five M Checklist, and analyze quality improvements before and after corrective measures.

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