

Improving The Quality of Product Packaging Using The Six Sigma Method

Mila Faila Sufa, Rima Ambarsari

Department of Industrial Engineering Muhammadiyah University of Surakarta
Email : mfs154@ums.ac.id

Abstract

This study aims to identify the types of defects that occur in the powder packaging process at PT. Marimas Putera Kencana as an effort to improve product quality. By doing this research, the benefits obtained include being able to know what problems are causing disabilities and can overcome these disabilities from the suggestions given by researchers. Multi-line machine is a packaging machine that is the object of research because in the packaging process using this machine there are still many defective products produced. The method used in this study is Six Sigma with the DMAIC approach which consists of Define, Measure, Analyze, Improve, Control stages. The results of data processing showed that the sigma level value was 4.10, which means that the quality control process carried out by the company was running well. However, more intense control is still needed to minimize the magnitude of the possibility of defects. Factors that cause leaking defects in primary packaging Marimas powder include four factors, namely Human, Machine, Method and Material factors. Then from the four factors given suggestions for improvement actions.

Keyword: quality, six sigma, improvement, defects, packaging

INTRODUCTION

In this globalization era, quality becomes the main strategy in controlling the market. Products with high quality oneness will be the main key for the company to be able to meet the desires of consumers, so that business competition can be won. Therefore companies are required to be able to achieve high quality and be able to maintain these qualities. By providing quality guaranteed producers and consumers alike will benefit from each other. Providing guaranteed quality to consumers makes producers easily obtain the trust of consumers and producers can also establish good relations with consumers. Quality control is an effort made to maintain the quality or the quality of the products produced to be in accordance with the quality standards set by the company. PT. Marimas Putera Kencana is a company whose main production is powder drinks, one of its products is Marimas. This powder drink production is carried out in Production Unit 2. In the packaging stage of making Marimas powder drinks there are still many defects. This results in a loss for the company because with product defects, the product cannot be marketed or must be reworked which means this will add to the cost. The packaging stage itself is divided into 3 stages, namely the primary, secondary and tertiary packaging stages as the writer explained in the production process in the previous chapter. The main focus of research is on the primary packaging stage on multi lane machines because at this stage the number of defective or reject products is still much compared to secondary and tertiary packaging. Quality control is an important key for the company so that the quality of each product produced is maintained according to standards. The Six Sigma method is one way to improve and improve the quality of the company. The Six Sigma method is an approach to improving quality in order to achieve the target of 3.4 failures per one million opportunities in each production activity. Therefore, Six Sigma can be interpreted as an effort made to be able to perfection (*zero defect*).

METHODS

The method of data collection is done by observation in the packaging area, interviews directly to the operator, as well as taking some data through literature studies and other sources related to the research being carried out. In data processing, the steps carried out in accordance with the DMAIC procedure (Define, Measure, Analyze, Improve, Control). Define is a stage to identify problems that are happening (Yanuarsih, Widaningrum, & Iqbal, 2012). Then after knowing the problem to be identified, the next step is to determine the key quality characteristics or Critical to Quality (CTQ) which is a picture of consumer needs for Marimas products and product packaging. The next stage is the measurement stage or measure. At this stage the measurement of DPO

(Defect Per Opportunities), DPMO (Defect Per Million Opportununities) and Sigma values are measured for each type of disability in each package. The sigma value obtained can also show the performance baseline of the company.

$$PO = Total\ Defect / (Total\ Production \times CTQ) \dots\dots\dots(1)$$

$$DPMO = DPO \times 1.000.000 \dots\dots\dots(2)$$

After getting a DPMO score, you can get a sigma level value for each disability type. To get the sigma level value, it can be obtained from the DPMO conversion table to the sigma value or can also use the function in Ms. Excel, which is :

$$= normsinv((1.000.000 - DPMO) / 1.000.000) + 1,5 \dots\dots\dots(3)$$

From the results of these calculations it can be seen which type of disability is farthest from the six sigma level and then makes a pareto diagram of the disability to find out which type of disability is most dominant. At this analyze stage the main cause of the problem is the analysis that causes sigma performance in the process to decline. In addition to determining the factors that influence the type of dominant disability that occurs using a fishbone diagram. At improve stage you have to select solutions and actions that need to be done based on the analysis that has been done and hope that these actions can improve the performance of sigma. At this stage it can be in the form of recommendations for improvement to minimize the defects that occur. Then the control stage is the last stage in the six sigma method. At this stage, control is carried out on the process that has been improved.

RESULTS AND DISCUSSION

PT. Marimas Putera Kencana in its production process has implemented high quality standards and good management, but in the production process precisely in the primary packaging process, many reject products are still found in the primary packaging process. The more products reject means the more losses that must be borne because the product must be reworked again or thrown into trash. The object of the main focus of the study was the primary packaging process on multi lane machines on shift 1. The types of defects (Critical to Quality) are grouped into 3 types, which are weight, leak out and visual. Weight is a type of disability where the weight of drink powder that has been packaged does not meet the established standards. Generally weigh less or even too much. Leaking is a type of disability where there are gaps or holes in the package because of several things that affect including cracking, comblong, tearing due to sealing temperatures that are too hot or not too hot. Visual is a type of disability where in terms of appearance of the packaging there is damage, namely a seal that is not neat, and there is a printing error and not neat. Here is the number of production and defect data for 15 days.

Table 1. Production and Packaging Powder Drink Disability Data

No	Date	Unit	Good	Defect			Total production
				Leak out	Weight	Visual	
1	04-Sep-19	Sachet	1646640	26864	0	0	1673504
2	05-Sep-19	Sachet	1763280	27423	830	0	1791533
3	06-Sep-19	Sachet	1833840	27555	0	0	1861395
4	07-Sep-19	Sachet	1519200	26678	170	0	1546048
5	08-Sep-19	Sachet	1949760	26879	0	0	1976639
6	09-Sep-19	Sachet	1977840	25368	160	0	2003368
7	12-Sep-19	Sachet	1197360	25366	360	0	1223086
8	13-Sep-19	Sachet	1647360	25346	0	700	1673406
9	14-Sep-19	Sachet	1756080	27353	240	0	1783673
10	15-Sep-19	Sachet	2077920	24591	1890	0	2104401
11	17-Sep-19	Sachet	1248480	21800	70	0	1270350
12	18-Sep-19	Sachet	1818720	7200	0	0	1825920

13	19-Sep-19	Sachet	1881360	23446	70	0	1904876
14	20-Sep-19	Sachet	1331280	23554	470	0	1355304
15	21-Sep-19	Sachet	1931760	24745	0	0	1956505
Total			25580880	364166	4260	700	25950006

From the table above can be seen that it can be seen that the value of the company sigma is around 4.10. From the sigma value, it can be seen that the quality control process carried out by the company has run well. However, more intense control is still needed to minimize the possibility of further defects. Then for the sequence of defects of each type of disability in a row that can be seen from table 2.

Table 2 . Pareto Diagram Disability Data

No	Defect Types	Number of defect	Percent	Cumulative Percent
1	Leak out	364166	98,7%	98,7%
2	Weight	4260	1,2%	99,8%
3	Visual	700	0,2%	100,0%
Total		369126		

Analyze stage is the stage for analyzing the factors that cause primary packaging defects based on data from observations and interviews conducted. At this stage a fishbone diagram is used to find out the root cause of disability or major damage to the product. Factors that cause disability in the Marimas powder packaging process with the type of leak. Based on research that has been done, there are 5 factors causing leaking defects on Marimas powder drink packaging. Explanation of the four factors that cause disability is as follows : Human, machine, method and material. Human factors that cause leakage defects in powder drink packaging are operator skills that are different in each individual where in setting the machine the less expert the operator will be the number of rejects will be more, then when there is damage to the packaging can be found several packaging operators. less responsive in stopping the engine to be reset. The next thing that affects adalah accuracy is still minimal when a leak occurs and the accuracy of each individual operator is also different. Machine factors that cause leakage defects in powder drink packaging between sealing temperature that is set too high or too low so that the results of pressing is not good resulting in product tear or cracking (leak) other things that cause this type of defect is the pressure (tension) that is less suitable both vertically and horizontally. In addition, an error sensor can also cause faults due to improper timing and result in the number of defective products that will be more and more Spare parts that are worn and damaged also have an important role in causing defects. The method factor which caused the leakage defect on the Marimas powder drink packaging is the first sealer itself. Because there is no fixed schedule related to the intensity of sealer cleaning, the sealer is often only cleaned when packaging damage occurs. In addition, improper sealer cleaning techniques in which the direction of the sealer brushing is not in accordance with the type of sealer because the shape of the brush that is not suitable to make stains or dirt in the sealer is still attached. This also causes the sealer to quickly not work properly again. The method factor that caused the leakage of Marimas powder beverage packaging is the quality of the etiquette used, this is caused by the distributors of the labels used differently and because it affects the quality of the etiquette which is also slightly different then the machine settings are also different, if an error occurs in the settings the tag will be damaged and cause leaks.

Improve is the stage where the production improvement planning is carried out in the primary Marimas packaging section using a multi lane machine. Proposed improvement is given based on the cause of the problem from the analyze phase, there are:

a. Human Factor

- 1) Refresh the machine training every 3 months to the old and new packaging operators so that they understand more about the machine.

- 2) Carry out regular supervision every day and give a warning or direction if the operator makes a mistake.
 - 3) Operators are expected to comply more with applicable SOPs.
- b. Machine Factor
- 1) Check the temperature, pressure and engine sensors regularly, especially when changing the label.
 - 2) Conduct more intensive checks on engine spare parts when the engine is going to run and when the engine makes a planned stop.
 - 3) Replace spare parts that have begun to wear out and do not wait until they are badly damaged first
- c. Method Factor
- 1) Improve the way the sealer is cleaned properly which is suitable with the type of sealer and is correct and uses a type of brush that is more in accordance with the shape of the sealer which is a brush that is not too wide and a thicker and stiffer brush bristles so that cleaning can be done more optimally.
 - 2) Schedule regular sealing cleaning every 1 hour so that the seal does not get dirty easily because it does not only clean when the packaging has leaked because the seal is dirty.
- d. Material Factor
- Operators are expected to be more thorough and sensitive to the type of etiquette used and to set the machine according to the label

CONCLUSION

Based on the results of research that has been done, several conclusions can be drawn, including:

1. Type of disability in the Marimas drink powder packaging process is divided into 3 groups : weight, leak out and visual disability.
2. The six sigma method obtained an average sigma value of 4.10 so that it can be concluded that quality control in the packaging area of PT. Marimas Putera Kencana is already in good condition but more intensive quality control is still needed so that disability does not recur.
3. The most common type of disability is leakage where the percentage of disability is 98.7%. The total number of defective products amounting to 369126 units of them are defective products with leakage defects.
4. The factors that cause leaking defects in the primary packaging of Marimas powder which consist of four factors, namely Human, Machine, Method and Material factors. Then from the four factors given suggestions for improvement

REFERENCES

- Ravi S. Reosekar, Sanjay D. Pohekar.2014. Six Sigma methodology: a structured review, www.emeraldinsight.com/2040-4166.htm IJLSS
- Chen-Yang Cheng & Pu-Yuan Chang.2012. Implementation of the Lean Six Sigma framework, Total Quality Management & Business Excellence
- Sandra Furterer & Ahmad K. Elshennawy. 2005. Implementation of TQM and lean Six Sigma tool in local government: a framework and a case study
- M. Kumar , J. Antony , R. K. Singh , M. K. Tiwari & D. Perry.2006. Implementing the Lean Sigma framework in an Indian SME: a case study
- Susana Duarte,V.Cruz-Machado.2009. Modelling lean and green: a review from business models
- Kusumawati, Aulia dan Fitriyeni, Lailatul. 2017. *Pengendalian Kualitas Proses Pengemasan Gula Dengan Pendekatan Six Sigma*. Jurnal Sistem dan Manajemen Industri, Vol. 1 No. 1. Universitas Serang Raya.
- Ningsih, Margie Subahagia dan Mada Esmi. 2018. *Metode Six Sigma untuk Mengendalikan Kualitas Produk Surat Kabar di PT X*. Jurnal Ilmiah Teknik Industri Prima, Vol. 2 No. 1. Universitas Al-Azhar Medan;

Sanjaya, Wira dan Susiana. 2017. *Analisis Kecacatan Kemasan Produk Air Mineral Dalam Upaya Perbaikan Kualitas Produk Dengan Pendekatan DMAIC Six Sigma (Studi Kasus: PT. Tirta Sibayakindo)*. Jurnal Karismatika, Vol. 3 No. 1. Universitas Negeri Medan.

Santoso, Mikhael, dkk. 2018. *Pengolahan Minuman Serbuk Rasa Buah di PT. Marimas Putera Kencana*. Laporan Praktek Kerja. Universitas Katolik Widya Mandala Surabaya. Surabaya