Proposed Quality Improvement Using Statistical Process Control (SPC) Method on Picking Process at JD.ID Warehouse FMCG Marunda

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ABSTRACT

JD.ID Warehouse FMCG Marunda is a company engaged in logistics which includes receiving goods from suppliers in the Inbound department, storing goods in the Inventory department and packing goods in the Outbound department. FMCG or Fast moving Customer Goods include Groceries and Health Care, Mother, Baby & Kids Products, Beauty Products. The main quality problem at JD.ID Warehouse FMCG Marunda occurs in the picking process in the Outbound department. The purpose of this study is to propose quality improvements to minimize the number of defective products during the picking process using three Statistical Process Control (SPC) quality tools, namely, Ishikawa diagrams, U Control Maps and Pareto diagrams. The use of Ishikawa diagrams to analyze the main causes of defects during the picking process with Man, Machine, Method, Measurement, Material factors. U Control Map to evaluate the picking process is within the limits of statistical quality control or not, the data processing process with U control chart uses the object of research, namely the defect data of the "Gulaku Gula Pasir Tebu 1 kg" product which is included in the Groceries product category with the highest defective rate during the period June-September 2021. Through analysis with the U Control Map, it is known that during the picking process it has not yet reached process stability so that it still produces defective products. The use of Pareto diagrams is to show the main types of defects in the the "Gulaku Gula Pasir Tebu 1 kg" product, namely 'Sobek' with a defect percentage of 72.7%. Therefore, need to manage Task Assignment to picker by considering the dimensions of the product, providing training related to material handling knowledge to the picker, making a routine 5R schedule, adding rubber as a bumper on the surface of the trolley. The implementation of this proposed improvement can reduce and streamline the standard time of the picking process, reduce the possibility of material handling products that are not suitable, causing defective products to be picked, and streamline picker mobility activities during the picking process.

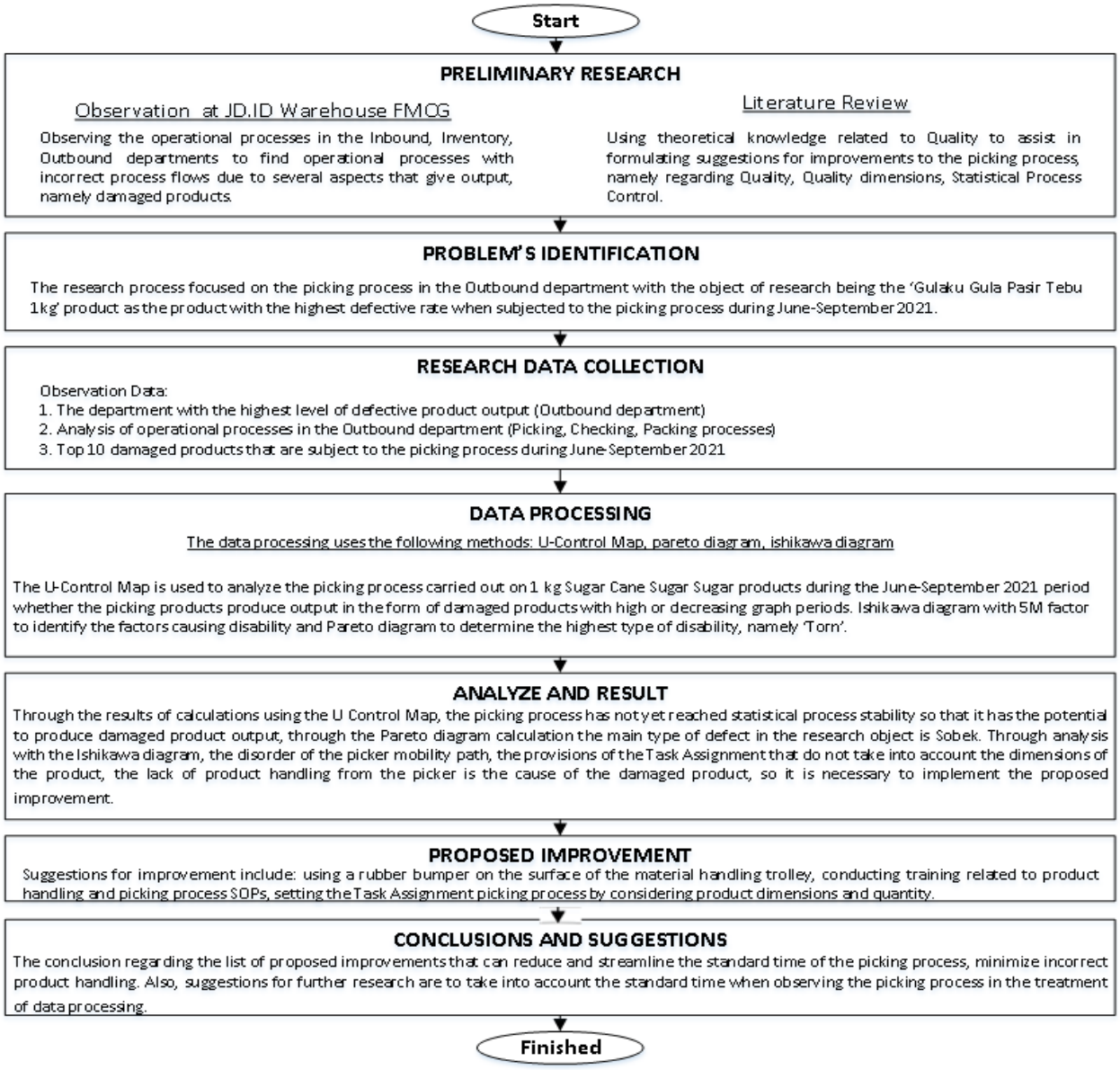
Keywords: *Quality, Statistical Process Control, Fast Moving Customer Goods, Warehouse, Outbound, Picking Process*

1. INTRODUCTION

JD.ID Warehouse FMCG Marunda is a company engaged in logistics. JD.ID Warehouse FMCG Marunda provides delivery and procurement services for Groceries and Health Care, Mother, Baby and Kids products, Beauty products. Warehouse FMCG (Fast Moving Customer Goods) is a warehouse for procurement, storage and delivery of goods with high sales levels, short product shelf life which affects the operating regulations that run so fast for each department (Inbound, Inventory, Outbound). The type of operation used by JD.ID Warehouse FMCG Marunda is FEFO (First Expired First Out) which means that the product with the shortest expiry date must be sent to the customer immediately. This is to avoid the product becoming stale so that it becomes a plate loss for the company, especially when the product is still within the scope of operations of JD.ID Warehouse FMCG Marunda. Based on historical data picking JD.ID Warehouse FMCG Marunda from June – September 2021, the product with the highest damaged level was'Gulaku Gula Pasir Tebu 1 kg' . This final project research aims to identify the causes of quality

problems that arise during the picking process with the object of research, namely the defect data on the 'Gulaku Gula Pasir Tebu 1 kg' product which is the product with the highest level of defects when subjected to the picking process during the period June - September 2021 using SPC (Statistical Process Control) method. Through the application of the SPC (Statistical Process Control) method using three tools, namely the U Control Map to analyze the entire picking process for the 'Gulaku Gula Pasir Tebu 1 kg' product, whether it has reached process stability, Pareto diagrams to determine the type of main defect in the research object product, namely 'Gulaku Gula Pasir Tebu 1 kg' , as well as Ishikawa diagram to analyze the factors that cause defects in products that are subjected to the picking process.

2. METHOD



3. RESULTS AND DISCUSSION

a. U Control Map

Tabel 3.1 Calculation of CL, UCL, LCL Control Limits Using U Control Map

No.	Date	Order's Amount	Defective's Amount	U Control Map		
				CL	UCL	LCL
1	5	150	26	0.19	0.2968	0.0566
2	8	98	20	0.19	0.3221	0.018
3	12	56	16	0.19	0.3647	0
4	14	150	20	0.19	0.2968	0.0566
5	17	69	18	0.19	0.3474	0
6	20	70	14	0.19	0.3463	0
7	21	122	10	0.19	0.3084	0.0392
8	24	89	8	0.19	0.3286	0.0077
9	27	28	11	0.19	0.4371	0
10	30	12	20	0.19	0.5675	0
Total		844	163	1.9	3.6157	0
Average		84.4	16.3	0.19	0.36157	0

$$\bar{U} = CL = \frac{\sum ci}{\sum ni} = \frac{163}{844} = 0.19$$

$$UCL1 = \bar{u} + 3\sqrt{\frac{\bar{u}}{ni}} = 0.19 + 3\sqrt{\frac{0.19}{150}} = 0.2968$$

$$LCL1 = \bar{u} - 3\sqrt{\frac{\bar{u}}{ni}} = 0.19 - 3\sqrt{\frac{0.19}{150}} = 0.0566$$

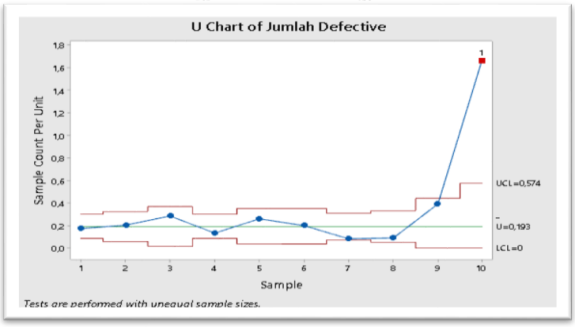


Figure 3.1 U Control Map of Defective Product 'Gulaku Gula Pasir Tebu 1 kg'

Based on Figure 3.1, it can be seen that there is data that is out of control towards the UCL (Upper Control Limit) limit, namely data on the 10th of each June-September 2021 period so that further review is needed. The calculation of the process capability of the picking process for the Gulaku Gula Pasir Tebu kg product is used to analyze the variability of the specifications of a product which will then be subject to action to reduce the variability.

$$DPMO = \left(\frac{D}{U \times O}\right) \times 1.000.000$$

$$= \left(\frac{163}{844 \times 5}\right) \times 1.000.000$$

$$= 38.862 \text{ DPMO}$$

Descriptions :

1. D = Amount of Defects Product
2. U = Amount of Units Product
3. O = Opportunity of Defective

Based on the calculation of process capability, using the DPMO calculation, the DPMO value is 38,862 DPMO, this if converted to a Six Sigma value based on the Motorola concept, the Six Sigma value used is 3.77. The value of Six Sigma refers to the stability of the picking process which is not yet good, so it is necessary to apply a proposal for improving the picking process so that the process capability can reach the 6 sigma level and can produce output of picking products with good quality, as well as streamline the standard time of the picking process. So that it can help companies to achieve fullfillment in a short period of time with maximum results.

b. Pareto Diagram

Tabel 3.2 Amount of Defective Product Gulaku Gula Pasir Tebu 1 kg

Juni - September 2021			
Order		*Defect*	
		Type	Amount
		Torn	120
		Stain	45
Total	844	**Total**	165

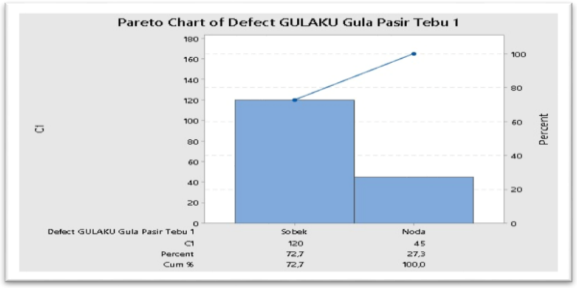


Figure 3.2 Pareto Chart of Defective Product Gulaku Gula Pasir Tebu 1 kg

Through Table 3.2, it can be seen that from 844 orders in pcs for the 'Gulaku Gula Pasir Tebu 1 kg' product, there were 165 defects. Types of defects that arise include tearing as many as 120 pcs, stains as many as 45 pcs of 'Gulaku Gula Pasir Tebu 1 kg' product. Through the Pareto diagram display, the type of tear defect is the main type of disability with a disability percentage of 72.7%. Meanwhile, the type of stain defect has a disability percentage of 27.3%.

c. Ishikawa Diagram

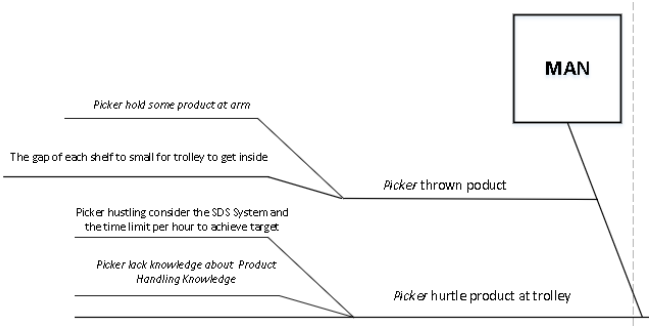


Figure 3.3 Factor Man of Ishikawa Diagram

The Man factor in question is a picker that performs the picking process directly. One of the causes of defects in the 'Gulaku Gula Pasir Tebu 1 kg' product is the picker carrying the trolley in a hurry, this raises the possibility that the trolley carried by the picker may collide with a trolley belonging to another picker or with storage shelves for goods such as small shelves, pallet shelves and palletize. In addition, pickers throwing things into the trolley are caused by the trolley being unable to fit into the small shelves because the dimensions of the trolley are larger than the aisle width of the small shelves. Indiscriminate product handling such as slamming and throwing things increases the possibility of the 'Gulaku Gula Pasir Tebu 1 kg' product being torn, and if the picker has to pick up the product in one aisle of the storage cupboard with the quantity of goods more than 2 by hand, there is a risk of the item falling and lack of product's knowledge.

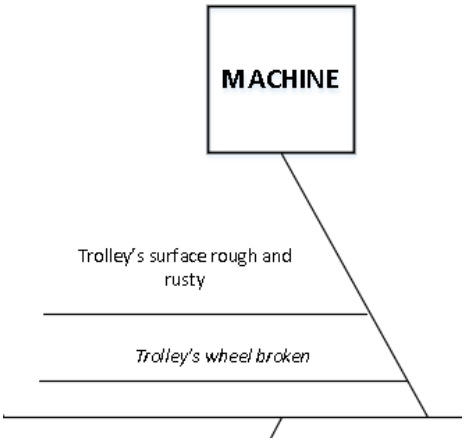


Figure 3.4 Factor Machine of Ishikawa Diagram

Machines that are followed up in the picking process are trolleys and OB (Order Box) baskets. Machines that are not subjected to regular maintenance processes, both in terms of the surface of the trolley, the completeness of the trolley wheels, the quality of the OB (Order Box) basket. The frequent use of the machine certainly has an impact on the usability performance of the machine. The new trolley used in the picking process certainly has a better performance than the trolley machine that is often used, because there is a possibility of dented surfaces, rust, incomplete trolley wheels. A perforated OB (Order Box) basket certainly allows items to fall which causes damage to the product. The surface of the trolley where rusty goods are placed so that the surface becomes rough provides an opportunity for defects to appear on the product due to friction and excessive piles of goods.

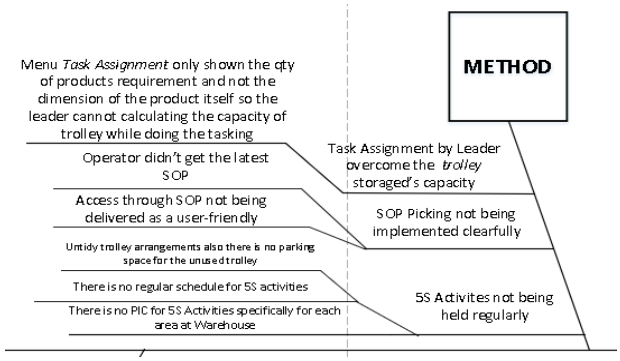


Figure 3.5 Factor Method of Ishikawa Diagram

The specified method factor becomes a task assignment process carried out by the Outbound department leader randomly with product specifications without being accompanied by cardboard dimensions, this causes the picker to take goods with several high stacks due to product dimensions with product requests with large quantities of cartons accompanied by product with a quantity of pcs, accompanied by a picker mobility method that must run as well as a target requirement of 50 orders per hour, with the instability of the arrangement on the trolley causing friction on the surface of the product packaging which can cause tearing defects on the product surface. not explained well, so the picking process sequence is not executed properly. Fast Moving Customer Goods activities show that there are many goods processes that are subject to picking processes in a fast period of time, causing the waste of cardboard used for product storage to increase in a fast period of time, scattered cardboard files, disorderly arrangement of trolleys in the picker mobility area can disrupt the mobility of the picker so that it is often a collision occurs and has an impact on the emergence of defects in the product, because the product is dropped.

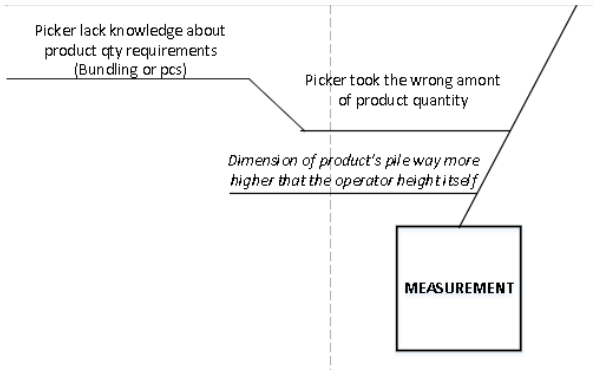


Figure 3.6 Factor Measurement of Ishikawa Diagram

The measurement factor specified was the error in picking up the quantity of goods, especially the picker's ignorance of the quantity of pcs and bundling or carton items so that the system's request for the quantity of pcs of goods was actually carried out by the picking process with the quantity of bundling goods so that there was a buildup of goods with high friction force due to the too fast mobility of the picker. In addition, product dimensions, especially in the quantity of bundling or pcs piled above the height of the picker, cause visual disturbances and the mobilization of the picker thereby increasing the possibility of items falling.

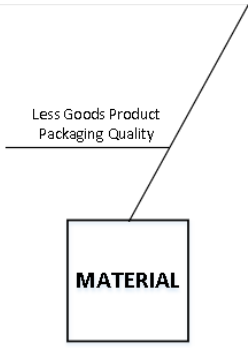


Figure 3.7 Factor Material of Ishikawa Diagram

The quality of the packaging from the supplier of 'Gulaku Gula Pasir Tebu 1 kg' is one of the factors that cause defects. The quality of the packaging is not good with the specifications, namely, the thin packaging which is subjected to a picking process with Product Handling by a picker who is in a hurry to cause tearing defects in the 'Gulaku Gula Pasir Tebu 1 kg' product. This is one of the things that must be considered that products with historically thin packaging quality need special treatment during Product Handling, as well as arrangement in the trolley so as to minimize the level of defects in the 'Gulaku Gula Pasir Tebu 1 kg' product.

d. Proposed Quality Impovement

1. Cleanliness of the Picker Mobility Path

By determine the regular 5S Activites along with the PIC, provide the parking area for material handling, provide trash box on each corner of the warehouse area.

2. Determination of the Task Assignment for Picker

Applied task assignment provisions for pickers in one picker mobility if on the Task Assignment system display with the order quantity category bundling/cartons and pcs, the maximum quantity of bundling/carton items that the picker can pick is 4 cartons. If the order with the quantity of bundling goods/cartons is more than 4, the picker is only allowed to pick up products in the bundling category using the Product Handling Hand Pallet.

3. Product Handling Knowledge

Implement training for picker regarding product handling knowledge with data history contains defective product's name for each specif period (every 3 months), provide user-friendly for data based SOP or any kind of operational documents.

Figure 3.8 Implementation of Training Product Knowledge to Picker by Klarette Vivian

4. Bumper Usage for Trolley's Surfaces

Applied a bumper to the surface of the trolley where to place the items that have been subjected to the picking process. Bumper is a barrier made of soft material that is used to reduce the impact of the external environment on the physical packaging of the product. The bumper used is made of rubber which is adjusted in length and width to the size of the trolley. The preparation of proposed improvements in terms of method

was carried out based on discussions with the Mechanical Team and the Planning team to produce the trolley with the Bumper.

Figure 3.9 Trolley's Dimension

4. CONCLUSION

Main defective types for the research object "Gulaku Gula Pasir Tebu 1 kg" is Torn, also the whole picking process still under level 3 Sigma with 38.862 DPMO, with the tools Ishikawa diagram with Man, Machine, Method, Measurement, Material's factor the proposed quality improvent to streamline the duration of picking process itself, minimize defective on product by educating the man (picker) by regular training using data history of product's defect, utilize rubber as a bumper for trolley's bumper to minimize friction produced by the picker mobility, 5S tools and schedule to maintain picker's mobility path neat.

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REFERENCES

[1] D.C. Montgomery, *Statistical Quality Control, 7th Edition*, Wiley, 2012.
[2] Gaspersz, Vincent, (1998), *Statistical Proses Control Penerapan Teknik- Teknik Statistik dalam Manajemen Bisnis Total*, Jakarta : Diterbitkan atas Kerja Sama Yayasan Indonesia Emas, Institut Vincent, PT Gramedia Pustaka Utama.
[3] Hayu Kartika. 2013. "Analisis Pengendalian Kualitas Produk Cpe Film Dengan Metode *Statistical Process Control* pada PT. Msi". Jurnal Ilmiah Teknik Industri (2013), Vol. 1 No.1, 46 – 52.
[4] Heizer, Jay & Render Barry, 2015. Manajemen Operasi: Manajemen Keberlangsungan dan Rantai Pasokan, edisi 11. Jakarta : SalembaEmpat.
[5] Kotler, P. and Keller, K.L. 2016. *Marketing Management*, 15th Edition New Jersey: Pearson Pretice Hall, Inc.
[6] Tjiptono, Fandy. 2007. *Strategi Pemasaran*. Edisi Pertama. Andi Ofset, Yogyakarta.
[7] Wulandari, S..D., dan Amelia, 2012, Pengendalian Kualitas Produksi di PT. Nutrifood Indonesia Dalam Upaya Mengendalikan Tingkat Kerusakan (*Defective*) Dus Produk Sweetener Dengan Menggunakan *Statistical Proces Control (SPC)*, Economicus, vol 05, hal 37, STIE Dewantara.