ISSN No:-2456-2165

Quality Improvement on Speaker Net Products using Six Sigma Method with DMAIC (Case Study at Pt.D)

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Abstract:-This research has the main objective to improve the quality of the speaker net products at PT. D. This study uses the six sigma method with DMAIC (Define, Measure, Analyze , Improve, Control) stages and tools such as FMEA (Failure Mode and Effects Analysis),and FTA (Fault Tree Analysis)tables. DMAIC consists of define, measure, analyze, improve, and control. In the early stages of the study, the define stage was used to identify existing defects using CTQ (Critical to Quality) identification and the SIPOC (Supplier, Input, Process, Ouput, Customer) table. This study uses p and c control charts at the measure stage to get a sigma level value of 3.57. In the analyze stage, the FMEA table is used to obtain the two problems that have the most impact, namely operator problems on scratch and dented defects. At the improve stage, improvements are proposed in the improve stage using the 5W1H table tools, where the results of the table are problems that occur such as ineffective operators. work and more. The proposed implementation is making SOPs and maintenance sheets for each machine. The results of this study obtained a sigma level value after implementing 3.67 at the control stage. The result of the sigma level value which has increased by 0.1 means that the results of the implementation used in the company have experienced an effect even though the effect is very small but has an impact on improving the quality of the product produced.

Keywords:- *Quality Control, Six Sigma, DMAIC (Define, Measure, Analyze , Improve, Control), FTA (Fault Tree Analysis), FMEA (Failure Mode and Effects Analysis), Speaker net.*

I. INTRODUCTION

The development of a manufacturing industry can be judged from the quality control provided by the company. Quality control is very important for large and small companies. From good quality control, companies can get more profit than companies that do not have quality control. Manufacturing companies that carry out quality control will have good quality finished products and a small percentage of defects. With quality control from the beginning of the assembly process to the end which is processed efficiently, it will guarantee the quality of goods that meet customer satisfaction standards. This is an important thing needed for companies to get product results that match expectations, especiallywith the existence of industrial competition with other companies.PT. D is a speaker net, metal parts, name plates, turbine ventlator, and fabricate throat for use in most factories in Indonesia. In PT Dthe finished goods produced are the result of customer orders. The speaker net product is one of the products with great demand. From the high demand, there are speaker net products that are defective during the production process, therefore the six sigma method with the DMAIC stage is used to reduce the results of defective products when the production process is carried out.

From the results of historical data for the last 3 months, it can be seen that the speaker net product has the highest number of defective products, namely 914 defective products from the total production, if the percentage of defects is made, the value is 9.45%. Therefore PT. D wants to implement quality control on these products to reduce product defects by evaluating the speaker net production process and then identifying problems or defects that arise and factors that influence the emergence of these problems or defects.Quality control in general can be interpreted as a system that maintains the desired level of product/service quality, through feedback on the characteristics of the product/service and the implementation of corrective actions. the product/service. This general area can be divided into three main subareas: off-line quality control, statistical process control, and acceptance sampling plans. [1].

In this study, the Define, Measure, Analyze, Improve, Control (DMAIC) method is used, which is one of the tools used to apply the concept of lean manufacturing. The DMAIC method is a systematically structured methodological cycle that aims to reduce waste in a system, so that the system can work efficiently and productively. [2].

Six sigma, or 6σ, is a methodology for process improvement and a statistical concept that seeks to determine the inherent variation in any process. The overarching premise of Six Sigma is that variation in a process leads to opportunities for error. Opportunities for service errors lead to customer satisfaction. By reducing variations and opportunities for error, the six sigma method is ultimately used to reduce process costs and increase customer satisfaction. [3].

The research objectives are to reduce defects that occur in speaker net products and also to improve the quality of speaker net products produced by the company.

No	Year	Researcher	Title	Research problem/objective	Previous research data processing methods used
1	2016	Dian Maulana ,Budi Sumartono , dan Hari Moektiwibowo	Pengendalian Kualitas Dengan Menggunakan Metode SixSigma Pada Proses Produksi Komponen Plate di Line 3 PT Gs battery [4]	the plate production process in line 3 of the pasting section, where many failures occur in the production process, which can result in product defects.	*Six Sigma, DMAIC, FMEA*
2	2016	Hery Suliantoro, Arfan Bakhtiar, Joy Irfan Sembiring	Analisis Penyebab Kecacatan Dengan Menggunkan Metode Failure Mode And Effect Analysis (FMEA) Dan Metode Fault Tree Analysis (FTA) Di PT. Alam Daya Sakti Semarang [5]	there are still many defective products and some are even damaged to the point that they have no selling value	QC, FMEA, FTA
3	2017	Neoninsa Risma Rossihanida, Renanda Nia Rachmadita, Farizi Rachman	Analisa Pengendalian Kualitas Proses Produksi Botol pada Departemen Blow Molding di Industri Packaging [6]	Functional defects are classified into nine defects with leaks being the most problem domain among other defects	FTA, FMEA, SIX SIGMA
4	2019	Darminto Pujotomo , Vinia Anida	Pengendalian Kualitas Dengan Metode Six Sigma Pada Produk Sepatu Di Cell 1 PT XYZ [7]	there are still reject products in every production. Based on field surveys and interviews that have been conducted, operators and supervisors said that the four cells have different reject rates because they have different production targets.	Six Sigma, pengendalian kualitas
5	2019	Evi Maria Ulfah dan Tuwanku Aria Auliandri	Analisis Kualitas Distribusi Air Menggunakan Metode Six Sigma DMAIC pada PDAM Surya Sembada Kota Surabaya [8]	The service process at PDAM Surya Sembada Surabaya City still has some complaints, especially on the quality of the water produced, such as IMR (cloudy and smelly water).	*Six Sigma, SIPOC, cause &effect diagram, diagram pareto*
6	2020	Achmad Bahauddin, Vicky Arya	Pengendalian Kualitas Produk Tepung Kemasan 20 Kg Menggunakan Metode Six Sigma (Studi Kasus pada PT. XYZ) [9]	Quality control of 25 Kg packaged flour products produced by PT. XYZ with the six sigma method. The product that is used as the object of research is a product that is prone to defects during production	*Six Sigma, DMAIC*
7	2020	Johnson Saragih , Rina Fitriana , dan Tri Andriyan	Quality Improvement for Product Body 2-1 at PT. X [10]	Improving the quality of body products 2-1 because there are still defects in the production of body products 2-1	*Six sigma, DMAIC*
8	2020	Rina Fitriana , Johnson Saragih , Salma Defina Fauziyah	Quality improvement on Common Rail Type-1 Product using Six Sigma Method and Data Mining on Forging Line in PT. ABC [11]	There is a defect percentage of 20% on common rail type 1.	*Six sigma, DMAIC, Data Mining*

9	2020	Lili Karmela Fitriani dan Aglin Tiara Putry	Pengendalian Kualitas Dengan Metode Six Sigma Untuk Menekan Tingkat Kerusakan Produk [12]	the products that are produced are not in accordance with the standards set by the company	*Six Sigma, DMAIC*
10	2020	Sri Lestari dan Mochamad Hasan Junaidy	Pengendalian Kualitas Produk Compound At-807 Di Plant Mixing Center Dengan Metode Six Sigma Pada Perusahaan Ban Di Jawa Barat [13]	the quality of the compound that does not meet the standards so that the resulting production is not in accordance with the production target	*Six sigma, 5w+1h*
11	2020	Johnson Saragih , Rina Fitriana , dan Tri Andriyan	Quality Improvement for Product Body 2-1 at PT. X [14]	Meningkatkan kualitas produk body 2-1 karena masih adanya kecacatan pada hasil produksi produk body 2-1	*Six sigma,* DMAIC
12	2020	Rina Fitriana , Johnson Saragih , Salma Defina Fauziyah	Quality improvement on Common Rail Type-1 Product using Six Sigma Method and Data Mining on Forging Line in PT. ABC [15]	Adanya persentase defect sebesar 20% pada comon rail type 1.	*Six sigma,* DMAIC, Data Mining
13	2020	Lili Karmela Fitriani dan Aglin Tiara Putry	Pengendalian Kualitas Dengan Metode Six Sigma Untuk Menekan Tingkat Kerusakan Produk [16]	produk yang dihasilkan tidak sesuai dengan standar yang telah ditetapkan oleh perusahaan	*Six Sigma,* DMAIC
14	2020	Sri Lestari dan Mochamad Hasan Junaidy	Pengendalian Kualitas Produk Compound At-807 Di Plant Mixing Center Dengan Metode Six Sigma Pada Perusahaan Ban Di Jawa Barat [17]	kualitas compound yang tidak memenuhi standar sehingga hasil produksi yang dihasilkan tidak sesuai dengan target produksi	Six sigma, 5w+1h
15	2020	Wahyu Setia Damayanti, Yustina Ngatilah	Analisa Dan Perbaikan Produk General Assy Roller Menggunakan Metode Six Sigma Dan Fuzzy Fmea Studi Kasus : Pabrik Peralatan Industri Agro [18]	komponen General Assy Roller yang diproduksi memiliki jenis cacat seperti Keropos, sinter dan crack yang mencapai hingga 30 % dari total produksi	Six sigma, fuzzy fmea
16	2021	Erni Krisnaningsih, Pugy Gautama, M.Fatih Kholqy Syams	Usulan Perbaikan Kualitas Dengan Menggunakanmetodeftadan Fmea [19]	Data yang diperoleh dari produksi semen instan di PT.XYZ mengalami banyak reject diluar batas toleransi.	FTA, FMEA
17	2021	Annisa Indah Pratiwi, Ragil Yuli Santosa	Pengendalian Kualitas Pada Proses Penerimaan Barang Untuk Menurunkan Defect Product Dengan Pendekatan Six Sigma [20]	produk dengan kondisi cacat dan tidak sesuai dengan identitas produknya yang disebabkan oleh ketidaktelitian man power dalam produsen untuk memakai jasa .	Six Sigma, FTA, FMEA
18	2021	Abdiel Khaleil Akmal , Risnadi Irawan , Khairul Hadi , Heri Tri Irawan , Iing Pamungkas , Kasmawati	Pengendalian Kualitas Produk Paving Block untuk Meminimalkan Cacat Menggunakan Six Sigma pada UD. Meurah Mulia [21]	Banyaknya cacat produk yang umumnya disebabkan oleh mesin, dan tidak dilakukanyan pengendalian kualitas secara statistik atau statistical process control dalam pengendalian proses produksinya	Six Sigma, DMAIC
19	2021	Tyas Eka Kurnia dan Sugiyanto	AnalisisPeningkatan Efektivitas pada Perusahan Kargo dengan Metode Six Sigma DMAIC dan FMEA[22]	Banyak komplain dari para pelanggan pengguna jasa sehingga perusahan harus membayar kerugian karena keterlambatan pengiriman yang terjadi.	Six sigma , fmea

20	2021	Arief Yuliandri Setiawan, Joko Susetyo, Risma Adelina Simanjuntak	Pengendalian kualitas produk menggunakan metode six sigma dan failure mode and effect analysis (fmea) pada pt. Papertech indonesia unit ii magelang [23]	Cacat pada produk kertas dengan jumlah produksi pada daur ulang kertas Chip Board. Dampak dari cacat produk tersebut mengakibatkan kerugian bagi perusahaan, dalam penjualan maupun pelanggan yang sudah menetap.	Six sigma, fmea, sql

Table 1: Previous Research

II. METHODS

The research methodology uses a flowchart, where the flowchart explains the methods used in this research from define stage to control stage. In collecting data, primary data is used such as the number of production of speaker net products and secondary data such as general company data and historical production data. From the existing data, it will be processed in the define stage, where at this stage the identification of the number of defects is carried out, making the sipoc table, and identification of CTQ. At the measure stage, p and c control charts are made as well as DPMO and sigma level calculations. In the analyze stage, Pareto, Ishikawa, FMEA and FTA diagrams are made. In the improve stage, suggestions for improvement and implementation of the results are made. At the control stage, the p and c control charts are calculated as well as the DPMO value and sigma level after implementation.

III. RESULTS AND DISCUSSION

A. *Define stage*

The define stage is the first stage in the DMAIC stage. At this stage have a clear goal to state the problem, objectives, potential resources, and scope. In the define stage, tools such as the sipoc table and CTQ identification will be used. The sipoc table is used to provide an overview in understanding the elements of the business process at PT D. This sipoc table consists of relationships between suppliers, inputs, processes, outputs, and customers. CTQ or critical to quality is a measurable characteristic of a product or process that is a sign of performance that is carried out and must be fulfilled to satisfy customer desires.

Supplier	**Input**	**Process**	**Output**	**Customer**
Gudang Bahan Baku	Sheet Metal Roll	Pengambilan Bahan Baku	Sheet Metal Roll	Perforating Machine
Perforating Machine	Sheet Metal Roll	Proses Pelubangan	Holed Sheet Metal Roll	*Stamping* Machine
Stamping Machine	Holed Sheet Metal Roll	Proses Pemotongan	*Speaker net* Body	Degreasing Machine
Degreasing Machine	*Speaker net* Body	Proses Pencucian	Cleaned Speaker Net Body	Paint Station
Paint Station	Cleaned Speaker Net Body	Proses Pengecatan	Painted Speaker Net Body	Drying Area 1
Drying Area 1	Painted Speaker Net Body	Proses Pengeringan	Painted *Speaker net*	Oven Machine
Oven Machine	Painted Speaker Net Body	Proses Pemanasan	*Speaker net*	Drying Area 2
Drying Area 2	*Speaker net*	Proses Pengeringan	*Speaker net*	Packaging Station
Packaging Station	*Speaker net*	Proses Pengemasan	Packed *Speaker net*	Gudang Bahan Jadi

Table 2: SIPOC

Critical to quality or CTQ is used to identify the quality of speaker net products in order to meet the quality standards desired by the customer. The following are the results of the CTQ carried out on the speaker net product:

- Scratch
  The surface of the speaker net has scratches which are usually caused by poor quality raw materials or in the perforating and stamping processes that are not careful when logging and cutting.
- Dented
  The surface of the speaker net is dented due to excessive pressure in the stamping process because it is done manually.
- Bending
  The surface of the speaker net which has bends on the sides due to the operator's carelessness places the speaker net during the stamping process.
- Bubble
  The surface of the speaker net has bubbles resulting from excessive paint clumping in the spraying process.
- Light Paint
  The surface of the speaker net has a thin paint during the painting process, which can be seen from the surface of the speaker net which has faded paint during the first drying process.

B. Measure stage

The measure stage is the second stage of the DMAIC stage. At this stage, calculations will be carried out using one of 7 tools, namely statistical process control. In the SPC calculation, 2 control charts will be used, namely control charts p and c which are used to determine whether the data obtained are within the control limits or not. After calculating the SPC, the DPMO and sigma level calculations are also carried out to be used as baseline values for comparison with the implementation results in the control phase.The control chart p is used to determine whether the data used is within the control limits or not. The calculation of this control chart uses historical data of speaker net products at PT D from August to October for 30 days.

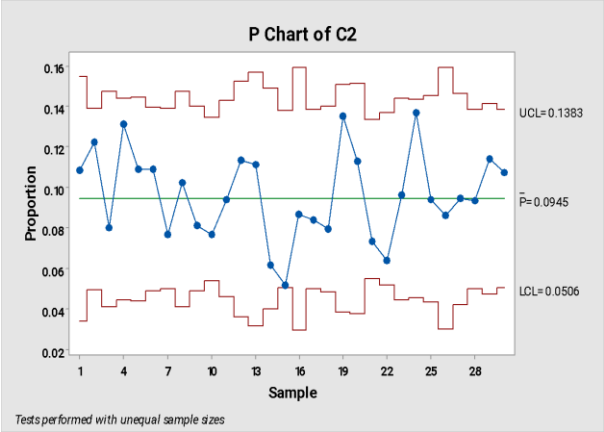

Fig. 3: Control Chart

Control chart c is used in the calculation of the measure stage to determine whether the distribution of data is within the control limits or not. Calculation of control chart c uses historical data of speaker net products from August to October for 30 days.

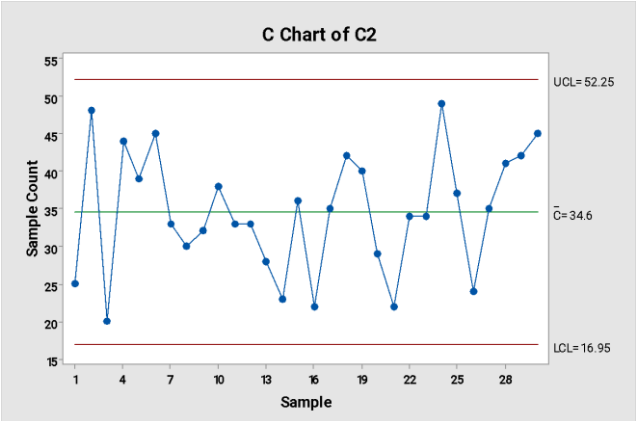

Fig. 4: c Control Chart

Based on the results of the calculation of DPU, DPMO, and sigma level, it can be concluded that the DPU value of 0.09445 is interpreted as the possibility that the speaker net product has a defect of 9.4% per unit. The DPMO value obtained is 18890.2 which means that for one net speaker unit there is an average value of 18890.2 failures per one million opportunities or opportunities. The sigma level value of 3.57 is obtained from converting the DPMO value using the sigma level calculation.

C. Analyze Stage

The analyze stage is the third stage of the DMAIC stage. At this stage, the results of the analysis of the data that have been processed at the measure stage are carried out. In the analyze stage, several tools from 7 tools of quality control are used, namely Ishikawa diagrams and Pareto charts. After analyzing using Ishikawa diagrams and Pareto diagrams, failure modes and effects analysis (FMEA) and fault tree analysis (FTA) tables were also used for the analyze stage.

In making this Pareto diagram the 80/20 principle is used, where 80% of the results are generated and 20% of the causes for each particular event. From the defects in the Pareto diagram, there are 4 defects whose value is 80% of all types of defects. The biggest causes of defects obtained from the Pareto diagram are dented, scratch, bubble, and thin. The Pareto diagram can be seen in Figure 5.

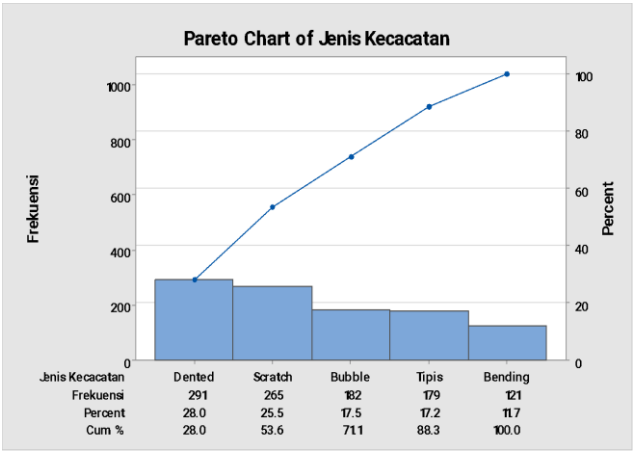

Fig. 5: Pareto Diagram

Ishikawa diagrams or fishbone diagrams are used in this study to find the root cause of the defects produced in speaker net products. Below are some Ishikawa diagrams made to find out the causes of defects in speaker net products.

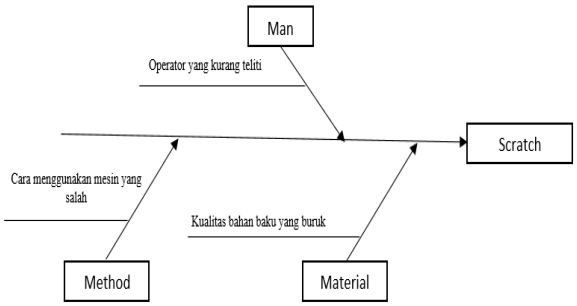

Fig. 6: Ishikawa *Scratch*Diagram

In Figure 6, the man factor consists of an operator who is not careful in carrying out work such as when lifting the speaker net item from the machine used and the product is hit by the machine chisel which causes scratches on the surface of the speaker net. The material factor consists of poor quality raw materials that occur due to lack of careful checking of the raw materials used. The method factor

consists of the way the operator uses the wrong machine or does not comply with the machine SOP.

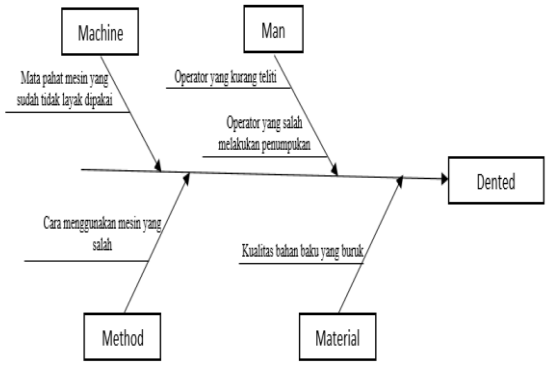

Fig. 7: Ishikawa *Dented* Diagram

In Figure 7, the man factor causes problems such as the operator being less careful in carrying out the machining process on the speaker net item in regulating the engine pressure and the operator being wrong in stacking the finished items. In the material factor, there are causes for problems such as the quality of raw materials that are not good or bad when the material is used in the machining process. On the machine factor, there are causes for problems such as the chisel used on the machine is not suitable for use which can make the surface of the speaker net dent. In the method factor, there are causes of problems such as the wrong way of using the operator or operating the machine.

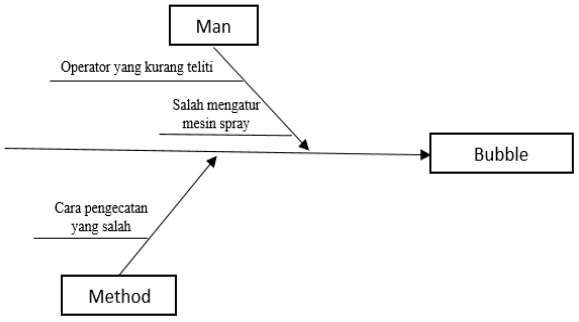

Fig. 8: Ishikawa *Bubble* Diagram

In Figure 8, the man factor has causes such as the operator being less careful in doing his job and the error in setting the spray gun machine used by the operator. In the method factor, there are causes such as the operator who uses the wrong method of painting that is not in accordance with the SOP in the painting process, the operator will paint from one side to the other and if the operator does the wrong method it can cause lumps or thinness on the surface of the speaker net. Making the FMEA table is the next step after identifying the root cause of the defect in the speaker net product. This FMEA table is used to understand more deeply the causes of defects that exist in speaker net products.The RPN value or risk priority number is the value obtained from the multiplication of the severity (S), occurrence (O) and detection (D) values. The RPN value is the value used to determine the most serious problem in the product being studied with the highest number indication meaning that the problem requires more serious handling than the problem that has a smaller number.

No	Process	Potential Failure	Effect of Failure	Severity (S)	Potential Cause	Occurance (O)	Current Detection Method	Detection (D)	RPN
1	Stamping	Scratch	The surface of the stamped speaker net has scratches.	8	Poor quality of raw materials	6	Re-checking the quality of raw materials after the process of purchasing raw materials	5	240
					Operators are not careful during the stamping process	7	Provide a briefing again to the operator	6	336

2		Dented	The surface of the speaker net as a result of the stamping process has a dent.	8	The operator is not careful in setting the pressure on the stamping machine	7	Provide a briefing again to the operator	6	336
					Stamping machine chisels that are no longer fit for use	6	Carry out routine machine checks	4	192
					Incorrect stacking of net speaker products	5	Given a limit on the number of net speakers at the time of stacking and not combined with other products	3	120
3	Sprayi ng	Bubble	The surface of the speaker net has bubbles resulting from excessive paint accumulation.	7	Operator paints in one place excessive surface of the net speaker	6	Provide a briefing again to the operator	4	168

Table 3: Failure Mode And Effects Analysis

Based on the results of the calculation of the RPN value in the FMEA table, there are 2 causes of failure of the stamping process on the speaker net product. The first cause of failure was an operator error who was not careful during the stamping process which could cause the result of the stamping process to have scratch defects on the surface. The second cause of failure is an error on the part of the operator when adjusting the pressure in the stamping process which can make the results of the staping process dented. From the causes of failure that have been identified in the FMEA table, a fault tree will be made to find out in more detail the causes of failures that have occurred. The following is the result of creating a fault tree for the causes of the problems that have been identified.

Fig. 9: FTA Failure *Scratch*

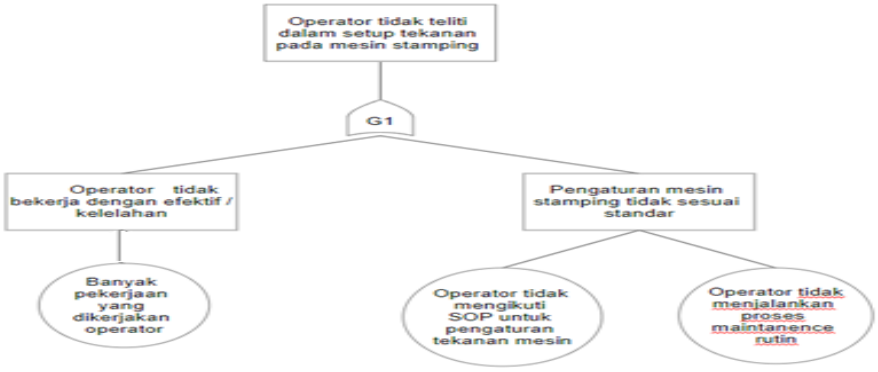

Fig. 10: FTA Failure *Dented*

D. Improve Stage

The improve stage is the next stage in DMAIC. At this stage, suggestions for improvement will be given to improve and improve the product quality of the speaker net item. The method used in this import stage is the 5W+1H or five W's and one H methods. This method is used based on the results of discussions with staff from the factory. The following is a 5W+1H analysis table from the results of the analyze stage:

What	Who	When	Where	Why	How
Scratch	Machine operator	During the Stamping Process	Stamping Process	Operators are no longer working effectively	Provide rest time after finishing the specified product batch
				Operator does not follow SOP	Provide initial briefing before doing work and provide more supervision
Dented	Machine operator	During the Stamping Process	Stamping Process	Operators are no longer working effectively	Provide rest time after completing the specified product batch and more supervision by the supervisor for non-conforming stamping processes
				Incorrect setting of the stamping machine	Conduct a briefing before carrying out the stamping process to check machine equipment and machine settings, use maintenance sheets to maintain machine quality and provide more supervision by supervisors

Table 4: 5W + 1H Table

E. Control Stage

The control stage is the last stage in the DMAIC stage. At this stage, implementation or control of the proposed improvements that have been made in the improve stage is carried out. At this stage, two suggestions for improvement are made because the proposed improvement for operators who work less effectively is the company's decision to add workers or not. The implementation of the proposed improvements that have been made can be seen in table V.

No	Failure Type	ReasonFailure	SuggestionRepair	Implementasion
1	Operators Who Work Less Effectively	The operator is less careful because a lot of work is done by the operator	Increase the workforce and provide small breaks and more supervision by supervisors	No
2	Operator Not Following SOP	Lack of carefulness of operators during the stamping process and lack of operators in training	Putting SOPs on the use of stamping machines on stamping machines and conducting training to operators every 3 months as well as conducting briefings at the beginning of work to remind them of the SOPs for the machines used.	Yes
3	Incorrect Stamping Machine Settings	Operators forget to follow the SOP during the stamping process and don't do routine maintenance (operators don't know or don't remember))	Using the SOP for using the machine on the stamping machine and using a maintenance sheet and holding a briefing before starting work	Yes

Table 5: Implementation of proposed improvements

The implementation of making SOPs for stamping machines can be seen in Figure 11. This SOP creation aims to improve operator performance by following the standard use of stamping machines and also reduce errors during the stamping process.

	PT. Denko Wahana Industri SOP untuk Mesin Stamping
Tujuan	Untuk memastikan hasil proses stamping sesuai standar dan berjalan denagn optimal dan aman.
Ruang Lingkup	Stamping Area dan mesin Stamping/power press machine
Tanggung Jawab	Operator mesin stamping, supervisor production
Prosedur	Tempatkan benda yang ingin di stamp di atas meja mesin. Sesuaikan mata pahat dengan produk yang dibuat Jauhkan tangan dari semua bagian yang akan bergerak Gunakan pegangan tekanan untuk menurunkan mata pahat secara perlahan Sejajarkan mata pahat dengan akurat pada benda kerja / produk yang akan dibuat lalu turunakan mata pahat Setelah melakukan press, naikan secara perlahan pegangan tekanan ke posisi defaultnya Jangan memberikan kekuatan lebih saat melakukan press Setelah melakukan proses stamping pada produk tertentu, keadaan mesin stamping dikembalikan ke posisi default. Setelah menggunakan mesin stamping, mesin tersebut dibersihkan dan semua skrap yang terbuat dari proses stamping di buang di tempat sampah yang sesuai
Pertimbangan K3	Operator menggunakan seluruh peralatan kemanan yang telah ditentukan.

Fig. 11: Stamping Machine SOP

Next is the calculation of the control chart p and c and the calculation of the sigma level value after implementing it. Here is a map of the p and c drive maps after implementation.

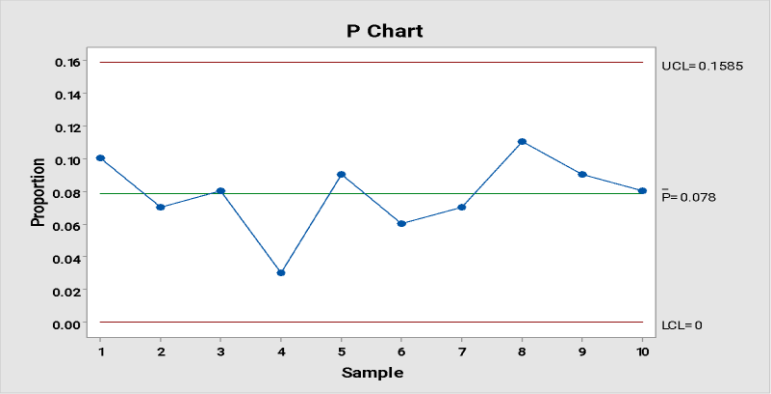

Fig. 12: p Control Chart after Implementation

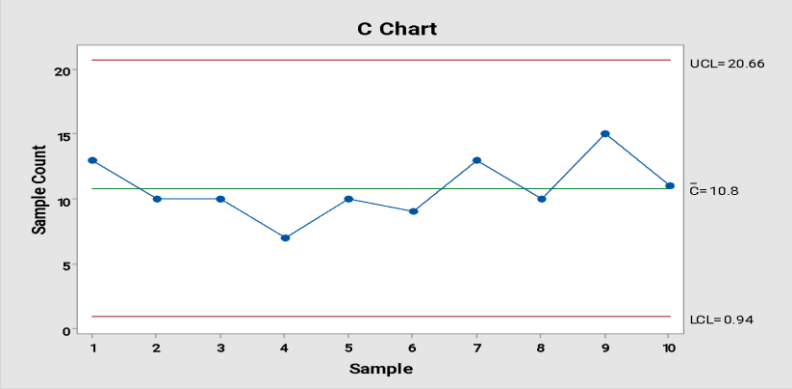

Fig. 13: c Control Chart after Implementation

Based on the results of the calculation of DPU, DPMO, and the level of sigma after implementation, it can be concluded that the DPU value of 0.078 is defined as the probability that the speaker net product has a defect of 7.8% per unit. The DPMO value obtained is 15600 meaning that for one net speaker unit there is an average value of 15600 failures per one million opportunities or opportunities. The sigma level value of 3.67 is obtained from converting the DPMO value using the sigma level calculation.

Comparison	Before Implementation	After Implementation	Difference
DPMO	18890.2	15600	3290.2
Sigma level	3.57	3.67	0.1

Table 6: Diffrence Table of DPMO and Sigma Level

The results of the comparison table in table VII can be seen that there is an increase in the value of the sigma level of 0.1 from 3.57 to 3.67 and a decrease in the value of DPMO by 3290.2 from 18890.2 to 15600. The result of the sigma level value which has increased by 0.1 means that the results of the implementation used in the company already experienced the effect even though the effect is very small but has an impact in improving the quality of the resulting product.

IV. CONCLUSIONS

Based on the results of data processing carried out, it can be concluded that at the mesusre stage, the sigma level value before implementation was 3.57 and the DPMO value was 18890.2. In the analyze stage, the results of the analysis using Pareto, Ishikawa, FMEA, and FTA diagrams are obtained. In the FMEA table analysis the causes of scratch and dented defects have the highest RPN values, therefore the two causes of disability are continued by using FTA analysis. In FTA, there are 3 basic events for scratch defects and 4 basic events for dented defects. At the improve stage there is an analysis using the 5W1H table tool where the results from the table are suggestions for improvements to make machining SOPs and maintenance sheets for stamping machines. At the control stage, there are results of making machining SOPs and maintenance sheets for stamping machines and from the implementation results, the sigma level value is 3.67 and the DPMO value is 15600, where the sigma level value is 0.1% greater than the sigma level value before implementation. From the 0.1 increase, it can be concluded that the proposed improvements can improve the quality of speaker net products at PT D.

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