Advances in Economics, Business and Management Research, volume 184
Proceedings of the Business Innovation and Engineering Conference 2020 (BIEC 2020)

Analysis of Lean Implementation on Spoiler Production Process with Monozukuri Innovation Activity Approach in PT. Inoac Polytechno Indonesia

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ABSTRACT
The importance of operations management in the manufacturing company has increased in the era of the globalization of the automotive industry, however many local manufacturing companies have not yet fully developed a systematical and integrated system to manage and monitor the efficiency of their performance capabilities in producing their products. This paper aims to provide insights into monozukuri innovation activity and analyze the lean implementation on the spoiler production process in PT. Inoac Polytechno Indonesia. In this research, after the primary and secondary data have been collected, then the data were processed using an approach called monozukuri innovation activity (MIA) which consists of 3 points of view, i.e. single format, variation, and supply chain. Monozukuri is a Japanese word consisting of "mono" which means "product" and "zukuri" which means "process of making products". The result of this research shows that MIA activity gave cost reduction of current production part cost around 3% and for future model part cost 20% compared to current part. It can be said that MIA is an approach that can be applied to bring systematic cost reduction activity to face global challenges in the automotive industry. The weakness of this research is that this research has only been conducted in one company. To prove that MIA can be generally accepted, the number of company samples needs to be increased.

Keywords: *Monozukuri, Lean, Process Improvement, Productivity*

1. Introduction

In the last two years, the automotive industry in Indonesia has new comer from China, offering affordable prices and many attractive features to customers. As a result, there is significantly changing in the market related to sales volume. China's car has already reached the top ten sales in Indonesia. This condition is one of the main reasons for local supplier manufacturing to improve the efficiency to keep their product competitive. The other factors like increasing labor cost, fluctuating of the foreign exchange rate fluctuation, and import ratio for material also become challenging to keep the cost in the competitive level. Another challenge is the lack of development of the domestic component industry which results in the domestic manufacturing process still being dependent on imported components. The unavailability of adequate local components, both in terms of price and production capability, makes automotive manufacturers rely on supplies from abroad even though this activity is greatly affected by fluctuations in foreign exchange rates. In the company PT Toyota Motor Manufacturing Indonesia (TMMIN), a company that manufactures cars such as Kijang Innova, Fortuner, Sienta, Yaris and Vios, factors mentioned above becomes the main concern in increasing the competitiveness of Toyota car products. Structurally the cost in one model, which in this case the Kijang Innova as the main model, the local content of the Kijang Innova is 85% with the import portion of 15% consisting of 10% from Japan and the rest from Thailand, Malaysia and Europe. [1]. Of the total 85% local contents in the Kijang Innova, 20% is produced in the PT TMMIN factories, and the remaining 80% comes from local suppliers. The role of local suppliers in improving quality and competitive prices is the main concern of PT TMMIN in developing and educating local suppliers. One of the activities carried out by PT. TMMIN in increasing competitiveness and exploring ideas in achieving cost and quality targets is to conduct Monozukuri Innovation Activity.

PT. Inoac Polytechno Indonesia (IPI) is one of PT. TMMIN's suppliers of automotive components. This company is a subsidiary of the Inoac group, which is

engaged in the automotive sector in collaboration with PT. Gajah Tunggal Tbk. PT. IPI itself has been established since 2013 with Toyota as the main customer at 60%, and the rest are Daihatsu, Mitsubishi, Honda, Suzuki, Nissan, and Hino. Automotive products produced by PT IPI are Spoilers, Headlining, Garnish, and Seal Fenders. Currently PT. IPI has a price that is more expensive than the price of its competitors in Thailand, and in terms of purchase value, the purchase price of spoilers is the largest among the products supplied by PT IPI to PT. TMMIN.

PT IPI which is the top ten of PT TMMIN's component supplier in terms of the purchase value is a company whose products still have a high dependence on imported raw materials, which is around 48%. This has an impact on its product prices due to the foreign exchange rate fluctuations. Hence, in order to be able to maintain competitiveness in terms of product prices and quality, PT IPI needs to conduct this monozukuri activity. The concept of "monozukuri" is sometimes used for discussing the uniqueness of Japanese management practices in manufacturing industries. The Japanese word "monozukuri" can be translated into "manufacturing" in English. However, monozukuri goes beyond a narrow understanding where "manufacturing" refers to production but actually includes all related activities such as product development, process control, and supply chain management.

This paper aims to analyze the lean implementation at PT IPI using the monozukuri innovation activity approach and then calculate its impact and benefit for the process cost improvement. This paper starts with an introduction, then continues with the materials and methods, results, discussion, and finally conclusions

2. Materials and Methods

2.1. Literature Review

Literally Monozukuri (mono: goods, zukuri: making) means making goods or products. However, philosophically the meaning is broader. In making goods, it is vital to understand every aspect related to the manufacture of goods, starting from the aspect of concept development, quality assurance, to the aspect of customer satisfaction, so that goods that can be produced are not only of high quality but also provide sustainable benefits for each user. Moreover, monozukuri must also pay attention to the human resources involved in it so that it always develops, or in Japanese is called Hitozukuri (hito: people). The monozukuri philosophy can be passed down from generation to generation, which will continue to produce product improvements in the future. So, it can be said that there are elements of education and tradition in monozukuri.

The philosophical meaning, Monozukuri has a deeper meaning that is only creating goods [2]. Monozukuri is an activity to add high-quality value to a product and sincerely provide a good product for customer satisfaction, from this definition, it has several keywords, high quality, customer satisfaction and sincerity [3]. Doing Monozukuri, the making must focus on making good quality products, for the sake of customer satisfaction, and done by sincere people. Making products is not only for self-satisfaction or internal profit but also for understanding customer feelings when buying and using the product. With good quality, it will attract the trust of customers. Good quality will also maintain future connections between customers and industry. Without focusing on quality, the manufacturing process cannot continue. The monozukuri process must be established based on strong people and their work culture. The process starts from an individual discipline such as respecting rules and standards, or also from good small behaviors, such as greeting each other. When building monozukuri, human character development cannot be ignored. It was concluded that Monozukuri Innovation Activity is an activity in making a product that focuses on customer satisfaction and continuous improvement so that a product or item can achieve the best results [4].

This monozukuri activity aims to: (1) increase production efficiency by reducing waste that occurs in the current model production process (short term target); (2) carry out cost reduction activities related to future models by analyzing current model designs and processes and providing ideas for designs and processes for new models (mid to long term targets); (3) conduct training to develop the skills of the work leader of the local suppliers in analyzing the conditions of the work process that is running and is able to identify deficiencies that arise and make improvements.

Systematic identification presented in the monozukuri innovation activity consists of 3 (three) points of view, namely: (1) Single format which consists of: product development, process flow, layout, product and process structure, yield of the product, and product defect ratio ; (2) Variation which consists of: type and amount of variation, component table, process flow of each variation, operational availability, yamazumi table, and layout of the factory; (3) Supply chain which consists of: MIFC (material and information flow chart), location map, supply flow diagram, type of packing, and packing list.

Monozukuri itself according to Fukushima (2009) is interpreted as a Japanese manufacturing style, where the spirit of work in individuals or better known as craftmanship, and also involves top management both at PT. TMMIN and component supply networks (Keiretsu). At TMMIN the application of monozukuri to local suppliers is done through a combination of TPS and JIT applications, as explained above that this monozukuri has an impact on changing costs to be lower for current products and also provides ideas for new products to be launched.

The basic difference between monozukuri and jishuken is the output. Although using a combination of TPS and JIT applications, monozukuri is more focused on reducing the cost of production that comes from simplifying the production process and also eliminating (waste) process waste. However, monozukuri and jishuken activities have in common, namely improving productivity in the work process [5].

One important factor in maintaining the competitiveness and quality of products is the strengthening of automotive manufacturing suppliers and

customers who mutually benefit one another in terms of science and learning processes, thus a long-term relationship with continuous improvement results in good quality products and low cost. It said that the principle of manufacturing lean automotive products applies equally to the supply chain. Supplier practice in production is value analysis or value engineering which is used to reduce costs and determine cost targets at each step of production. Through this monozukuri activity, the outputs obtained are divided based on time periods (short-term and mid-long term) and also related to the product, for current and future products [6].

Lean Supply Chains

The main focus of the Toyota Production System is to eliminate waste and respect for people [7]. Lean Manufacturing is also a method used to increase productivity and reduce costs by minimizing waste in the production process. There are several components in the supply chain that are the focus of lean, namely:

1. Lean Suppliers

Lean suppliers are able to respond to changes. The prices or costs they provide are generally relatively lower due to the efficiency of their production processes. Then also their quality is good so there is no need for the next post to conduct the inspection. Lean suppliers are able to deliver their products on time and one of their cultures is continuous improvement. To develop lean suppliers, organizations or companies must involve them in value stream planning, which can help to solve problems and share profits.

2. Lean Procurement

The key to lean procurement is automation. The definition of e-procurement is related to automation in the transaction process, supplier selection, competition between suppliers which are all carried out on the web platform. Suppliers and manufacturers can also see the operational activities of this procurement automatically so as to increase the value of a process.

3. Lean Manufacturing

Lean manufacturing is a production system which only produces what customers need, in the amount that customers want, and the time they want using the minimum resources. The application of this concept will contribute to reducing production costs and improving quality.

4. Lean Warehousing

This is related to eliminating non-value-added steps and waste that occurs during the product storage process. Waste can occur in warehousing, inventory if the resulting production is excessive and due to the low accuracy of the information received.

5. Lean Logistics

The concept of lean can also be applied to the process of moving raw materials starting from transportation in trucks, optimizing road routes, where by eliminating non-value adding activities, lean logistics will experience improvements.

6. Lean Customers

Lean customers have a deep understanding of their business needs and explain in detail the requirements they want. Lean customers expect the value of the products they buy and provide that value to the next customer.

2.2. Research Methodology

The steps in this study use the methodology that is following [8]. The first step is to conduct a literature review to understand each step of the process and tools to be used, in addition to journals, research articles are used to find information related to the relationship between monozukuri and the application of lean. The next step is primary and secondary data collection. The primary data is done by an interview with the head of the production division of PT. IPI, head of the quality control division, and top management of PT. IPI. The data is used for the needs of making VSM (value stream mapping), including data of production requirements, lead time, cycle time, and standard tables of work combinations. While secondary data is taken from various literature and internal data of the company.

This research is a mixture of quantitative and qualitative-descriptive, which means the researcher tries to explain the facts, circumstances, processes, phenomena, and variables on an object, including the relationships with variables or problem-solving.

For making VSM, in the initial conditions is to get data needs from customers, and then calculate production needs, inventory requirements, the number and frequency of deliveries to customers. The steps are as follows:

1. Identify the family of products made by PT. IPI

2. Establish priority analysis of products that will be used as "pilot projects" in implementing "lean manufacturing."

3. Making VSM in the present condition and analyzing all selected improvement processes.

4. Making VSM after the repair process so that they can see the ideal conditions.

5. Schedule implementation, make improvements, monitor implementation, and establish communication.

An essential basis in implementing lean and making VSM is takt time. Takt time is the ratio of available work time to the volume of production needed to meet customer needs. From here, we can set out to calculate the cycle time. Cycle Time is the time required by each operator to complete one work cycle, where the cycle time should be less than takt time [9].

Work balance is a production strategy for balancing time and workload in several interconnected processes in a production line so that there is no process bottleneck or excessive capacity. The time and workload at each assembly station must be controlled following the specified cycle time, bottlenecks (too long) the process at production or excessive capacity (too fast) in the interconnected production process will result in losses for the manufacturing company concerned [10].

An excess capacity that causes idle machinery and labor is usually referred to as "idle" in production to ensure optimal line balance, tasks or workload for each work station must have an amount of work that is almost the same time to be done and must not exceed the station cycle time predetermined work [11].

Production lines must be designed effectively, and tasks need to be distributed among workers, machines, and work stations to ensure each line segment in the production process can be fulfilled within the available time frame and production capacity [12].

3. Results

This part reviews and solves problems based on the results of the Monozukuri Innovation Activity analysis. Based on the analysis of the production line of blow molding and cutting spoilers it was found that the initial problems where there was still less efficient work such as man power waiting for the engine for too long or vice versa. This was a concern of observation. It should be analyzed whether it will affect the productivity of the process of making goods, and then solve these problems in order to improve efficiency.

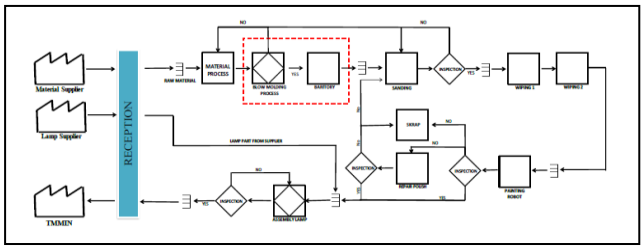

Figure 1. Flow of spoiler production process

The picture above is the flow of the production process in making spoilers at PT. IPI, the manufacturing process goes through 6 main stages, namely:

• Blow molding: This process is an initial process that aims to print products using blow molding techniques.

• Drill / baritory jig: This is a process after the product is printed from a blow molding machine and allowed to reduce the temperature of the part, the drill / baritory jig is the process of finishing cutting from the remaining material that has come out of the blow molding machine and drill the assembly site of the product

• Sanding: This is the process of sanding / refinement of the product, it functions to make fine products according to the specified tolerance.

• Waping: This is a product cleaning process, this process is carried out before the part enters the painting process, this process is carried out so that the part is protected from defects / errors in painting caused by dirt from the part.

• Painting: This process represents the product painting process, the painting is done automatically with the help of a robot.

• Assembly: This process is the process of combining several parts of spoiler products, for example: lights and cables.

Yamazumi Chart or Yamazumi Board is a visual tool used in Lean Manufacturing to help design production cells and monitor continuous improvement. The use of the Yamazumi Chart will enable the visualization of various elements of the work that takes place in the production process and then compare them with the outputs that are needed by consumers.

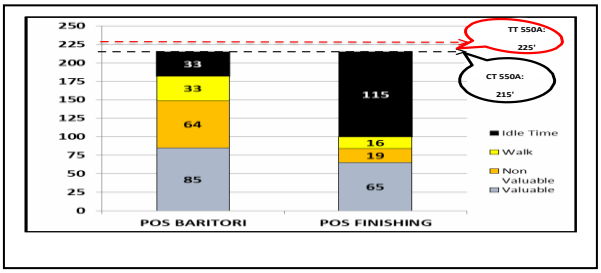

Figure 2. Yamazumi Chart Spoiler 550A(Fortuner)

From the observation of the 550A spoiler (Fortuner) production process time, it was obtained a 215 second cycle time to produce 1 spoiler part, and based on the Yamazumi Chart data above, it can be seen that a process is still relatively inefficient, due to the large amount of waiting time done in the production process. This is the focus to improve the efficiency of the process.

This research is focused on the blow molding and cutting production line, through this activity it is found that is still in less than optimal condition, such as a machine that waits too long for a man power or a man power that waits too long for a machine. So there are too many indications that the waiting time which causes the production process in the blow molding and cutting line is still less efficient. Work balance is a production strategy for balancing time and workload in a number of interconnected processes in a production line so that there is no process bottleneck or excessive capacity. The time and workload at each assembly station must be controlled in accordance with the specified cycle time, bottlenecks (too long) the process at production or excessive capacity (too fast) in the interconnected production process will result in losses for the manufacturing company concerned.

Overcapacity that causes idle machinery and labor is usually referred to as "idle" in production to ensure optimal

line balance, tasks or workload for each work station must have an amount of work that is almost the same time to be done and must not exceed the station cycle time predetermined work.

Production lines must be designed effectively and tasks need to be distributed among workers, machines and work stations to ensure each line segment in the production process can be fulfilled within the available time frame and production capacity. In balancing jobs this is based on a changing plan.

The final stage of the improvement plan is to reduce man power, this is because the production process is less efficient.

One employee of PT. IPI was given a salary of Rp. 6,414,840 / month. With plans for improving layout and balancing jobs, PT. IPI can reduce 1 man power / employee in the production process. So, in 1 year PT. IPI can reduce production process costs by: Rp. 6,414,840 x 12 months = Rp. 76,978,080 per year. This cost reduction occurs by calculating the price scale and points that have become an agreement between the buyer and PT IPI.

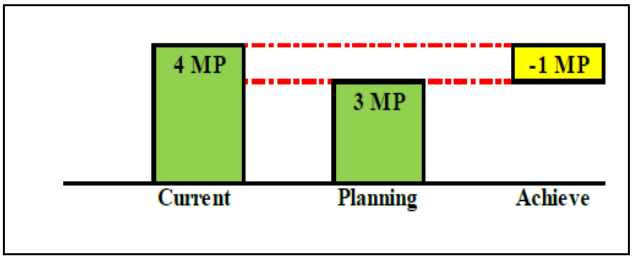

Figure 3. Target reduce man power

Cost reduction calculation has been agreed between PT. TMMIN and PT. IPI as follows :

• Improvements related to cycle time up (productivity increase) Rp. 305 /repair process.

• Reduction or addition of man power / employees to the production process is Rp. 618 / person.

• The selling price of 550A spoiler parts is Rp. 632,670 / pcs

• The selling price of 560A spoiler parts is Rp. 578,560 / pcs

Improvements contain 2 aspects, cycle time up (productivity increase) and reducing man power/ employees.

Then, according to the agreed cost, it will have an effect of : Rp. 305 + Rp. 618 = Rp. 923 / part.

Therefore, the cost reduction of the price of the 550A spoiler parts is: Rp. 632,670 - Rp. 923 = Rp.631,747 / part.

Within a month ordering 6000 products. And cost reduction of the total production cost during one month to 6000 pcs x Rp. 923 = Rp.5,538,000

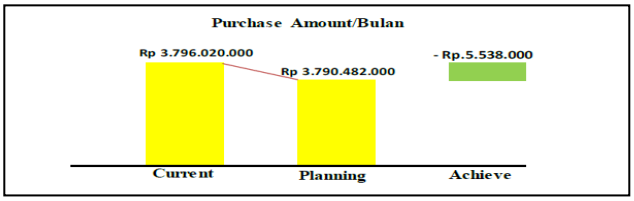

Figure 4. Purchase amount per month for 550A spoiler

While the cost reduction of the 560A Spoiler is:

Rp. 578,560 - Rp. 923 = Rp. 577,637

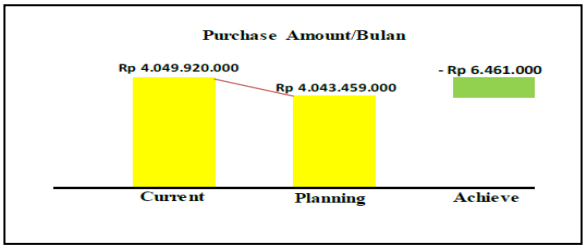

Figure 5. Purchase amount per month for 560A spoiler

In one month the product order is 7,000 pcs . Based on that the total cost reduction can be achieve is 7000 pcs x Rp. 923 = Rp 6,461,000.

4. Conclusion

Based on the results of the analysis and improvements made in this study it can be concluded that:

1. Improvement conducted by the Monozukuri Innovation Activity method can increase productivity and efficiency in the production process of 550A and 560A blow molding and cutting spoiler lines which previously amounted to 162% to 216% or an increase of 54%

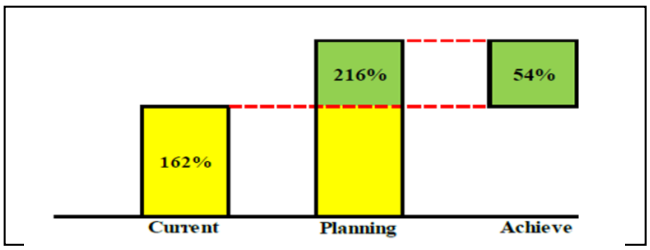

Figure 6. Productivity up increase in 550A and 560A line

2. Improvement made by the Monozukuri Innovation Activity method can affect the cost reduction of the price of goods to improve the competitiveness of the company.

• The 550A spoiler gets a cost reduction of Rp.5,538,000 from the purchase amount / month.

• The 560A spoiler gets a cost reduction of Rp.6,461,000 from the purchase amount / month.

As for suggestions that can be given for further research:

1. Observations and analysis stages on the problem This production line should be used as a reference in finding a root cause (root cause) in the automotive industry.

2. The improvement using the Monozukuri Innovation Activity method should be used as a reference in increasing company competitiveness amid intense global market competition.

ACKNOWLEDGEMENTS

The author would like to acknowledge the support and contribution of the employees of PT. Inoac Polytechno Indonesia. The author also wishes to thank all parties for their help and support in participation and data gathering.

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