Improving Delivery Performance through Part Control Centre in Plastic Injection Industry

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ABSTRACT
Delivery performance usually showed from the ability of production line while producing the product that customer request in a certain time. However, the various kinds of customer orders, limitation of resources, and bad scheduling can caused a bad delivery performance which means cannot deliver the product to the customer on time. The purpose of this research is to improve delivery performance through implementation of the part control centre. It was recorded that delayed delivery was found 12 % in June 2018 that make a bad delivery performance. Therefore, thepart control centre will be provided as an improvement in order to solve those problems. After applying part control centre, the delayed delivery became 0 % which means this improvement successfully makes a good delivery performance.

Keywords:*delivery performance, delivery, limitations of resources, scheduling, part control centre.*

I. INTRODUCTION
As one of a requirement to meet customer expectation, delivery already becomes a major concern in most company. Usually, customers required on-time delivery from their suppliers, and both early and late deliveries can be disturbed for the supply chain. Diva-Portal's survey on delivery performance and customer satisfaction found that 97% of customers felt that on-time delivery was important or very important to their overall satisfaction [1]. Therefore, a good delivery performance must perform in order to satisfy the expectation of the customer.

Delivery performance can be shown from the ability of production line while producing the product that customer requested in a certain time. It means all products that produced in the production line have to follow customer orders.This condition definitely needs more resources regarding the various kinds of customer orders, the limitation of resources and bad scheduling.

In one of the plastic injection industry that produces automotive injected part, delivery performance already become the main concern for satisfying customer expectation. The process flow of the production line in the plastic injection industry will be shown in figure 1.

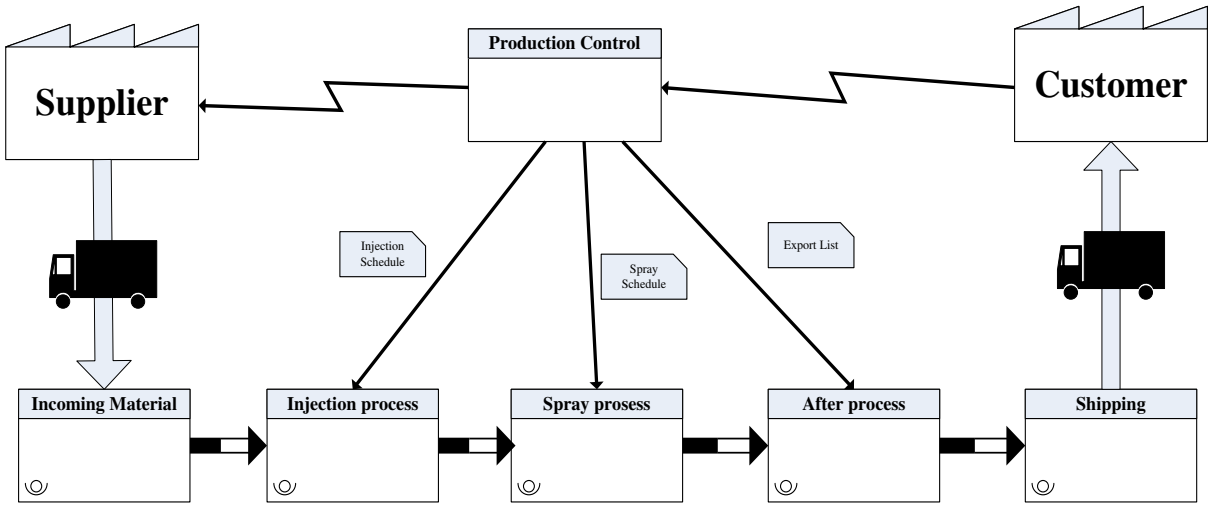

Figure 1. the process flow of injection production line

In figure 1, the process of making automotive injected part start from incoming material, injection process, spray process, after process which is character printing & inspection, and shipping. Actually, customer will order product by sendingpurchase order that will be forward to production control. The production control has important roles in arranging customer orders as production schedule. It also shown in figure 1 that the production control will give the production schedule as a signal to start production activity. However, the limitation of resources often makes the production schedule cannot be run smoothly and caused the delayed delivery that makes a bad delivery performance.

In June 2018, delayed delivery was recorded 12 % from the total delivery. This delayed delivery was caused by the limitation of production capacity compare to customer orders. Moreover, the total of customer orders per day also has differences that make the production control hard to decide production schedule which makes bad scheduling happened.

In addition, those processes in this production line have different problems while running the production. For instance, the various kinds of customer orders cannot be applied in Injection machine which caused by long set up time. If the injection machine follows the customer demand, there was so many machine stop that caused by set up time. Besides that, spray process still need to follow customer orders even though injection machine sometime cannot supply the part that want to spray. It caused the spray process will often stop because of waiting the part from injection machine. Eventually, those problems need to be solved regarding to make a good delivery performance for satisfying the customer expectation.

II. LITERATURE REVIEW

In simple way, delivery performance can be defined as the level up to which products and services supplied by an organization to meet the customer expectation [2]. Delivery performance has many synonyms such as delivery process performance, delivery reliability, and dependability of delivery [3]. There are four variables which are divided into two main categories, namely speed and reliability. In the first category is order fulfilment, time for complete order. In the second category is the percentage of late delivery, how badly customers were inconvenient about lateness. However, in the second category, late delivery is interpreted more broadly to include service levels [4]. The factors that influence delivery performance include: product customization, production instability, size of the organization, JIT, and TQM [5].

Delivery process performance measurements divided into a number of different situations which based on the objectives to be achieved by the company there were three categories, namely routine, normal, custom. But in all three there are similarities, namely delivery performance measurement based on three general aspects, namely time, cost, and quality. The differences in the three categories are the proportion levels of these three aspects [6]. While delivery reliability is being able to deliver products or services when promised, not only time, but delivering high quality products in reliable time [7].

In addition, the time promised to send goods is very important, and then Finch also added the service qualification is just as important as the quality of the product. The quality service described here refers to the previous statement regarding timeliness [8].

Moreover, delivery performance can show the indication of how successful the supply chain in providingproducts and services to the customer [2]. The supply chain in providing products and services can be described through Value stream mapping (VSM). Actually, VSM is a quality management tools that can be used to arrange the current situation of a process by opening opportunities to make improvements and reduce waste [9].

VSM already used as development method that capable in systematically visualizing, analysing and optimizing multistage manufacturing processes from a quality assurance viewpoint [10]. It also used in the chemical textile laboratory for azo dye test help to identified waste in every step and find which part of the step is generating most bigger waste for the laboratory system [11]. Besides, VSM can reduce travel time which means that the total distance travelled is small than the current method [12].

III. METHODOLOGY

In order to find the best solution for improving delivery performance, this research will performby following several steps as describe in figure below.

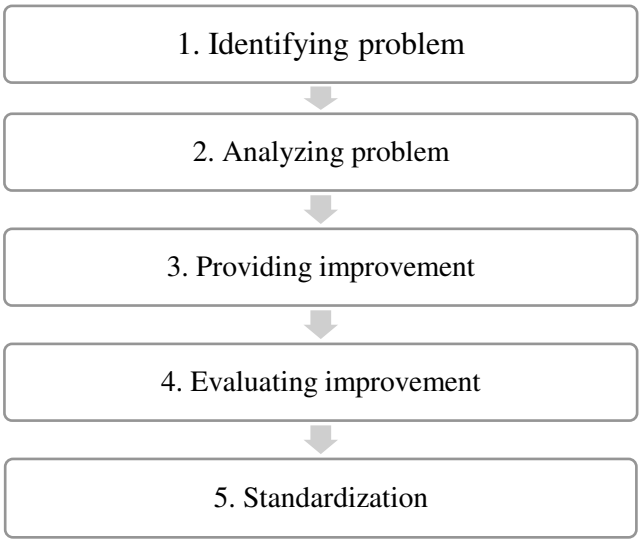

Figure 2. research methodology

In figure 2, this research will start with identifying the problem that caused of a bad delivery performance which is delayed delivery. After finding the problem,the main problem that caused delayed delivery will be analysed. Then, the part control centre will be provided as solution to improving delivery performance. After that, the improvement will be evaluating in order to findthe impact of part control centre in reducing delivery delay for making a good delivery performance. Eventually, the standardization will be providing as the way how to use the part control centre.

IV. RESULT AND DISCUSSION

4.1. Identifying problem

As shown in figure 1, injection production line hasthree main process which are injection process, spray process, and after process. It also shown that push system was performed in injection production line. The push system itself will allow production control to create production schedule based on customer orders and work in progress (WIP). In injection production line, all processes were controlled by production control who received the customer orders. The customer orders became the reference for creating production schedule as signal to start production activity. The schema of production activity will be shown in figure below.

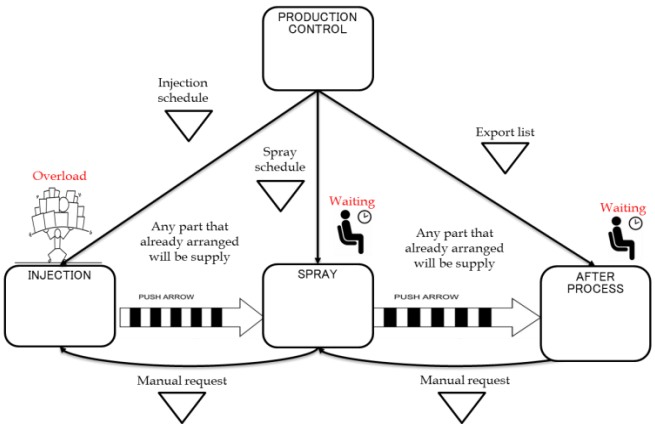

Figure 3. the production activity schema

In figure 3, the production control prepared a schedule for each process. In after process, the production control gave export list as production schedule which is the list of product that customer orders in that day. Then, the production control also gave production schedule to spray process and injection process. The production schedule was created by referring work in progress (WIP) in each process. However, the production schedule cannot always follow in each process that will create a delayed delivery.

4.2. Analysing problem

In order to analyse the problem that caused a delayed delivery as a bad delivery performance, the why-why analysis will be provided as describe in figure 4.

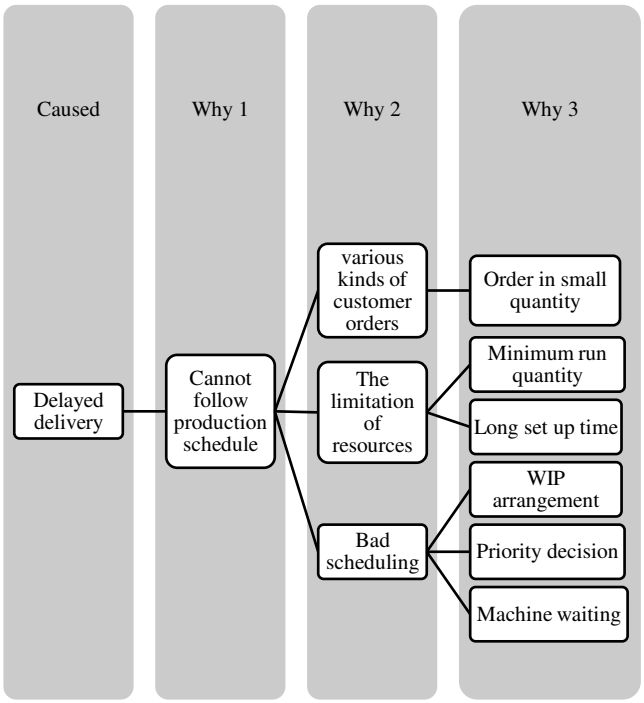

Figure 4. why-why analysis

As shown in figure 4, the main caused of delayed delivery was cannot follow production schedule. Then, there were several caused that makes injection production line cannot follow the production schedule. The first cause is various kinds of customer orders. In this case, the customer orders were randomly request by customer regarding their want. Sometimes, customer requests a product with big quantity. Otherwise, the same product was requested in small quantity. This conditions makes production control need to consider to make production schedule in order to prevent an over production.

Then, the second caused is the limitation of resources. The limitation of resources was found when the injection machine and spray machine have a minimum run quantity. It means that this process cannot produce for small quantity in certain time. It needs a long set up time to change the design. However, the customer order required several design in same time. In additional, the injection machine and spray machine already invested as a common machine which means used for all design.

Finally, the third caused is bad scheduling. In figure 3, in after process, the export list that already prepared by production control cannot run smoothly. This condition happened because not all products in export list were finished from spray process which means after process need to waiting product from spray process. It happened because the WIP arrangement still not performing well. Moreover, the spray process also got production schedule that will creating a dilemma in running production schedule. The spray process needs to decide the priority which one the part need to run first.

This dilemma continues when startingspray process. While running production activity based on production schedule, some product still not finished from injection process which makes the spray process need to wait the part from injection. On the other hand, the after process also waiting the product from spray process in order to fulfil customer orders based on export list. This conditions makes so many products cannot be sent to customer because the after process need to wait product from spray process and spray process need to waiting product from injection.

4.3. Providing Improvement

After analysing problem that caused delayed delivery, the improvement needs to be provided as the solution to make a good delivery performance. Asknow before, the delayed deliveryalready happened in injection production line that caused by various kinds of customer orders, the limitation of resources, and bad scheduling. Therefore, the part control centre will be applied as an improvement to solve the problems that already analysed before.

In this improvement, there are three part control centre will apply in injection production line.The first part control centre located between injection process and spray process which called part control centre injectionorPCCI.The PCCI used for bridging the part from injection process to spray process. PCCI will store all parts that already finished in injection process and send the part that only need to spray process based on orders. The second part control centre located between spray process and after process which called part control centre spray or PCCS. The PCCS also used as bringing station where all parts that already sprayed will store and only part that need in after process will be sent. The third part control centre located between after process and shipping which call supermarket. The supermarket will be stored all products that already finished and ready to send to customer.

In applying part control centre, the WIP racks will be provided as the place for storing parts. Then, the part that stored will be recorded which are store in and store out. This recording has important rules for knowing the conditions of part control centre. Therefore, there are a person in charge (PIC) how handle transaction in part control centre. Besides, PIC also compare the production schedule with actual conditions in part control centre and request the shortage of part in production schedule to previous process.The following of part control centre implementation will be describe through Value stream mapping as shown in figure 5.

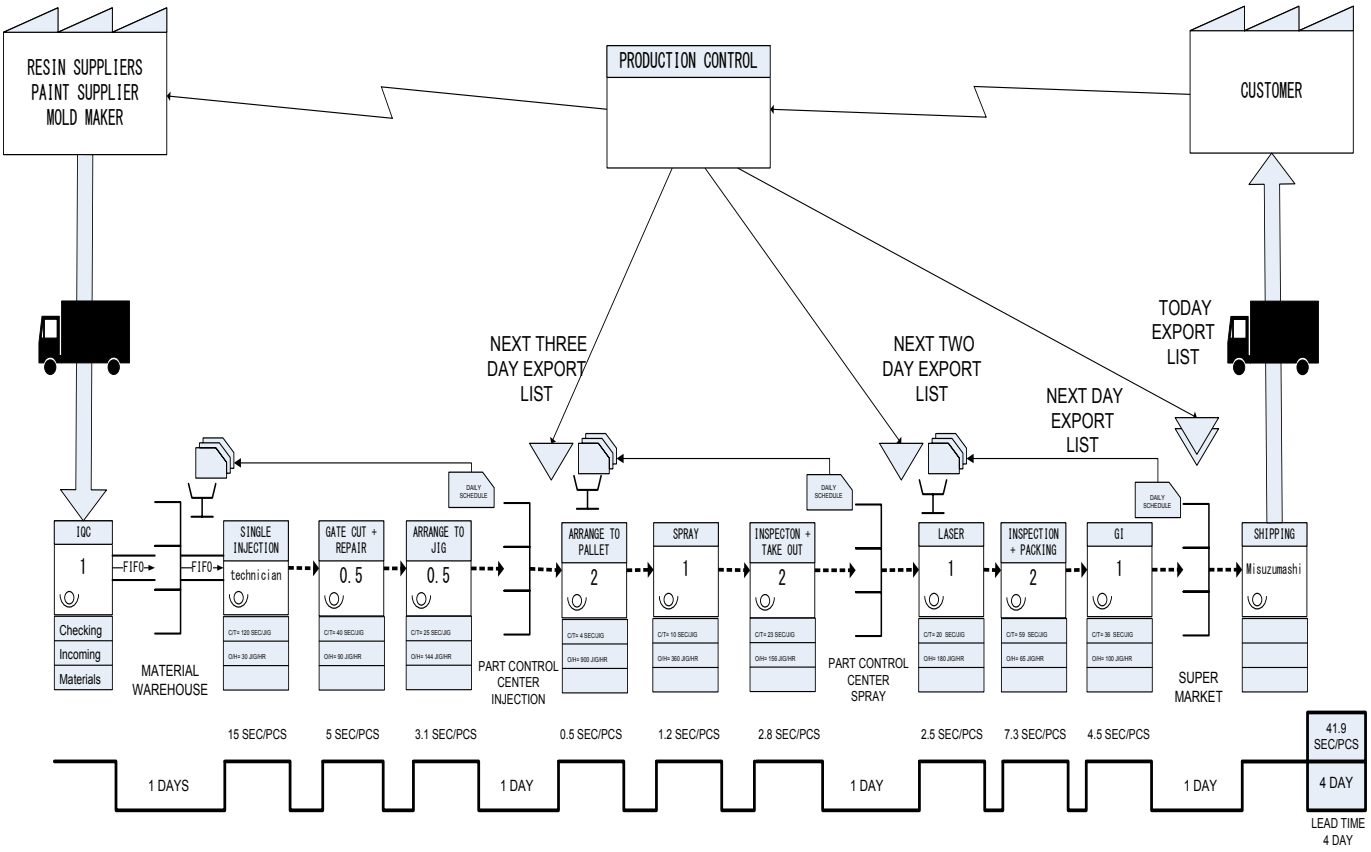

Figure 5. process flow of injection production line after improvement

Figure 5 shown that the injection process start from single injection machine, gate cut & repair, until arrange to jig. Next, the spray process start form arranges to pallet, spray robot, until inspection + take out, prepare. Then, after process start from laser machine, inspection + packing, until guarantied inspection (GI). The part control centre located between processes.

In figure 5 also shown that the activity of production control willsend the production schedule to injection production line. In this case, the production schedule will be changed to export list that production control already got from customer. The export list will be arranging as today export, next day export, next two-day export, and next three-day export. Those of export list will be sent to part control centre as described in figure 6.

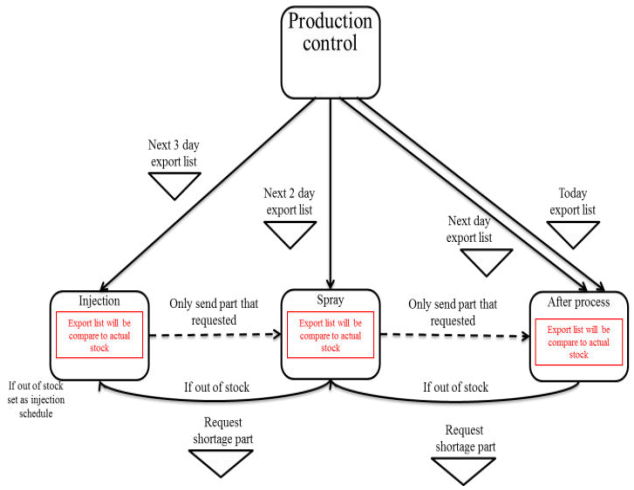

Figure 6. production activity schema after improvement

First of all, production control will send today export list and next day export list to supermarket. Then, PIC of supermarket will compare the today export and next day export list with actual product that store in supermarket. The product that shortage in supermarket will be request to PCCS for sending that product to after process. Second of all, production control will send next two-day export list to PCCS that need to be stored. PIC of PCCS will compare the next two-day export list with actual conditions in PCCS. If the product was shortage, PIC will request to PCCI for sending the part to spray process. Third of all, production control will send next three-day export list to PCCI and PIC will compare with actual conditions. If product was shortage, the PIC will make production schedule of injection machine.

4.4. Evaluating Improvement

After providing an improvement, the flow of injection production line already supports with part control centre. In performing daily activity, all production schedule which are today export, next day export, next two-day export, and next three-day export that prepared by production control will run continuously. It means the product that want to send to customer already processed yesterday. The product that want to after process already sprayed yesterday. The product that wants to spray already injected yesterday. This production activity schema will can be used for preventing delayed delivery which means can making a good delivery performance.

Then, the part control centre will always be performing store in and store out which makes the production control did not worry to creating a bad production schedule. The production control only need to share the export list to part control centre. Then, PIC of part control centre will prepare the shortage product that needed.

Moreover, the part control centre can cover a various kinds of customer orders by providing 3-day stock which is in PCCI, PCCS, and supermarket. These stocks also can be used as an answer for solving the limitation of resources in injection production line. Finally, after applying part control centre in injection production line, the delayed delivery was successfully reducing from 12 % until 0 % as described in figure 7.

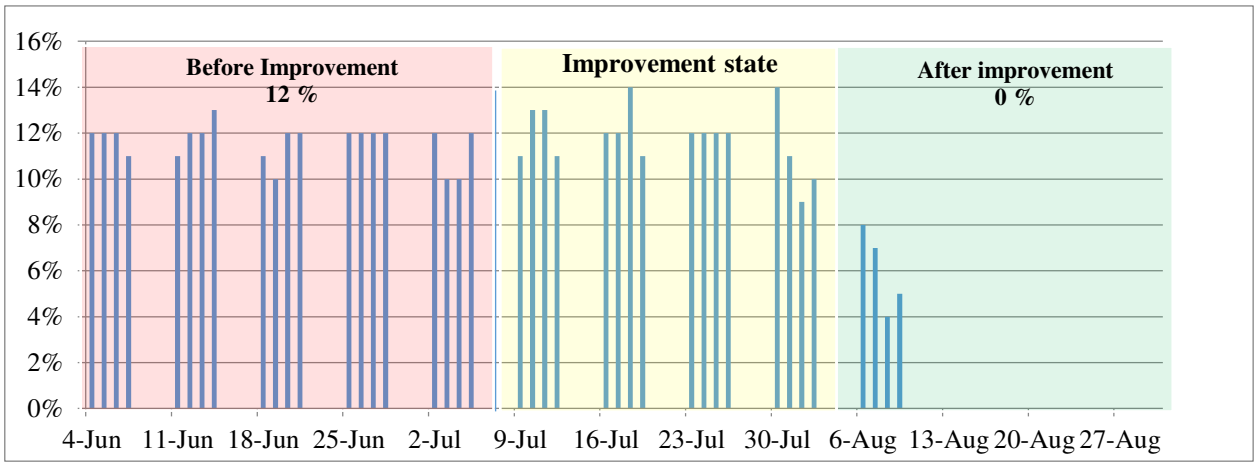

Figure 7. delayed deliverypercentage in injection production line

4.5. Standardization

After applying part control centre as an improvement to make a good delivery performance, standardization will be provided to keep the results of improvement. The standardization can describe from a standard operating procedures and work instructions [13].

V. CONCLUSION

After evaluating the improvement, the application of part control centre had several results which are:

1. The application of part control centre can be used for making a good delivery performance.
2. Part control centre prevent the production control to make a bad production schedule.
3. Delivery delay was cover by providing 3-day stock in part control centre regarding to various kinds of customer orders and limitation of resources.
4. Delivery delay in injection production line was successfully reduced from 12 % to 0 % by applying part control centre.

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