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PRODUCTIVITY IMPROVEMENT PICKING ORDER BY APPROPRIATE METHOD, VALUE STREAM MAPPING ANALYSIS, AND STORAGE DESIGN: A CASE STUDY IN AUTOMOTIVE PART CENTER

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ABSTRACT

Spare parts are one of the important pillars in the after-sales service of automotive business. Customers will be satisfied and comfortable if the availability of spare parts is guaranteed. Spare Part Center is one of the functions to support unit sales and as well as profit-oriented, so the accuracy and speed of spare part acceptance by the customer is an important key to winning the competition. Order Picking is one of the supply chain processes that play a role in warehouse operations to meet customer needs. Order Picking is the most expensive activity in warehousing and can reach 55% of the total cost of warehousing operations, so it is considered a top priority in increasing productivity, even reaching 65% of total warehouse operating costs. The purpose of this research is to increase productivity in the process of picking order through reduction of processing time. Increased productivity is done by improving the working method of the picking process. From the result of the comparison, the method by zone requires less total picking time (193.712 seconds) than by routing (249.559 seconds) decreased 55.85 second time, in other words, an increase of 22.38%. With the Visual Stream Mapping (VSM) in this research can reduce travel time, it means that the total distance traveled is smaller than the current method. The impact from VSM approach will eliminate time for preparation of 1.960 seconds, and take empty trolley of 200 seconds. In this case some of the traveling non-value adding for customer, so this should be taken off from the picking process because it is a waste.

KEYWORDS

picking order, productivity, value stream mapping, picking method.

Introduction

The automotive industry in Indonesia continues to grow and develop compared to other Southeast Asian countries, with an average rate over the period 2014–2016 over 1 million units/year, or an average of 35% of car sales occurring in Indonesia. Of the three periods of the year above the top ten contributed by brands from Japan such as Toyota, Daihatsu, Honda, Suzuki, Mitsubishi Motors, Mitsubishi Fuso, Nissan-Datsun, Hino, Isuzu and Ford [1]. At

this time the competition in the automotive world is no longer absolutely determined by the technology but is determined by the after-sales service. Often customers who will buy a vehicle brand at the beginning have been questioning how the service after sales such as spare parts and service. Related to this factor the automotive industry players competing to focus their competitive strategy on after-sales service. At this timing strategy, after sales tend to be focused on the concept of Customer 1st (C1), the customer is the number 1. Delivery of spare parts on time is a weapon

that is almost applied by all after sales automotive companies in Indonesia, with spare part 1×24 hours or free, online order, the establishment of depots in various regions, home service, online service, 1 hour late or free. This all aims to eliminate the time gap between the needs of customers with services either in the form of services or goods. The timeline between the customer's order and the product's delivery should be studied and the related wastes should be eliminated in order to reduce its duration [2]. Regarding customer satisfaction, according to Hanna Larson and Selma Tica [3] that customer service is an important, Customer service can be described as a company's ability to meet customer needs and requests considering delivery, before, during and after.

Spare parts are one of the important pillars in the after sales service of a vehicle. Customers will satisfy and comfortable if the availability of spare parts is guaranteed. Spare Part Center is one of function to support unit sales and as well as profit-oriented, so the accuracy and speed of spare part acceptance by the customer is an important key to winning the competition. Generally, companies focus on small lead times, low costs and high customer service. Companies continuously improve to reduce lead time, how to deliver products or materials quickly, low cost, and good quality. The several companies build the reputation based on results related to production improvement and cost reduction [2]. According to Dharit Pambhar, and Shubham [4] that applying of Value Stream Mapping can reduce cost and cycle time. They research succeeded to achieve 7% cost saving & also reduction in the cycle time.

Basically, warehouse processes operation is the following: receiving (loading and unloading), put away (binning), internal replenishment, order picking, accumulating and sorting (checking), packing, dispatch and shipping [5]. The five main of activities in the warehouse that is receiving, put away, storage, order picking, and shipping [6]. In this research we are just focused to Picking Order Productivity, there is analyst base on packing method and warehouse layout.

Picking Order is a process of taking goods starting from take the picking slip as written instructions for taking goods until handover the checker. Order Picking is the process of picking up goods from a shelf location based on customer demand [7]. Picking Order is a function which is critical for managing and operating distribution warehouses efficiently [8] Order Picking is the most expensive activity in warehousing and can reach 55% of the total cost of warehousing operations, so it is considered a top priority in increasing productivity, even reaching 65%

of total warehouse operating costs [9]. Order Picking is also a process that uses a lot of labor both in warehousing using manual systems or automation systems [10]. The efficiency of Picking Order affected to some of the factors, there are the product demand, warehouse combination with the routing methods, and experience of the employees [11]. Time for picking is divided into time to travel, time for picking process, and time remaining.

Time for travel is the time related to the movement between locations to be visited where goods are stored and retrieved. While picking time is the time related to the taking of goods, including also put the goods into the trolley, checks the pick list and read pick list. Travel time component is a major contribution to the time for picking, it can be said that excessive travel time is a waste [12]. Basically, the key to improving productivity order picking is how to eliminate waste in the form of time, distance and movement by analyzing layout and existing methods which then proposed a new method. One of the tools that can be used to do this approach is by Value Stream Mapping method. Value Stream Mapping is a set of methods to visually display the flow of materials and information [13].

Literature review

Literature provides a lot of publication regarding Picking Order improvement, in this section some of them will be used as the reference in this research According to J. Webster [3] picking order is defined as the retrieval of stock keeping units from a warehouse according to a pick list generated from a customer order prior to the dispatch of the completed order to the customer. This process is done based on the picking list that has been printed as an instruction as well as evidence of customer demand. By using picking slip picker will immediately go to the storage of goods to pick up the goods in accordance with the information on the picking list, the item code, the name of the goods, the location, the number, and the name of the buyer. In picker-to-parts systems, which are referred to in this paper, human operators (order pickers) walk or ride through the warehouse and collect the requested items from the different storage locations [14]. Picking Order as one of the most significant activities in a warehouse. The picking tasks may contribute by over 65% in the warehouse operating costs [11].

Order Picking is also a process that uses a lot of labor both in warehousing using manual systems or automation systems and the process of getting the right amount and the right product [10]. The

other definition according to Dukic and Opetuk [7] that picking order is the process of taking goods from a shelf location based on customer demand.

In the picking process, starting from taking the picking list as the converted customer orders and also as work instruction to pick goods from storage. Time for picking is divided into time to travel, time to do the picking process, and remaining time. Time for travel is the time related to the movement between locations to visit where goods are stored and retrieved. While picking time is the time related to the taking of goods from bin storage location, including put into the trolley, check and read the pick list or location of goods to be taken next. The remaining time related with activities to put the trolley, and waiting for the next assignment.

The reduction of travel distance and time has an important influence on the total time for order picking [15]. Related to travel time and distance about excessive travel time, they have the major contribution to the time for picking, and it is can be said waste [12]. Waste is any activity that does not add value to the final Product. [16]. According to Rahul R. Joshi, G.R. [14] that can use Value Stream Mapping for eliminating the waste. With the current state, map is used to identify, and a future state map is created with the waste activities eliminated and improve process cycle time.

The various journals generally, researchers managed to increase productivity through elimination waste of time. Some examples of the success of researchers using Value Stream Mapping, both in manufacturing and services. such as India Dinesh Seth and Vaibhav Gupta managed to increase worker productivity in a company from 13.95 to 17.54, and lower lead time from 3.215 days to 0.54 days. Rhonda R. Lummus, J. Vokurka and B. Rodeghiero implementing Value Stream Mapping at a clinic successfully reduced the waiting time by 25%, Harwinder Singh and Amandeep Singh [17] able to reduce cycle time until 69.41%, and many other examples that cannot be mentioned one by one in this journal.

For manual pick-picking systems, travel time increases related with mileage, so the mileage is often the main goal in the planning and optimizing the warehouse. According to Roodbergen [10] the method for efficient picking orders that combine travel times can be categorized into 3 groups: routing, storage and batching Routing method for determining the direction and route of travel and used for mileage, storage method is used to allocate goods to the location based on certain rules, and order batching is grouping customer orders into one picking order [7]. A good routing strategy can reduce travel

time as much as 30% [15]. With reduced distance it means less energy consumption, this is called the greener warehousing [18].

Regarding the picking policies, Ackerman [19] dividing the picking order into 3 categories, there are strict, batch and zone picking depend tailored to each case *Strict picking*, a single order is assigned during a picking tour. This category lower service times but capable to customer satisfaction, so ideal for the picking products is quite small and easy to be found. The weakness of this category increase in the overall transportation time. *Batch picking*, is assigned to a picker more than one orders during a picking tour [15, 20, 21]. The benefit of this category significant to reduce the total picking time, but need time for monitoring and separating the orders at a later stage. *Zone picking* assigns a picker to a designated picking by zone, where the picker is responsible for those products in each of zone in the warehouse. This category to decreasing destructions and mistakes, but a possible delay in a zone if the entering picking for a big order [11]. The alternative solution zone picking divide into 3 step sequential zone, batch zone and wave picking order [22], In the sequential zone the order integrity is maintained, in batch zone the orders are batched together and each picker collects the products within a zone, and in wave picking a group of orders is programmed in precise time period [21].

Basically, a simple structure-storage concept in part warehouse grouping according to movement part (demand base), product or material type (kind of material), sizing (measurement and weighting of the part), and volume. There are depending on to company policies and kind of business. Ven den Berg [23] suggested that a separation of the warehouse into a forward and a reserve area. The forward area was for order picking, while the reserve area was used for replenishing the forward area. Related to productivity and efficiency, Jarvis and McDowell [24] suggested that for reducing the travel time should be to place the items with great demand in the aisle, A stated related to increase picking efficiency, the locating high volume items must be near to the Picking Drop point [20].

According to Tompkins and Smith [11] the overall picking time could be reduced by approaching on the storage arrangement and picking policies. There is the fast moving item or item with high demand will be placed in near distance with the main road and grouped into classes. The different methods and techniques make it difficult to identify the most appropriate policy to increase the overall performance of the picking activity. The decision and policies to

be applied depend on the characteristics product and warehouse.

The average travel distance per picking is important in the order picking performance, which reflects the efficiency of an order picking system. It is determined by some of the factors: layout, storage location assignment strategy, and routing strategy. Measures should, therefore, be taken to reduce it [25]. In the context of order picking, the layout design concerns two sub-problems: the layout of the facility containing the order-picking system and the layout of the order-picking system. The first problem is usually coming from the facility layout problem; it concerns the decision of where to locate various departments (receiving, picking, storage, sorting, and shipping, etc.) [10].

Value Stream Mapping (VSM) is the tool for the identification of the value-adding activities for the eliminate waste as impacted from the non-value adding activities. This is one of the lean tools with the using of mapping the material and information flows, to know the activities performed in each of section floor to deliver products to internal or external customers. The process starting from drawing a current state map to analyze the source of waste and then finds how to improve to eliminate. Value Stream Mapping technique has some information like as flowcharting the steps, activities, material flows, communications, and another process [26]. There are have four major steps, select a product family, draw current state map, draw future state map, and develop work plan for implementation future state [27].

Methodology

In this study to improve the productivity of the picking process through time and process flow analysis. Research is done by comparing Routing Methods with Zoning Method for calculating total picking time each of method. Beginning by determining factors that affect picking a time of the process, such as warehouse layout, picking preparation, traveling time, search and retrieval time, and return time after the pickup process finished. Also used Value Stream Mapping to analyze the movement of picker from one zone to another zone. This is to see whether the movement or the journey of a picker is quite optimal or not. of course by looking at the total time travel picker. This is related to the function of Value Stream Mapping. The objective is to identify and improve value-addition as well as eliminating or minimizing non-value adding activities [28] Value Stream Mapping can also be applied to all other sectors with necessary adjustments [29].

By creating a location mapping and flow of picking route process in current condition, then measure each distance and zone in order to calculate the travel time during the picking process. Flow process is drawing the base on routing picking process. While the picking time (search and picking of goods) is done calculating the time of picking 2.800 lines item with 10 zones. All storage bin locations are assumed randomly and all item in warehouse zone have same of opportunity to the pick from there [10]. From a result of comparing the above will be select one method as the better. Two main steps carried out for the productivity improvement in picking order, there are create the mapping and analyst flow process. This is related with one Value Stream Mapping journal in an automotive supplier to **great concern over improving quality and delivery and decreasing cost, which improved productivity. In this order to remain competitive, waste from the value stream must be identified and eliminated so to run the system with maximum efficiencies** [29]. In this case, the mapping can calculate the average travel distance per picking. This is important for the order picking performance, which reflects the efficiency of an order picking system [42]. After that is calculate picking time, this is for getting the data picking process.

Create the mapping storage and analyst flow process

The purpose of creating mapping storage is to know or calculate the distance and see what activities happen in each section. One of main problems in the warehouse is layout not optimal on the area storage or order picking area, where the main criterion is the distance traveled (travel distance) or travel time. Travel time will increase at the distance more traveled [10]. As illustration for current lay out as Fig. 1.

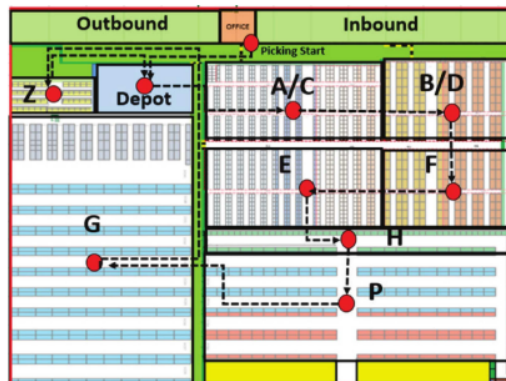


Fig. 1. Storage lay out and flow process.

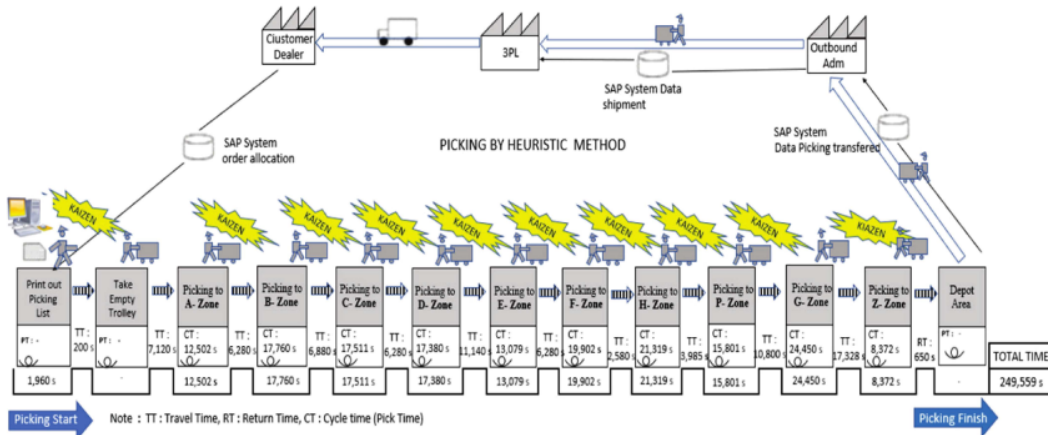


Fig. 2. Current state map.

At the Fig. 1 Picking Order process start from print out picking list, then take empty trolley in depot, travel to Zone according to route heuristic, picking process, go to the next location, until finished at the last location, and return to the location of check (depot) for the next trolley. The objective of heuristic routing policies is to sequence the items on the pick list to ensure a good route through the warehouse. The problem of routing order pickers in a warehouse is actually a special case of the Travelling. And the efficiency of heuristic routing in minimizing the distance traveled by the picker. But in practice, many warehouses use the traversal policy.

In there figure we can see some of proposed to improve. This is will be explain in result and discussion, after analyst from picking order cycle time. Refer to Lay out and flow description we can create the current state map as Value Stream Mapping identification, Fig. 2.

Base on current state map then make the matrix table for calculating the distance and time [11]. From time study results in the location that the time required to walk picker is two seconds/meter, so we can see the Table 1.

From Table 1 can to know how many meters the distance from one location to others, and then also can calculate the travel time. With using travel time 2 second per meter (time study result). Example if picker move from area A to Area B have travel time: $31.4M \times 2 \text{ second} = 62.8 \text{ second}$, in the same way for each travel, please on Table 2.

Table 1
Matrix distance from to in meter.

To	From									
	A	B	C	D	E	F	G	H	P	Z
A		31.4	31.5	34.4	21.5	52.9	89.8	34.4	68.5	44.4
B	31.4		34.4	37.1	52.7	21.5	120.9	34.4	71.5	75.9
C	31.5	34.4		31.4	24.5	55.9	92.8	37.4	71.5	47.4
D	34.4	34.4	31.4		55.7	24.5	123.9	37.4	74.5	78.9
E	21.5	52.7	24.5	55.7		31.4	46.4	12.9	61.7	75.8
F	52.9	21.5	55.9	24.5	31.4		99.4	12.9	32.8	97.4
G	89.8	120.9	92.8	123.9	46.4	99.4		60.3	54.0	86.6
H	34.4	34.4	37.4	37.4	12.9	12.9	60.3		19.9	96.4
P	68.5	71.5	71.5	74.5	61.7	32.8	54.0	19.9		116.4
Z	44.4	75.9	47.4	78.9	75.8	97.4	86.6	116.4	96.4	
T	35.6	66.8	38.6	69.8	54.2	99.5	64.8	67.2	87.1	3.3

Table 2
Matrix travel time by area in second.

To	From									
	A	B	C	D	E	F	G	H	P	Z
A		62.8	63.0	68.8	43.0	105.8	179.6	68.9	136.9	88.8
B	62.8		68.8	74.2	105.4	43.0	241.7	68.9	142.9	151.8
C	63.0	68.8		62.8	49.0	111.8	185.6	74.9	142.9	94.8
D	68.8	68.8	62.8		111.4	49.0	247.7	74.9	148.9	157.8
E	43.0	105.4	49.0	111.4		62.8	92.8	25.8	123.3	151.7
F	105.8	43.0	111.8	49.0	62.8		198.7	25.8	65.7	194.8
G	179.6	241.7	185.6	247.7	92.8	198.7		120.6	108.0	173.3
H	68.9	68.9	74.9	74.9	25.8	25.8	120.6		39.9	192.9
P	136.9	142.9	142.9	148.9	123.3	65.7	108.0	39.9		232.7
Z	88.8	151.8	94.8	157.8	151.7	194.8	173.3	232.7	192.9	
T	71.2	133.6	77.2	139.6	108.5	199.1	129.6	134.3	174.2	6.5

Calculate picking time

The picking time analyst main concern to four component there are travel time for the picker reach the pick point, search time for the products to be found, retrieval time or the products to be retrieved, and return time for the picker to transport the products to the order point [11]. The picking process starting print out the picking list as the instruction to take the parts from the location. At the picking, the list contains some information, customer data, order number, item number and quantity, and storage location. The maximum line item in one sheet picking list is 10 lines item and one trip each of trolley maximum 3 sheet picking list. Bellow (Table 3) data process picking the time for one month will be used for comparing in analyst and select one better of the method. Data is taken from the average picking time of each area.

Related with picking by Zone, should be offset by warehouse assignment. There is grouping part base on product family (small part, medium, and big) and grouping by class (fast moving, medium and slow moving). For time reduction and distance, the fast moving should be allocate near with depot in each of product family. Please see in Fig. 3, Fast Moving Items (A) in each product family allocate near main road and depot (front location), and than Medium Moving Items (B) in the middle location, and in the behind allocation for Slow Moving Items (C).

Table 3
Picking time by zoning.

Zona	Picking time
A	44.65
B	63.43
C	62.54
D	62.07
E	46.71
F	71.08
G	87.32
H	76.14
P	64.23
Z	29.9

Compare picking methods

In this step, we will discuss the method of routing (heuristics) which is now used with the zoning method. Taking into account the preparatory time (time for print and empty trolley taking) is the same for the second method. The calculated time is the travel time (traveling time from one zone to another), picking the time (searching time and pick the time of the goods from bin to trolley), and the return time (return time from the picking point to the checkpoint). Based on the existing picking capacity of 2800 line items per day, with 10 lines item per the list of pickers, and a maximum of 3 randomly picked lists per trolley with the same expectation in each zone [10], then obtained the composition of line order, picking list, and trolley, please on Table 4.

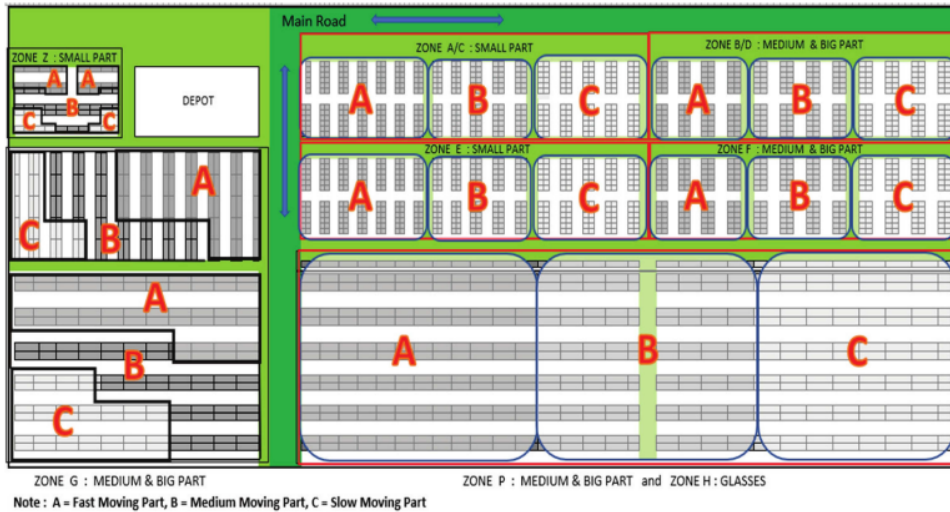


Fig. 3. Warehouse assignment (product family & class).

Table 4
Picking distribution by zone.

Zone	Line item order	Picking list sheet	Unit trolley
A	280	28	10
B	280	28	10
C	280	28	10
D	280	28	10
E	280	28	10
F	280	28	10
G	280	28	10
H	280	28	10
P	280	28	10
Z	280	28	10
Total	2800	280	100

By using data picking distribution, picking time, and travel time correlated with distance, and flow

process that can be calculated total time of each method. The picking area of the layout has a significant influence on the picking of the travel distance [30]. Calculation of Routing Methods is based on that the picking process is done in sequence (heuristic) in accordance with the current state map existing at the Fig. 2.

At this time calculation starts from where the empty trolley, then walk into the zone in sequence, Zone A, B, C, D, F, E, H, P, G, and Z. With the number of line items taken 2800 line or 100 trolleys. For picking by zone picking method is calculated based on that done by one zone, then it will continue in next zone, keeping in mind limiting factor that is 1 trolley only maximum for 3 picking list or about 30 lines item. The results of the calculation of both methods can be seen in Table 5 (before improved) and Table 6 (after improved).

Table 5
Picking time by routing (heuristic) in second.

Zone	Preparation time [second]	Taking empty trolley [second]	Traveling time [second]	Search & retrieval time [second]	Return time [second]	Total time [second]
A	196	20	7.120	12.502	-	19.838
B	196	20	6.280	17.760	-	24.256
C	196	20	6.880	17.511	-	24.607
D	196	20	6.280	17.380	-	23.876
E	196	20	11.140	13.079	-	24.435
F	196	20	6.280	19.902	-	26.398
G	196	20	10.800	24.450	-	35.466
H	196	20	2.580	21.319	-	24.115
P	196	20	3.985	15.801	-	20.002
Z	196	20	17.328	8.372	650	26.566
Total	1.960	200	78.673	168.076	650	249.559

Table 6
Picking time by zoning in second.

Zone	Preparation time [second]	Taking empty trolley [second]	Traveling time [second]	Search & retrieval time [second]	Return time [second]	Total time [second]
A	196	20	712	12.502	712 14.142	
B	196	20	1.336	17.760	1.336	20.648
C	196	20	772	17.511	772	19.271
D	196	20	1.396	17.380	1.396	20.388
E	196	20	1.085	13.079	1.085	15.465
F	196	20	1.991	19.902	1.991	24.100
G	196	20	1.296	24.450	1.296	27.258
H	196	20	1.343	21.319	1.343	24.221
P	196	20	1.742	15.801	1.742	19.501
Z	196	20	65	8.372	65	8.718
Total	1.960	200	11.738	168.076	11.738	193.712

Discussion and implementation

The purpose of this research is to increase productivity in the process of picking order through reduction of processing time. Increased productivity is done by improving the working method of the picking process. By comparing the existing picking work method (routing method) with the proposed method (method zoning). By using Value Stream Mapping analyst, can to proposed the new method with change the current state map.

That is for reducing the cycle time due to productivity improvement can see Fig. 4. From the data processing results obtained comparative data time on Table 7.

Table 7
Picking time compare in second.

Phase	By routing	By zone
Preparation	1.960	1.960
Take Empty Trolley	200	200
Travel Time (TT)	78.673	11.738
Search & Retrieval Time	168.076	168.076
Return Time (RT)	650	11.738
Total Picking Time (PT)	249.559	193.712
Travel Time (TT) & Retrieval Time (RT)	79.323	23.476

From the above data, the method by zone requires less total picking time (193.712 seconds) than by routing (249.559 seconds) decreased 55,847 sec-

ond, in other words, an increase of 22.38%. When viewed from travel time seen that the method picking by zone has the greater contribution to the total picking time of 31.8% (79.323 seconds of 249.559). This means that the total distance traveled is greater than the method by zone.

Furthermore, the increase in productivity can also be done with the Value Stream Mapping approach. There are several processes that are still likely to be minimized by way of relay out depot to the area of empty trolley and utilization of information system technology.

The impact from Value Stream Mapping approach will eliminate time for preparation of 1.960 seconds, and take empty trolley of 200 seconds. So the total time of picking to be $193.712 - (1.960 + 200) = 191.552$ (1.12% of 193.712) or the total picking time decreased 58.007 seconds (there is a productivity increase of 23.24%). In this case some of traveling non-value adding for customer take off from process picking because it is a waste. Value-adding actions and resources are those which create value for the customer. Non-value-adding is everything done in the process which contributes no value for the customer but which they are forced to pay for when they buy the product or service [31].

Bellow is comparison result by Value Stream Mapping, those the flow figure are showing the picking travel, picker runs from each zone to complete picking order as per customer request.

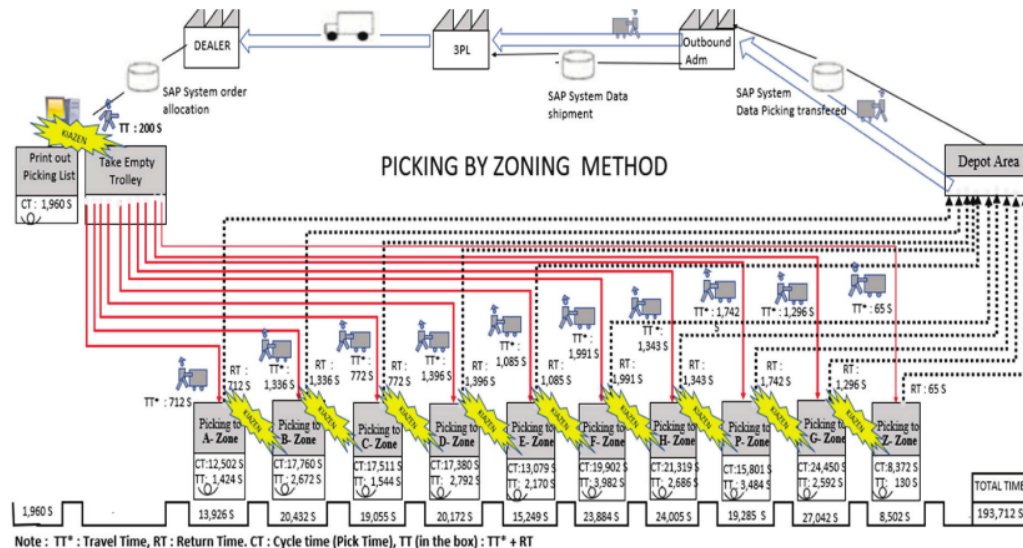


Fig. 4. Future state map and development (after VSM).

Figure 2 shows the initial process before done improvement, the picking order is done by routing. A picker will run sequentially by location, so each zone will be passed. As a result, the picker will run into each zone as many as a number of the trolley that will take the order, which is 100 times trip. This resulted in a considerable travel time 31.8% of the total picking time. Total picking time is picking time (PT) plus travel time (TT).

Figure 4 shows the picking order process after the improved, picking order using the method by zone. A picker will pick up the goods by spending all the orders in the zone. This is very effective to reduce travel time picker. Because the picker only runs in one zone in question, unless all the order to be taken in the zone has been done. This is seen in the total travel time requirement has a contribution to picking time is very small compared with the routing method, which is 12.15%. Figure 4 also shows the displacement of the picking slip printer area to the empty trolley area, thus eliminating the distance previously used by the picker to prepare picking slip an empty trolley. thus travel time for preparation can be eliminated.

Graphically, the increase in productivity by decreasing the total picking time by using the zoning method and Value Stream Mapping analysis is as follows.

The graph in Fig. 5 is used to clarify the total gap of picking the time between the heuristic method and the zoning method, which has been calculated in the previous explanation. The graphically depicted clearly decreases the time significantly by 55.847 seconds or 15.51 hours/day. This is the waste that must be eliminated so that with the decrease in picking order time, which in other words the increase in productivity. So in this case study, sales of spare parts will be more competitive and able to compete with other automotive companies.

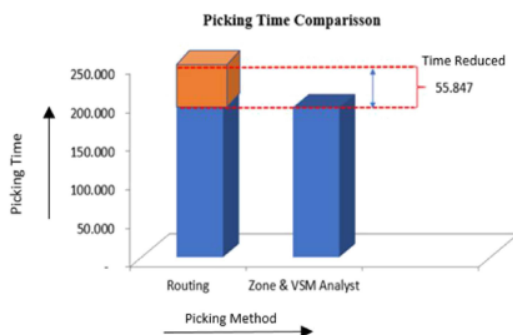


Fig. 5. Graph of picking time compare and reduced.

In addition to the end of this study, after obtaining the correct method that is by Zone method, and also the improvement of picker trip during process picking, it is advisable to do the next step that is making a storage design (product layout). This impacted to productivity too, there is capable to increase until 11.25% [32]. The preceding storage is made based on the grouping of part movements, where the part that has a high level of movement/demand from the customer should be placed near the main road so that the picking process will be faster. A storage assignment method is a set of rules which can be used to assign products to storage locations. The products with the highest sales rates are located at the easiest accessible locations, usually near the depot. Slow-moving products are located somewhere towards the back of the warehouse [10].

Conclusion

To survive in marketplace, companies need to be able to deliver products on time, maintain market credibility and services faster than competitors. One of the important pillars in the automotive industry is the provision of spare parts for customers, where customers must meet their needs with a fast time. Because at this time car sales in Indonesia is not absolutely determined only by technology but which is very important is after sales service, especially the availability of spare parts. Spare part delivery is determined by the operation in the warehouse, namely order picking. because the picking order is the shaping of the form of service to the needs of spare parts to customers.

Order Picking is one of the supply chain processes that play a role in warehouse operations to meet customer needs. Order Picking is the most expensive activity in warehousing and can reach 55% of the total cost of warehousing operations, so it is considered a top priority in increasing productivity, even reaching 65% of total warehouse operating costs. It is necessary to implement the strategy and tools that can help to analyze the flow process, this is done to eliminate waste in the form of time. In this research is done by using Value Stream Mapping tool, with aim to see and compare applying picking method.

From the results and discussion, it can be concluded that the picking by Zone method is more productive compared with the routing method, in this study obtained increased productivity in terms of reduction time of 22.38%. Furthermore, the total time of picking process is determined by the distance traveled by the picker, so it is necessary to study and analyze the flow process. This role of Value Stream

Mapping is needed because by using that can be seen that need to change the method of picking from by heuristic method became to the zoning method.

In this case author suggestion for support the once of selected the picking method more effective and productivity continuously warehouse management should be doing analyst product by class (movement part) periodically. This is due to the ever-changing customer demand, and should be aware that for now customers are smarter and always demand fast, precise and accurate order service. As a further study material for increasing the productivity of picking orders associated with the method and warehouse assignment is to collaborate the application of seventh storage concept (grouping by family or classes storage, vertical storage, ergonomic storage, storage base on weight sequence, fixed bin storage, abnormal or over stock part control storage, and based on sales movement).

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