VOL. 10, NO. 18, OCTOBER 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

ENGINEERING OF AUTOMOTIVE PAINTING PROCESS USING INTEGRATED INFORMATION SYSTEM TO IMPROVE TOTAL PAINTING AND SUPPLY CHAIN PERFORMANCE OF PAINT IN INDONESIA

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ABSTRACT

As the increasing demand in auto–refinish industry, workshop has to work their process an order rapidly. There are workshops do not accept any orders as they already have reach the maximum capacity. One of the problems is the delayed by interval of painting delivery process. It is caused by the suddenly order. To overcome the situation carried out the reengineering process by using of integrated information system between workshop and supplier. Based on the simulation result, the output increase is 21%.

Keywords: reengineering process business, supply chain, autorefinish Industry.

INTRODUCTION

In the modern era, every single activity must move in fast. There are not the material price and quality as main factor only in charm the customer, but the rapidity service and efficiency to do the business, including in auto body repair. In 2011s, the demand is out of control. The workshop also do not concern about the paint inventory that it is order suddenly to the supplier and getting worst by competition among the supplier of auto paint with the differential brand.

Along with the progress of information technology, it is can be used to be supply chain certainty by supplier to the workshop effectively. It can make the workshop should not control the existing paint inventory only and the supplier can integrate the information system, thus the supplier find out the real-time inventory on every single workshop and actively distribute the paint in accurate with effective schedule.

According to the Tan, Kannan, and Handfield (1998), Supply Chain Management is the material direction or supply management from raw to the finished product (recycle and reused when it possible). The management of supply chain focused on control the supply, technology, and competence to improve of competitiveness. It is a management philosophy to extend the activity by brings the trading partner into the similar target of optimization and efficiency.

In Martin, Syntetos, Parodi, Polychronakis, and Pintelon (2011) the most important things in supply chain process is spare parts as the information resource of demand. In order to the supplier can manage the inventory in vendor, the information of inventory level, requirement prediction, promotion activity, and the charge in correlation with the available product must available from vendor to supplier (Kumar and Kumar, 2003).

In Amstrong (2001), the information system defined as integrating, restore, process, and delivering relevant information to the organization (or community) in such the manner that it can be accessed and useful to individual whose need, including manager, staff, client, and public.

It is required business process engineering (called BPR) to change ineffective process previously. Davenport and Short (1990) define the BPR as redesign the process and implement the new one in make sense and be in touch to the defined business result. Hammer and Champy (1993) adding that business process reengineering is an organizational initiative in fundamental to re-examine and redesign the business process in attempt to attain the acceleration of quality, responsive, charge, satisfaction, and other important process in the performance measurement. There are four reasons on why the business must developing BPR-to attain and improve of service for customer, reducing cycle time in production and/or service, as well as increase the quality (Dachyar and Christy, 2014).

In Muthu, Whitman, and Chareghi's (1999) Integrated BPR Methodology, there are any attempts to reengineering the business including preparation of BPR, mapping and analyze the As-Is process, design the To-Be process, implementation of reengineered process and increased continuously.

Wu (1994) arguing that there are nine structured approaches in modeling the system including Structured Analysis Design Technique (SADT); ICAM Definition (IDEF); Structured System Analysis Design Methodology (SSADM); Jackson System Design (JSD); Soft System Methodology (SSM); Data Flow Diagram (DFD); Concept Mapping (CM); Unified Modeling Language (UML); Architecture for Integrated Information System (ARIS).

In other side, the Business Process Simulation (BPS) is an instrument rooted from manufacture system analysis, however, in current the BPS can used to assist the management change in any several manufacture process of service (Greasley, 2003).

RESEARCH METHODOLOGY

The study intends to improve of output and supply chain effectiveness of auto-paint and avoid the impediments caused by incomplete information. The first phase of data collection is field observation directly. The collected data consists of process business occurred among the workshop and supplier, transaction data of paint purchasing from the workshop and supplier, and time study on system obtained from supplier and ten workshops. Moreover, other data collected by interview as the reference of this research.

By total approaches of modeling process, the study prefer to Unified Modeling Language (UML). It is a universal standard language occupied by management of object group in represents whole kinds of software system including specification, construction, and documentation. Establishment of UML diagram practically much used to be specification of technique, design, and modeling of information system variation in increase the technical accuracy and description of requirement in many things refer to the information system (Kanwalvir and Himanshu, 2011). The structure of UML, including class, interface, collaboration, use-case, behavioral things comprise of interaction, state machine, grouping things comprising of packages, and notes. Meanwhile the standard of UML consists of use case diagram, class diagram, collaboration diagram, sequence diagram, state diagram, activity diagram, component diagram, and deployment diagram (Yusuf, Folorunso, Akinwale, and Adejumobi, 2011).

Afterward, established process mapping by one of UML standards-use case diagram; Eichelberger (2008) arguing that it is can used to find out the behavior of actor involved in the system. Jacobson (1992) describes three main concepts on it: (1) there is an actor who represent an individual, system or machine interact to the developed system; (2) use case, a work must doing for support of the developed system; it is represent the particular function of the system; and (3) correlation that represent the dependency between use cases or inter-actor and uses case that bring us can made the particular policy of the system by integrate the existing features.

An analysis of transaction data

By the historical data of transaction, painting order of the car always by the run and unpredictable order. By the selling analysis of spare part in Pareto diagram, from any colors only one product from many can be sold, that make the delivery ineffective as the order is one and only. Without a color, however, the paint cannot be produced perfectly thus it is delayed or inappropriate in expected result.

Analysis of As-Is process

There are any processes categorized in NVA (Non Value Added) Activity or process without proceed. In Muthu, Whitman, and Cheraghi's (1999) theory, there is a phase must be doing to do the BPR-analyze any activities in NVA-the overproduction, waiting, transport, over-processing, inventory, motion, and defect (Dennis P., 2002). The activity of SPK delivery categorized in NVA transport, inspection of paint stock and restock decision making categorized in over-processing, production of paint is in delay category, and investigation of the working result categorized in defect. The activities categorized in NVA caused by information system without effective and appropriate integration.

Meanwhile, there is a use case in the business process occurred in supplier including in NVA over-processing category-transaction analysis. It is caused by activity of data duplication of delivery invoice into the computer, that with appropriate information system, automatically it will entered to the information system, thus the supervisor of supplier do not have to duplicate the invoice anymore into the computer.

By the simulation, it is find out that in average the workshop can accomplish 154 of 200 automobiles a month. It is mean that only 77% of order can accomplished. The main problem of the process is longer material delivery thus result in delay when the stock is empty. In average, by the simulation find out that delayed of the delivery process is 29.9 hours of order will be delivered. The situation result in delay in painting process.

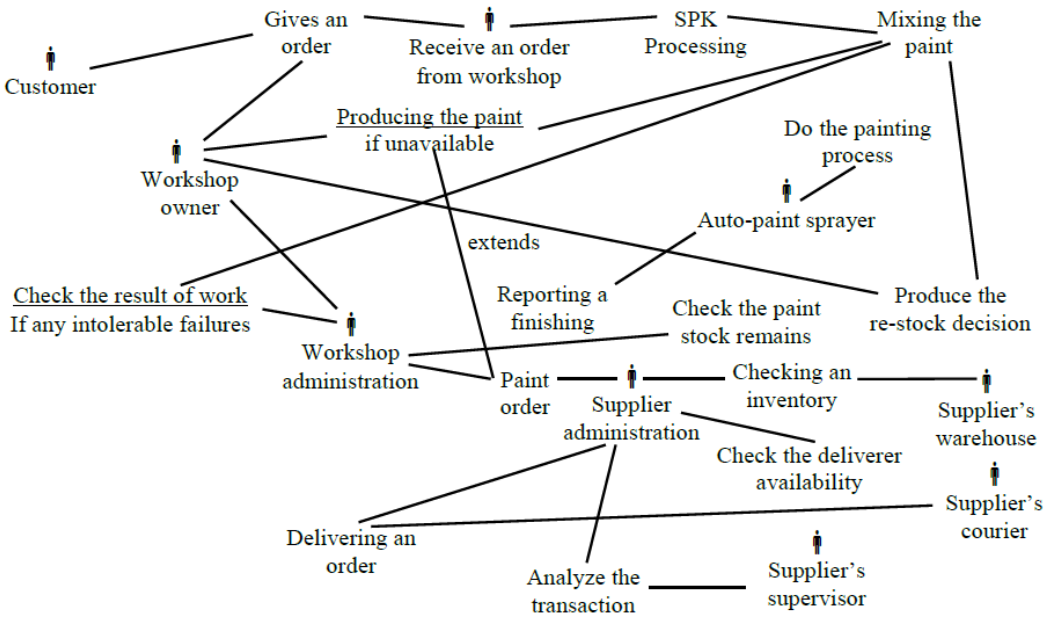

Figure-1. Use case of As-Is.

An analysis of To-Be process

The process of To-Be established by analysis the existing problem in As-Is process. There are five activities in the integrated information system can removed-delivering process of SPK, examination process of paint stock, decision making of restock, delaying activity waiting for paint from production process of paint. Meanwhile, in supplier party, the transaction analysis process also, can maximize to avoid the waste time.

The thing can changed by the As-Is process is preliminary integration of establishment process of SPK from order maker to the paint mixer, thus the delivering activity of SPK can removed. Even if it doesn't significant, but the change can reduce the cycle time that in prior is 58.39 hours to be 58.07.

In this study carried out three scenarios. The first of To-Be process's simulation is interpretation of information in order receiver at the workshop and paint mixer to remove the SPK process that order receiver must deliver an approved SPK. The process is shown in Figure-2.

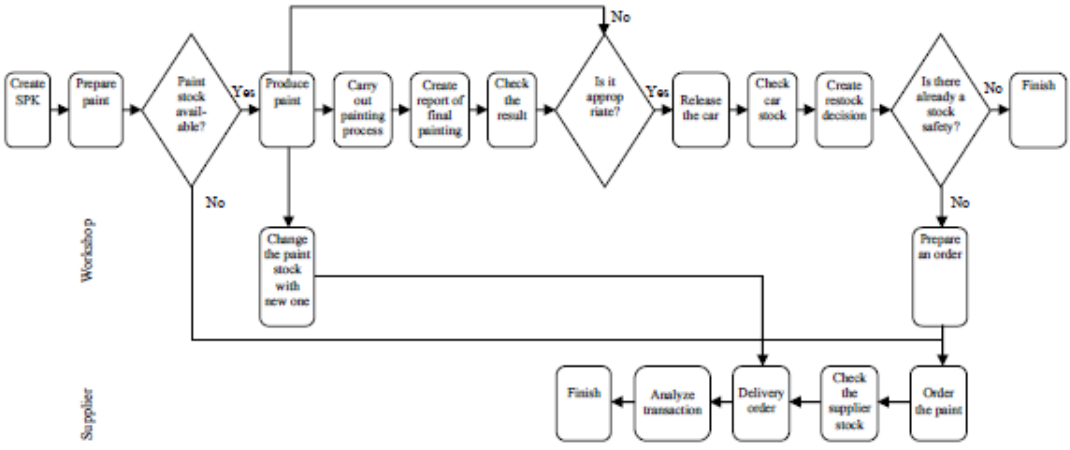

Figure-2. Process flow of To-Be scenario #1.

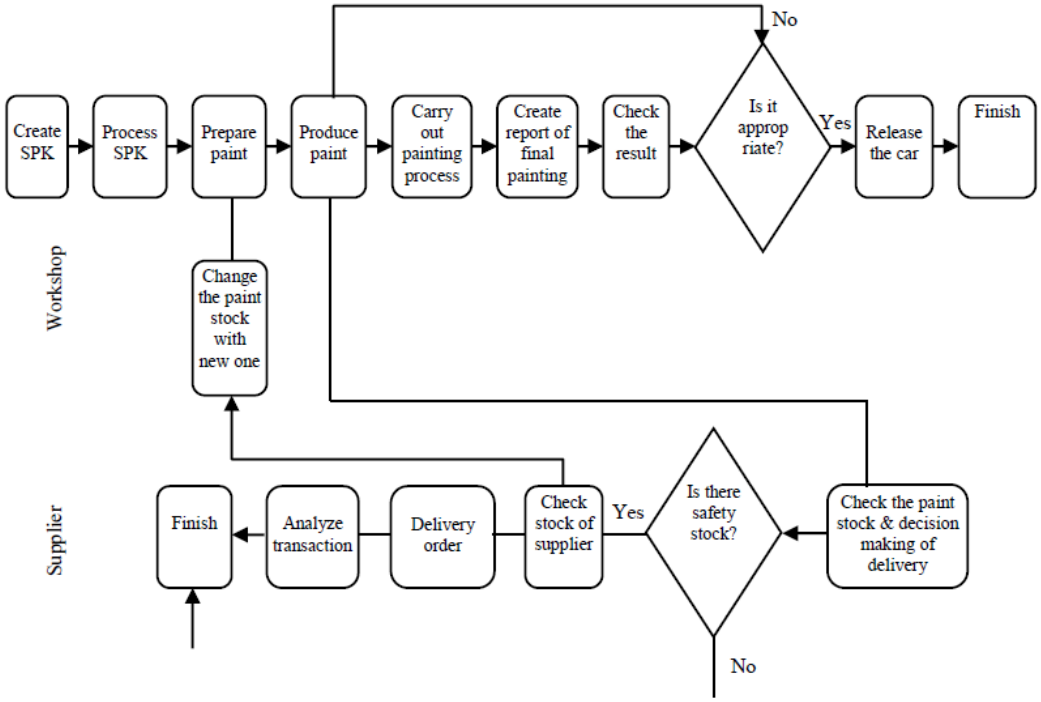

Figure-3. Process flow of To-Be scenario #2.

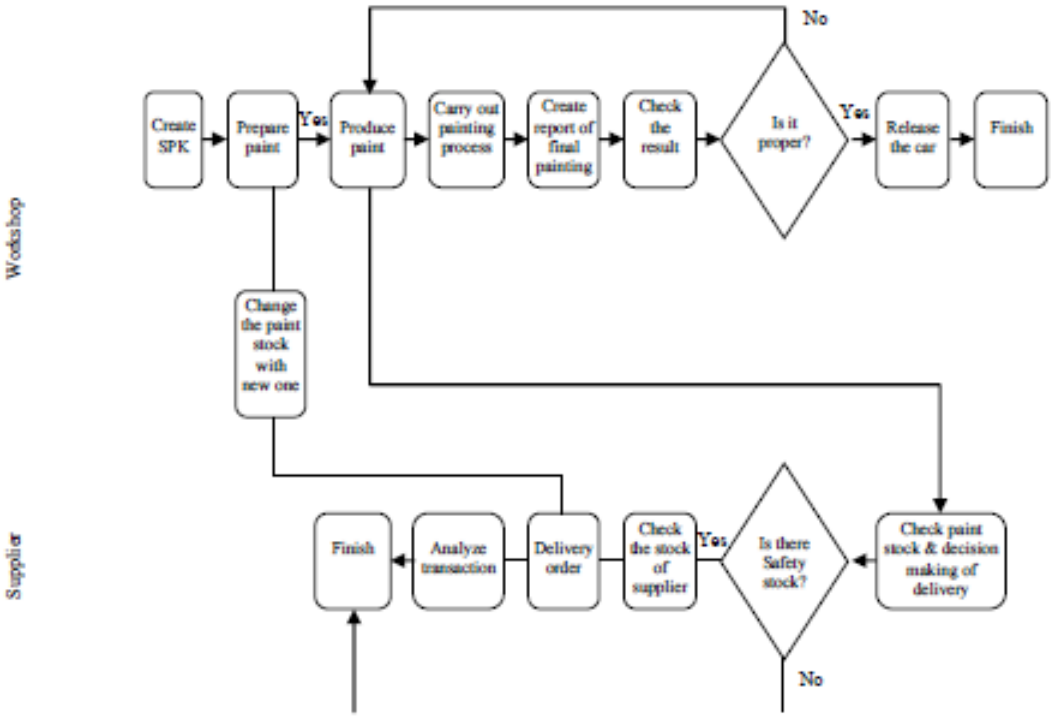

Figure-4. Process flow of scenario #1 and 2 combined to be #3 (To-Be).

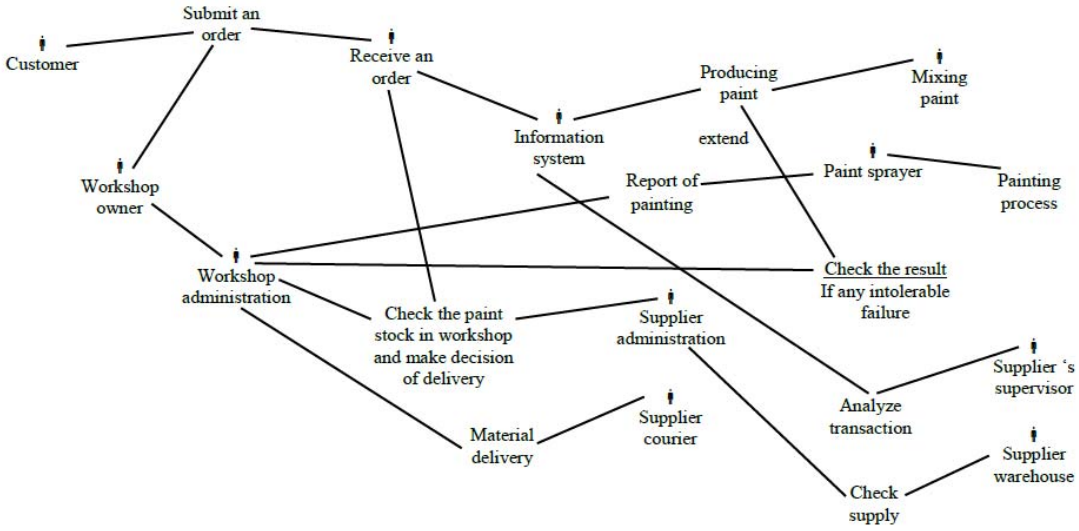

Figure-5. Use-case process of To-Be.

The second scenario of To-Be process is the most important, integrating information system in supplier and workshop. By integrated system, the delayed delivery can remove, and the delivery schedule of supplier could be done. The comprehensive process of the second scenario is shown in Figure-3.

The third scenario of the To-Be process is combination of scenario 1 and 2. Whole the process of third scenario can see by Figure-4.

The most significant of To-Be process is scenario 2 as beside improve of output the workshop from 154 to 187, it is because a delivery scheduling thus the courier to be scheduled in material delivery. By the second scenario it is combined and under simulation there is a significant exchange than As-Is process. The comparison of second process is shown in Table-1.

Table-1. Tabulation of simulation comparison result of As-Is process, scenario 1, 2, 3.

	Transaction statistics (Hours**)**				
	Count	**Avg cycle**	**Avg work**	**Avg wait**	**Avg res wait**
As-Is	154	58,39	5,74	52,65	8,43
Scenario 1	154	58,07	5,72	52,35	8,3
Scenario 2	187	48,25	1,6	46,65	2,45
Scenario 3	187	48,02	1,54	46,48	2,45

In addition the painting process, the transaction analysis process acceleration arranged by supplier's supervisor for the next import policy also decrease and the comparison of process acceleration of analysis listed on Table-2.

By comparison of any scenarios, the third is the best and could be the To-Be process.

Table-2. Comparison of transaction analysis acceleration.

		Transaction statistics (Hours)	
	Count	**Avg cycle**	**Avg work**
As–Is	1	5,58	4,58
To–Be	1	1.08	1.08

Table-3. Shows comparison between As-Is and To-Be processes.

Process	As - is	To - be	Ratio	Percentage of change
Count	154	187	33	21%
Avg Cycle	58,39	48,02	10,37	18%
Avg Work	5,74	1,54	4,2	73%
Avg Wait	52,65	46,48	6,17	12%
Avg Res Wait	8,43	2,45	5,98	71%

By the integrated information system and according to the simulation result, it can be seen that there is increase an output per month of 21%. It is shows that the integrated information system can increase an output thus the business process to be more effective.

CONCLUSIONS

The problem occurred in research correlated to the suddenly delivery process of auto-paint, so that it is resulting in delay of painting order in the future. It is caused by inexistence of effective information integration, thus the supplier who cannot schedule the delivery and process is ineffective.

The problem is can handle by reengineering the process involved inside. By using of use the case diagram, correlation between actor and the process occurred can describe clearly. Next, by diagram activity, every single activity of use case is can described in detail. By integrated information system, supplier can find out in real-time the inventory of paint on each workshop and predicting the schedule of paint delivery on-time.

By the simulation, it is can be seen that there is no delay occurred under reengineering process and order can increase about 154 cars in average at the As-Is process to 187 in To-Be one.

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