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BUSINESS PROCESS REENGINEERING OF A PAINT FACTORY TO REDUCE DELIVERY LEAD TIME

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering Program in Engineering Management
The Regional Centre for Manufacturing System Engineering
Faculty of Engineering
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วิทยานิพนธ์ฉบับนี้มีวัตถุประสงค์ เพื่อลดเวลาในการจัดส่งสินค้าให้แก่ลูกค้าในประเภทธุรกิจสี เนื่องจากในกระบวนการปัจจุบัน ระยะเวลาในการจัดส่งสินค้าของบริษัทมีระยะเวลานานกว่าค่าเฉลี่ยในธุรกิจประเภทเดียวกัน ซึ่งทำให้บริษัทสูญเสียความได้เปรียบในการแข่งขัน ดังนั้น การปรับโครงสร้างทางธุรกิจ (Business Process Reengineering) จึงถูกนำมาใช้เพื่อปรับปรุงประสิทธิภาพ และ ลดการกระทำที่ไม่ก่อให้เกิดคุณค่า หรือ ไม่ก่อให้เกิดประโยชน์ (Waste) จากกระบวนการสั่งและส่งสินค้าในปัจจุบัน ซึ่งในวิทยานิพนธ์ฉบับบนี้ โครงร่างของการปรับโครงสร้างทางธุรกิจที่ได้ผลจริง และ หลักวิชาการในการปรับโครงสร้างทางธุรกิจต่างๆ จะถูกนำมาประยุกต์ใช้

ในวิทยานิพนธ์ฉบับบนี้โครงร่างของการปรับโครงสร้างทางธุรกิจจะมีทั้งหมด 7 ขั้นตอน ได้แก่ 1) การศึกษาบริษัท และ สิ่งตีพิมพ์ต่างๆ, 2) การเข้าใจโครงการ, 3) การเริ่มต้นโครงการ, 4) การศึกษาและ วิเคราะห์กระบวนการปัจจุบันของโครงการ, 5) การเปลี่ยนแปลงกระบวนการในโครงการ, 6) การลงมือทำโครงการ, และ 7) การประเมินผลของโครงการ โดยเริ่มตั้งแต่การวิเคราะห์สภาพแวดล้อมทางธุรกิจของบริษัท โดยใช้ SWOT, PEST, และ Porter's 5 forces จากนั้นบุคคลที่เกี่ยวข้องทุกคนต้องเข้าใจในโครงการที่จะทำ หลังจากที่เข้าใจโครงการแล้วจะต้องมีการตั้งทีมในการปรับโครงสร้างทางธุรกิจ และ ตั้งวัตถุประสงค์ของโครงการ จากนั้นกระบวนการปัจจุบัน (As-Is process) จะถูกนำมาวิเคราะห์เพื่อหาสาเหตุที่แท้จริงของปัญหาในแต่ละกระบวนการย่อย โดยปัญหาจะถูกแบ่งออกเป็น 4 หมวด ได้แก่ กระบวนการ, นโยบาย, ระบบ, และ คน กระบวนการย่อยในโครงการนี้มีทั้งหมด 6 กระบวนการ ได้แก่ การรับใบสั่งซื้อสินค้า, กระดำเนินการใบสั่งซื้อสินค้า, การจัดการสินเชื่อของลูกค้า, การตรวจสอบสินค้าคงคลัง, การจัดการ และ วางแผนในการส่งสินค้า, และ การจัดการการขนส่ง จากนั้น คำแนะนำต่างๆที่ใช้ในการแก้ปัญหาเหล่านั้นก็จะถูกนำเสนอ และ ถูกกำหนดความสำคัญเพื่อใช้ตัดสินใจในการลงมือทำโครงการ ในขณะเดียวกัน กระบวนการทำงานใหม่ (To-Be process) ก็จะถูกออกแบบโดยนำข้อเสนอแนะเหล่านั้นมาประยุกต์ใช้ ต่อจากนั้นแผนการในการทำโครงการก็จะถูกทำขึ้นมาให้แก่แต่ละฝ่ายที่มีหน้าที่รับผิดชอบในการทำโครงการ สุดท้ายผลลัพธ์ระหว่าง กระบวนการปัจจุบัน และ กระบวนการทำงานใหม่ ก็จะถูกนำมาเปรียบเทียบเพื่อทำการประเมินผลของโครงการ

จากผลลัพธ์ที่ได้แสดงให้เห็นว่าโครงการที่ทำไปนั้นค่อนข้างที่จะประสบความสำเร็จ เนื่องจากผลลัพธ์ต่างๆของการใช้กระบวนการทำงานใหม่นั้นดีกว่ากระบวนการทำงานแบบเก่า ดังนี้ การกระทำที่ไม่เกิดคุณค่าถูกลดลง 24% เวลาในการส่งสินค้าลดลง 48% จำนวนสินค้าที่ถูกปฏิเสธลดลง 51% จำนวนคำร้องจากลูกค้าเกี่ยวกับการส่งสินค้าช้าลดลงจาก 33.38% เป็น 11.64% จำนวนคำร้องจากลูกค้าเกี่ยวกับการส่งสินค้าผิด จำนวนผิด และ เอกสารผิด ลดลงจาก 10.25% เป็น 5% ในส่วนของต้นทุนรวมของการทำ Logistics นั้นถึงแม้ว่าต้นทุนรวมนั้นจะสูงขึ้น แต่ต้นทุนที่เกี่ยวข้องกับประสิทธิภาพในการทำงาน เช่น ค่าล่วงเวลา, ค่าใช้จ่ายเบ็ดเตล็ด เช่น ค่ากระดาษ, ค่า Sticker tag, ค่าของใช้ต่างๆในคลังสินค้า ลดลง 15%

ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต.....

สาขาวิชา การจัดการทางวิศวกรรม ลายมือชื่ออาจารย์ที่ปรึกษา.....

ปีการศึกษา 2549

4771607421 MAJOR: ENGINEERING MANAGEMENT
KEY WORD: Business Process Reengineering/ Order to Delivery/ Paint

CHAOW LIMPIWATTAKEE: BUSINESS PROCESS REENGINEERING OF A PAINT FACTORY TO REDUCE DELIVERY LEAD TIME. THESIS ADVISOR: ASSIST. PROF. PAVEENA CHAOVALITWONGSE, Ph.D. 197 pages

The objective of this thesis is to reengineer business process of a paint factory to reduce delivery lead time of order-to-delivery process. Since the delivery lead time of current process is longer than the industry standard, the company has lost the competitive advantage in the paint industry. Therefore, Business Process Reengineering (BPR) is used to improve the efficiency and reduce non-value added activities or Muda (wastes) in the current order-to-delivery process. The practical BPR framework and BPR theories are applied to use in this thesis.

In this thesis, the BPR framework can be divided into seven steps, which are 1) Company and Literature study, 2) Understanding the project, 3) Initiating the project, 4) Programming the project, 5) Transforming the project, 6) Implementing the project, and 7) Evaluating the project. The company business environment is analyzed by SWOT, PEST, and Porter's 5 forces. Then, all related people are made understand the project. Next, the project objectives and reengineering team is set. Then, the current or as-is process is analyzed to find the root causes of the problem in each sub-process. There are six sub-processes, which are Orders Capture, Sales Orders Processing, Customer Credit Exposure Management, Inventory Availability Checking, Planning and Delivering Management, and Transportation Management. The problems are divided into 4 categories, which are Process, Policy, System, and People. Next, recommendations to solve those problems are proposed and assigned priority for implementing, while To-Be process is designed by applying those recommendations. Then, the implementation plan is created for each responsible party. Finally, the comparisons on results between before and after implement are used to evaluate the project.

As results, the project is quite successfully implemented. All of the comparison results of new process are better than the old process. Non value-added activities are reduced about 24%, Delivery lead time is reduce about 48%, Number of rejected orders are reduce about 51%, Number of complaints on delay delivery are reduced from 33.38% to 11.64%, Number of complaints on incorrect product/quantity and incorrect documents are reduced from 10.25% to 5%, and operations efficiency related costs are reduced15%.

The Regional Centre for Manufacturing System Engineering Student's signature .....

Field of study Engineering Management Advisor's signature Paveena C.

Academic year 2006

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CONTENTS

PAGE

PAGE

PAGE

PAGE

LIST OF TABLES

TABLE **PAGE**

TABLE **PAGE**

LIST OF FIGURES

FIGURE **PAGE**

FIGURE **PAGE**

FIGURE **PAGE**

CHAPTER I

INTRODUCTION

1.1 Background of the Research

ABC Paint Co., Ltd founded in 1979, is a manufacturer and distributor of masonry, decorative paints (interior and exterior) and industrial paints (e.g. alkyd, enamel). The company is currently producing averaging 4 millions gallons of paint per year. The company employs 250 employees. The sales office and factory are located in Ladkrabang Industrial Estate. The company approximately has 1,600 customers overall Thailand, which can be classified into 3 main types are Official Dealer (Traditional Trade): 1,200 shops, Modern Trade: 30 Branches, and Project: 360 projects. The company sales revenue is around 900 million baht per annual, which 70% come from Official Dealer and 30% come from Modern Trade and Projects. The company supply chain is show in the Figure 1.1.

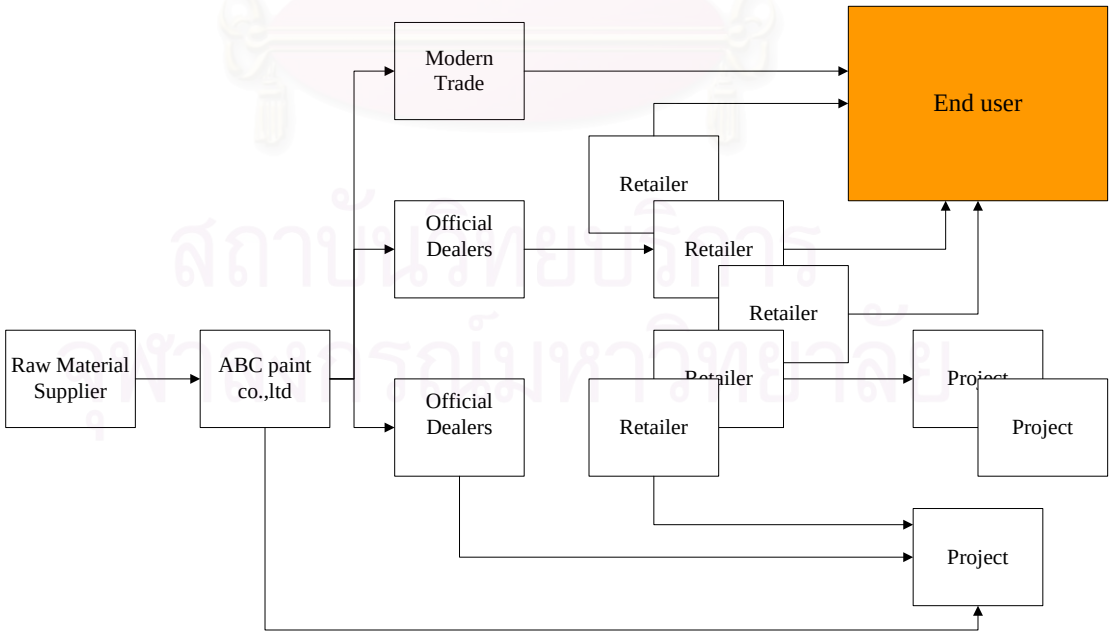


Figure 1.1: Chain of the company

The current processes (Order-to-delivery process) when an order comes are shown in Figure 1.2.

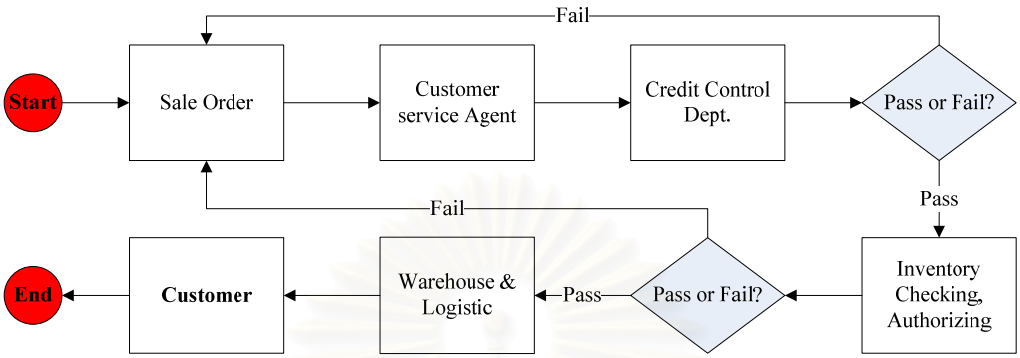


Figure 1.2: Order-to-delivery process

Sales agent receives customer order via 2 channels. First, customers directly fax sales/purchase order to the company. Second, customers order through sales representatives who will forward the order to sales agent via telephone call. Customer agent record orders in ABC sales order form (SO) then manually key in those orders to AS400 system. The system will check for customer credit limit. If that order value does not exceed credit limit, the system will further proceed to check for inventory availability and record as invoice. In case of customer order exceed the credit limit, account receivable officer (AR) will print out the report and revert sales order back to sales representative to either discuss with customers or send to Manager to extend credit limit. If the company cannot fulfill every line item in the SO, that SO will be automatically cancelled. Sales agent will print out the report and revert back to sales representative to discuss with customers. If the SO can be fulfilled, Warehouse Administrative will print out invoice and sort type of invoice (to be delivered by the company or outsource for delivery). Warehouse Supervisor will do routing planning based on geographical area. Logistic officers will take invoice to warehouse to pick products. At this stage, if officer cannot find physical inventory, the SO will be revert to sales representative. If all products can be found, they will be consolidated in an area and delivery form will be filled by Warehouse officers and fax to Sale Agent. Then products are loaded into the pick-up/truck ready to be delivery. Sticker tag that contains the receiver and company address will be attached to products which are delivered by outsource to protect lost during delivery. Warehouse officer will final approve, sign in delivery form and keep original copy at office while the driver take

the copy. After products are delivered to customers, invoice with receiver signature will be mapped with the invoice kept at sales agent. The actual delivery date will be recorded in original invoice and send back to office.

Nowadays, paint market has a very high competition and it tend to become higher. The company must consider not only the quality of the product, but also to delivery the product to market. This is because it is very difficult to do the product differentiation in paint industry. So, the delivery performance is one of the main order-winning of the company to gain the competitive advantage. In the current situation, company has some problems in the processes to delivery the products to customers. The lead time from order entry to delivery products to customer of the company is below the industry standard, which make the company lost the sale opportunity.

In the processes of order-to-delivery the products to customers, there are some non-value added activities or wastes (Muda) in each process, which make the whole process inefficiency. Inefficiency process not only results in the late delivery but also causes the higher logistics cost. Because the over time working is required to keep the delivery on time. Each process has interrelation with others; therefore, one process delay can cause the overall process delay. So, the effective processes are required to achieve the company objectives. There are some examples of non-value added activities or wastes (Muda) in order-to-delivery process are listed as follow:

- Delay from paper work which is needed to be sent back between the office and the warehouse in order to ask for authorization, permission, and approval.
- Error from misunderstanding in communication between sales and administration officer.
- Delay from correction the error records in many kinds of documentation such as Sale Order, Invoice, and etc.
- Delay from recording unnecessary data both in the system and documentations.
- Inappropriate warehouse layout and dock layout which lead to time consuming in logistics activities.

- Delay from finding the products when prepare (picking) finished goods process due to wrong stock data.
- Delay from printing order due to combine orders to fulfill the truck load in each route.
- Delay from loading the products in wrong sequence and needed to be re-load.
- Delay from waiting order to fulfill the truck load in each route.
- Etc.

In order to increase the efficiency of the order-to-delivery process, these kinds of non-value added activities or wastes (Muda) are needed to be reduced or eliminated from the processes.

There are many methods to reduce or eliminate non-value added activities or wastes (Muda) from the processes. Business Process Reengineering (BPR) is one of the popular methods, which is used to solve these problems. The concept of BPR is a fundamental rethinking and radical design of processes to achieve the dramatic improvements in performance. The company will use this method to eliminate the non-value-added activities.

1.2 Statement of Problem

In the current situation, the management feels that the processes from order entry to delivery products to customer are performed under performance, which will make the order-to-delivery lead time of the company longer than the industry standard. This will make the company loose the sales opportunities and the competitive advantage in the industry. The company has established the customer satisfaction survey to investigate the problems. The number of observation is 800 surveys, which are separated by region: Bangkok 400, Central/East/West 100, North 100, Northeast 100, and South 100. Figure 1.3 shows the delivery lead time of the company compare with competitors in paint industry from customer survey. The deliver lead time is the measurement from the day customer place an order to the date they received the products.

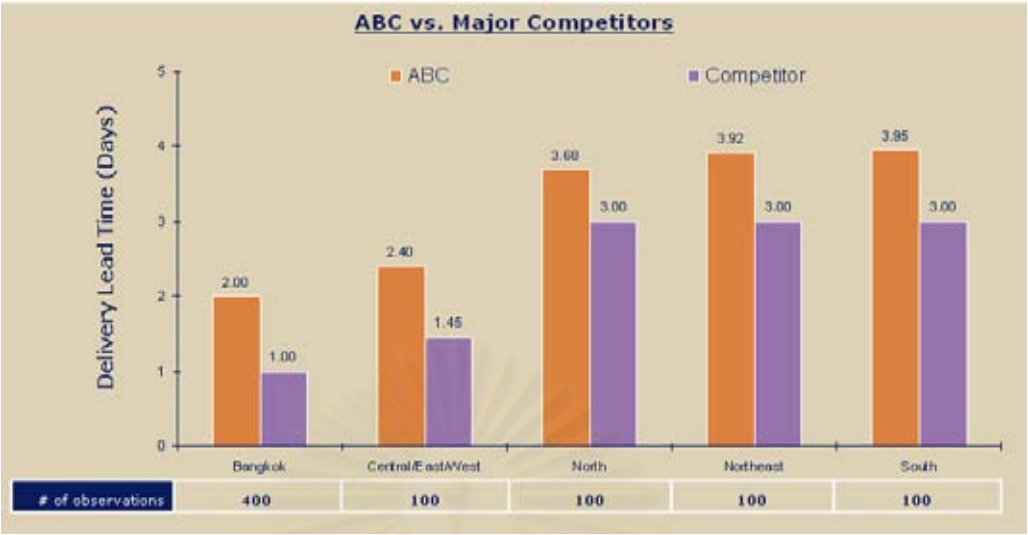


Figure 1.3: Delivery Lead Time of the company compare with major competitors

Overall, ABC company delivery lead time is greater than competitors in all regions. The region that ABC performs worst compare to competitors is Bangkok. The major competitors are able to deliver within 1 day while ABC takes 2 days. For Central/East/West, North, Northeast, and South, ABC takes 0.95, 0.68, 0.92, and 0.95 day more than competitors respectively.

Figure 1.4 shows the number of rejected order per quarter in percentage of the company compare with competitors in paint industry from customer survey. The rejected order is measured when customers does not accept the products delivered which could happen due to many reasons e.g. wrong quantity, wrong products, etc.

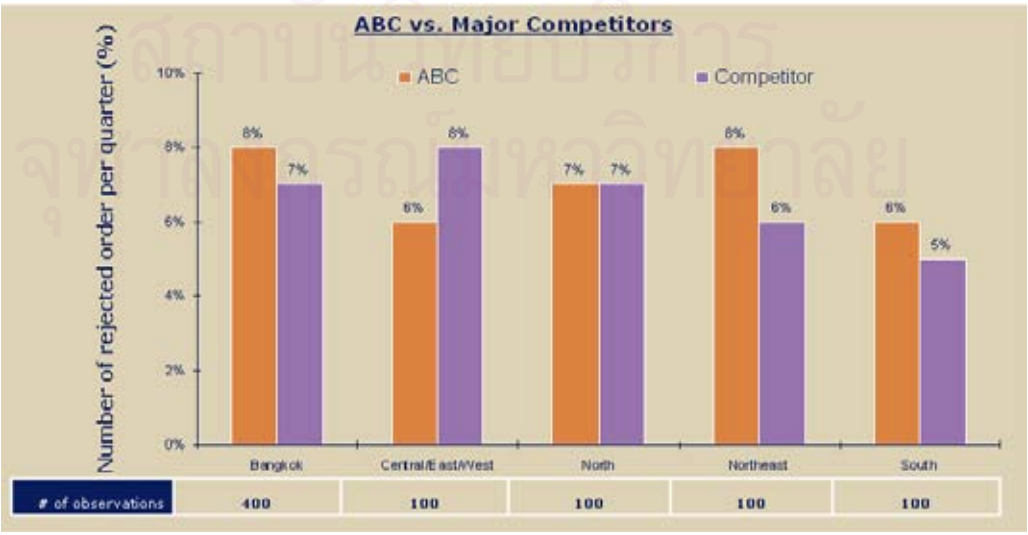


Figure 1.4: Number of rejected order per quarter compare with major competitors

In Central/East/West, ABC has lower rejected rate at 6% than competitors at 8% while the rest of the regions ABC has equal or higher reject rate. The rejected orders come from errors in the inefficiency order-to-delivery process and will make the customer can not get the products on time.

From those problems above, the company is lost the competitive advantage in the industry for example:

- Higher cost due to working overtime is required to keep on time delivery.
- Customers are unhappy at late delivery and cancel the order.
- Losing orders which should be a sale (especially repeat orders).
- Etc.

The root cause of the problems is there are many non-value added activities or waste (Muda) in current processes of order-to-delivery the products to customers. The management therefore intends to use Business Process Reengineering (BPR) to solve the mentioned problem.

1.3 Objective of the Research

To reengineer business process of paint business to improve its delivery performance, especially for delivery time and operations cost.

1.4 Scope of the Research

The scopes of the research are listed as follow:

1. The research is only implementing on the processes from customers push order to delivery the products to customers, which is shown in Figure 1.2.
2. The research assumes that product always available in the stock, all customer orders are fulfilled by the existing products, which already produced from production side.

3. The research only focuses on normal process and does not cover the difficult design, special design, and any other special cases.
4. The research is mainly focus on delivery lead time and operations cost of the selected process.
5. The research is only study about:

    - Evaluate current processes and document of the selected process.
    - Design new processes of the selected process.
    - Recommend for resource requirement needs for the selected process.
    - Education for employee, who is involved in the selected process.
    - Redeployment of IT, which is involved in the selected process.
    - Comparison results between current process and new process of the selected process.

6. Benchmarking the results of the objectives with the industry standard.

1.5 Research Procedure

1. Study the company, related literature and theory.
2. Define and understand the project with the top management.
3. Select the business process that needs to be redesign and define clear and measurable objectives. Then, form the reengineering project team.
4. Evaluates current processes, define bottlenecks, and identify opportunities and designing new work steps or processes that will create competitive advantage.
5. Propose of the new process design. Enhancing management/employee to understand the new processes.
6. Implement and evaluate the success of the project against the objectives.
7. Summarize the study with recommendation and Thesis write up

1.6 Expected Benefits

1. Reduce delivery lead time to customer.
2. Reduce total logistics cost for both administration and operations activities.
3. Improve total logistics performance when benchmarking inside paint industry.
4. Increase customer satisfaction by delivery on-time.
5. Using this study as a model for performance improvement in other sections, which outside the study areas.

1.7 Organization of Thesis

This Thesis is organized as follows:

1. **Chapter 1- Introduction:** This chapter gives the overview of this Thesis, which includes Research Background, Problem Statement, Thesis Objectives, Scope of Thesis, Thesis Procedure, and Benefits. These details will give the idea for readers to understand the purpose of this Thesis.

2. **Chapter 2- Literature Survey and Theoretical Consideration:** This chapter provides the papers or researches, which are related with this Thesis. Moreover, there are some theories and techniques about Business Process Reengineering (BPR), Muda (Waste), and many analysis tools, which will be used or applied in this Thesis.

3. **Chapter 3- Methodology:** This chapter discusses about the BPR Framework, which is applied from the related papers or researches to use as methodology in this Thesis. The details of each step from start to the end of the project will be provided to make clearly understanding in Thesis procedure. Additionally, examples of deliverable in each step will be illustrated in this chapter.

4. **Chapter 4- Company Analysis and As-Is Process:** In this chapter, in-depth analysis of company current situation and current (As-Is) process of order-to

delivery will be discussed. Analysis tools, which are SWOT, PEST, and Porter's 5 Forces will be used to analyze the company environment. Then, the operations flow of current order-to-delivery process will be shown in IndustryPrint™ format. Next, the Fish bone diagram will be used to analyze each sub-process to find the key points that causes of inefficient order-to-delivery process. Finally, Deloitte Capability Maturity Model™ will be used to evaluate the level of current operations of the company.

5. **Chapter 5- Recommendations and To-Be Process:** In this chapter, recommendations for each sub-process will be provided to minimize non-value added activities and reduce delivery lead time in order-to-delivery process. Then, the new (To-Be) process will be established by including all recommendations of each sub-process. Moreover, all recommendations will be prioritized based on impact/benefits to the business and ease of implementation, which is easily to understand and to make the decision on the sequence of recommendations that will be implemented.

6. **Chapter 6- Implementation and Results:** This chapter begins with the Gantt chart that illustrated the implementation plan. Some problems during the implementation will be discussed and modifications of To-Be process will be proposed. Then, results of implementation the new process will be evaluated by comparing total lead time, number of rejected orders, and other issues between As-Is and To-Be of order-to-delivery process. Additionally, Deloitte Capability Maturity Model™ will be used again to evaluate the level of capabilities after implementation.

7. **Chapter 7- Conclusions and Further Study:** A summary of this Thesis is presented here along with the potential directions of future research.

CHAPTER II

LITERATURE SURVEY AND THEORETICAL CONSIDERATION

2.1 Literature Survey

Since the objective of this thesis is to improve delivery performance in a paint factory especially in delivery lead time and operations cost, some related literatures, which studied to improve delivery performance by using many methods are reviewed. In order to perform delivery performance improvement project, two main things, which are appropriate strategies or concepts used and model or methodology to implement are required.

2.1.1 Strategies and Concepts

There are many strategies, approaches, or concepts, which are proposed to improve deliver performance or reduce delivery cycle time. According to Daugherty et al. (1995), time-based strategies were presented to gain competitive advantage in the industry. Distribution service was especially critical to the successful implementation of time-based strategies. It did not matter how fast a product can be manufactured if merchandise got tangled in the distribution chain. When delivery was delayed, potential advantages from speedy manufacturing processes were diminished if not completely destroyed. Four time-based strategies, Competitive advantage through time management, Increasing corporate responsiveness, Flexibility, and Communication/information were proposed to improve delivery performance. From a definition recently proposed by the Institute of Logistics states that: “Logistics is the time-related positioning of resources”, Walding and Newton (1996) also studied to enable time-based strategies through logistics, which used time to competitive advantage. By using time-based strategies, the company would achieve the goal of sustained competitive-advantage-enhancing profitability and growth.

The logistics strategies such as Carrier alliances and Electronic Data Interchange (EDI) were presented by Ng et al. (1997) for reducing transportation cycle time. Establishing alliance relationships with carriers and the subsequent sharing of information often with EDI systems may help in reducing the transit time aspects of total cycle time. The options of using higher-priced freight transportation services from a reliable carrier can meet the performance standards for time reduction. In the same year, Larson et al. (1997) also studied the impact of performance improvement initiatives on logistics people, as well as performance. Two of the most popular programs, EDI and outsourcing, had profound impact on people in logistics. Both outsourcing and EDI required cooperative relations to reach their full potential. The authors also suggested that leading edge logistics organizations commit to alliances, use outside service providers, and are involved in EDI.

Moreover, there are some approaches such as Total Quality Management (TQM) or Business Process Reengineering (BPR), which are often used in cycle time reduction program. In 2001, Chen et al. presented new developments in creating cycle time reduction by using these approaches. For example, At American Standard Inc., demand-flow manufacturing fits under the big tent known as TQM, the cluster of techniques that many American businesses had been adopting to improve the quality of their goods and services. The demand-flow system not only improved efficiency and quality but also shortened cycle time so that firms were more responsive to the customers and gained market share. In the other hand, Re-engineering and cycle time had been successful at Texas Instruments Inc., where re-engineering had been going on for several years. The company had successfully used BPR to redesign the material procurement process for the company's defence systems business.

Additionally, the operations management concepts such as pre-sorting of material to avoid double handling and cross docking were studied by Apte et al. (2005) to improve delivery performance. These concepts were used to reduce cycle time of delivery, and workloads balancing among delivery routes to effectively increase delivery capacity. The redesigned delivery operations will reduce the cycle time and the cost of delivery by almost half. Furthermore, through balanced utilization of existing truck capacities, the delivery operations will be able to handle significantly

larger delivery volume and thereby accommodate future delivery service growth without additional investments. The average cycle time and delivery cost were significantly reduced after using these operations management concepts.

The strategies, approaches, and concepts above might give many ideas or initiatives to find the suitable solutions or recommendations for solving the problems, which are the cause of inefficient order-to-delivery process. However, the appropriate models, methodologies, or frameworks are also important in order to perform the delivery performance improvement project. Some successful methodologies in cycle time reduction program are discussed in the next section.

2.1.2 Models and Methodologies

From the related literature, some models to implement logistics strategies and some methodologies to perform cycle time reduction project are presented.

To implement the logistics strategies, the basic areas to implement a competitive logistics strategy have to identify. According to Fawcett and Clinton (1996), they studied to enhance logistics performance to improve competitiveness of an organization by proposed logistics excellence model, which is shown in figure 2.1

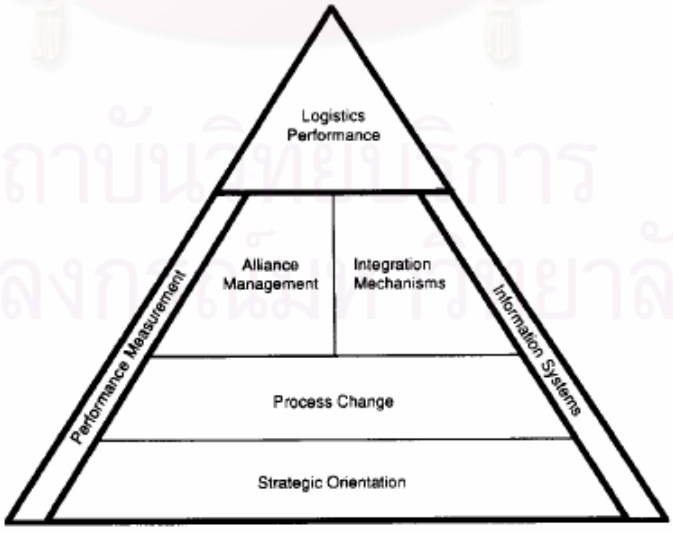


Figure 2.1: A model of logistics strategy implementation

From the proposed model, the seven basic areas to implement a competitive logistics strategy were identified. Developing excellent logistics processes would allow the company to produce and deliver a more competitive product/service to their customers.

Another factor in successful implementation the cycle time reduction project is methodologies or steps for implementing. Some methodologies and steps had been proposed below.

Firstly, Process quality model (PQM) were developed by Beamon et al. (1998) to use in the assessment, improvement and control of a manufacturing supply chain system. Delivering the right product at the right time in the right amount were essential objectives of efficient and effective supply chain systems. The proposed PQM consist of 7 modules as follow: 1) Define the process and activities being performed, 2) Identify customers and their requirements, expectations, and perceptions, 3) Define quality, 4) Identify current quality performance measures, 5) Evaluate current processes and set quality standards, 6) Improve process, and 7) Control and monitor process. The model provided a methodology to implement a quality program or improving an existing program. It also applied principle of TQM for using in a manufacturing supply chain. Improving the quality of all supply chain processes resulted in reduced costs, improved resource utilization, and improved process efficiency.

Secondly, five steps of methodology of successful process flow improvement to reduce the delivery delay in jewelry factory were presented by Jirawangul (2000).

1) **Study the current operation system:** Observe the existing production workflow constraint and collection of necessary information
2) **Identify area of improvement:** To specify the areas that can apply improvement ways, which are Process flow, Document flow, and Material Handling
3) **Develop improvement plan:** Select the improvement methods to match with the existing process.

4) **Implement the actual system:** After the appropriate method is selected, the implementation plan to apply with entire process flow system starts.
5) **Evaluate the improvement:** Performance measurement will be performed by comparison with the existing collect data. Then the evaluation should be done.

Finally, Puich (2001) also presented the five steps in cycle time reduction program methodology, which is shown in figure below.

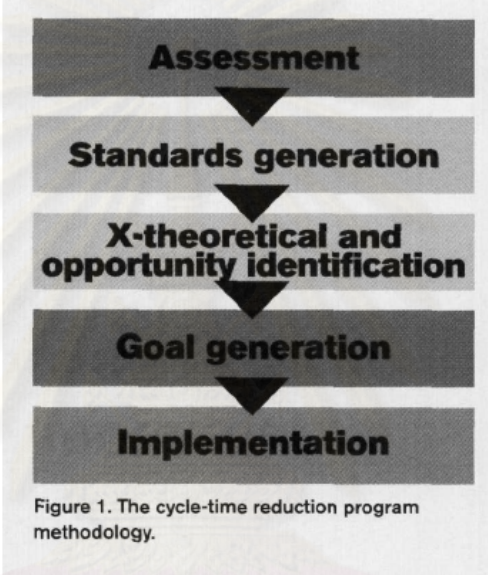


Figure 2.2: The cycle-time reduction program

1) **Assessment:** The first step is to generate the process map to identify value added vs. non-value added activities. Two maps should be generate, one showing the current flow, one demonstrating the improved process. This will used as a guideline for cycle time improvement.
2) **Standard Generation:** To understand where cycle time is suffering the most, a baseline process time must be developed for each process step. This can be done by several ways, which are Time studies, Knowledge-based activities, and using historical data
3) **X-theoretical calculation and opportunity identification:** Use the actual cycle time and theoretical cycle time, which are given in the previous step to identify where the biggest cycle time problems are occurring.

4) **Goal generation:** Set the cycle time performance goals for each step of the process. The best way to do this is to set goals based on the X-theoretical benchmarks available for each operational area.
5) **Implementation:** Create the steering committee to see all the activity surrounding cycle time reduction. Then, create sub-team within each functional area. The sub-team will implement the improvement in their area.

From proposed methodologies, the appropriate steps to improve delivery performance are quite similar. Firstly, the company has to study or assessment the current operations of the selected process. Secondly, specify the areas of improvement or identify bottleneck and non-value added activities of the selected process. Thirdly, objectives of the project are set. Fourthly, the implementation plan is created and implemented. Finally, the results will be evaluated and monitored.

Not only the useful strategies or knowledge such as time-based strategies, logistics strategies; carrier alliance, logistics outsourcing, EDI, traditional approach; TQM, BPR, or any operation management concepts, but also the practical methodologies to perform this kind of project are important. Therefore, the company has to clearly understand about the strategies, concepts or any other knowledge and carefully select the methodology, which will be used to improve the delivery performance before starting the project. By using the right concepts and right methodology, the company would have higher chance to successfully implement the project.

2.2 Theoretical Consideration

2.2.1 Business Process Reengineering (BPR)

The Business Process Reengineering (BPR) is the concept of re-invent or radically change the company's way of doing business. BPR achieves breakthrough business results through the rapid and radical change of critical core processes and the systems, organization structures, and policies that support them. BPR is necessary because the business is changing too fast for more traditional improvement techniques to keep up.

BPR will drive the company into new areas of performance, profitability, into new markets, and into changed cost levels, which are better than the results of possibility using traditional approaches. BPR also reduces the difference between the current performance and the ultimate possible performance by the use of advanced technology, the use of advanced methods, aligning process objectives with strategy, or designing process model that optimally achieve process objectives. Four factors contribute to success BRP are listed as follow:

1) **Leadership:** On BPR projects, there should be a single boss who has no limited authorized or power. All people on the project report directly to this boss.
2) **Teamwork:** Team members who are assigned to the BPR projects must take the team's mission very seriously.
3) **Communication:** Plans and definitions of the project are settled and shared. Any conflicts are resolved early and each member signs a formal pledge to do what the whole team agrees to do it.
4) **Simultaneous Development:** All activities are initiated in parallel as soon as information is available.

Four basic ways to measure the performance improvement before and after implementing BPR projects are list as follow:

1) Compare present performance to past performance or standards e.g. past year profit, ROI, sales.
2) Compare customer's perceptions or needs from customer survey, complaints, or comment cards.
3) Compare the company performance to the best competitor performance.
4) Compare the present performance to the ultimate possible performance.

According to Armistead et al. (1994), there are four "business processes", which are shown in figure 2.3, produced from BPR.

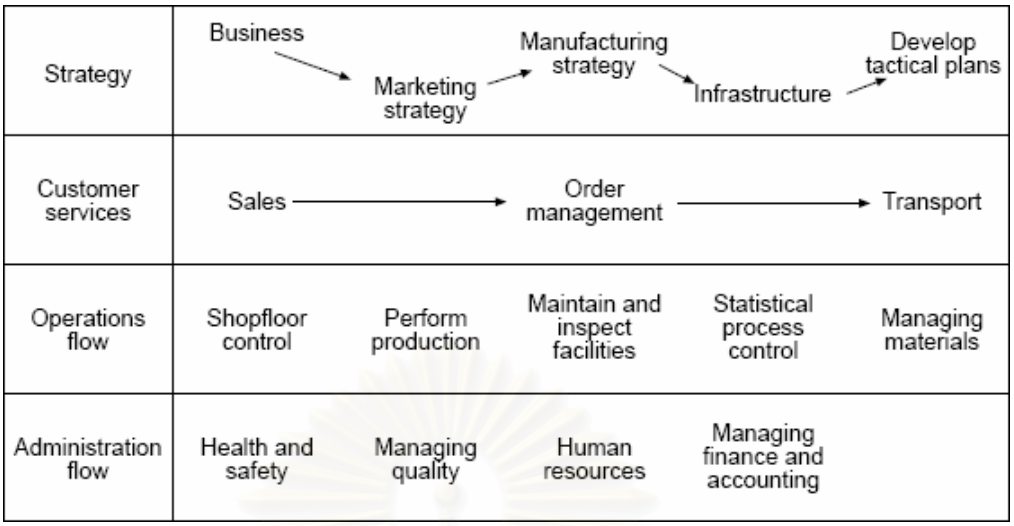


Figure 2.3: Redefining business processes outcomes

1) **Strategic flow:** To develop strategy to ensure long-term profitability and to optimize tactical business performance.
2) **Customer service:** To respond effectively to customer needs as a total business system.
3) **Operations flow:** To assure support and development of all processes.
4) **Administration flow:** To assure support and development of all processes development is carried out elsewhere in the company.

However, Business Process Reengineering is difference with Continuous Process Improvement (CPI) and Total Quality Management (TQM). BPR targets radical change while CPI is focused on incremental change, and TQM is the systematic application of methods and tools to accomplish CPI.

2.2.2 Muda (Waste)

Muda, Japanese word, means waste or any activity for which the customer is not willing to pay. Consider a delivery product process, customer is willing to pay for product to be prepared, consolidated, and delivered. But the customer is not willing to pay for waiting time, rework, or excess paperwork or any of the other forms of muda. In day-to-day operations, Figure 2.4 is shown three categories of human motion, which are:

1) Actual work is any motion that adds value to the product.
2) Auxiliary work is motion that supports actual work, usually occurs before or after the actual work e.g. product consolidation, product loading, and etc.
3) Muda is motion that creates no value to products.

Figure 2.4: Work versus Muda

Source: Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production System, Pascal Dennis

Figure 2.5 is shown eight different kinds of muda. The figure also shown is the remarkable 5/95 ratio of value to muda common in most operations. Most of the day-to-day activity is muda.

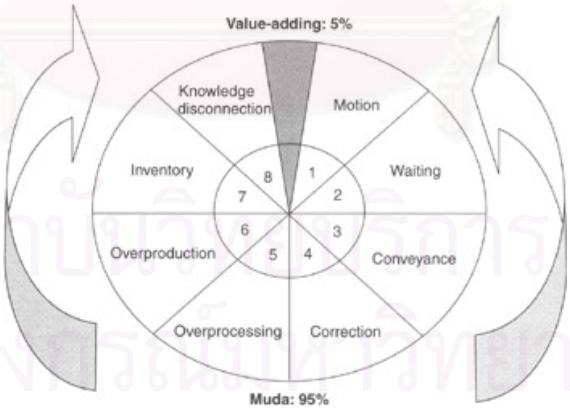


Figure 2.5: Type of Muda

Source: Lean Production Simplified: A Plain Language Guide to the World's Most Powerful Production System, Pascal Dennis

1) **Motion:** Wasted motion occurs in both a human and machine element. Wasted human motion is about workplace ergonomics. Poor ergonomic design negatively affects productivity, quality, and safety. The example of the wasted machine motion is machines placed too far apart result in unnecessary of motion.

2) **Waiting:** Waiting waste occurs when employees have to wait for information or document to be delivered or when employees stand around waiting for a system processing to get the results.

3) **Conveyance:** This kind of waste is about the large-scale waste caused by inefficient workplace layout, large equipment, or traditional batch production, which leads to over transportation within the company. However, this kind of waste is necessary but its must be minimized.

4) **Correction:** Correction waste is about making and having to fix the defects or errors. This kind of waste makes high cost and time consuming in the process.

5) **Overprocessing:** This kind of waste related to doing more than what the customer needs or doing more work than its necessary e.g. unnecessary data entry, unnecessary copy of documents.

6) **Overproduction:** Overproduction is about making thing that don't sell. This will make many related costs such as extra employee/machine, extra energy, and etc.

7) **Inventory:** Inventory waste is related to the keeping of unnecessary raw materials, parts, and WIP. This will make an unnecessary inventory holing cost and hidden problems.

8) **Knowledge disconnection:** This kind of waste occurs when there are disconnects within a company, or between the company and its customers and suppliers. This waste slows down the flow of knowledge, creativity, and missed opportunities.

In order to do the process improvement or BPR projects, all of these wasted must be minimized or eliminated from the process, which will increase the efficiency of process and reduce unnecessary costs.

2.2.3 Fish bone diagram

Fish bone diagram or Cause and Effect diagram is used to define the problem or undesirable event, which is effect. Then, identifying the contribution factor, which is cause. Causes are typically classified into four or five categories e.g. Man, Machines,

Methods, Materials, and Environment, each cause can be subdivided into subcauses. The process will continue until all possible causes are listed. The good diagram should have many levels of cause. It will provide a good overview of the problem and related factors. The factors will be analyzed in term of their possible relate to the overall problem. Using fish bone diagram also tend to identify the potential solutions. Fixing the root cause is almost always better than fixing the symptom.

2.2.4 Deloitte IndustryPrint™

IndustryPrint™ is developed by Deloitte Consulting to capture internal knowledge of best-practice business process for 33 industry segments e.g. Consumer Business, Energy, and Manufacturing. Each IndustryPrint™ depicts key processes at three levels (Process-Subprocess-Activity) in the form of decompositions and flows. Mapping to common enterprise software package such as SAP, PeopleSoft, and Siebel show how they support the business. IndustryPrint™ is used to prepare proposals, scope projects, jumpstart fit/gap analysis and process modeling, and accelerate other project tasks.

IndustryPrint™ of "General Manufacturing Industry" is used in this thesis as a guideline for current process assessment and new process recommendations. Figure 2.6 and 2.7 is the illustrative of IndustryPrint ™.

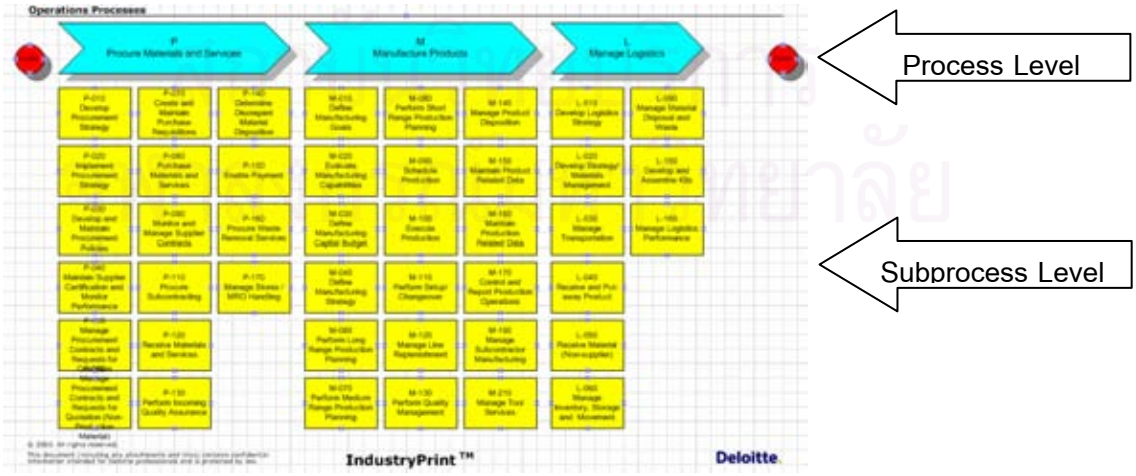


Figure 2.6: Process and Subprocess level IndustryPrint ™

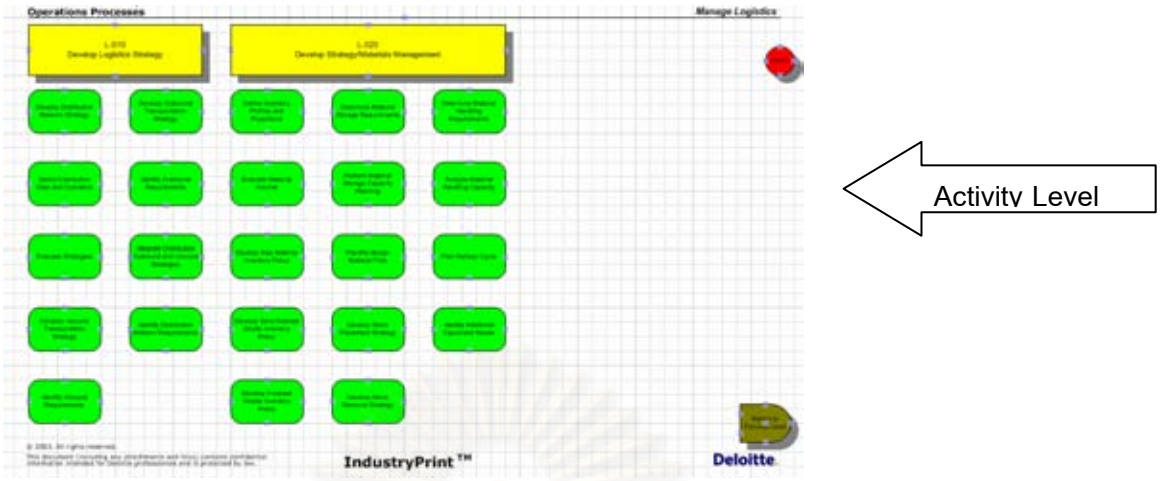


Figure 2.7: Activity level IndustryPrint ™

2.2.5 Deloitte Enterprise Value Map™

Deloitte Enterprise Value Map™ is developed by Deloitte Consulting. It is a practical tool that links potential improvement initiative and shareholder value. The Enterprise Value Map is the framework of The Value Initiative, an integrated suite of tools and approaches focused on the realization of value for clients. The Value Initiative directs Deloitte people to understand the business issues that matter most to clients and gives them the means to create value and measurable results. The Enterprise Value Map is shown in figure 2.8.

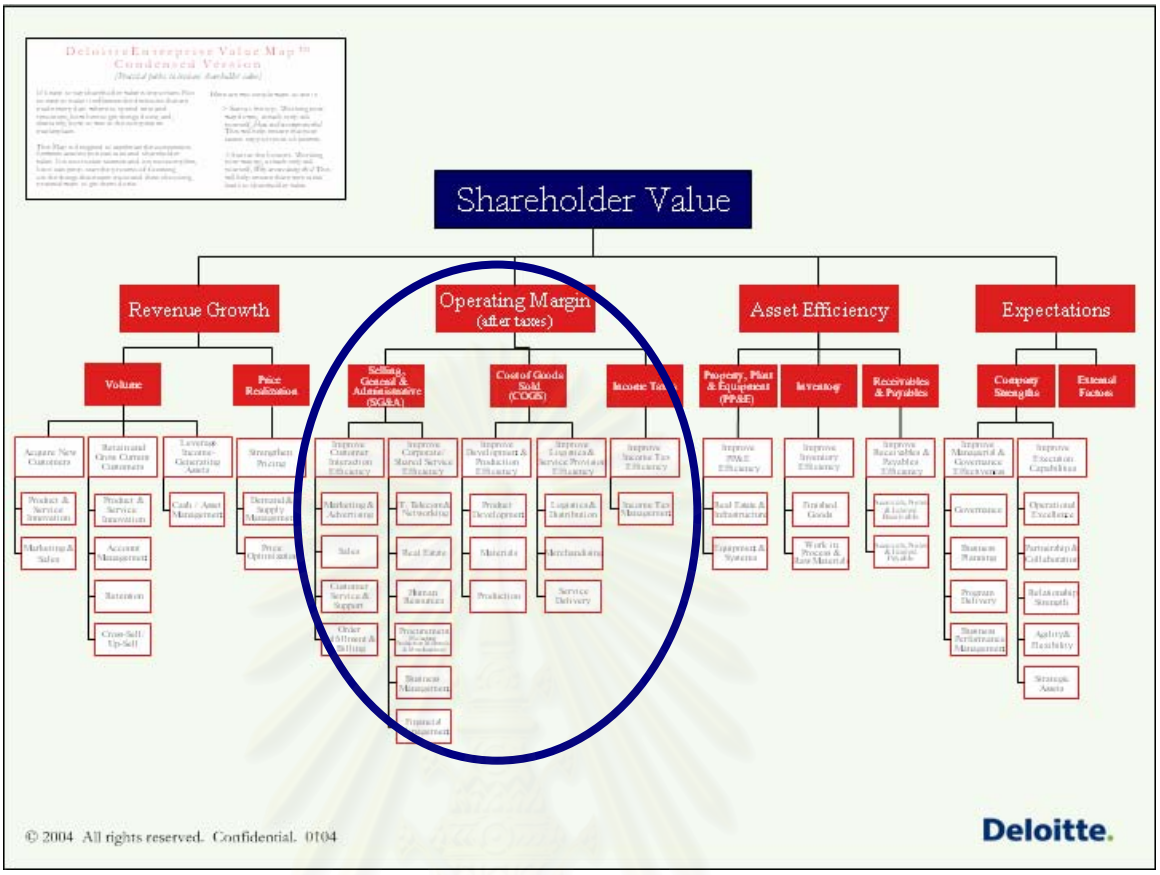


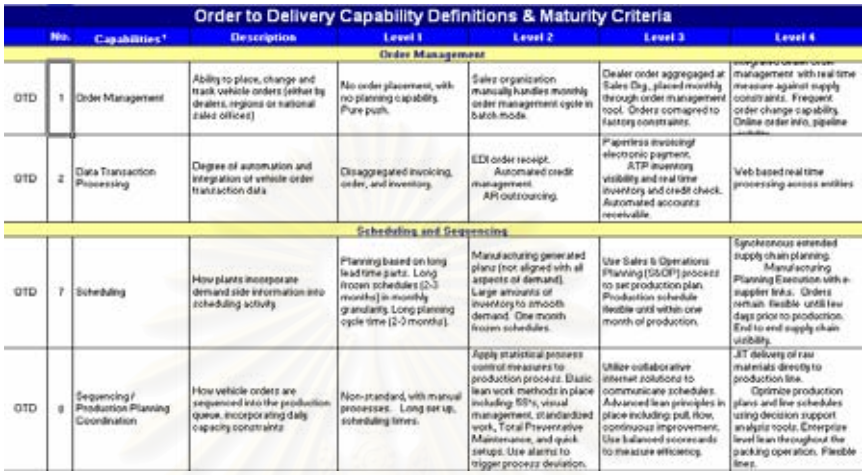
Figure 2.8: Enterprise Value Map™

In this thesis, the focus will be on Operating Margin which consists of Selling, General & Administrative (SG&A) and Cost of Good Sold. Deloitte Enterprise Value Map™ is used to understand critical strategic and tactical factors that impact value creation, design the new process to reduce delivery lead time and determine priority implementation plan.

2.2.6 Deloitte Capability Maturity Model™ (CMM)

Deloitte Capability Maturity Model (CMM) is developed by Deloitte Consulting. CMM is a framework that can be used to differentiate between organizations with immature development processes and those with mature processes. The CMM framework lays out an evolutionary path that organizations can follow to move from ad hoc, chaotic process with no repeatability to a mature, discipline set of development processes with a high degree of repeatability and clear methods for continuous improvement. The CMM uses a four-level framework for determining the

maturity of development organizations and for guiding in processes development. In CMM, there are four maturity levels in each process. An example of CMM is shown in figure 2.9.



Order to Delivery Capability Definitions & Maturity Criteria

	No.	Capabilities*	Description	Level 1	Level 2	Level 3	Level 4
				Order Management			
OTD	1	Order Management	Ability to place, change and track vehicle orders (either by dealers, regions or national sales offices)	No order placement, with no planning capability. Pure push.	Sales organization manually handles monthly order management cycle in batch mode.	Dealer order aggregaged at Sales Org., placed monthly through order management tool. Orders comapred to factory constraints.	management with real time measure against supply constraints. Frequent order change capability. Online order info, pipeline
OTD	2	Data Transaction Processing	Degree of automation and integration of vehicle order transaction data	Disaggregated invoicing, order, and inventory.	EDI order receipt. Automated credit management. API outsourcing.	Paperless invoicing/ electronic payment. ATP inventory visibility and real time inventory and credit check. Automated accounts receivable.	Web based real time processing across entities
				Scheduling and Sequencing			
OTD	7	Scheduling	How plants incorporate demand side information into scheduling activity	Planning based on long lead time parts. Long frozen schedules (2-3 months) in monthly granularity. Long planning cycle time (2-3 months).	Manufacturing generated plans (not aligned with all aspects of demand). Large amounts of inventory to smooth demand. One month frozen schedules.	Use Sales & Operations Planning (S&OP) process to set production plan. Production schedule flexible until within one month of production.	Synchronous extended supply chain planning. Manufacturing Planning Execution with e-supplier links. Orders remain flexible until few days prior to production. End to end supply chain visibility.
OTD	9	Sequencing / Production Planning Coordination	How vehicle orders are sequenced into the production queue, incorporating daily capacity constraints	Non-standard, with manual processes. Long set up, scheduling times.	Apply statistical process control measures to production process. Basic lean work methods in place including 5S's, visual management, standardized work, Total Preventative Maintenance, and quick setups. Use alarms to trigger process deviation.	Utilize collaborative internet solutions to communicate schedules. Advanced lean principles in place including pull, flow, continuous improvement. Use balanced scorecards to measure efficiency.	JIT delivery of raw materials directly to production line. Optimize production plans and line schedules using decision support analytic tools. Enterprise level lean throughout the packing operation. Flexible lines.

Figure 2.9: The Capability Maturity Model

Level 1: It is a lagging level. Organizational processes are unpredictable and poorly controlled. Processes are informal and ad hoc.

Level 2: It is a developing level. Process are characterized and fairly well understood. Technical practices are integrated with management practices and institutionalized.

Level 3: It is an advanced level. Process are measured and controlled.

Level 4: It is a leading level. The focus is on process and technology improvement. Improvement is institutionalized.

In this thesis, CMM will be used as a guideline for helping to identify and evaluate the current process of ABC. CMM also help ABC to set the target of where ABC wants to be. The target of each process will be set accordingly to ensure that ABC will achieve the project objectives.

CHAPTER III

METHODOLOGY

3.1 Methodology

In order to do the Business Process Reengineering project, understanding the current situation and problems of the company is the first step. More importantly, management commitment needs to be obtained in order to do BPR efficiently and effectively. Then, it is necessary to study the current process, flow, and system, which will be redesigned. All required data must be appropriately collected. Many tools and methods are used to gather and analyze the data. Next comments and recommendations will provide to top management to discuss about the new process design. After the discussion, the implementation plan of the new process is established. Finally, the new process is implemented and evaluated. For doing the successful BPR project, Figure 3.1 is shown the practical framework for doing BPR project, which presented by Motwani et al.

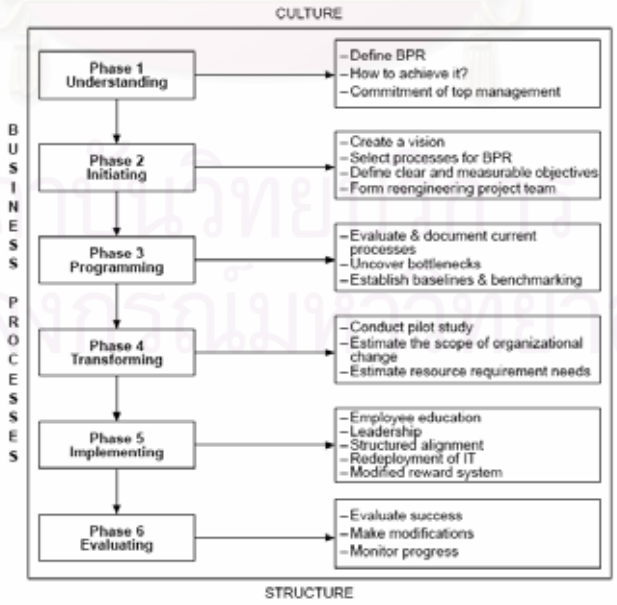


Figure 3.1: Practical Framework for BPR process

Source: Business process reengineering A theoretical framework and an integrated model, International Journal of Operations & Production Management, Motwani et al

In this chapter, the methodology for this thesis, which is applied from the practical framework, is shown as follow:

3.1.1 Company and literature study

Before forming any strategies, methodologies, or tactics, company needs to understand the environment that they operate in and its own capability. Then, background and current situation of the company have to be analyzed. The analysis tools, which are SWOT, PEST, and Porter's 5 forces, will be used to analyze the capabilities, macro-environment, and micro-environment of the company. The results from the analysis will provide the overview of the current situations and the surrounding environment of the company. With the broad view over the current market trend and understanding of company capability, the company can best form strategies, methodologies, or tactics to exploit the market opportunity while managing to minimize risks, which can make the company gain the competitive advantage in their business.

After background, current situation, and all related factors of the company are analyzed, some of related theories and literatures have to be studied to get the ideas for doing the thesis. Many strategies, methodologies, or tactics are used to achieve the objectives, which same as the thesis's objectives. Business Process Reengineering (BPR) is one of the popular strategies, which is often used in the cycle time reduction or performance improvement projects. Thus, the top management has made the decision to use BPR for solving the problems, which make the company loss the competitive advantage.

However, there are many BPR frameworks, which are used in successful BPR projects. In this thesis, the frameworks are carefully selected and be modified to best fit the objective of reducing delivery lead time. In addition, the selected frameworks are also practical for ABC Company for successful implementation.

3.1.2 Understanding the project

It is extremely important for consultant to ensure that the management recognize the need for change and commit to fully support during the entire project. Next, the employee should fully understand why the company needs reengineering and realize the benefits of it in order to create teamwork environment and working momentum along the reengineering process.

3.1.3 Initiating the project

In this stage, reengineering team should be formed with guidance from consultant with the following members:

Project Sponsors: Project Sponsors are those in the top management position e.g. CEO, CFO, COO. Their main roles and responsibilities are to give direction, advice, support, control and approve major spending, and monitor process to ensure that the project is on track. Project Sponsors are also responsible for selecting Project Manager and Project team. In addition, the resources that are pull out for this project need to be substitute by someone to take care of their normal roles & responsibilities.

Project Manager (PM): Project Manager should be the one who has project management skill, have good knowledge of internal process, open-mined and have good communication skill. PM should be well accepted among employees and be trusted by top management. In addition, PM has to be full-time for the project in order to ensure his/her commitment and the incentive/bonus should link to the performance of the project in order to create common interest and goals.

Consultant: Consultant must have project management, analysis and communication skill and knowledgeable in business reengineering process specifically in operation and logistic functions. Consultant has to be familiar with consulting process in order to closely coordinate with PM to drive the project from the start to finish.

Project Team: There are 2 types of project team: Process owner and Support team. Employee need to have a clear direction on how much time they should spend for this project. The core teams are those who has breath of understanding of each sub-process, how it links to other processes and able to make some discussions e.g. Finance Manager, Sales admin Manager, and Warehouse Manager. Typically, Process owner should be full time to the project. The Process owner are supported by support teams who have in-depth understanding of each process and very keen on day-to-day operation. Support team time allocation could range from 20-80% of their time. As mentioned above, project team should share the same goal as PM and their incentive/bonus could be partially based on the success of the project.

Once the team is formed, the project may start by selecting the process that needs to be redesigned. For ABC Company, the most priority issue now is delivery lead time. This is due to the fact that ABC customer retention rate continue to decrease for the past few years. Management did some survey and found out that customers are not satisfied with delivery lead time, therefore, they switch to buy from competitors who can respond to their request faster. This partially results in slow sales growth which leads to lower profit margin. In conclusion, the reengineering project team will redesign all the processes that are related to delivery lead time e.g. ordering, invoicing, picking product, and delivery.

Next, project team need to define and agree on clear and measurable objectives. In the thesis, the objective is to reduce lead time in BKK from average 2 days to 1 day. The time line to achieve this objective is within 3 months. Objectives and measurement method should be communicated across the team periodically along the project timeline. For ABC Company, the delivery lead time counts from customer place an order to customer receive products. In order to achieve the objective, project team need to do project planning in term of activities, timeline, and resource.

3.1.4 Programming the project

Before doing any reengineering process, it is essential for project team to understand the current way of working (As-Is). Project Manager with guidance from consultant

assigns each process owner to document their own process and combine later. The team gathers data by interviewing all employees who are responsible for each process and sub-process or reviewing their process documents. Team should note for problem and issues of every process and sub-process. For ABC Company which is an ISO certified company, project team may refer to ISO document for As-Is analysis. The document from all process owners should be documented using the same format for the ease of consolidation and analysis.

After gathering all processes, team will spend most the time in brainstorming session to identify issues in those processes; bottleneck, long time consuming, long waiting time etc. by using Capability Maturity Model, Industry Print, Process flow chart and Muda concepts. Consultant acts as a moderator to facilitate brainstorming session where all process owners make comments and input for all processes to ensure fresh view and radical changes. Capability Maturity Model, Industry Print, and consultant's view will give view from outside perspectives. Referring to Capability Maturity Model, now ABC Company knows their current status compare to others in the same industry. Therefore, team should analyze further on the impact of moving forward to find out at which level they have to be in order to achieve the project objective of reducing delivery lead time to 1 day. The issues are also categorized using fish bone diagram (people, process, policy, and system) and then prioritized based on their impact to total delivery lead time. The Fish bone diagram will show cause-effect relationship of the main issues.

Finally, Consultant/Project Manager presents to project sponsors their findings, analysis and confirm on way forward. Project sponsors will make final decision on which process need to be redesigned and to what stage they are willing to do and invest.

3.1.5 Transforming the project

In this stage, Consultant lead the team and start to redesign the processes to meet the desired level by eliminating non valued-added activities (Muda), solve bottleneck and other issues using Industry print and best practice as a guideline. Consultant as a

moderator must be experience in brainstorming technique because the session is very crucial to the result. Input from cross-function give new perspective for process owner. Consultant input give views from other companies/ industries which are important for radical change. To-Be design or the new process design must meet the project objective but yet practical. To-Be design state clearly which process/sub-process/activities will be eliminated or modified and the effect of the elimination and modification. It also includes cost-benefit relationship analysis for the new process design.

High level recommendation of 4 perspectives: people, process, policy and system will be presented to project sponsors for them to understand and give feedback on key observations, implication, recommendation, benefits and priority.

With feedback from top management and further discussion with those who will implement the new processes, project team fine tune and finalize the new processes to ensure practicality and optimize the result. Next, Consultant/Project Manager prepare change management program to reduce risk in resistant to change.

3.1.6 Implementing the project

Based on many recommendations and To-Be analysis and design, project team establish implementation plan or a master plan, which includes all key activities/task and timeline. Project Timeline documents will be used to represented implementation plan, which includes:

- Gantt chart: Timeline of each project
- Timeline rational: The reason of schedule timeline
- Responsible party: Person or Department in-charge for specific project

Reward system need to be built to the plan to ensure commitment from all parties. Project team is also responsible for knowledge transfer through employee education. Each process owner trains their own team for new processes and test if they are ready to change to the new process. If not, they need to be retrained to ensure readiness.

Consultant/Project Manager need to align the timeline of all function training so all will be ready at the same time.

Once everyone in the company is ready for the change, Consultant/Project Manager can decide for the launch date. It is very important to keep the momentum of the project for successful changes, therefore, endorsement from project sponsors can help driving all the actions. Once the changes start, Consultant/ Project Manager and Process owner have to stand by for fully support for operation people in case they are not clear in the new processes. Moreover, support from project team also gives morale support to the entire company.

3.1.7 Evaluating the project

Project team follow up the performance by comparing actual performance with between As-Is and To-Be process. If the objective cannot be achieved, project team has to identify roots of the problem whether it is people or process. In case that people cannot meet the objective due to lack of knowledge or resistant to change, process owner has to retrain both knowledge and attitudes. In case that process is not practical to do, project team has to come up with new method to achieve or revise the process.

3.2 Deliverable

The deliverable is the documentation of output in each phase of work. It contains the information and analysis presented in the format that is easy to follow and understand. This thesis consists of 5 main deliverables which are As-Is analysis, To-Be analysis, High level recommendation, Project chartered, and KPIs. The detail of each deliverable is discussed as follows:

3.2.1 As-Is Analysis

The objective of As-Is analysis is to understand current ABC process and document in the process map or flow chart form. In this thesis, IndustryPrint format will be applied to illustrate the process while SWOT, 5-forces and PEST analysis are used to explained internal and external analysis in the paint industry and ABC Company. The

activities include interview, observation and data collection. As-Is process map document, which is shown in figure 3.2, needs to be verify by related parties to ensure accuracy. The analysis will be guided by Deloitte IndustryPrint and capability for business process reengineering of ABC Company. The focus will be on uncovering bottleneck, identifying breakthrough opportunities and designing new steps or processes that will help ABC to reduce delivery lead time to gain competitive advantages.

The issues will be identified using fish bone diagram, which is shown in figure 3.3, to show cause-effect relationship. In addition, Capability Maturity Model, which is shown in figure 3.4, is used to evaluate current performance of ABC to demonstrate which level (Lagging, Developing, Advanced, and Leading) it is operating in. The benchmark also gives idea to ABC Company on where they want to be.

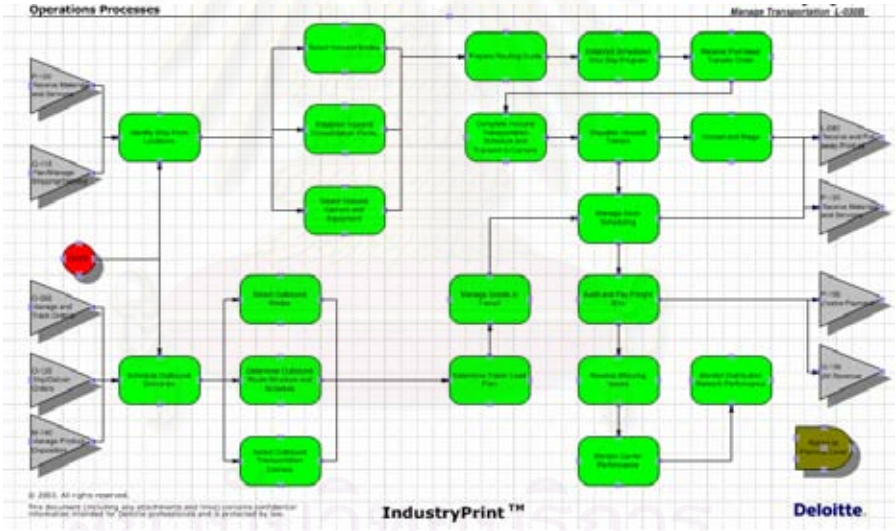


Figure 3.2: As-Is process map document

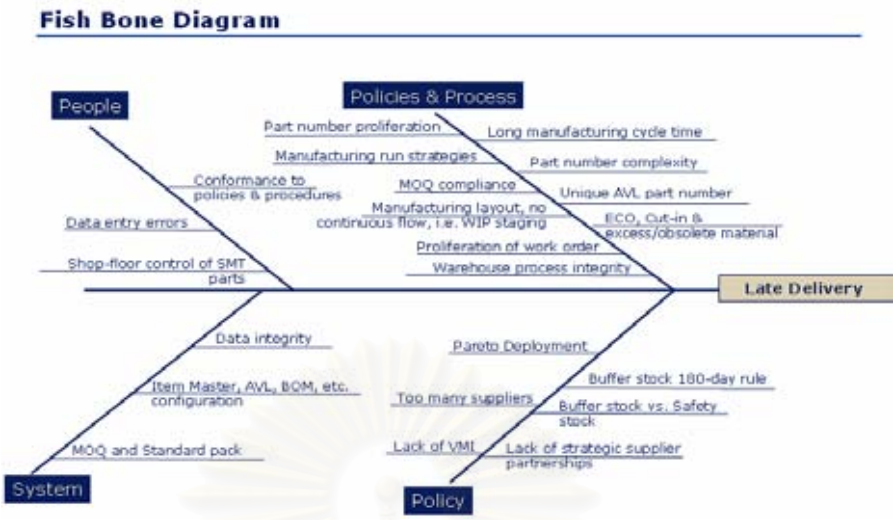


Figure 3.3: Fish Bone Diagram

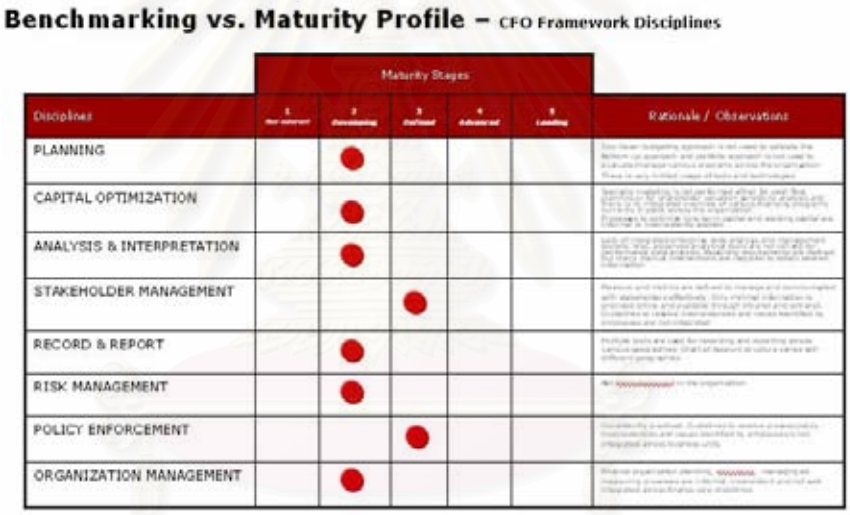


Figure 3.4: Capability Maturity Model document

3.2.2 To-Be Analysis

The objective of To-Be analysis is to document the new process that helps ABC Company in reducing delivery lead time. Through the discussion in the workshop with Management and related department, the new process flow will be enhance and fine-tune. At the same time, the workshop is the main communication channel of the new processes. To-Be process map document, which is shown in figure 3.5, is the new process designed based on As-Is process map. The changes which include both elimination and redesign will be highlighted in red box.

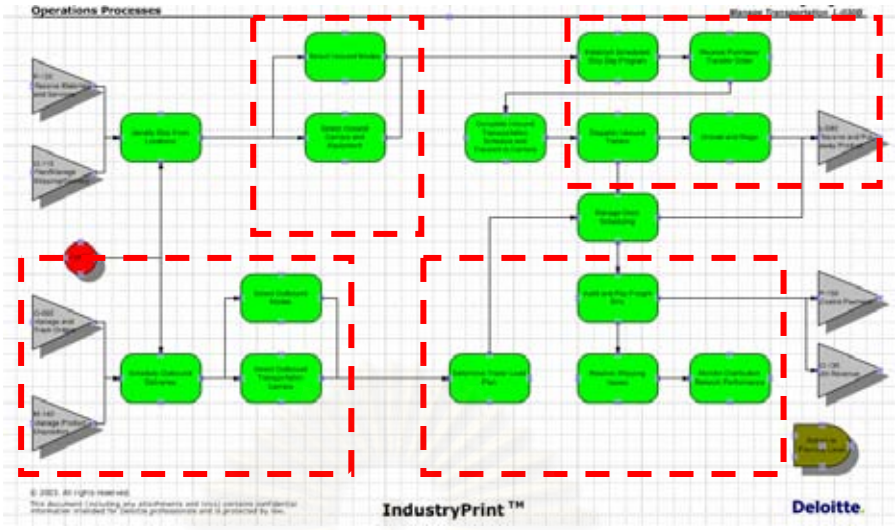


Figure 3.5: To-Be process map document

3.2.3 High Level Recommendation

High level recommendation includes all process change that derived from new business process categorized into process, system, policy and people. The recommendations are prioritized based on impact/benefits to the business and ease of implementation, which is shown in form of four quadrant priority chart (Figure 3.6). Communication plan is also included in this phase. In general, communication plan consists of employee education, leadership, change management, structural alignment of technical and human resources. Resistance to change may occur during the transition period, hence, continual communication among management and employees is needed.

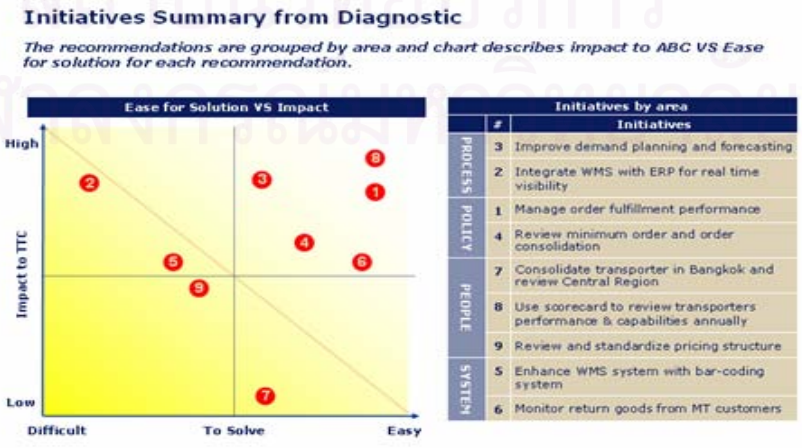


Figure 3.6: Four quadrant priority chart

3.2.4 Project Timeline

Project Timeline is the schedule plan of each process change. Project Timeline document includes description, timeline, timeline rational, and responsible party (Figure 3.7). Management and employees may refer to the project timeline for implementation action and steps.

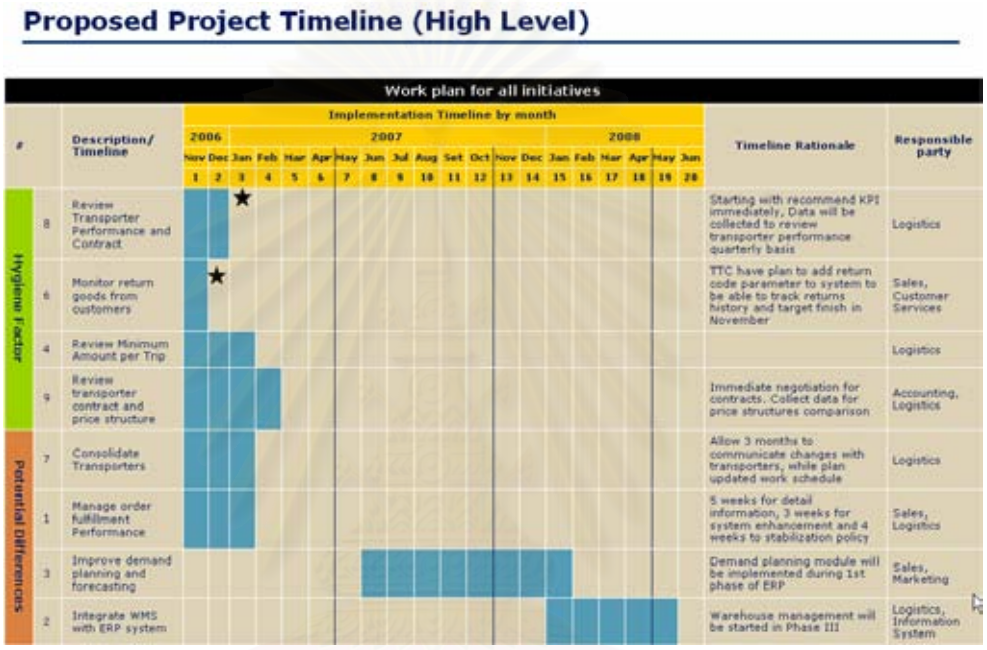


Figure 3.7: Project Timeline document

CHAPTER IV

COMPANY ANALYSIS AND AS-IS PROCESS

4.1 Company Background

ABC Paint Co., Ltd is one of the leading paint companies in Thailand. ABC Paint Co., Ltd founded as a mid size family owned manufacturer of emulsion paint and high gloss alkyd enamel for architectural and decorative paint purpose in 1979. The company is Thai Industrial Standard Institute (TISI) approved. The products line include ABC's 'ABC Shield' a low PVC semi-gloss paint with high quality binder and pigments aimed at the upper market section, 'ABC Acrylic Pro' positioned in the mid market, and other two fighting brands for the low-end market.

Currently the company has more than 2500 government's site and building to its references list, and is serving more than 1,600 customers all over Thailand. The current strong point lies in the 36 sales forces and technical services that are able to give their advices on the paint applications and related problems based on their understanding in the leading paint technology as well as strong background in different substrates and surfaces that the paint is being applied on. The company also arranges seminar for the influencer such as painters, dealer/sub-dealers, architects, and interior designer to share and exchange problems, current trends as well as experiences to ensure the customers has the up to date high quality product and services. ABC Paint co., ltd's vision statement is as followed

Vision : *"We aim to supply our customer with quality, environment friendly, affordable paint, informative and good sales after sales services and aim to give our customer knowledge with the up to date technology while keep the company's stake holder with reasonable return on investment."*

Mission: *"We aim to be in the top three of the leading brand domestically in customer mind quantitatively and qualitatively by the end of the fiscal year 2008."*

4.1.1 Organization Chart

ABC Paint Co., Ltd has approximately 250 people in 6 main departments, which are Sales, Marketing, Operations, Accounting, Financial, and Information Technology. Figure 4.1 shows the current ABC organization chart, which is identified many sections and manpower under each department. From the organization chart, Financial department is working under Managing Director, while the rest is working under Assistant MD including IT department.

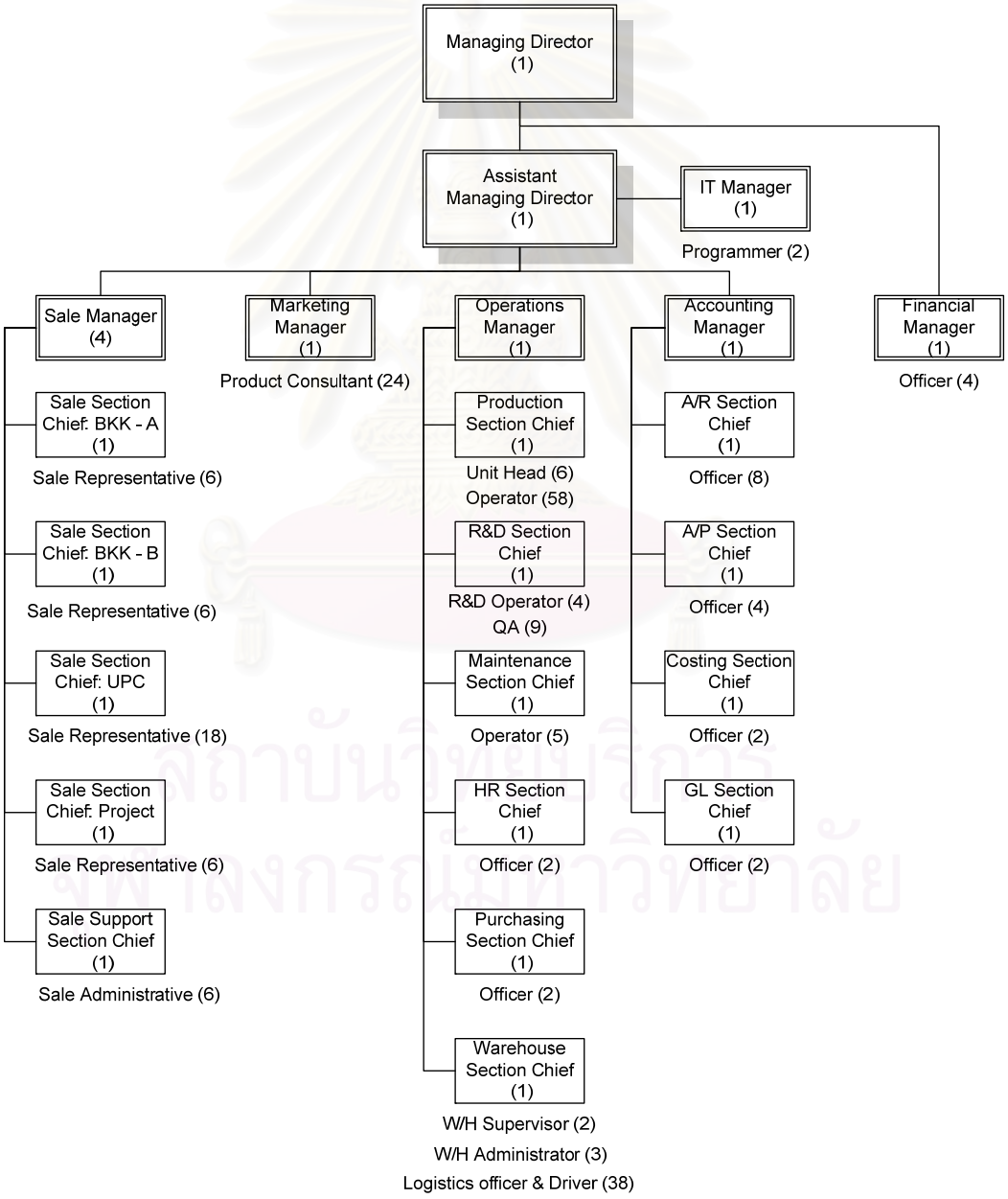


Figure 4.1: ABC Organization chart

4.2 Company Analysis

The analysis tools, which are SWOT, PEST, and Porter's 5 forces, will be used to analyze the capabilities, macro-environment, and micro-environment of the company respectively. The results for all analysis can be seen in Appendix A.

From the overall analysis, ABC Company has a good foundation for competition and the market show a promising growth at least over the next 5 years. However, the inability to delivery product as fast as major competitors is a real issue to the ABC company. From management's perspective, ABC has already lost competitive advantage in delivery service due to the inefficiency from processing order to delivery step. This results in opportunity lost and low repeat order rate. The result reflects in slow revenue growth and lower margin which worries management. Therefore, reducing delivery lead time becomes the first priority of ABC management.

4.3 Setting up Reengineering team

In order to setting up the reengineering team, all members are carefully selected from their experiences, knowledge, and current job responsibilities. Process owner should be managers, who work in the high level process of their functions, while support team should be section chiefs, who better know the operation processes of their functions

From the previous section, reducing delivery lead time to customers is the first priority of the company. Then, the order to delivery process is selected to reengineer with the measurable objectives in reducing delivery lead time to customers. As mentioned in Chapter 3, the company has to form the suitable reengineering team, which is shown in figure 4.2, to achieve the project objectives.

Motwani et al (1998) suggested that *"The executives and key staff members from the primary organizational units involved in the process(es), as well as from the information systems department, should be included in the team(s)"*.

Al-Mashari and Zairi (1999) also suggested that *"Cross-functional BPR teams are a critical component of successful BPR Implementation. Teams should be adequately composed. Team members should be experienced in variety of techniques. Teams should be made up of people from both inside and outside the organization"*.

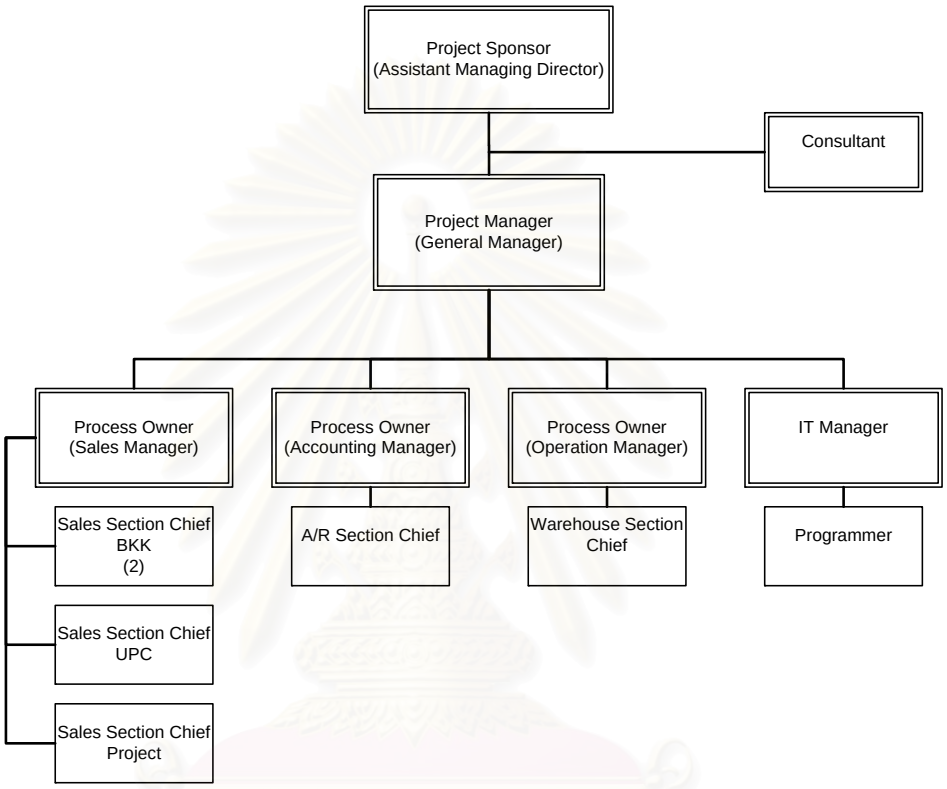


Figure 4.2: ABC Reengineering Team

From figure 4.2, there are 14 persons involved in the reengineering team; Project Sponsor (Asst. MD), Project Manager (General Manager), Consultant (The author), 3 Process Owner from related departments, and 8 persons in support team including IT manager and Programmer. Each member has different roles and responsibilities, which are already discussed in Chapter 3.

Team members, who come from all related department in order to delivery process, are charged with develop work flow of current processes. Once documentation of current processes is completed, the team will engage in "out-of-the-box" thinking, develop improved processes, summarize the benefits, and provide an explanation of the improved processes. Finally, the team will develop an implementation plan for the improved processes and proposed to Project Sponsor.

4.4 As-Is Analysis

In this section, the author gathers data and analyzes current process of ABC Company. Information is gathered by reviewing internal documents, interview and also observation. The 6 sub-processes are described using process flow chart with explanation. The raw data for analysis comes from transactions in AS400 for 3 months period. There are 20,016 orders in this period. The warehouse operations data, which is separately collected due to the system between office and warehouse does not link, is used for analysis in the operations part. Moreover, 800 observations of Customer satisfaction survey 2005 are also used for this analysis.

There is one important issue to be noted. In order to correctly measure delivery performance, the measurement should start from the day customer send order to ABC counting the amount and SKU that they order to the day customer receive the product in full. However, the data that available at ABC starts from what is recorded in ABC Sales Order (SO) form which is by some means manipulated by Sales Administrator after they preview the stock and find out that the products are not available, for example, Customer A orders 10 cartons of SKU Y but Sales Administrator informs customer after previewing stock that only 7 are available. Thus, customer A change order from 10 to 7 as advised and order the remaining 3 later. When ABC measures on time in full performance, it gets 7/7 not 7/10. Moreover, the delivery lead time is measured for 7 items not 10. This effect the correctness of measurement because instead of capturing the real demand and timing, ABC can only capture the demand that is already altered. Hence, the average BKK delivery lead time of 2 days is optimistic and perhaps overestimated.

4.4.1 AS-IS Process

In this thesis, the processes that directly relates to delivery lead time are analyzed. The related processes are Perform Order Management and Manage Logistics. In this thesis, there is an assumption that product always available in the stock, all customer orders are fulfilled by the existing products, which already produced from production side. The problems about long delivery lead time are not related with production

processes. Therefore, there is no production processes include in the order-to-delivery process, which is the selected process to reengineer.

Below is the process mapping for the current process flow, which can be divided into 2 main processes; Perform Order Management (OM) and Manage Logistics (LO), which are shown in figure below.

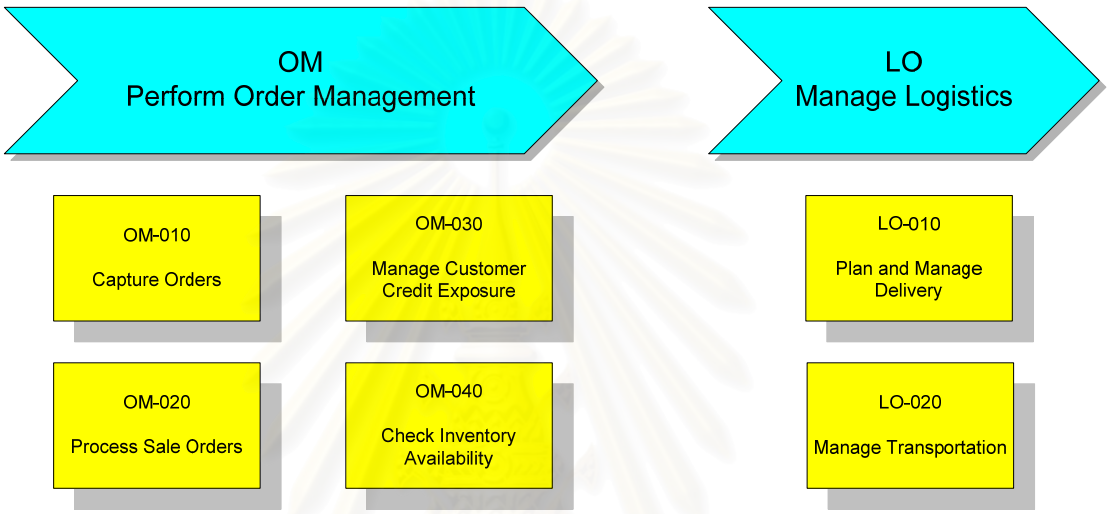


Figure 4.3: Related Processes and Sub-processes in Order to Delivery process

Perform Order Management process can be divided into 4 sub-processes are;

- OM-010: Capture Order
- OM-020: Process Sales Order
- OM-030: Manage Credit Customer Exposure
- OM-040: Check Inventory Availability.

Manage Logistics process can be divided into 2 sub-processes are;

- LO-010: Plan and Manage Delivery
- LO-020: Manage Transportation.

Each sub-process will be shown in IndustryPrint^{TM} format. The mapping symbol is shown in Figure 4.4.

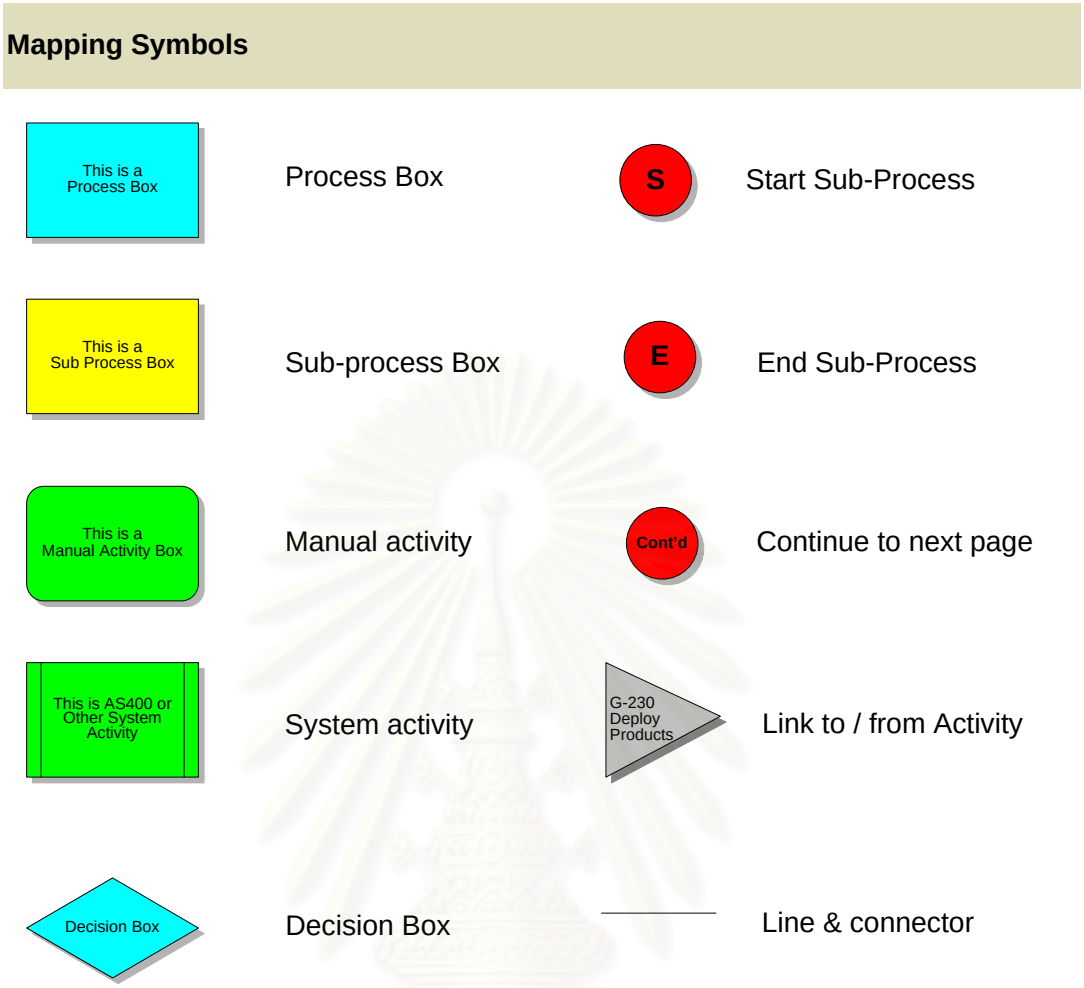


Figure 4.4: Mapping Symbol for process mapping

After the current process flow and the explanation of each sub-process is completed, the usage time for each activity will be collected and calculated. Thus, the time will be summarized into sub-process time.

Then in the next section, key observations of each sub-process are identified by using fish bone diagram, which consists of 4 categories, which are Process, Policy, People and System, to analyze the root cause that lead to the efficiency processes.

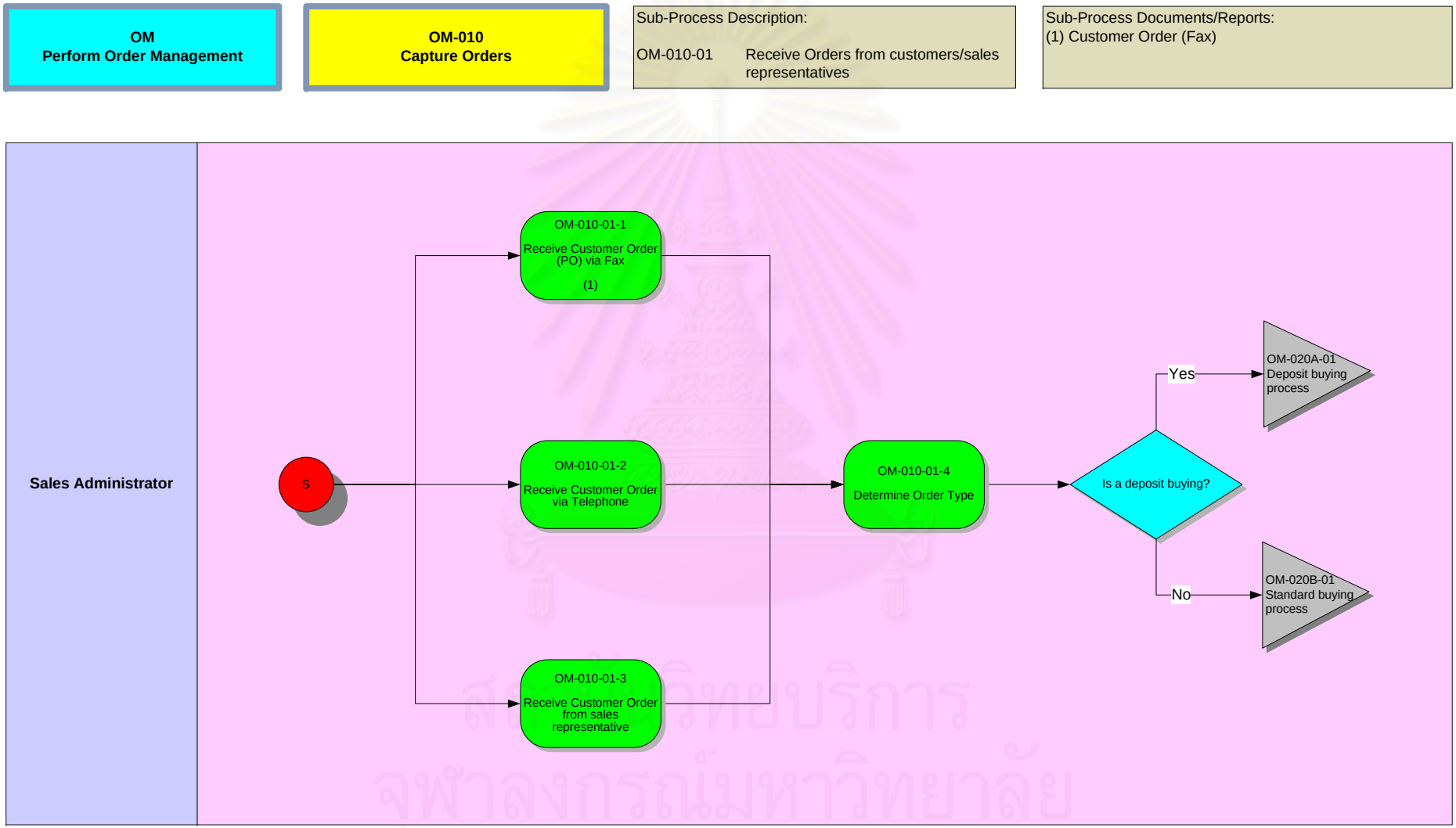


Figure 4.5: Current Capture Order sub- process flow

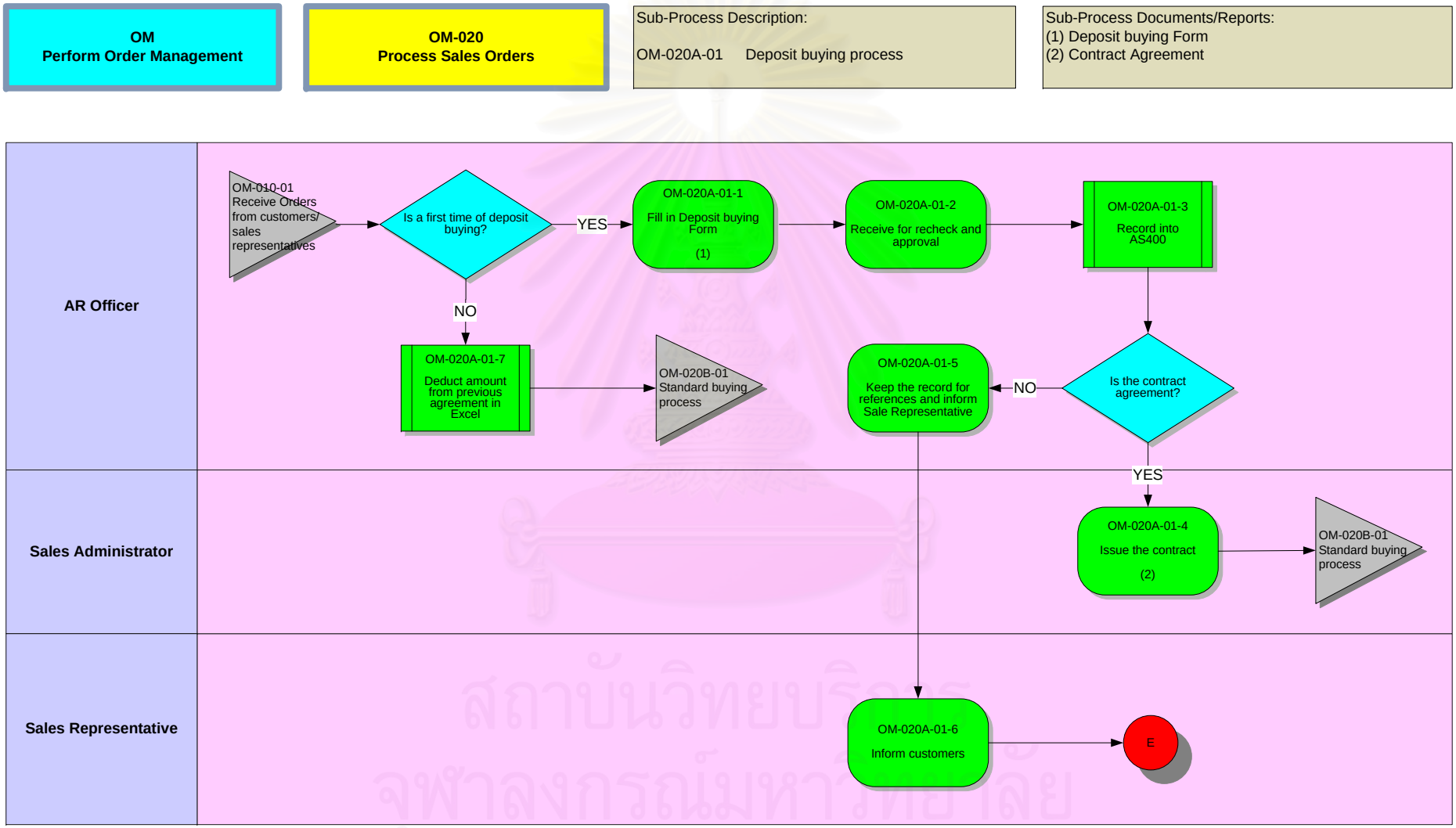


Figure 4.6: Current Process Sale Orders sub-process flow (1)

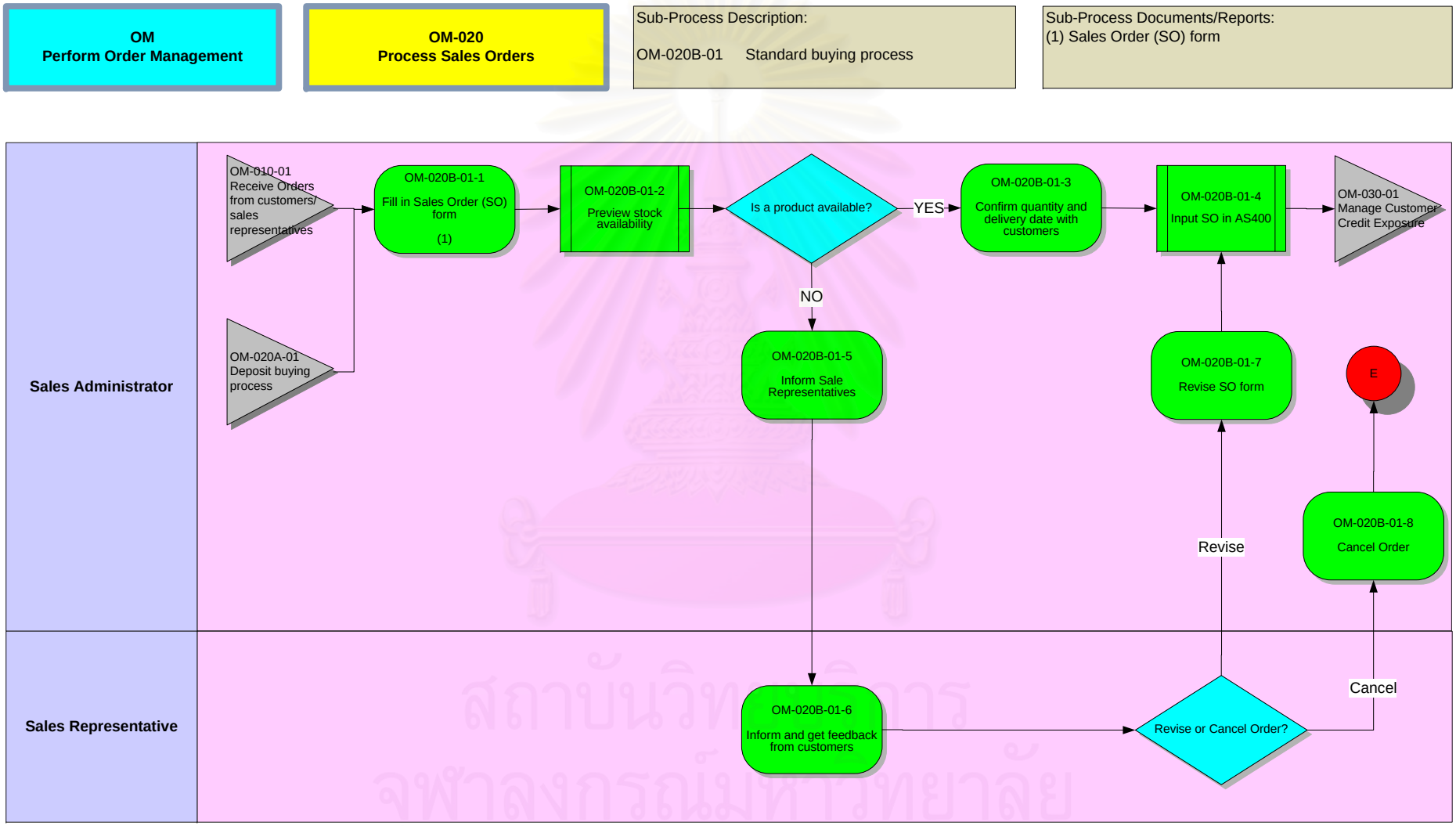


Figure 4.7: Current Process Sale Orders sub-process flow (2)

OM
Perform Order Management

OM-030
Manage Customer Credit Exposure

Sub-Process Description:

OM-030-01 Check customer credit limit and approve credit expansion process

Sub-Process Documents/Reports:
(1) Invoice

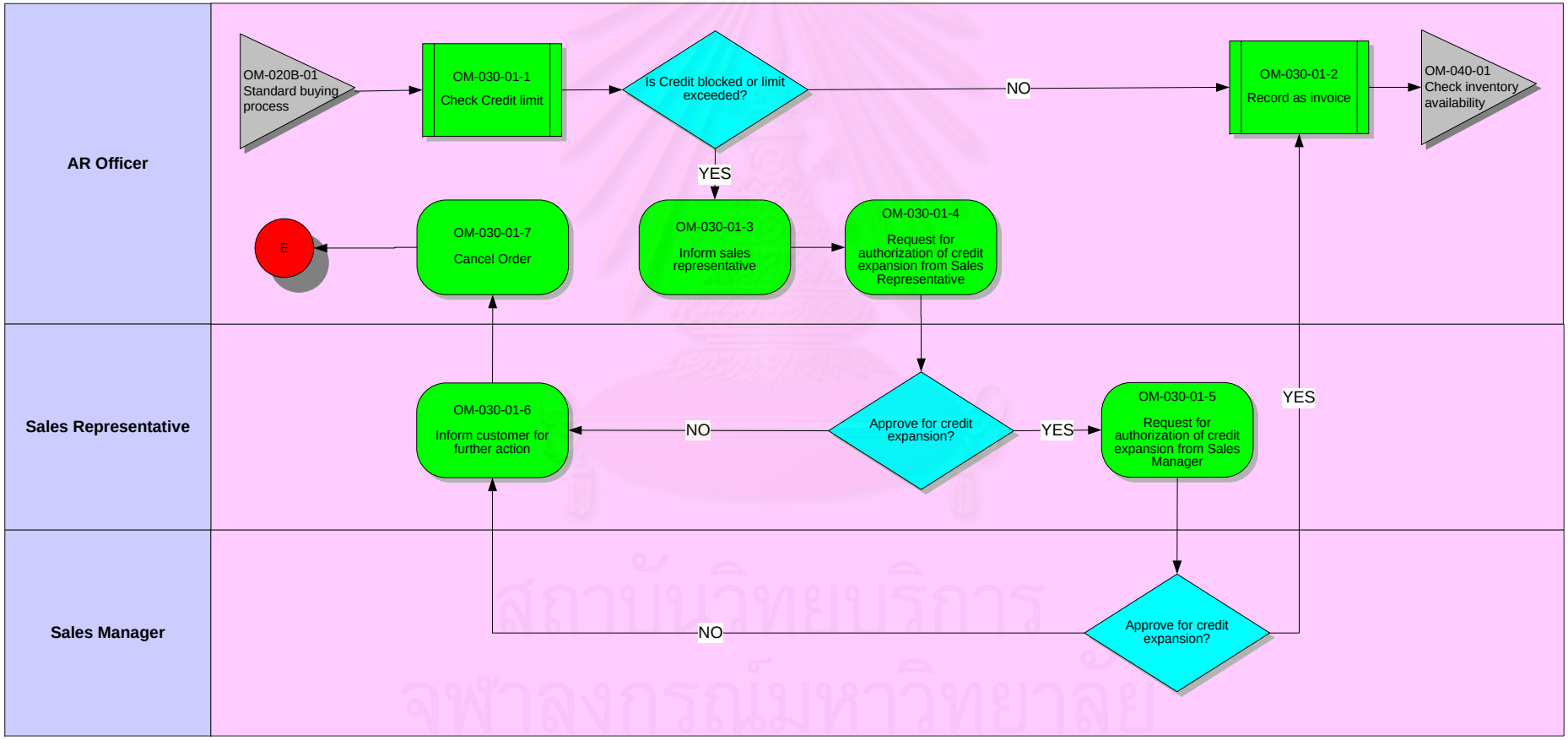


Figure 4.8: Current Manage Customer Credit Exposure sub-process flow

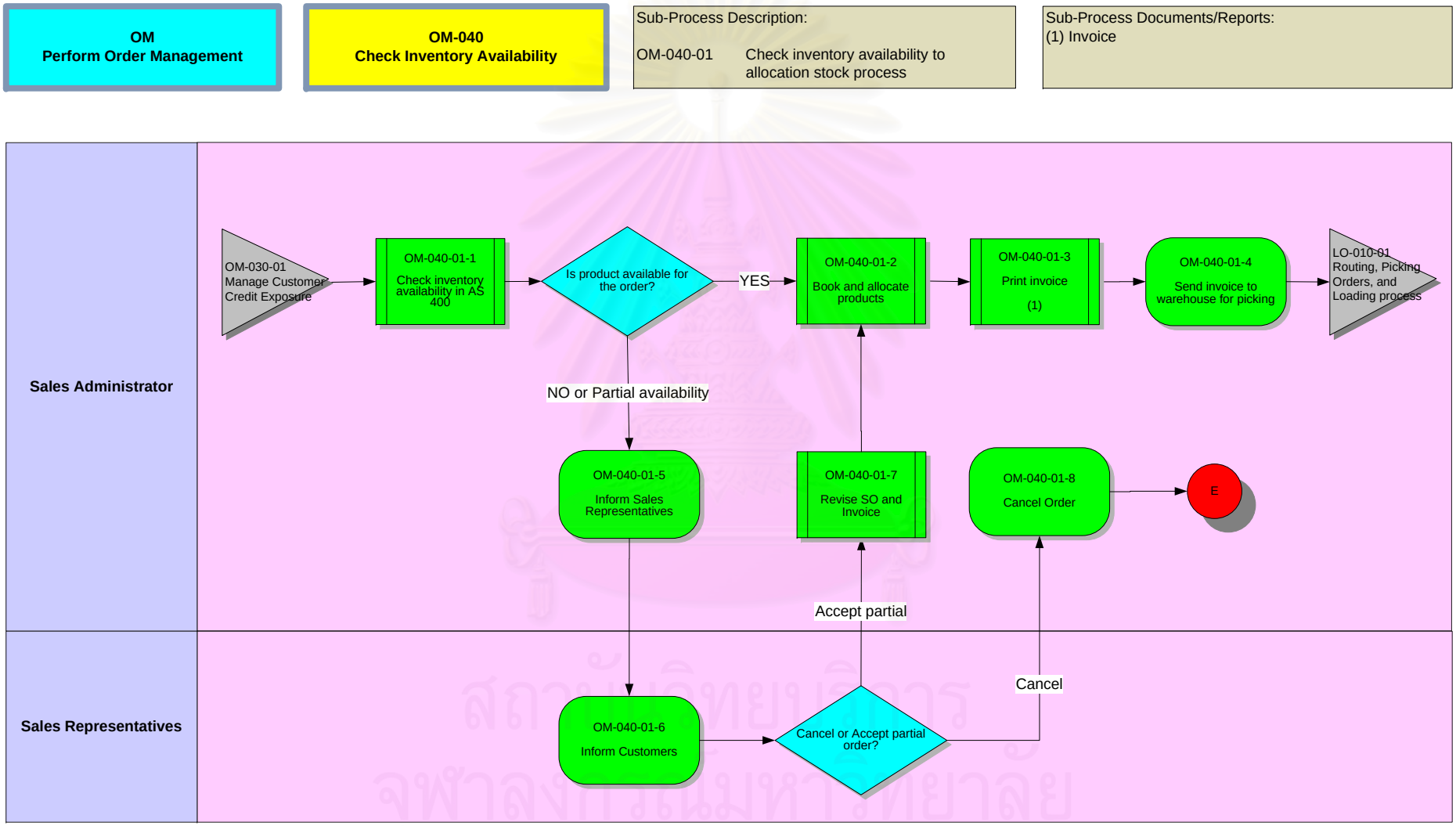


Figure 4.9: Current Check Inventory Availability sub-process flow

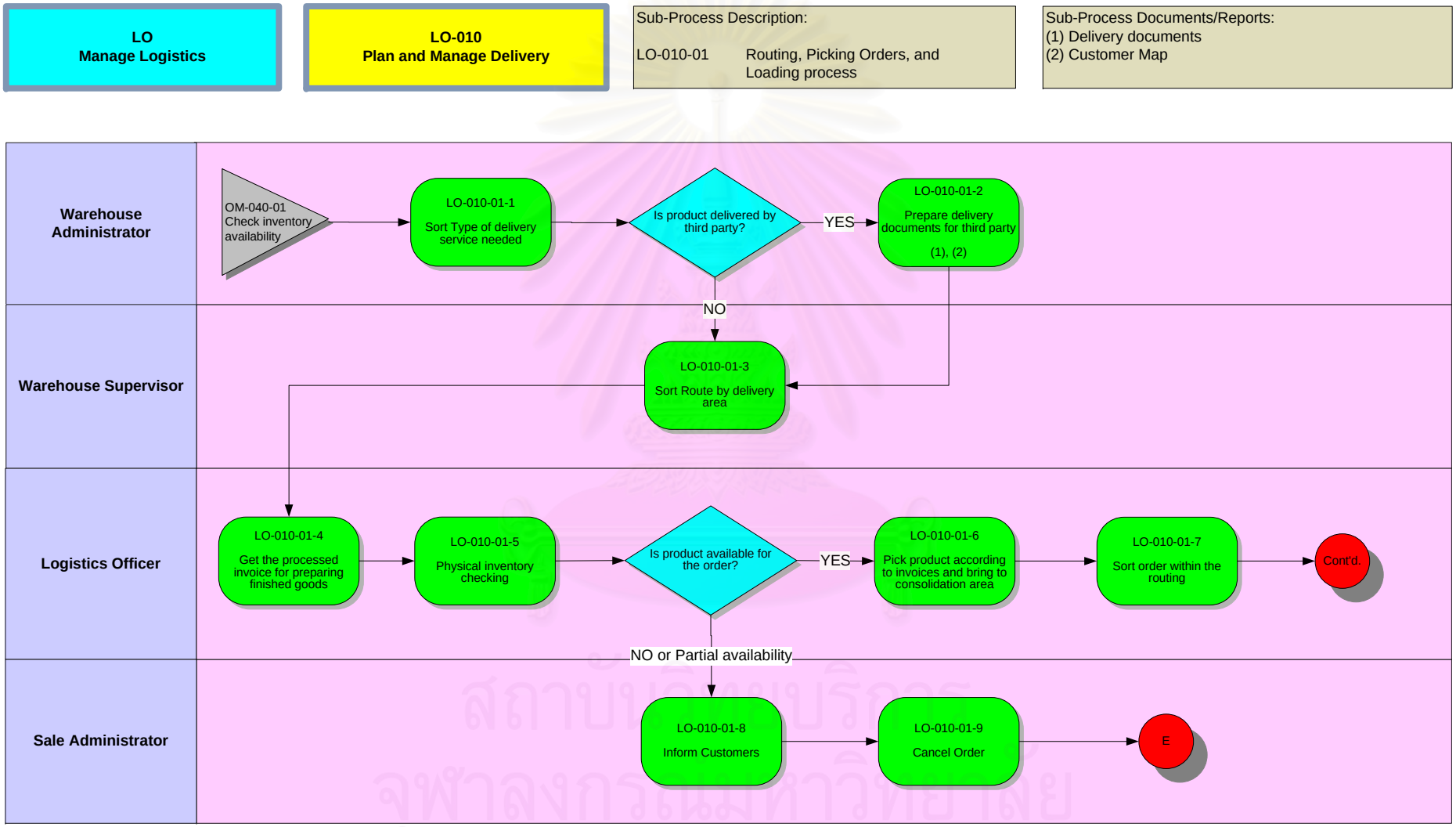


Figure 4.10: Current Plan and Manage Delivery sub-process flow (1)

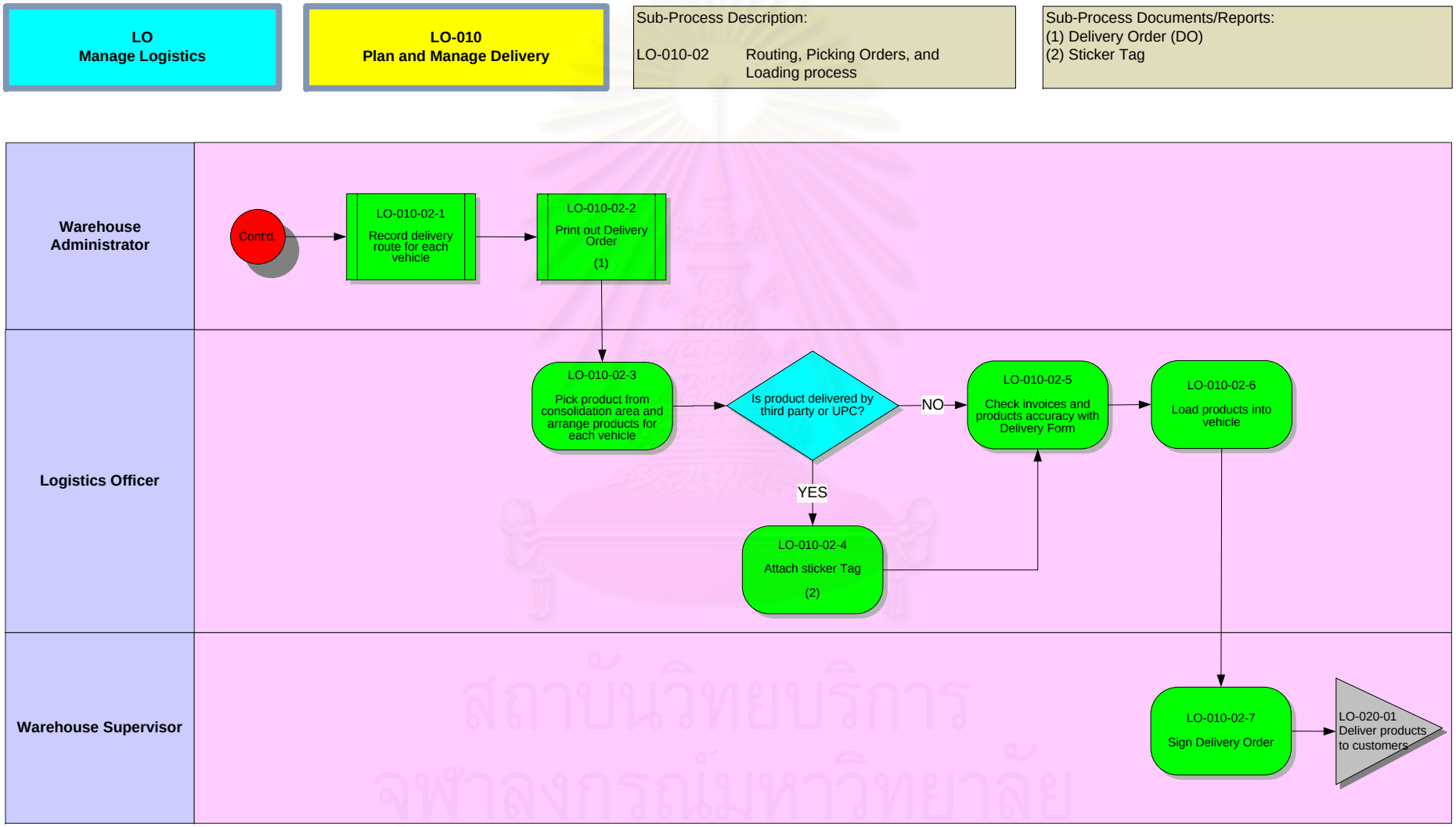


Figure 4.11: Current Plan and Manage Delivery sub-process flow (2)

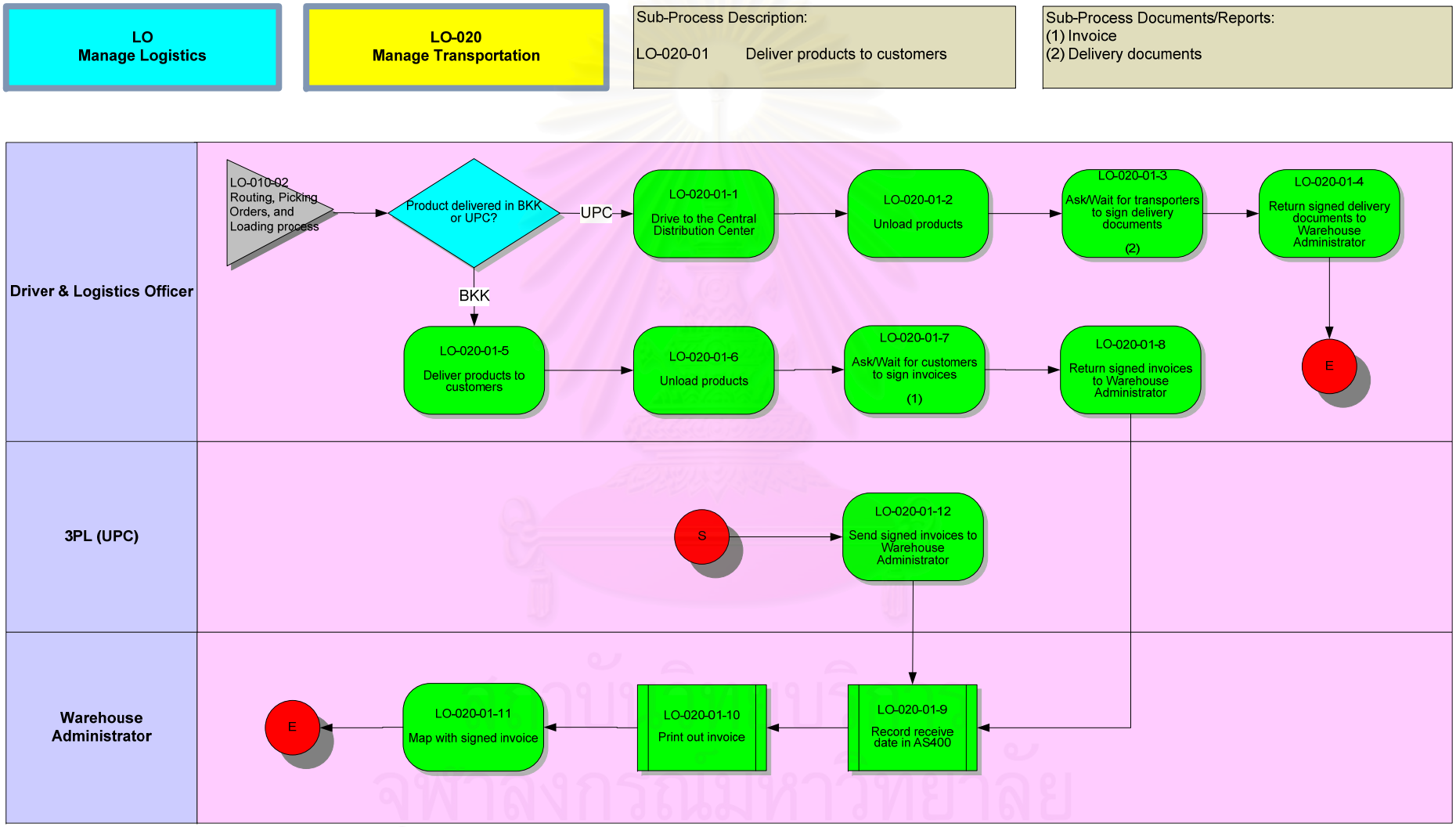


Figure 4.12: Current Manage Transportation sub-process flow

1) Sub-process OM-010: Capture Order

This is the starting point of the whole process. It starts from customer send in Sales order via 3 methods: fax, telephone call to Sales Representative and telephone call to Sales Administrator. Sales Administrator then has to determine order type: deposit buying and standard buying.

2) Sub-process OM-020: Process Sales Orders

As mentioned above, there are 2 types of sales orders. 1) Deposit buying; deposit buying process is used as a tool to guarantee buying price for customer. At the same time, it serves as a forecast guideline for raw material purchasing and production scheduling. AR Officer and customer have to mutually agree on the price and amount that they can buy within a specific period of time. Contract is then issued. Therefore, AR Officer has to update the remaining amount when transactions occur. In this process, AR Officer has to determine whether the order is first time or not because for first time buyer, they have to issue the contract while second time or third time buying requires AR Officer to update the remaining amount. Moreover, AR Officer has to recheck and gets final approval for all deposit buying before recording into AS400 and let Sale Administrator issuing contract and send it to customers. 2) Standard buying process; this process is for all normal credit sales and all deposit sales as well. Sales Administrator fill in Sales Order (SO) form and preview for stock availability without booking and let customers know and revise order if the order cannot be fully fulfilled. On the contrary, if the order can be fulfilled, Sales Administrator also has to contact customers to confirm product, quantity and promised delivery date. Next, Sales Administrator input the data into AS400.

3) Sub-process OM-030: Manage Customer Credit Exposure

All order must be checked for credit limit in order to reduce risk of default payment. If that order exceed credit limit, AR officer will inform Sales Representative who will then approve and request for credit expansion from Sales Manager. In the case that

the credit line is not approved, that order must be cancelled. On the other hand, if credit line is expanded or has no issue in the first place, the order is record as invoice.

4) Sub-process OM-040: Check Inventory Availability

Once, the order is checked for credit limit next process is to check inventory availability which is done in AS400. In the case that there is not enough product to fulfill the order, Sales Administrator will inform Sales Representative to further inform customers to make decision of cancelling order or accepting partial order. Order is then revised and re-input in AS400. If there are enough products for that particular order, products will be booked and allocated accordingly. Invoice will be produced and sent to warehouse ready for picking process.

5) Sub-process LO-010: Plan and Manage Delivery

Warehouse Administrator receive invoice from office and start sorting type of delivery: internal vehicle or third party transporter (3PL). All up country and some Bangkok customers (modern trade and non-complicate customers) are delivered by 3PL. ABC will delivery product to central distribution center for products to be delivered in up country. On the contrary, 3PL who delivery products within Bangkok is exclusive for ABC and receive product at the warehouse. ABC needs to prepare delivery documents for 3PL transporter who service up country customer. For orders to be delivered by ABC vehicle, Warehouse Supervisor will use invoice to sort route (total of 13 routes in Bangkok). Logistic Officer will be used the sorted invoice to prepare finished goods. At this stage, it is still possible that the product cannot be found so Logistics Officer has to inform Sales Administrator if that invoice cannot be completed. Sales Administrator will then inform customer and cancel order. In the case that products are fully picked according to invoice, products are arranged in the consolidated area. Next, the invoice is sorted for order of delivery and is recorded manually to produce Delivery Order (DO) form. Again, the products are arranged into routing and order for each vehicle. For products that are delivered by 3PL, tag that contains company address is attached. Then, Driver and Logistics Officer will check

invoice and product with DO form and load into the vehicle ready for delivery. Warehouse supervisor will sign every DO form as a final check.

6) Sub-process LO-020: Manage Transportation

This is the last process which is to drive to the destination and complete the document. Products for up country customers will be delivered at central distribution center by 6 wheels truck. Driver and Logistics Officer unload the products and wait for co-loading transporter to sign delivery document and returns that document to Warehouse Administrator. After co-loading transporter complete the delivery, they will return signed invoice to ABC to map with original invoice for tax purpose. For Bangkok customers, drivers will drive the pick up (4 wheels truck) to the location suggested by route planning, wait for customer to check and sign invoice and then return the document to Warehouse Administrator. Once the signed invoice is return, received date is recorded, original invoice is print out to map with the signed one and end the total process.

After the explanation, the usage time of each sub-process in order-to-delivery process will be shown in the table below.

Table 4.1: Time collection for each sub-process of order to delivery process

Sub-process	Time (Min.)	Time (Hr.)
OM-010	95.66	1.59
OM-020	251.63	4.19
OM-030	61.41	1.02
OM-040	158.28	2.64
LO-010	304.17	5.07
LO-020	284.31	4.74
Total	**1155.47**	**19.26**

** Source: Time measurement for each activity from 14 Aug 2006 to 25 Aug 2006 done by reengineering team

The calculation comes from the average 255 orders/day, then orders are separated into many options for example: 60% of total orders go through Deposit buying, 10% of total orders exceed the credit limit, 20% of total orders are needed to revise the SO

and invoice, 15% of total orders are delivered by 3PL, and 33% of total orders are sent to central DC for UPC customers.

From table 4.1, the usage time of each sub-process is the average time that calculated from each activity in the process (See Appendix C). The calculated time is done by time measurement** of each activities about 2 weeks.

After the usage time is calculated by considers all options, the average total lead time of the whole process is 19.26 hours. The total working time of ABC is approximately 9 hour/day, which are 8 hours for normal working time and 1 hour for overtime. Thus, the average total lead time for order-to-delivery process in BKK is approximately 2.1 days, while the industry standard is 1 day.

Additionally, to develop further understanding of customer, ABC Customer Satisfaction Survey 2005 is reviewed and the Perato Chart will be established. The survey sample size is 800 observations; 56% of the observation does not have any complaints while 44% shows dissatisfaction for ABC service. The count is reported in the table below.

Table 4.2: Results of ABC Customer Satisfaction Survey 2005

Complaints	Count
No problem	448
Incorrect product and/or quantity	51
Incorrect document	31
Delay delivery	267
Damaged delivery	9
Poor delivery service	19
Poor office service	5
Inflexibility	12
Lack of sales promotion and support	15
Incorrect billing	11
Wrong delivery place	26

Source: Customer Satisfaction Survey 2005 (December 2005) done by customer service department

To create Perato Chart for complaints, no problem answer is eliminated and the rest of the data is sorted and cumulative count & percentage are computed as illustrative in the Table 4.3.

Table 4.3: Sorting of ABC Customer Satisfaction Survey 2005

Complaints	Count	Cumulative. Count	Cumulative Percentage
Delay delivery	267	267	60
Incorrect product and/or quantity	51	318	71
Incorrect document	31	349	78
Wrong delivery place	26	375	84
Poor delivery service	19	394	88
Lack of sales promotion and support	15	409	92
Inflexibility	12	421	94
Incorrect billing	11	432	97
Damaged delivery	9	441	99
Poor office service	5	446	100

Source: Customer Satisfaction Survey 2005 (December 2005) done by customer service department

This data is converted to Perato Chart, Figure 4.13, for ease of understanding. The bar represents the count of each complaint and the line illustrates the cumulative complaint count percentages.

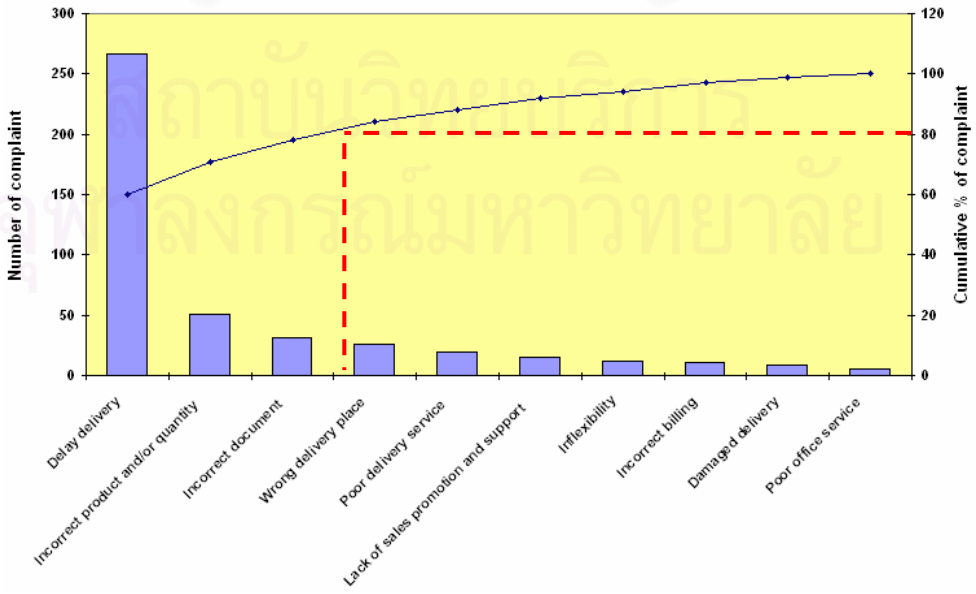


Figure 4.13: Perato Chart of Customer Satisfaction Survey 2005

With the graph, finding vital few is simple. By locating the 80% point of the right y-axis and find the corresponding on the x-axis. It clearly highlights that ABC needs to address 3 issues; “delay delivery”, “Incorrect product and/or quantity”, and “Incorrect document” complaint categories to respond to 80% of customer complaints.

4.4.2 Key Observation and Analysis

In this section, the key observation and analysis of each sub-process will be discussed. Fish bone diagram will be used as an analysis tool to find the root causes, which make an inefficient and long lead time in each sub-process of order-to-delivery process. The concept of Muda or Waste will be applied and used as a guideline to find out the non-value added activities and waste in the process.

In each sub-process, the root causes and non-value added activities, which make an inefficient sub-process, will be classified into 4 categories, which are Process, Policy, System, and People. The data for analysis comes from historical data in the system both in AS400 and in Warehouse system, observation the real situation by reengineering team, customer survey data, and interview the person who are working in the related processes.

4.4.2.1 Analysis of Capture Order sub-process

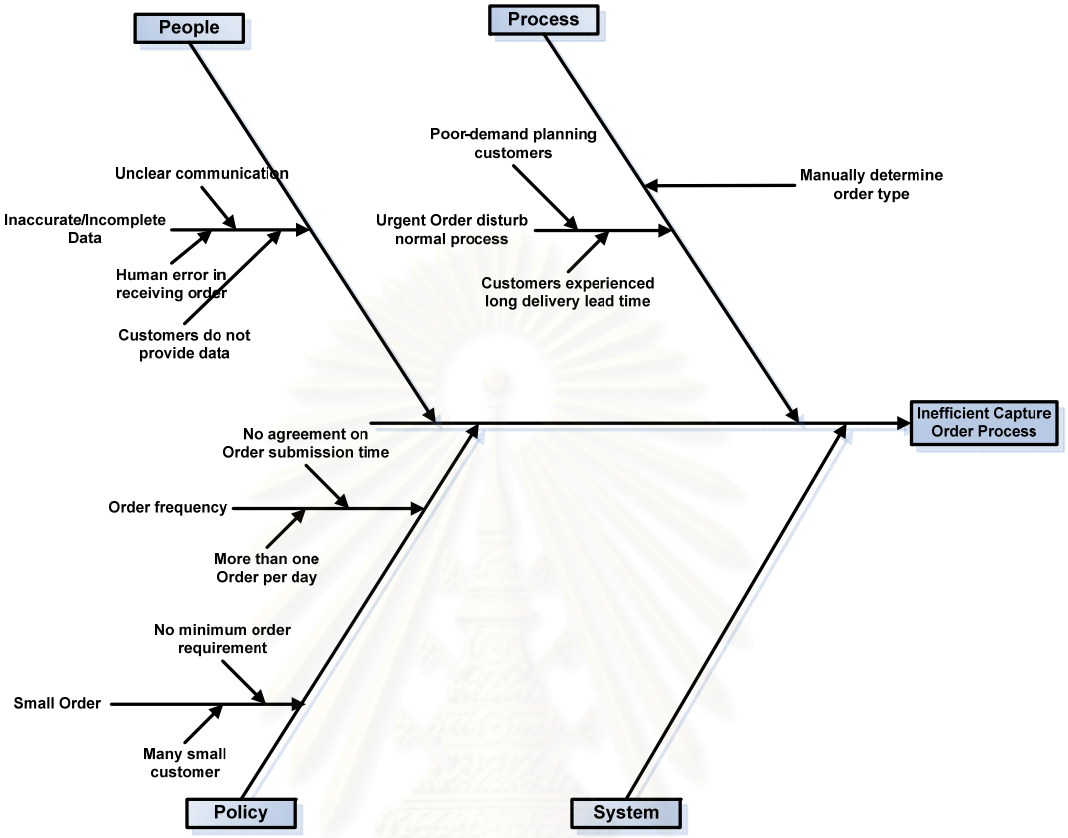


Figure 4.14: Fish bone diagram of Capture Order sub-process

1) Process

- **Urgent order disturb normal process**

Urgent order is an important cause of the inefficiency in capturing order process due to the fact that when Sales Administrative receive urgent order, they have to stop other activities and start process the urgent order immediately. Moreover, they need to treat urgent order separately when managing transportation and other processes. During the observation period, urgent order contributes to 3.7% of total order or an average of 10 orders /day. As a result, ABC spent more to these customers in term of administrative cost and transportation cost since sometimes a whole truck need to be solely allocated for a small urgent order. In addition, urgent order reduces service capability for other normal orders which are the majority of the orders and also

revenue. Further analysis showed that there are 2 main factors that cause customers to have urgent order. Firstly, customers who experience long delivery lead time tend to have urgent order since they are lack of confidence in company service. Since most of the urgent orders are from Bangkok customer, the data of delivery lead time in BKK, which is shown in Figure 4.15, was collected for analysis.

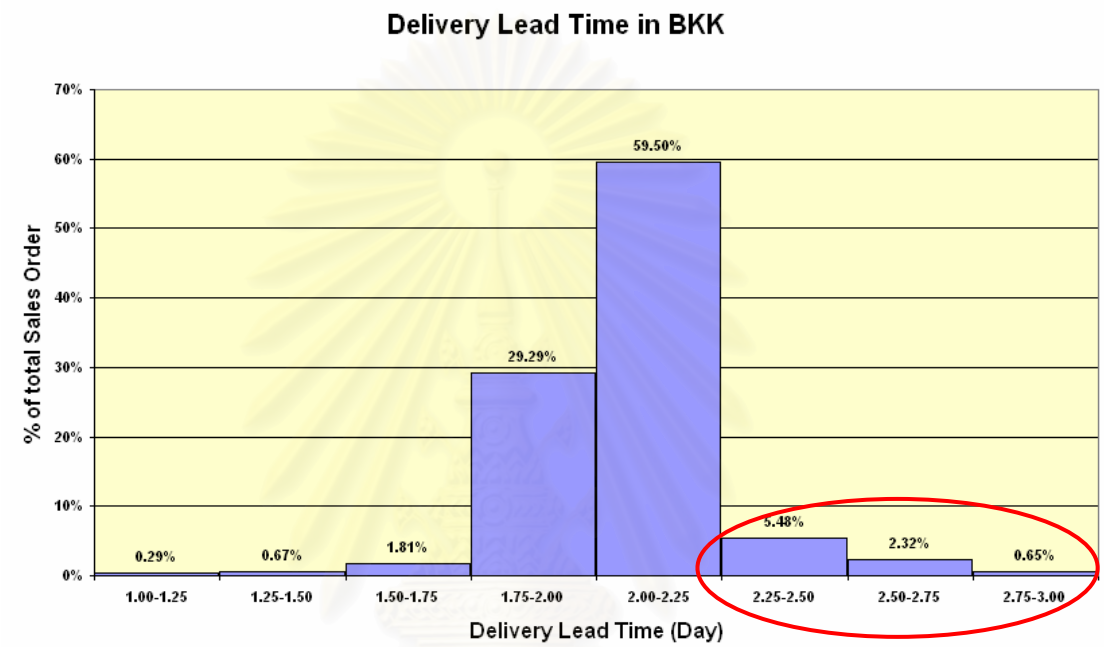


Figure 4.15: Deliver lead time in BKK

Source: Actual delivery leads time in BKK from April 2006 to June 2006 based on data in AS400 done by Sales Department

The graph reveals that ABC has a wide range of delivery lead time. As much as 8.45% of order receives the products more than 2.25 days after they place orders when the average delivery lead time for ABC is 2 days and industry standard is 1 day. This clearly shows that customers have a high chance of dissatisfaction for ABC delivery lead time.

Secondly, customers with poor-demand planning are likely to have urgent order. Since wholesaler and retailer do not want to keep high inventory level, the change in demand pattern from their customers directly affect their demand for ABC products, therefore, wholesaler and retailer needs to place an urgent order to ABC.

- **Manually determine order type**

There are 2 main order type, which are Deposit buying type and Standard buying type. Deposit buying is a method to guarantee price for customers and is used as a guideline for raw material forecast for ABC. Customer will issue cheque in a total amount and the amount will be deducted every time they place the order. Deposit buying process causes slow process because Sales Administrator has to manually identify who is eligible for deposit buying. Sales Administrator approximately uses 1 minute to manually sort per order. Additionally, Deposit buying type contributes to 60% of total customers.

2) Policy

- **Small order**

ABC Company does not have minimum order policy. Thus, customers are able to place the order at anytime at the quantity they want. ABC approximately receives 200-300 orders /day which generate revenue of 2 million baht. An average of value/order is 8,000 baht. However, ABC Company experiences a high amount of order that generate low value. The table below shows the number of order at different value per order in percentage.

Table 4.4: Percentage of order at different value

Value per Order	Percentage of Total Order
Less than 2,000 baht	24%
2,000 - 4,999 baht	41%
5,000 – 8,000 baht	16%
More than 8,000 baht	19%

Source: Value per order of customers from April 2006 to June 2006 based on data in AS400 done by Sales Department

The data shows that 65% of the orders or majority of order are small order with less than 5,000 baht. Small order is one of the causes of delay in delivery since it consumes a lot of time in every process. Another reason that contributes to small order problem is ABC Company has a lot of small customers. Since ABC Company

does not have a policy of minimum sales amount per year, many small customers buy products directly from ABC instead of buying though wholesaler or retailer.

Table 4.5: Number of customer at different buying value per year

Value per Year	Number of Customers	Percentage of total Customer
Less than 100,000 Baht	332	21%
100,000 – 499,999 Baht	602	38%
500,000 – 999,999 Baht	285	18%
More than 1 million Baht	365	23%
Total	1,584	100%

Source: Value per year per customers from June 2005 to June 2006 based on data in AS400 done by Sales Department

The table shows that 21% of ABC current customers buy less than 100,000 baht a year or less than 8,333 baht a month. The sales amount per month of 8,333 is approximately 10 bin of product per month. As mentioned earlier, small order creates a lot of manual work which could slow the whole process of delivery.

- **Order Frequency**

Due to the lack of policy/agreement on order submission time, customers can place order at anytime they want. The wide scatter of order leads to inefficiency in order capture process because Sales Administrator and Logistics Officers are unable to plan for workload. The table below shows the distribution of order at particular hour.

Table 4.6: Percentage of order at particular hour

Time	8:00-9:00	9:00-10:00	10:00-11:00	11:00-12:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00
BKK	14%	34%	16%	8%	5%	11%	7%	5%
UPC	8%	7%	37%	22%	11%	9%	4%	2%

Source: Order frequency from Apr 2006 to June 2006 based on data in AS400 done by Sales Department

The data was collected and sorted out by hour for both Bangkok and upcountry customers. Even if the orders come in randomly, it is found that 48% of Bangkok order is placed during 8:00 to 10:00 and as much as 72% of order is placed before

noon. On the other hand, almost 60% of upcountry order is received during 10:00 to 12:00.

3) People

- **Inaccurate/Incomplete Data**

This includes wrong quantity, wrong SKUs and wrong address during data entry. From the observation of 20,016 sales order, 44% or 8,800 sales order were received in Purchase Order form via fax, 39% or 7,800 sales order were received via telephone call from ABC Sales Representatives while 17% or 3,400 sales order were received directly from customer call. The analysis showed that 6%-7% of total sales orders were inaccurate and incomplete which results in a delay or inability to delivery on time in full. ABC experienced the most inaccurate/incomplete data from telephone channel from both Sales representatives and customers. The causes of inaccurate/incomplete data are as follows:

Firstly, unclear communication issue. Use of different product name, product code, and abbreviation creates confusion among customers, Sales Representatives and Sales Administrator. Unclear telephone signal or disturbance during a call also contributes to miscommunication problem. From the interview with Sales Administrator, “Sales reps are always in hurry so they talk very fast and assume that we know customer very well”, “ Customer always use their own term when ordering product from us. It is very confusing but I’m afraid to ask them”.

Secondly, human error in receiving data issue. Since ABC offers many closely-related types and color of products, this creates high chance for human error in recording data manually.

Thirdly, customers provide incomplete data. Customers sometimes provide incomplete information such as ship-to address and bill-to address which cause a wrong or delay of delivery.

Summary of Capture Order sub-process

From analysis above, issues in current capture order sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.7: Issues VS Related waste: Capture Order sub-process

Issues	Related Wastes (Muda)
Urgent order	Waiting
Manually determine order type	Waiting
Small order	Overprocessing
Order frequency	Overprocessing
Inaccurate/incomplete data	Correction

From the table above, Waiting, Overprocessing, and Correction wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- Urgent order and small order should be minimized to reduce lead time of the sub-process, reduce unnecessary work, and reduce number of SO.
- The easier and faster method to determine order type should be proposed to speed up the sub-process.
- Strategies to control the small order and order frequency should be suggested to better manage customer behavior.
- Manually data entry should be minimized to reduce the human error and reduce lead time of the sub-process.

4.4.2.2 Analysis of Process Sale Orders sub-process

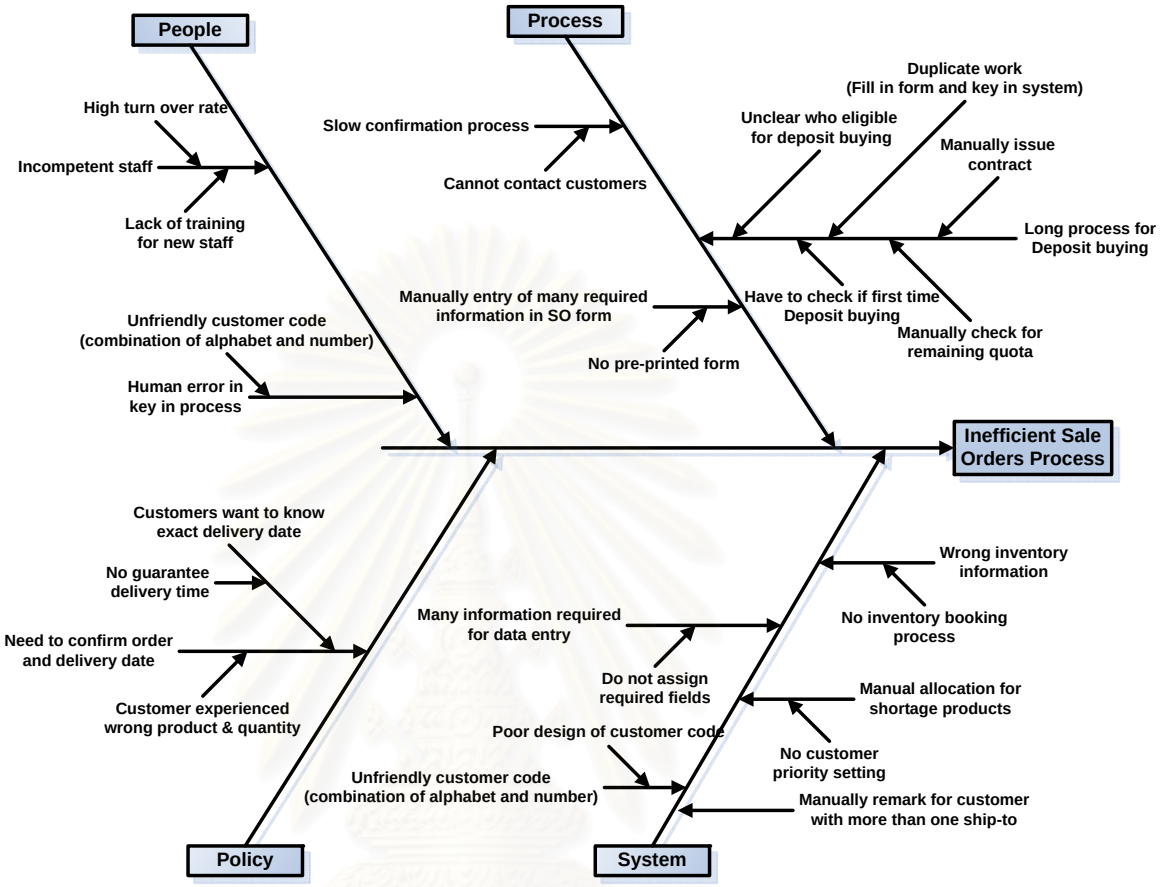


Figure 4.16: Fish bone diagram of Process Sale Orders sub-process

1) Process

- **Time Consuming Deposit Buying Process**

Currently, ABC keeps deposit buying customer record of the product and amount of each customer who already paid by cheque in excel file that does not link to AS400. Thus, AR officer has to manage and update price and remaining amount in the excel file after every transaction which causes complexity and time consuming. Not only that this activity consumes a lot of time but it is also prone to error, for example, disagreement with customer for remaining amount which lead to the delay in delivery.

For first time deposit buying, there is a duplicate of work in for Sales Administrator to fill in the form and key in AS400. Furthermore, the contract must be issued manually and require signature of authorized person.

- **Manually fill in Sales Order Form**

Sales Administrator has to fill in many information fields which includes customer code, customer name, address, product code, product name, quantity, payment method, contact person, and required delivery date. Since there is no pre-printed form, Sales Administrator spends approximately 3 minutes to fill in each Sales Order. This activity has a high degree of exposure in error such as wrong product code and missing ship-to address.

- **Slow confirmation process**

Given that every sales order must be confirmed, Sales Administrator faces difficulties in contacting with every customer at particular time. Moreover, this activity does not add much value to ABC since customers do not take this verification process seriously or the call is answered by an unauthorized person.

2) Policy

- **Order Confirmation**

ABC requires that all sales order must be verified and confirmed on delivery date via telephone call. This policy is issued due to the fact that customers had bad experience on delivery service. Refer to customer satisfaction survey (Table 4.2), 34% of customer experienced delay in delivery lead time when compared to promised delivery date. This creates frustration to the customers because they are unable to deliver products to end users on time. In addition, 6% experienced wrong product and/or quantity.

3) System

- **Wrong Inventory Information**

This activity lead to inefficiency in sales order process because Sales Administrator provides wrong information to customers. The root cause of wrong inventory information is that there is no booking process and information is not captured in real time basis. Sales Administrator is only preview the inventory and commit to customers for the amount that they required, however, these amount of inventory may be picked by other customers already. This case occurs quite often when large lot is ordered.

- **Requirement of many information**

Sales Administrator is required to key in at least 7 fields in the AS400; customer code, product code, quantity, payment method, credit term, contact person, and required delivery date This is due to the fact that currently the system does not assign the default value for some required field. Some information that should be linked with customer code is not linked, for example, payment method and contact person. It takes approximately 2.5 minute to key in 1 order.

- **Unfriendly Customer Code**

Not only that Sales Administrator has to key in many fields but also the customer code that they have to key in is not in a user-friendly format; combinations of alphabet and numbers. The concept of the best practice in part numbering system by BPIC can be seen at Appendix B. This poor-design type of customer code slows the process and also create easy to make an error.

- **Manually remark for customer with more than one ship-to**

For customers with more than one delivery place (8% of total customer or 128 customers), Sales Administrator has to specify the delivery location in the remark

since the system does not have different customer code for different ship-to place. From the interview with customer, “I don’t understand how it works in ABC but I always get the products that ordered from other branches and my order is delivered to them”.

- **Manually allocation for shortage product**

Since customer priority is not assigned in the system, Sales Administrator has to do manual allocation in the case of product shortage. This activity consumes a lot of time since it involves many parties in the discussion for quantity allocation. From the observation, it is found that production shortage occur 2-3 times/ month. In case of wrong inventory data, Sales Administrator also has to do manual allocation to solve the issue.

4) People

- **Incompetent Staff**

In order to process sales order, staffs are required to have certain knowledge and skills in specific program to work efficiently. Experienced staffs tend to work more efficient in this process due to the learning curve. However, ABC turnover rate is quite high, thus it lacks of experienced staff. In addition, without proper training program, new staffs are unable to perform efficiently and effectively. Currently there are 6 Sales Administrators while 4 of them stayed with the company for less than 6 months. When compare new staffs performance to those experienced one, it is clear that those with experience perform 25% better in term of speed and accuracy.

- **Human Error**

Human error is expected to happen in any process that involves people, however, unfriendly customer code could be one of the main reason as mentioned above. Human error not only cause delay in delivery but also cause dissatisfaction to the customers. Refer to ABC customer survey in 2005, the second and third customer

complaints are “incorrect product and/or quantity” and “incorrect document” where one of the cause is human error.

Summary of Process Sales Order sub-process

From analysis above, issues in current Process Sales Order sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.8: Issues VS Related waste: Process Sales Orders sub-process

Issues	Related Wastes (Muda)
Time Consuming Deposit Buying process	Waiting, Correction
Manually fill in SO form	Waiting, Correction
Slow confirmation process	Waiting
Order confirmation	Waiting
Wrong Inventory Information	Correction
Requirement of many information	Overprocessing
Unfriendly Customer Code	Correction
Manually remark for customer with more than one ship-to	Overprocessing
Manually allocation for shortage product	Waiting, Overprocessing
Incompetent Staff	Knowledge disconnection
Human Error	Correction

From the table above, Waiting, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- The easier and faster deposit buying process should be proposed to reduce error, reduce redundancy work, and reduce lead time of the sub-process.
- SO from and customer code should be redesigned to reduce error and speed up the sub-process.
- New methods or policies to speed up confirmation activity should be proposed.

- The methods to improve accuracy of inventory data should be suggested.
- System should be re-configured to reduce error, reduce overprocessing work and reduce lead time of the sub-process.
- Transition period should be well managed and training structure should be created to keep the business run smoothly.
- Manually data entry should be minimized to reduce the human error.

4.4.2.3 Analysis of Manage Customer Credit Exposure sub-process

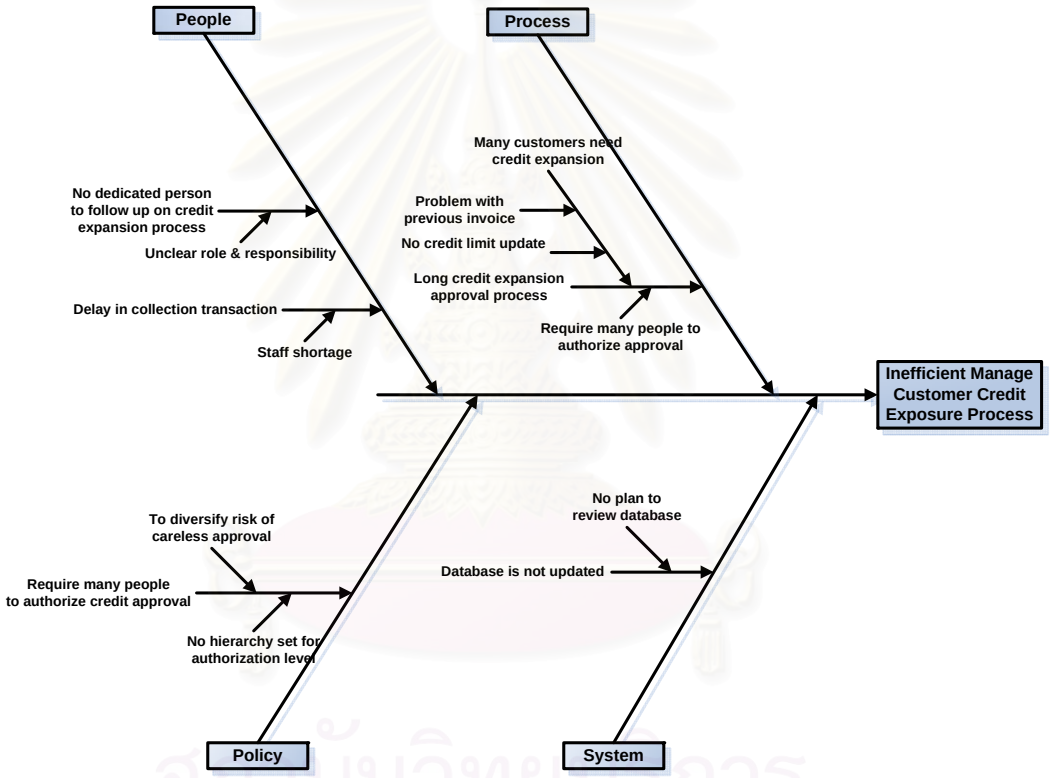


Figure 4.17: Fish bone diagram of Manage Customer Credit Exposure sub-process

1) Process

- **Time consuming credit expansion approval process**

This process requires a long time to finish due to 2 main reasons. Firstly, there are a lot of customers who needs to go though this process. Approximately 20% or 320 customers need credit expansion per month. This is partially due to the fact that there

is no periodically credit limit update. Moreover, customers who have problem with previous billing require a long time to solve the issue.

Secondly, this process involves 2 persons for authorization, therefore, AR Officers spent 5 minutes to 1 hour to contact and get approval from both Sales Representative and Sales Manager.

2) Policy

- **Require many people to authorize credit approval**

ABC policy states that it takes 2 persons; Sales Representative and Sales Manager to approve all credit expansion decision in order to diversify risk of careless approval. However, AR Officers find it difficult to contact both persons. From the interview with AR Officers, one officer said “It’s very hard to contact these people especially Sales Manager who is always in the meeting with either client or internal people and I can’t process this order because I have to wait for the approval”.

3) System

- **Database does not updated**

As mentioned above, there is no periodically schedule to update credit limit, therefore, there are many customers who need to go though approval process. Some customers who have been with the company for more than 5 years and have shown continuous growth in buying still have the same credit limit.

4) People

- **No dedicated person to follow up credit expansion approval process**

Given that it takes 2 persons to approve this process, there is unclear responsibility and focus for AR Officer of who to follow up and finish the approval process. “I have

many things to do apart from trying to reach Sales Manager" "If I can't contact them right away, I sometimes forget to follow up for the approval" said AR Officers.

- **Delay in Collection Transaction**

Since collection transaction has direct impact to credit limit of that customer, shortage in collection people at the moment causes delay in collection and thus affects the credit limit of customers. Customer only have full credit limit when they clear all the bill with ABC, therefore, the delay in collection transaction affect credit of that particular customer. As a result, AR Officer has to go though managing customer credit exposure process which involve a lot of parties and time consuming which affect company performance in delivery lead time.

Summary of Manage Customer Credit Exposure sub-process

From analysis above, issues in current Manage Customer Credit Exposure sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.9: Issues VS Related waste: Manage Customer Credit Exposure sub-process

Issues	Related Wastes (Muda)
Time consuming credit expansion approval process	Waiting
Required many people to authorize credit approval	Waiting
Database does not update	Correction
No dedicate person to follow up credit expansion approval process	Waiting
Delay in Collection Transaction	Waiting

From the table above, Waiting and Correction wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- New credit expansion approval process should be designed to speed up this process.
- Policies to reduce people to authorize credit approval should be issued.
- Database should be maintained correctly to reduce error.
- New collection process should be designed to speed up the collection transaction.

4.4.2.4 Analysis of Check Inventory Availability sub-process

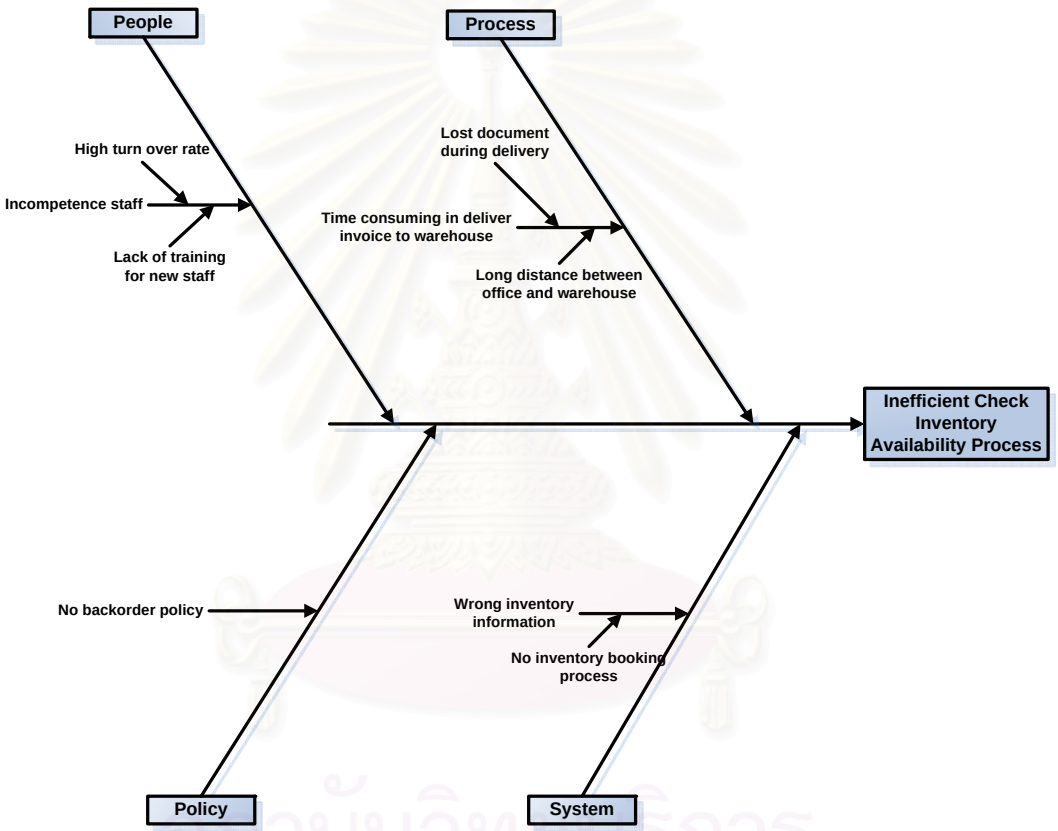


Figure 4.18: Fish bone diagram of Check Inventory Availability sub-process

1) Process

- **Time consuming in deliver invoice to warehouse**

The proximity of office and warehouse is 200 meters and it takes approximately 1 hour/day for sending invoice to warehouse which is considered as conveyance according to Muda. This is a waste caused by inefficient workplace layout.

Additionally, from the observation, it is found that there is a 0.14% lost of document during delivery process. Obviously, this process could be further improved.

2) Policy

- **No backorder policy**

Due to lack of backorder policy, order which cannot be fully fulfilled is cancelled, therefore, customers have to resubmit the sales order and start the whole process again which cause delay in delivery. With backorder policy, the remaining amount will be automatically sent once it is available. During the observation period of 3 months, ABC experienced product shortage 6 times or a few time per month.

3) System

- **Wrong inventory information**

As mentioned earlier in process OM-020, when Sales Administrator check stock before key in the system, there is no booking process in AS400**,** therefore, it is possible that the order is not fully fulfilled. Sales Administrative has to contact Sales Representative and/or customers for authorization to revise the product or amount. Next, Sales Administrator has to revise sales order and invoice in AS400 which create redundancy and complexity of work.

4) People

- **Incompetent staff**

The result of high turnover rate of Sales Administrator leads to inefficiency of this process. Since this Sales Administrator team is the same as those who perform Process Sale Orders (OM-020) sub-process, the issue is the same as mentioned above.

Summary of Check Inventory Availability sub-process

From analysis above, issues in current Check Inventory Availability sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.10: Issues VS Related waste: Check Inventory Availability sub-process

Issues	Related Wastes (Muda)
Time consuming in deliver invoice to W/H	Conveyance
No Backorder policy	Waiting, Correction, Overprocessing
Wrong inventory information	Correction
Incompetent staff	Knowledge disconnection

From the table above, Waiting, Conveyance, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- Changing responsibility of printing documents should be suggested to minimize transportation within the company.
- Backorder policy should be issued to speed up the sub-process, reduce documents correction, and reduce unnecessary work.
- The way to improve accuracy of inventory data should be suggested.
- Transition period should be well managed and training structure should be created to keep the business run smoothly.

4.4.2.5 Analysis of Plan and Manage Delivery sub-process

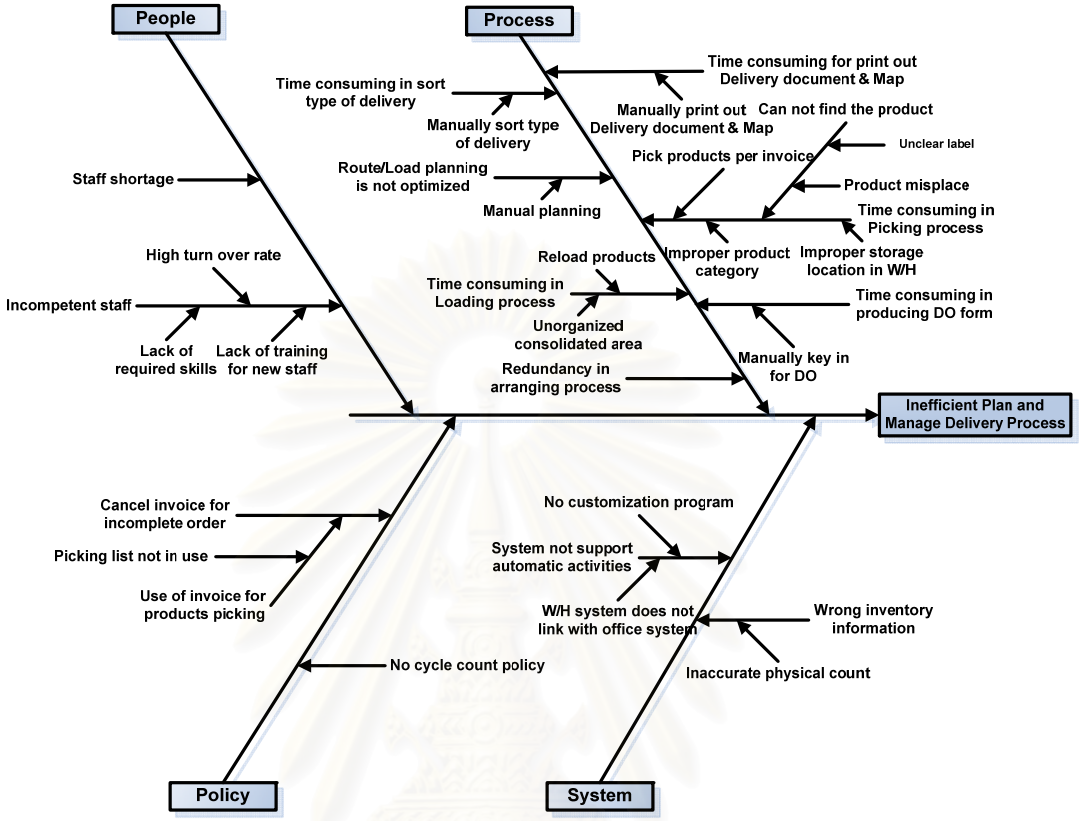


Figure 4.19: Fish bone diagram of Plan and Manage Delivery sub-process

1) Process

- **Time consuming in sort type of delivery**

ABC has 2 types of delivery; third party (3PL) transporter and ABC internal vehicles. 3PL transporter serves only large non-complicated customers within Bangkok which are approximately 240 customers. In this activity, Warehouse Administrator takes 40 minute/day to perform this activity.

- **Time consuming in print out Delivery Document and Map**

For products being delivered by 3PL, ABC needs to prepare delivery document and print out customer map for 3PL driver. Since the system is not set for automatic

printing, Warehouse Administrator has to manually print out twice for both Delivery document and customer map for each customer. This process takes 26 minute/day.

- **Route/Load planning is not optimized**

Currently, ABC prepare route and load planning (sort order) manually, therefore, the route/load planning is not always optimized and consume a lot of time (2.3 hours/day). By using experience in planning for different pattern of order in both customer and quantity order, it is unlikely that a person can optimize the vehicle utilization and routing. This could be seen from the fact that not all vehicles are loaded in full, only 54% utilization rate, and some drivers complain about routing. A driver said “I drive almost the same route everyday but not all customers order product everyday. So to respond to different customer order pattern, I think the routing should be flexible and adjust everyday according to the order that sent in that day”. Moreover, 3% or 7-8 invoices/day are sorted into the wrong routing.

- **Time consuming in picking process**

From the observation, 20% of total order face problem of slow picking process (cannot find product at the first trial). There are many reasons that contribute to inefficiency in picking process. Firstly, Logistic Officer pick product according to invoice rather than picking list. By doing so, the officer has to walk longer distance and more often to pick product according to each invoice.

Secondly, the products are not properly located in the warehouse. Products that has high turnover are not located in the place where it is easy to reach. In addition, there is no product location for each product category. This creates confusion to the officer because product packaging is quite the same.

Thirdly, Logistic Officer cannot find the product according to invoice because of three reasons: product does not exist, misplace, lost label, and unclear label. The table below shows the percentage of each reason.

Table 4.11: Reason of time consuming in picking process

Reason	Percentage
Product does not exist	37%
Product misplace	28%
Unclear product label	19%
Lost product label	16%

Source: Reasons of picking activities from Apr 2006 to June 2006 based on data in warehouse system done by Warehouse & Logistics Department

- **Time consuming in producing Delivery Order (DO) form**

Since current process require manual key in of invoice number, product code and quantity to produce delivery order for each vehicle, this activity consumes up to 1.5 hours/day without much of value added. Not only that Warehouse Administrator has to key in but also print out the delivery form. This document needs to be signed by Warehouse Supervisor before giving to the driver.

- **Redundancy in arranging product**

Presently, the products are arranged in order according to load planning twice. Once after picking from consolidation area, the products are arranged for each vehicle. Another arrangement is done when loading product into the vehicle. This redundancy leads to inefficiency in managing delivery process.

- **Time consuming in loading process**

In current situation, loading process consumes a lot of time due to 2 reasons. First, the consolidated area is unorganized. Even though the Warehouse Staff pick and place according to invoice and order, it is not done properly because the consolidated area is too small so products are misplaced and unorganized. Consequently, Logistic Officer spends time to select and find the products from the disorganized consolidate area and load the products into the trucks.

Second, Logistic Officer has to reload the products because they load in the wrong sequence and/or products into the wrong vehicle. As a result of many handlings, there is a high possibility that the products are damaged and/or lost.

2) Policy

- **Cancel invoice for incomplete order**

If the order cannot be fully fulfilled, the order must be cancelled. Then, customers have to start the whole process again. According to the current process, invoice is print out and is used to pick the product instead of picking list. Therefore, when the invoice is not fulfilled, that invoice must be cancelled because Warehouse Administrator cannot revise hard copy invoice, rather, it needs to be revised in AS 400. The order that need to be cancelled is approximately 15-25 orders/ day.

- **No cycle count policy**

Cycle count directly affects the accuracy of inventory between the system and physical inventory. As mentioned earlier, Logistic Officer cannot find actual products even if the system said so because of this reason. In current situation, ABC does not have cycle count period. There is only annual physical count at the end of each year. This is one of the main reasons that make the much difference between system inventory and physical inventory.

3) System

- **System does not support the automatic activities**

ABC lacks of automated and customized programs. So it uses manual operation for many activities, which are sort type of delivery, print out the document, route planning, and load planning to complete this process. Given the fact that order (customer, product, quantity etc.) come in differently everyday, manual operation not

only leads to inefficiency (slow and error) but also not optimize in the planning activity.

- **Wrong inventory information**

Due to inaccuracy in inventory physical count, actual inventory and what system shows are not the same. As mentioned earlier, Warehouse Officer cannot find the product for 50 orders /day at their first trial while approximately 15-20 orders are the case where they cannot find actual product as system suggested. This case is a result of wrong inventory information from inaccurate physical count.

4) People

- **Incompetent staff**

The issue for people in this process in similar to the previous one, however, the skill set is different. In the warehouse, skills such as driving fork lift truck and other material handling equipment are required. Incompetent staff especially in the warehouse could lead to inefficiency and accident. Another issue is that at ABC, the employee who is responsible for sort route (Warehouse Supervisor) has been with the company for 15 years and uses his experience in sort route activity. Thus, it is very risky that if this particular person resigns, there will be no one who is competent in doing his job.

- **Staff shortage**

According to the interviews with Logistics staff, it is found that there is a staff shortage issue. “My work is overload. I have to pick product which are difficult to find and I also have to arrange the product to the truck. Obviously, I need more people to help me” said a staff, “Right now the bottleneck is at picking process because they are very slow” said a driver. Further analysis from data on overtime expense shows that approximately 40 staffs in Warehouse do overtime at average 1 hour/day.

Summary of Plan and Manage Delivery sub-process

From analysis above, issues in current Plan and Manage Delivery sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.12: Issues VS Related waste: Plan and Manage Delivery sub-process

Issues	Related Wastes (Muda)
Time consuming in sort type of delivery	Waiting
Time consuming in print out documents	Waiting
Route/Load planning is not optimized	Waiting, Correction
Time consuming in picking process	Waiting, Conveyance, Correction
Time consuming in produce DO form	Waiting, Overprocessing
Redundancy in arranging product	Correction, Overprocessing
Time consuming in loading process	Waiting, Correction
Cancel invoice for incomplete order	Waiting
No cycle count policy	Correction
System does not support the automatic activities	Waiting, Correction
Wrong inventory information	Waiting, Conveyance
Incompetent staff	Knowledge disconnection
Staff shortage	Waiting

From the table above, Waiting, Conveyance, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- Easier and faster methods of all time consuming activities should be proposed to reduce lead time of the sub-process.
- New transportation programs should be implemented to increase vehicle utilization, optimized route/load planning, and speed up the sub-process.
- New picking methods and new picking documents should be proposed to minimize transportation within warehouse and speed up picking activities.

- New material handling equipment should be used to speed up loading activities and reduce redundancy work.
- Warehouse system and programs should be customized to reduce manual activities, minimize unnecessary and redundancy works, reduce human error, and reduce lead time of the sub-process
- Policies such as perform cycle counting should be issued to increase accuracy between physical inventory and system inventory.
- Transition period should be well managed and training structure should be created to keep the business run smoothly.

4.4.2.6 Analysis of Manage Transportation sub-process

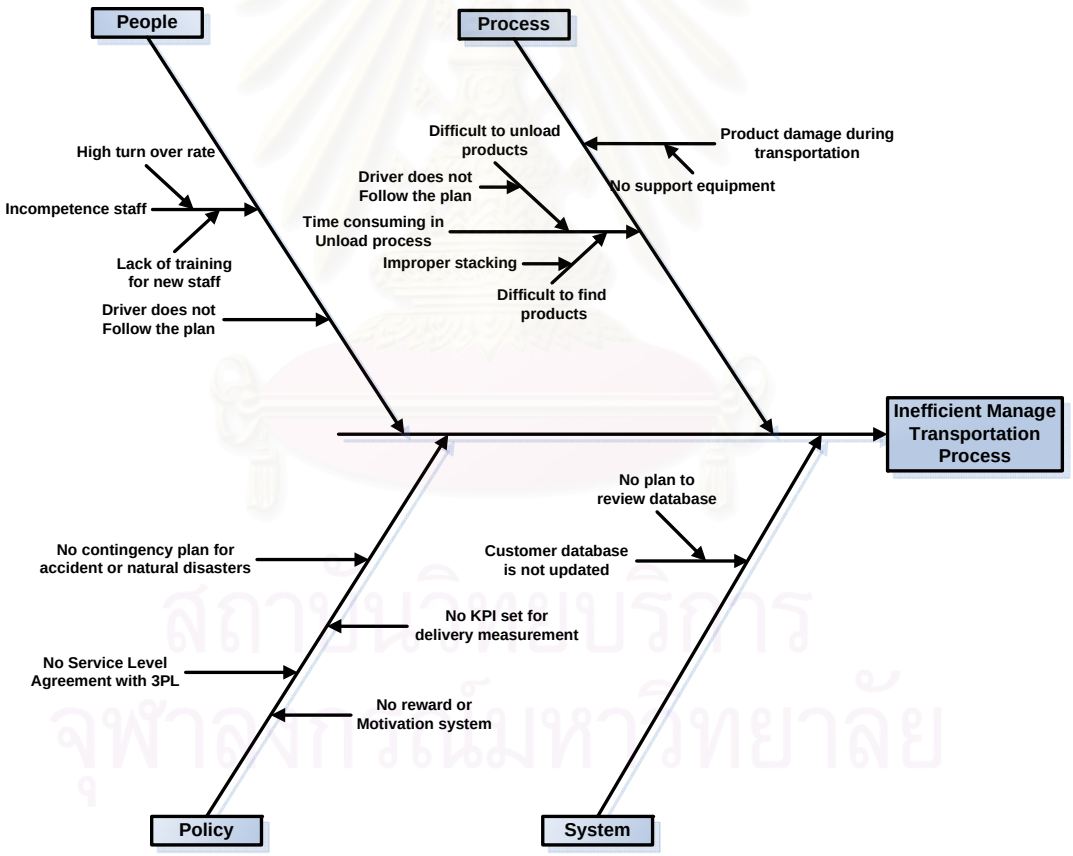


Figure 4.20: Fish bone diagram of Manage Transportation sub-process

1) Process

- **Time consuming in unloading process**

Firstly, it is difficult to find the products in the truck because of improper stacking. Poor labeling is also another cause of this issue. Secondly, it is difficult to unload the product because the driver does not follow the routing plan. The drivers believe that they know the better/faster way to delivery the product, therefore, when they unload the products, there is a confusion in finding the products in the truck because the pre-arranged order is not followed.

- **Product damage during transportation**

Refer to the last year, there are 9 complaints or approximately 1% on damaged delivery. The damage is likely to occur because of low truck utilization. Products are moved easily within the truck when they are not fully loaded. Moreover, ABC does not have protection equipment installed within the vehicle.

2) Policy

- **No contingency plan for accident or natural disasters**

ABC does not have back up plan in the case of unexpected events. There were 21 accidents in 2005 and all was not managed well. Customers experienced extreme delay as a result of those accidents because the order needs to be reprocessed. In addition, there is no policy regarding handling extraordinary cases such as natural disaster or terrorism.

- **No Service Level Agreement (SLA) with 3PL transporter**

Service Level Agreements are used to manage the expectations between customers and suppliers of services. Since there is no SLA with 3PL, the delivery performance cannot be tracked for further analysis. In addition, ABC cannot give promised delivery date to customers since there is no guarantee for delivery service from 3PL.

"The old adage that you can't manage what you don't measure is especially true when you are outsourcing the activity you are supposed to be managing" says RobertSpira, a transportation attorney in Cleveland, Ohio, who specializes in third-party logistics contracts. (Foster, 1998)

- **No Key Performance Indicators (KPIs) set for delivery measurement**

Key Performance Indicators are quantifiable measurements that reflect critical success factors of an organization. Currently, ABC's drivers and operators do not have key performance indicators, therefore, it is possible that drivers do not perform efficiently and not up to standard of expectation. Moreover, due to lack of performance measurement, the data is not available for detail analysis. *"High-level business goals need to be broken down into, effectively, very specific critical success factors and key performance indicators that can be monitored."* (Hiles, 2000)

- **No reward or motivation system**

Reward or Motivation systems are the mechanisms that help employees do their job effectively and help the company to achieve the objectives. Since the company does not have performance measurement policy, the reward or motivation system also does not exist. Drivers and operators do not have motivation to deliver better result. A driver said "I just have a duty to drive. No one cares if I perform well so I have no incentive to complete my work in a better way".

3) System

- **Customer database does not updated**

Since customer database does not updated properly, drivers are informed verbally when there is a change in address while the documents still state the out-dated one. So there is a high chance that drivers will drive to the wrong place. In addition, new customer database is not complete before the first order. Thus, driver still does not have customer map for the first delivery which leads to inefficiency in delivery service.

4) People

- **Incompetent staff**

3PL does not always assign the same driver for ABC so drivers who are not familiar with the routing and products perform worse than those experienced one. Furthermore, due to high turnover of driver especially in third party, drivers do not know ABC customer well. As a result, the process is inefficient.

- **Drivers do not follow the plan**

From the interview earlier, it is found that drivers do not always follow the plan because they believe they have faster way to delivery products and no one knows that they do not follow the plan.

Summary of Manage Transportation sub-process

From analysis above, issues in current Manage Transportation sub-process produce many types of waste. The table below shows the relationship between issues and related wastes.

Table 4.13: Issues VS Related waste: Manage Transportation sub-process

Issues	Related Wastes (Muda)
Time consuming in unloading process	Waiting
Product damage during transportation	Correction
No contingency plan	Waiting
No SLA with 3PL transporter	Waiting, Correction
No KPI set for delivery measurement	Waiting, Correction
No reward or motivation system	Waiting, Correction
Customer Database does not update	Correction
Incompetent staff	Knowledge disconnection
Drivers do not follow the plan	Waiting, Correction

From the table above, Waiting, Correction, and Knowledge disconnection wastes are the main problems of this sub-process. In order to improve the efficiency of this sub-process, the suitable recommendations should be proposed. The recommendations should focus on minimize wastes from sub-process as much as possible. The initiatives of recommendation in this sub-process are:

- New material handling equipment should be used to speed up unloading activities and prevent product damage during transportation.
- Contingency plan should be created to prevent delay from unexpected situations.
- KPIs and SLAs should be set to measure delivery performance, which is used to manage and control transportation activities for both internal and 3PL.
- Motivation system should be created to increase employees' morale, which leads to increase the overall performance of them.

Conclusion

From the analysis above, there are many problems or issues, which make an inefficient order-to-delivery process. These issues lead to long delivery lead time, which decrease the customer satisfaction of the company and make the company loss the competitive advantage in the industry.

Long process time significantly affects the number of trip per vehicle for both internal vehicle and 3PL. Since the first trip starts to deliver around 9:00 or 10:00 in the morning, vehicles will come back to the company around 15:30 to 16:30, which is impossible to make the second trip. So, if the first trip starts around 7:00 in the morning and come back before 13:30, it is possible to make the second trip in some routes. Moreover in current situation, vehicles have to wait for the products, which make vehicles idle for a long time.

In order to shorten the order-to-delivery process, many recommendations to minimize wastes will be provided in chapter 5. These recommendations will give a result in reduce delivery lead time and improve the efficiency of the order-to-delivery process.

4.4.3 Capability Maturity Model

In this section, Capability Maturity Model (CMM) will be used to evaluate the current capabilities, circle sign, of ABC. Table 4.14 shows the sub-process that related with each capability. Each capability will be measured in 4 levels; Lagging, Developing, Advanced, and Leading. Moreover, each level also has the definition, which explains the advancement level of that particular capability (See Appendix D). After all current capabilities are assigned (Where are we now?) to their level, the company target for each capability (Where we want to be?) will be set in the framework.

Table 4.14: Capabilities Maturity Model of ABC

Related Sub-process	Capabilities	1 Lagging	2 Developing	3 Advanced	4 Leading
OM-010 OM-030	Capture Orders		● ★		
OM-020	Enter Orders	●	★		
OM-030	Bill and Collect Revenue		●	★	
OM-020 OM-040	Plan Production and Delivery for Customers	●	★		
OM-020	Process Orders		● ★		
OM-040 LO-010	Manage Distribution Center Operations (Technology)	● ★			
LO-010	Manage Order Assembly/Packaging (Process)	●	★		
LO-010	Manage Order Assembly/Packaging (Technology)	●	★		
LO-010	Manage Packing and Packaging (Conveyance)	●	★		
LO-010	Manage Packing and Packaging (Process)	●	★		
LO-010	Product Placement and Distribution Center Configuration	●	★		
LO-010	Manage Transportation Cost		●	★	
LO-010	Order Transportation Service	●	★		
LO-010	Schedule Carriers		●	★	
LO-010 LO-020	Create Shipping Documents	●		★	

From the table above, only 1 capability, which is Bill and Collect Revenue, is in developing level. ABC's Capture Order, Process Order, Manage Transportation Cost, Schedule Carriers, and Fulfill Transportation capabilities are in between developing and lagging level, while the remaining capabilities are in lagging level. Details of each capability of current process will be discussed below.

1) **Capture Order:** Currently in capture order sub-process, ABC receives orders via fax and telephone from both customers and Sale representatives. It is paper extensive process. However, the customer data can be verified by manually entered some details in the system. So, this capability is located between lagging and developing level.

2) **Enter Orders:** Since Sale Administrator manually fills in both Deposit buying and SO form before record in AS400, there is a high chance that many errors occur from human error in order entry activities. From Customer satisfaction survey (Table 4.2), there is approximately 10.25% come from incorrect product and/or quantity and incorrect document. Thus, this capability is located in lagging level.

3) **Bill and Collect Revenue:** Presently, pricing structure is linked in AS400 and automatically calculates the total price when invoice is printed. In collection activity, AR aging report is used to review the payment status of all customers. These will help AR Officers perform their job easier and faster. Thus, this capability is located in developing level.

4) **Plan Production and Delivery for Customers:** Since ABC has problem about long delivery lead time in order-to-delivery process, the company can not guarantee both ship date and promise date to customers. So, this capability is located in lagging level.

5) **Process Orders:** Currently, ABC uses long order processing time due to many non-value added activities and many paper works in Process Orders sub-process. However, some order status information, which is in AS400, available to customer

up on request. Therefore, this capability is located between lagging and developing level.

6) **Manage Distribution Center Operations (Technology):** In current process, the communication exchange between warehouse and office, supplier, or customer is limited to telephone, fax, and mail. Most of warehouse transactions, which are receiving, storing, and shipping, are manually recorded and performed by Warehouse Administrator and Logistics Officer. Thus, this capability is located in lagging level.

7) **Manage Order Assembly/Packaging (Process):** Since there is no automation system or specific equipment such as conveyor, flow rack to support the operation in warehouse. All orders are manually picked from a large stock of finished goods inventory. So, this capability is located in lagging level.

8) **Manage Order Assembly/Packaging (Technology):** Currently, ABC does not have picking list in the process. Invoices are used as picking lists for picking activities. Warehouse people responsible for sorting, routing planning, loading planning and direct picking activities. Therefore, this capability is located in lagging level.

9) **Manage Packing and Packaging (Conveyance):** Currently, Logistics Officers perform manually pick and pack the products. There are no conveyors or flow rack to speed up this activity. Thus, this capability is located in lagging level.

10) **Manage Packing and Packaging (Process):** Same as Manage Order Assembly/ Packaging (Process), all orders are manually picked from a large stock of finished goods inventory. So, this capability is located in lagging level.

11) **Product Placement and Distribution Center Configuration:** From table 4.7, about 28% of the reason that cause of time consuming in picking process is “Product misplace”. It shows that there is no discipline in product placement, which makes high frequency of searching for products’ location in the warehouse. Thus, this capability is located in lagging level.

12) **Manage Transportation Cost:** ABC has selected 3PL transporter without clear goal setting, No metrics of cost item in use or manage reporting, and No specification of equipment types and call-off time. However, ABC used co-loading transporter to deliver products in UPC for cost saving. Thus, this capability is located between lagging and developing level.

13) **Order Transportation services:** In order to communicate with 3PL transporter, ABC order transportation services via telephone, fax, and mail. There is no EDI used to transfer any data. Moreover, this activity relies on manual paperwork. Therefore, this capability is located in lagging level.

14) **Schedule Carriers:** Currently, there is much paperwork in transport scheduling process. The rush orders will be scheduled via telephone. Planning and control activities reliant on experienced personnel. Additionally, many SO taking is schedule deliveries without approve of expedition. So, this capability is located between lagging and developing level.

15) **Create Shipping Documents:** In current process, Warehouse Administrators manually prepare delivery documents and customer map for 3PL. Moreover, they have to re-key order data in to warehouse system to print out “Delivery Order” for each vehicle. Thus, this capability is located in lagging level.

From details above, the current capabilities level, which related to order-to-delivery process, is quite low. There are many requirements to shift up these capabilities to better level in order to improve efficiency and reduce delivery lead time of order-to-delivery process.

After discuss with top management, the possible target of each capability after implement this project has been set. The targets, which represent in star sign, are set in the framework. In order to achieve the target, many recommendations will be discussed in chapter 5. These recommendations will be implemented for both improving the capability level and reducing delivery lead time in order-to-delivery process, which is the main objective of this thesis.

CHAPTER V

RECOMMENDATION AND TO-BE PROCESS

5.1 Recommendations of New Process

Since there are many problems, which are discussed in previous chapter, in order-to-delivery process, reengineering team need to establish the brainstorming session to find out solutions for these problems. As mentioned in chapter 3, brainstorming session gives recommendations from cross-function in reengineering team, which creates the new ideas from different point of view from top management level to operational level. These recommendations will be used to design the To-be process, which eliminate or minimize the non-value added activities or wastes to meet the thesis objectives.

Additionally, reengineering team will uses Deloitte Enterprise Value Map™ (EVM) as a suggestion tools to determine the improvement areas, which related with objectives of the thesis, from proposed recommendations.

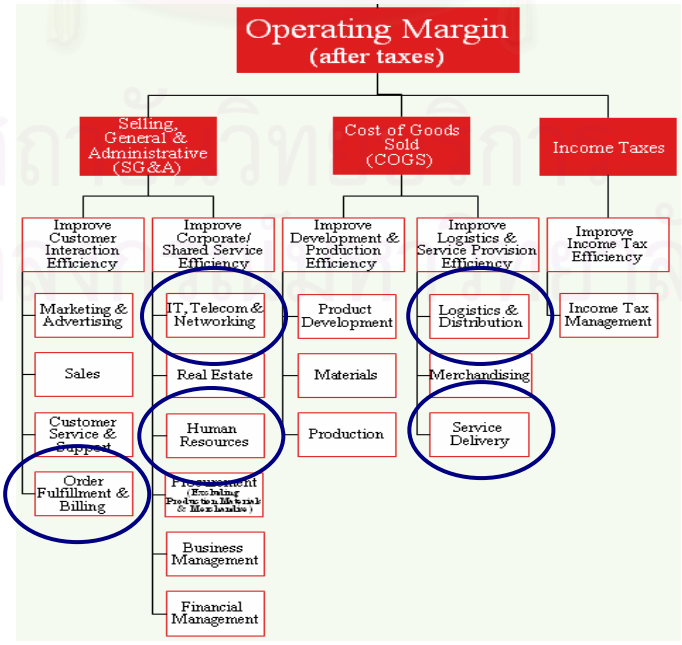


Figure 5.1: Enterprise Value Map™ (Operating Margin area)

Most of proposed recommendations should be in the related EVM's functions, which are Order Fulfillment & Billing, IT, Telecom & Networking, Human Resource, Logistics & Distribution, and Service Delivery. Top management should ensure that the proposed recommendations will give benefits to both delivery lead time and operations cost.

From figure 5.1, it can be seen that the recommendations in the mentioned areas not only reduce delivery lead time of order-to-delivery process, but also improve in SG&A and COGS areas, which will give benefits to operating margin of the company.

Recommendations to improve the efficiency of each sub-process will be classified into 4 categories, which are Process, Policy, System, and People.

5.1.1 Recommendations of Capture Orders sub-process

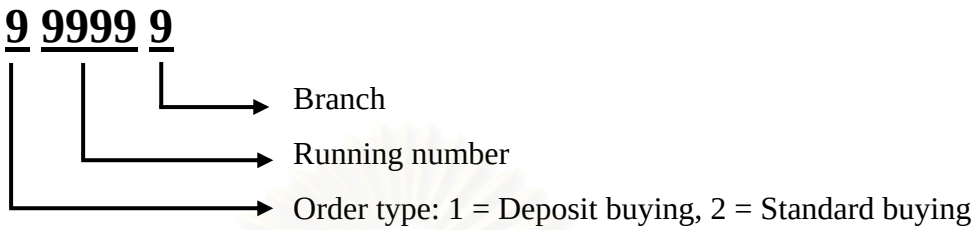
From section 4.4.2.1, Waiting, Overprocessing, and Correction wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

1) Process

- **Design new customer code**

Due to the fact that ABC has approximately 1,600 customers, Sale administrator can not remember buying type; Deposit buying or Standard buying, for all of them. Sale administrator needs to use the customer list to identify the order type for each customer. This is because the current customer code does not tell anything. The format of current customer code starts with 2 digits of alphabet and follows by 4 digits of numeric for example AC0001, KG0152, and TS0767.

To reduce the process time, customer code needs to be redesigned to make the difference between two types of customer. The proposed customer code is 6 digits of numeric. The coding structure is shown below.



From the structure above, Sale administrator can determine the type of customer immediately when the order come, which will make this process faster and easier.

- **Using of SO pre-printed form**

There is a redundancy work when Sale Administrator receives the order via telephone. Firstly, Sale Administrators record the order in blank paper, when they receive order via telephone both form customers and Sale Representative. After type of order is determined, Sale Administrators have to record the order again in SO form. As mention in As-Is process, the current SO form is required to fill in many information. Thus, Sale Administrators do not have enough time to record in SO form immediately when orders come.

The company should apply pre-printed SO form to ordering process with the objective to reduce lead time and human error. The pre-printed SO form includes the list of all product code and product name which make it easy for Sales Administrator to note down the order while receiving calls from either customers or Sales Representative. The new form only requires customer code, customer name, required delivery date, and quantity of the required products. The use of SO pre-print form will help in reduce the redundancy work by 3minute/order, speed up the process, and also reduce the human error in unclear communication issue and receiving data issue.

2) Policy

- **Consolidate order for each customer**

As discussed in chapter 4, 65% of orders are less than average of 8,333 baht. These small orders come from some customers, who place their orders more than 1 time/day. ABC is recommended to issue the policy about order consolidation, which allows customers to place their order only 1 time/day. This significantly helps reduce number of sales order (expected to reduce 20 sales order /day) which leads to reducing lead time (4.52 minute/order) as well as better ability to manage transportation cost. However, the policy must be clearly communicated to all related parties including internal people. It is almost impossible to expect 100% result within the first month of implementation, therefore, the grace period is set to be 3 months.

- **Separately receive order between BKK and UPC**

There are benefits from separately receive order between BKK and UPC. Not only the documents will be processed in batch, but also the day-to-day operations in warehouse will easier to be planned. This directly affects the efficiency in picking process and arranging products for each vehicle. Each picking list will only contain orders for either Bangkok or UPC so it shortens the process of arranging the products for each vehicle. From analysis of in table 4.6, ABC should establish the policy stating that orders to be delivered within Bangkok will be received within 08:00-10:00 hours and UPC orders will be received within 10:00-12:00 hours. Having this policy is a way to ensure batch processing for BKK and UPC.

5.1.2 Recommendations of Process Sale Orders sub-process

From section 4.4.2.2, Waiting, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

1) Process

- **Eliminate fill in and recheck Deposit buying form activities**

As mentioned in As-Is analysis, filling the Deposit buying form is a double work and considered as non-value added activity, which slow the total process. So, AR officer should record it directly into the system and recheck before issue the contract. There are approximately 15 orders /day that need to renew the contract or first time of Deposit buying. By removing fill in and recheck deposit buying form activities, ABC will be able to reduce processing time by 1 hour/day.

- **Eliminate Preview stock availability in AS400**

Preview stock availability activity causes incorrect measurement of OTIF because Sale Administrator advises customers to change their PO according to stock availability. Thus, when the service level in term of in full is measured, the picture is distorted since the customer order does not reflect real demand. Rather, the SO is already manipulated by the preview of stock. This issue is already discussed with top management and they agree to eliminate this process with expectation of 2 objectives; 1) To reflect real demand and 2) To reduce lead time.

Preview stock availability in AS400 is time consuming and not effective activity. The company does not get any benefits from this activity because there is no booking in the system since it is only a preview. Therefore, there is no guarantee that customer will receive the products even if Sales Administrator see the stock availability. This is one cause of customer dissatisfaction. In order to remove “preview stock availability” activity, Backorder order process must be put in place and will be further discuss in detail in section 5.1.4 in Policy category.

- **Issue contract by AR officer instead of Sale Administrator**

Currently, Sale Administrator has responsibility to issue the Deposit buying contract because it is manually issued by typing and printing a new contract. Since the

customization program has been installed, the contract can easily issued by anyone, therefore, AR Officer who is currently responsible for coordination between Sales Manager and customers is best suitable to complete this activity. With this change, it involve less party to complete the activity which leads to less complexity, less prone to error and definitely less lead time. Once the agreement is set, AR Officer can enter the agreement in term of price and maximum amount that will be used for this particular agreement to AS400 ready for next order. This also gives make benefit when customer order next time in term of accuracy and speedy.

2) Policy

- **Terminate the confirmation policy**

The objective of confirmation policy is to demonstrate that ABC is actively working on their orders and also to show that ABC takes high responsibility of all orders regardless of size. It is very important for existing customer base to know that all orders are well-taken care of. In contrast, this policy does not guarantee that the customers will receive products as ordered on time. Thus, to make a further step, ABC should guarantee delivery time to customers e.g. guarantee within 24 hours delivery service.

However, this policy must be issued after the project is successfully implemented and the results of the project are achieved. Moreover, the new policy will increase customer satisfaction of the company and also reduce the number of urgent order, which always disturb and slow the normal process.

3) System

- **Customize program for Deposit buying in AS400**

Since there is no linkage between AS400 and excel file, which is used to deduct the amount of Deposit buying type. AR officer need to open both AS400 and excel file simultaneously, which make their work more difficult. Thus, the customization

program that can operate in AS400 is necessary. The program will have a function for AR officer to enter some information from agreement such as amount of total money, period of price list, and other information required. Then the program will automatically calculate the total price from guarantee price list in AS400 and the remaining amount when AR officer enter the new orders. This customization program will make the process faster and reduce the human error from deduction amount of money.

Additionally, another customization program to print the contract directly from AS400 is needed. Currently, Sale Administrators have to manually issue the contract agreement for keeping in the company and send to customers after the contract is agreed. The customization program will derive the data that AR officer has entered in AS400 and create the contract in PDF file. Then, contract will be kept in the database and can be printed at anytime.

The benefits of these customization programs will reduce the lead time about 3.5 min /order. Moreover, the programs also minimize the human error both from manually calculate the price or remaining amount and from manually issue the contract.

- **Re-configuration SO screen in AS400**

As mentioned in As-Is analysis, the current configuration of AS400 in SO screen requires many field of data entry. Therefore, the use of default setting should be used to reduce time consumed by keying data in some fields, which the data is not often changed such as credit term, payment method, and contact person. These kinds of data should be derived from Customer Master Setup as same as Customer name and Address, which automatically show when Customer code is entered. After re-configuration the SO screen, it will reduce the lead time about 34 min/day.

- **Design new customer code**

In section 5.1.1, the new customer code is proposed for determine order type purpose. However, the proposed customer code is designed by apply the concept of the best

practice in part numbering system by BPIC (See Appendix B). Since the new code is all numeric, it will speed up and less human error in data entry activity. Moreover, the new code also eliminate the activity that Sale Administrator has to manually remark the different ship-to address for customers who have many ship-to place. From those benefits, the new code will reduce lead time about 51 min/day and minimize the wrong delivery place issue.

- **Assign customer priority**

In order to prevent the time consuming in allocation process, the customer priority must be assigned in the system. The criteria of priority setting depend on type of customer, which are Modern Trade, Project, and Official dealer. Modern Trade customers have the highest priority due to high penalty for stock shortage. For project customers, they have medium priority due to the emergency needs to finish their project. In case of product shortage, customers who have higher priority will get the product first. If the priority is equal, customers who order the product first will get it first (FCFS). So, the priority assignment will help Sale Administrator to make the decision faster to allocate products.

4) People

- **Conduct proper training session for new employee**

With high turnover environment at ABC, it is extremely necessary for the company to prepare new employees so that the operation still runs smoothly. Structured standard training should be set for each department, for example, Sales Administrative needs to be able to use Microsoft Excel, Word and Sales and reporting function in AS400. They also should be familiarized with ABC screen and working process. Structured training must be a mandatory for all new employees and all managers should not interrupt their training time. After training, new employees should be tested on the knowledge to ensure that they are capable to perform their task immediately. Periodic evaluation is highly recommended. By doing so, ABC can ensure that with high turnover rate, they can manage the work to run smoothly. In addition, training also

makes employees feel good about the company. The standard training structure called “the right way” proposed by Laird et al., 2003 is shown below.

This "right way" is called a standard—and one major function of training is to produce people who do their work "at standard." In fact, one simple way to envision how training contributes is to look at the steps by which people control their positions:

- *Step 1: Define the right (or standard) way for performing all the tasks needed by the organization.*
- *Step 2: Secure people to perform these tasks.*
- *Step 3: Find out how much of the task they can already perform. (What is their "inventory" of the necessary technology?)*
- *Step 4: Train them to meet skill gaps—the difference in what they cannot already do and the standard for performing the task.*
- *Step 5: Test them to make certain they can perform their assigned tasks to minimum standards.*
- *Step 6: Give them the resources necessary to perform their tasks.*

- **Manage Transition Period**

Further to the previous recommendation, ABC has to well manage transition period. The implementation of 1 month notice must be strictly followed to ensure that the company has enough time to find and select new candidates for replacement. It will be beneficial if new employee can spend a few days with those who resign. This is due to the fact that most of the knowledge is not in a written form and only be transferred though personal communication. However, ABC should encourage all employees to write down relevant information about customers in the customer profiles and others tips or techniques, which is used in their positions.

5.1.3 Recommendations of Manage Customer Credit Exposure sub-process

From section 4.4.2.3, Waiting and Correction wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

.

1) Process

- **Reduce approval process**

Currently, manage customer credit exposure sub-process takes both Sales Representative and Sales Manager to approve credit expansion which is a time consuming activity when AR Officer needs to contact both. These activities are considered as non-value added activities, which should be eliminated from this sub-process. Thus, it is recommended to set hierarchy of approval so that it will take only one person in approval process in order to shorten lead time. After reduce the approval process, it will reduce lead time about 35 min/day.

2) Policy

- **Change approval policy that using only one person to approve**

Refer to the previous recommendation, the hierarchy of approval is set by using amount of credit expansion required as a criteria that each level is able to authorize. For example, Sales Representative has authority to approve credit expansion up to 30% of the pervious credit limit while Sales Manager has authority to approve credit expansion more than 30% of the pervious credit limit. This makes AR Officers do their job easier when they contact person for approval. Moreover, this emphasizes responsibility in authorizing credit expansion.

3) System

- **Establish schedule to update database**

Many problems occur because master file such as customer and pricing master file are not updated. For example, there are a lot of credit expansion approval because the credit limit was set when customer open the account for the first time which was long time ago. Thus, ABC should update all master file on a regular basis e.g. every 6 months or when it is necessary. Pricing master file may need to be updated more often, for example, every month or every 3 months.

4) People

- **Assign A/R officer to specific account**

At present, the activity to contact Sales Representative and Sales Manager for credit expansion approval is assigned in a broad way which leads to a bouncing in work responsibility. ABC is recommended to assign specific AR Officer to specific account so that the work is clearly divided and make the process more efficient. Once the responsibility is clear, it is faster and easier to follow the issue if there is any delay or problem with credit expansion for that particular account.

5.1.4 Recommendations of Check Inventory Availability sub-process

From section 4.4.2.4, Waiting, Conveyance, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

1) Process

- **Eliminate inform customer and revise order activities**

Without Backorder process, Sales Administrator spends time to inform customer if products are not available once they check at process and additional time to revise order. Thus, Backorder process, which will be mentioned in section 5.1.4, will help to eliminate the activity of informing customers and revising SO which lead to reduce the overall delivery lead time.

- **Print picking list by Warehouse Administrator**

Presently, Sales Administrator are responsible for printing documents which are used in picking process which causes inefficiency in the process because it takes time to carry the documents from office to warehouse and also has a chance that documents are lost during delivery to warehouse. Thus, ABC should change the responsibility in printing documents used in picking to be Warehouse Administrator task. This will benefit total process because Warehouse Administrator works closely with Warehouse people and have more understanding is solving issues if some problems occur. It will also create a teamwork environment among warehouse people since they manage the activity from start to end.

2) Policy

- **Change policy to use Picking List instead of Invoice**

Presently, the document used for picking purpose is invoice in which party involved are dealing with approximately 250 documents per day. In order to improve on efficiency, picking list will be a replacement of invoice. Picking list is a list that combine many invoices for picking purpose so information that are not relevant to picking process such as customer address are not included in picking list. Picking list will contain only relevant information and arranged/sorted in a way that is convenience for warehouse people. With batch processing that mentioned earlier,

picking list can be sorted by Bangkok and by UPC which make it easier for those who consolidates the product for uploading into vehicles.

Using picking list has another big benefit to revising document process. Currently, invoice needs to be revised if products are not found in the warehouse because invoice is already printed out for picking purpose. By using picking list, invoice does not need to be printed out until products are completely picked. Therefore, it totally reduces lead time used in revising process.

- **Using Backorder policy**

"Backorder: An unfilled customer order. A backorder is demand (immediate or past due) against an item whose current stock level is insufficient to satisfy demand." (www.supplychainmetric.com)

Backorder is refers to the status of products on SO that is presently not in stock, but it will be sold or delivered when it become available. Currently, ABC does not use the backorder policy. Sale administrators have to revise or cancel orders, which can not be fulfilled. These activities slow the whole order-to-delivery process. ABC is recommended to use the Backorder policy instead of revise or cancel orders. Once the product is back in stock, products will be allocated first to backorders. These orders are then available to be fulfilled in the normal process. The benefits of using Backorder policy will help in reducing total lead time about 73 min/day.

3) System

- **Using of Backorder menu in Sales function of AS400**

Currently, Backorder menu is already available in Sales function of AS400 but it is not being used by ABC because there is no policy for backorder. Therefore, the recommendation is to use Backorder menu which will help facilitate order for out of stock items. Once the item is back in stock, the order will automatically be booked and allocated to the backorder status first. Due to the new menu usage, ABC staffs

need to be trained on how to use the required functions in backorder menu, which take approximately 2 hours.

4) People

- **Conduct proper training session for new employee & Manage Transition Period**

As mentioned in section 5.1.2, the training session for new employee and well manage transition period are required to keep the company to run the business smoothly. However, each sub-process has different kind of training session. It depends on key responsibility of each department.

"Training and development, though primarily concerned with people, is also concerned with technology and processes, or the precise way an organization does business." (Laird et al., 2003)

5.1.5 Recommendations of Plan and Manage Delivery sub-process

From section 4.4.2.5, Waiting, Conveyance, Correction, Overprocessing and Knowledge disconnection wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

1) Process

- **Separate consolidation area**

Unorganized consolidation area is one of the main issues, which slow process in warehouse. ABC is recommended to organize consolidation area into 3 main areas, which are BKK-Internal, BKK-3PL, and UPC. By doing this, products in each area will be picked easily by Logistics Officers of each route. This will reduce human error from picking wrong product and make less confuse to employees. Moreover,

Logistics Officers can attach sticker for UPC orders, which will be delivered by co-loading transporter, faster and easier. The new picking list report also support the batch picking method by combining the grouping rule and sorting rule to match with this layout. With separate consolidation area, delivery lead time will be reduced about 15 min/day.

- **Pick products by delivery type and location**

As mentioned earlier, ABC will use picking list instead of invoice in order to pick products in the warehouse. Picking list contains only relevant information and can be arranged /sorted in the way that is easy for those who use the document. With the separate picking list by delivery type and location, Logistics Officer can pick the same products from different orders in one time and then bring to specific consolidation area. This recommendation will minimize the transportation (Muda) in picking activities, which will reduce lead time about 3.5 min /order.

- **Minimize usage of sticker tag**

Currently, ABC attaches sticker tag on the products, which are delivered by 3PL and to UPC area. Since 3PL transporter, who deliver products in BKK area, works as same as internal transporter, sticker tag for 3PL-BKK is unnecessary. The purpose of sticker tag is to protect the product that might be lost during delivered by co-loading transporter. So, using sticker tag only for the products, which are delivered to UPC area will help in cost saving and speed up the operations. By doing this, ABC can reduce approximately 34 sticker tags/day.

- **Using of roll container**

Roll Container is one type of bulk material handling equipment, which is used in many logistics companies. Roll container will help in many activities in warehouse operations, especially in loading activity. Roll container is significantly helping in loading activities both loading and unloading products from vehicles. It also helps in reducing products damage during deliver to customers. Moreover, using of Roll

Container allows the Logistics Officers to do their work outside the vehicle, which easier to manage and arrange products before loading into vehicles. Logistics Officer can separate orders by wrapping group of products per order for each customer. This will minimize the human error when deliver products to each customers. There are many types of Roll Container, which is shown in figure below.

Figure 5.2: A Frame 2 Sided

Figure 5.3: A Frame 4 Sided

Figure 5.4: Demountable

Figure 5.5: Security Roll Container

Source: www.clares.com

Each type of Roll Container is used for specific reason. It depends on purpose of usage. To select the suitable type of roll cage, cost and benefit analysis needs to be done before making the decisions. Using of roll container will reduce lead time in this sub-process about 30 min/day.

- **Relocate products in Warehouse**

Without good product location in the warehouse, warehouse officer spend a lot of time to find and pick products. Thus, it is recommended to have a well-managed location for process efficiency. In general, each product type should have specific location for install and fast-moving product should be located in a more convenience area such as lower level in the stack and nearer to the consolidation area. Warehouse layout planning needs further investigation before implementation.

"*A good warehouse layout can (1) increase output, (2) improve product flow, (3) reduce costs, (4) improve service to customers, and (5) provide better employee working condition. The optimal warehouse layout and design for a firm will vary by type of products being stored, the company's financial resources, competitive environment, and needs of customer. In addition, the warehouse manager must consider cost trade-offs between labor, equipment, space, and information.*" (Lambert et al, 1998)

- **Create Work Instruction for Route and Load planning (Short-Term plan)**

ABC is now based on individual knowledge and experience to execute route planning and load planning. As mentioned earlier, the problem will occur if the person with the knowledge and experience resign. Therefore, ABC should prevent the case by creating work instruction that consist of way / method to execute route planning and loading planning. Work instruction must be written by those with experience from a brainstorming session to ensure completeness. Some ideas such as using fixed routes instead of variable routes for some shipments or changing the customer delivery hours to avoid the peak hours, which can improve the efficiency of delivery process, should be included in the work instruction also.

Moreover, work instruction should contain as much information as possible such as how to pre-scheduling shipments into specific area to increase vehicle's load or how to reduce the frequency of delivery to reduce level of transportation to deliver the same amount of products.

"The benefits to a carrier of improved routing and scheduling include greater vehicle utilization, higher levels of customer service, lower transportation costs, reduce capital investment in equipment, and better management decision making." (Lambert et al, 1998)

2) Policy

- **Issue Cycle count policy**

Many products cannot be found in the warehouse even if there is the amount shown in the system. As mention in Chapter 4, this is a result of discrepancies in actual stock and system due to lack of regular cycle count. The concept of cycle-counting from case study by Deloitte Consulting is described as follows:

Inventory cycle-count is a form of Quality Assurance for inventory Management. Counting inventories on a regular basis throughout the year (cycle-counting) combined with a process for continuous improvement in inventory accuracy is the best methodology for achieving accurate inventories.

- *The accuracy of inventory records is the "product" of the inventory keeping practices i.e. the records are only as accurate as the record transactions themselves. As such, procedure must be in place not only to assure that expected results are achieved, but to provide feedback so that causes of error can identified. The quality assurance procedure is known as cycle-counting.*
- *Attaining and maintaining inventory record accuracy is as important especially as we lower the inventory level.*
- *Controlling the inventory is not an exercise in technology, but a simple exercise in quality assurance- that is, conforming to expectation.*
- *Cycle-counting is the Quality Assurance procedure by which errors can be properly identified and resolved so that accuracy can be achieved.*

There are three basic methods of cycle-counting, i.e. Control Group, Random & Ranking

- *The Control Group Cycle-Counting is devised to identify the root cause of the errors.*
- *Random Cycle-Counting is geared towards measure conformance.*
- *Ranking Cycle-Counting is typically based on a Pareto analysis, i.e.*

    - *"A" rank items (responsible for the top 80% of sales) count six times per year*
    - *"B" rank items (responsible for the next 15% of sales) count three times per year*
    - *"C" rank items (responsible for the next 4% of sales) count twice per year*
    - *"D" rank items (responsible for the last 1% of sales) and products with no sales count once per year*

3) System

- **Customization program for linking AS400 with warehouse system**

Delivery order (DO) is now manually recorded and printed by warehouse team after picking. The recommendation is that recording and printing delivery order activity should be linked with Sales order so that it does not require manual work. From Sales Order to Delivery Order, in the case that product are fully picked, the amount will be the same while in case of partial picked, the Delivery order quantity will be less than ordered. With customization, AS400 should be able to convert the Sale Orders, which are already booked, allocate, confirm in picking activity, and print out invoice into specific DO. Then, the program also allows Warehouse Administrator to create the report that group DO documents for each vehicle. This program is used for eliminating the record delivery route for each vehicle activity, which will reduce lead time about 90 min/day.

- **Reconfiguration customer master database**

This is information that is attached to customer but has not put in the customer master file; therefore, it is unable to utilize that information effectively. One example is customers that will be delivered by 3PL need to separate when printing picking list. With the reconfiguration, the information is recorded in the system and can be used easily to improve efficiency in the process. This allows ABC to eliminate sort delivery type activity which currently is done manually.

- **Work around AS400 and Customization report for route planning purpose**

Since there are some fields in customer master database not using for any purpose. ABC is recommended to work around or apply "Customer sub-group" field as customer route. This information will be used in route planning purpose. Then, the customization report will be derived the data from SO and this field, then grouping customer orders, which have the same route, into the report. However, this report is only the support document for making the decision on route planning. Warehouse Supervisor needs to review and make the adjustment on vehicle utilization before send to Logistics Officers to sort order in the given route.

This customization report will reduce route planning time about 1 hour /day. Moreover, this report is very useful and easy to understand when experienced employees training their people.

- **Customization report for Picking List**

As mentioned earlier, ABC will change the document for picking products from Invoice to Picking List. Due to the fact that products delivered in different delivery type and area must be separated since there are some processes that are slightly different so picking list must be organized in this way. Thus, the customization report for Picking List is required. Picking List report will print all picking line details in a picking batch. This report is used by Logistics Officer to collect all items included in shipments. The details in the report are derived from Sales functions in AS400.

Picking List report can be sorted or grouped in many forms such as group by transporter (Internal or 3PL), group by Area (BKK or UPC), group by delivery date, sort by Sale Order number, and sort by customer priority. Moreover, the report can be combined the grouping rules and sorting rules by enter relevant parameters to make the report into the easiest form to use by different groups of user. However, the report can be printed only for the orders that are already booked and allocated.

- **Customization program for automatically print Delivery document and Map**

Currently, Delivery document and Map are print manually due to lack of customized program. With manual work, there is a high chance of human error because there is more than one type process to do. Customization is set to print documents automatically at the same time as invoice is printed. In addition, refer to customer master data documents are printed according to the usage based on type of delivery and location:

  - Bangkok customers delivered by ABC vehicle: No need to print documents
  - Bangkok customers delivered by 3PL vehicle: Print map
  - All UPC customers: Print delivery document and map

- **Implement Route and Load planning program (Long-Term plan)**

Refer to the new technology that helps optimizing routing and loading plan, it is initially recommended to implement the software that helps optimizing routing and loading plan. Further investigation for cost and benefit study is needed before implementation since the cost of implementing new software is high. This is why this recommendation is for long-term purpose while creating work instruction for route and load planning is the short-term recommendation.

4) People

- **Conduct proper training session for new employee & Manage Transition Period**

Again for people category, the proper training session and good manage transition period is recommended. In this sub-process, warehouse people are required to train about picking product, driving fork lift, or using of new material handling equipment (roll container). The experienced people are required to be a trainer for new employee because most of the jobs in warehouse use experiences more than educations. Experienced people will teach about specific tips and techniques, which make new employee working properly, efficiently, and safety.

5.1.6 Recommendations of Manage Transportation sub-process

From section 4.4.2.6, Waiting, Correction, and Knowledge disconnection wastes are the main problems of this sub-process. Therefore, solutions or recommendations, which are used to minimize these wastes, will follow to the initiatives of this sub-process.

1) Process

- **Using of roll container**

As mentioned before in section 5.1.5, the roll container will be used as material handling equipment to support logistics activities. This equipment will speed up the unload product from vehicle activities, especially for products that delivery to UPC area at central DC.

Currently, Drivers and Logistics Officers have to unload products to many drop point, because each co-loading transporter is located in many location in central DC. They have to manually unload products in piece by piece, which is time consuming activity.

With roll container, Drivers and Logistics Officer able to unload all products one time and easily move the roll container to deliver products to many co-loading transporter. For BKK areas, there are some situations that customers' dock is full from loading or unloading other products. Drivers have to wait until those activities finished, which make the whole trip delay. With roll container, Drivers and Logistics Officer allow to unload the product in other nearby areas and then move the roll container to deliver products to customers. Using of roll container will speed up the whole Manage Transportation sub-process about 1 hour/day, which will increase the possibility to make the second trip for each vehicle.

2) Policy

- **Establish Contingency Plan for Accident or Natural disasters**

Even if the extraordinary situation does not happen often, it is worth establishing contingency plan because the cost is extremely high if the situation happen and not managed properly. *"Contingency plans for each organization will differ in their structure and level of detail. Therefore in developing a program of unannounced testing, the parts of the plan to be included will depend on how your plan is currently structured."* (Rothstein, 1994)

There are 10 tips on planning for a crisis, and handling emergency shipping when a major disruption happens, from Joel Childs, vice president of marketing, FedEx Custom Critical (www.inboundlogistics.com)

(1) Designate a business continuity point person.

(2) Define all possible disruptions to your business.

(3) Hope for the best but plan for the worst.

(4) Know where to get help.

(5) Understand all your transportation options.

(6) Test your plan.

(7) When an emergency strikes, put your plan into action.

(8) Even the best-laid plans can go wrong.

(9) Stay current on factors that can change your plan.

(10) If you don't have a contingency plan, punt!

- **Establish Service Level Agreements (SLAs) with 3PL**

"SLA is a formal negotiated agreement between two parties. It is a contract that exists between customers and their service provider, or between service providers. It transcripts the common understanding about services, priorities, responsibilities, guarantee, etc. with the main purpose to agree on the level of service." (en.wikipedia.org, 2007)

Since ABC does not have any contracts or agreements with 3PL transporter, ABC can not manage and evaluate their performance. ABC is recommended to establish SLAs with all 3PL who have worked for the company. However, SLA cannot guarantee that the company will get the service as describes in the contract agreement. The SLA is only a communication tool that specified what will happen if something go wrong. For example, there are some penalties when 3PL transporters perform their jobs under performance, which are already agreed in SLAs. *"SLAs help to mitigate risk by clearly stating the responsibilities of the various roles involved in the consumption and provision of services, thus managing expectations and helping to avoid possible contractual disputes."* (Hiles, 2000)

Form the survey of Association for Transportation, Law, Logistics and Policy (ATLLP), the most common performance aspects in SLAs are shown in table below.

Table 5.1: Performance aspects most commonly measured

Activity Measured	% of Shipper or 3PL Measuring Activity
On-Time delivery	37.8
On-Time pickup	25.1
Loss and Damage level	13.5
Overall system cost reduction	10.8
Satisfaction of shipper's customer	10.8
Cycle Time reduction	7.2
Others	7.2

Source: You can't manage what you don't measure, Logistics Management and Distribution Report; May 1998, Thomas A Foster

- **Set up Key Performance Indicators (KPIs) and Motivation System**

Refer to previous recommendation, SLAs are used with measure and evaluate 3PL transporters performance. Therefore, Key Performance Indicator will be used as a tool to measure and evaluate ABC performance.

ABC is recommended to define KPIs, which reflect to critical success or company objectives. For this project, the main objective is about an efficiency of delivery performance. Most common KPIs, which is used to measure delivery performance called Perfect Order. *"The perfect order is achieved when customer's service requirements are met in full."* (Christopher, 1998)

Performance measurement factors, which are used to measure the perfect order, will show in table below.

Table 5.2: Performance measurement factors of Perfect Order

Factors	Description
On-Time	Percentage of success in delivery product to customer on time.
In-Full	Percentage of success in delivery product to customer in full order.
Error-free	Percentage about the mistake in documentation, labeling, and damage to product and package.

After the KPIs and method of measure has been defined a clear target must be set and understand by everyone, which will make every individual can take actions towards accomplishing it. Additionally, motivation system is required to motivate employees to achieve their target and improve their morale. Figure 5.6 shows the motivation system, which is suggested by Jim Cairo

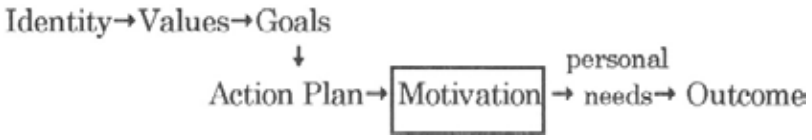


Figure 5.6: Motivation System

Source: Motivation and Goal-Setting: How to Set and Achieve Goals and Inspire Others, Jim Cairo

ABC is recommended to use reward system in order to motivate their employees. Reward system is more than just bonus plan or incentive. It can also about promotion, recognition, or only a simple thank you. By doing this, you help employees directly connect the reward with behavior and higher performance they've attained.

3) System

- **Establish schedule to update customer database**

As mentioned earlier in section 5.1.3, all databases in the company need to be updated. In this sub-process, customer database is not updated properly, which make some problems to drivers and lead to long delivery lead time. So, ABC is recommended to update all databases on a regular basis about every 3 or 6 months.

4) People

- **Make an agreement on people with 3PL**

In this sub-process, new employees of 3PL transporter always perform their jobs under performance. Then, ABC is recommended to make an agreement with 3PL transporter to train their new employees before sending to the company. The new Drivers or Logistics Officers should able to perform their works as well as the old one. Additionally, SLAs will still be used to measure and evaluate their performance with no excuse about new employee issue.

5.2 To-Be process

In this section, To-Be process or the new process design of order-to-delivery process will be proposed. To-Be process will be designed by reengineering team. In To-Be process, non value-added activities will be minimized. Many customization programs and reports will be used to reduce human errors, speed up manual activities, and also help in decision making processes. Brainstorming session will be established for applying all recommendations into the new process design to reduce delivery lead time and improve the efficiency of order-to-delivery process, which are the main objectives of this thesis.

Same as in As-Is process flow, To-Be process flow of order-to-delivery process will be shown in IndustryPrint^{TM} format. In To-Be process, there are still 2 main processes, which are Perform Order Management (OM) and Manage Logistics (LO), and the same 6 sub-processes. After all figures of To-Be processes flow are shown, the explanation of each sub-process will be discussed.

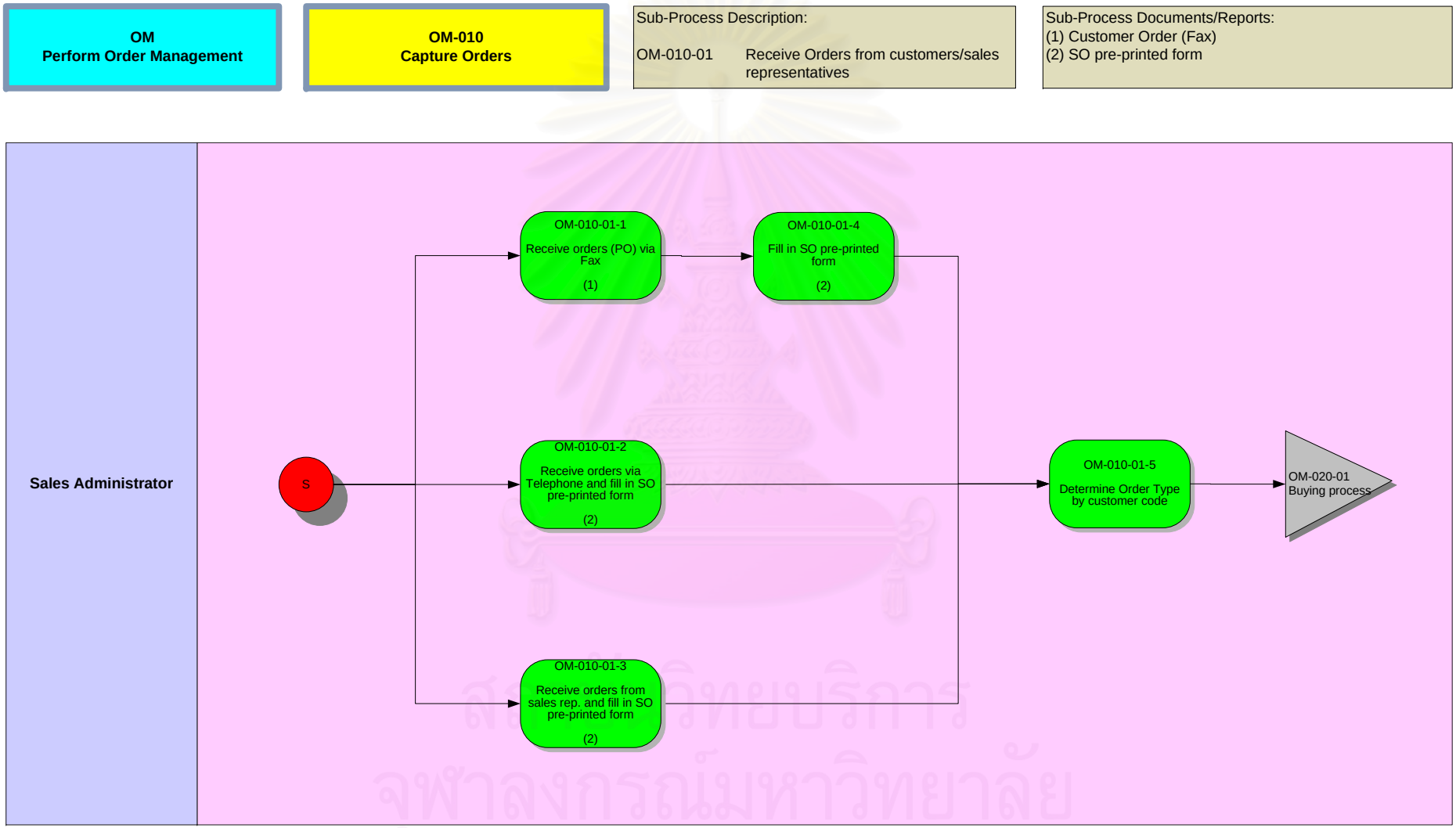


Figure 5.7: New Capture Order sub- process flow

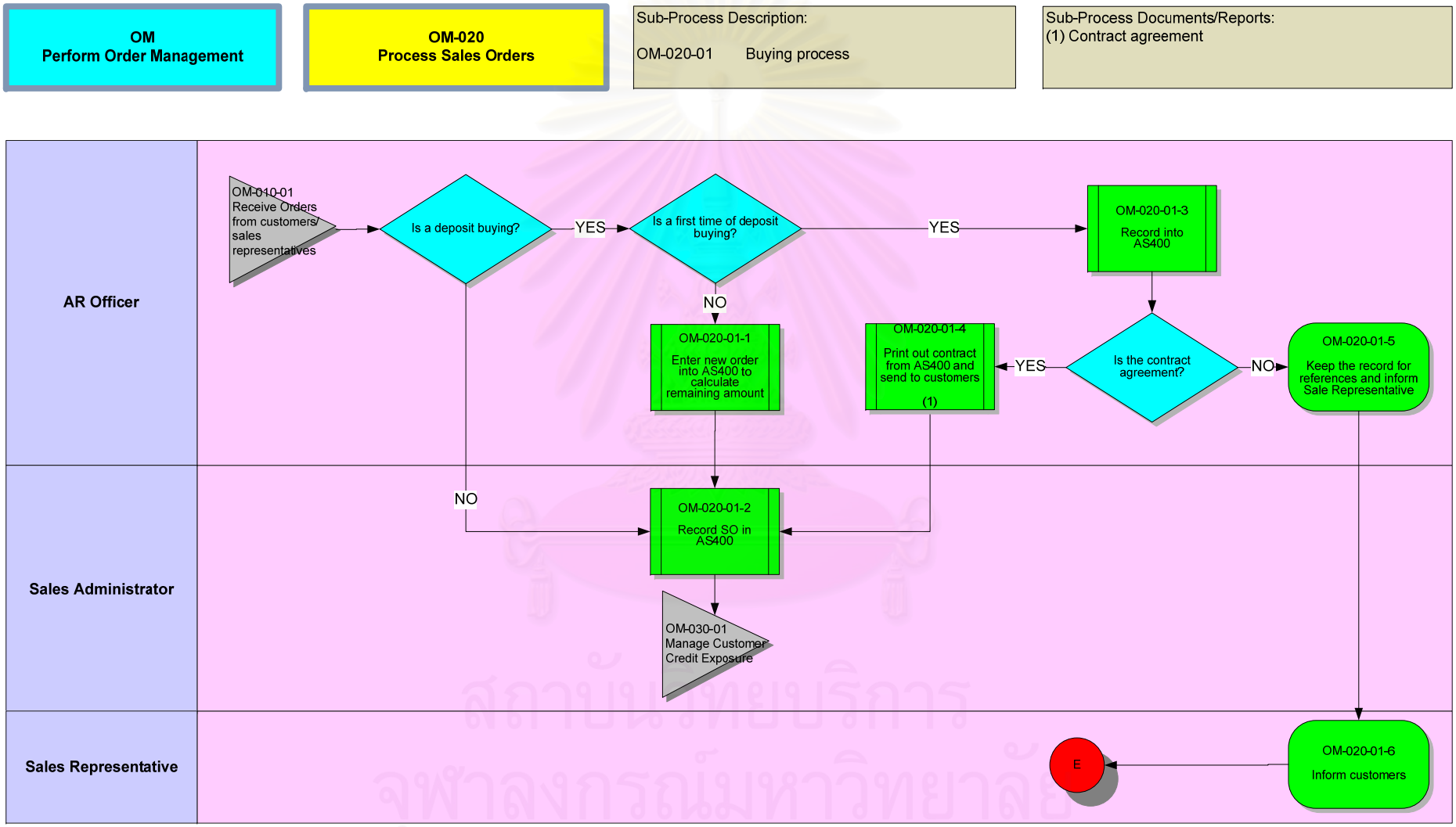


Figure 5.8: New Process Sale Orders sub-process flow

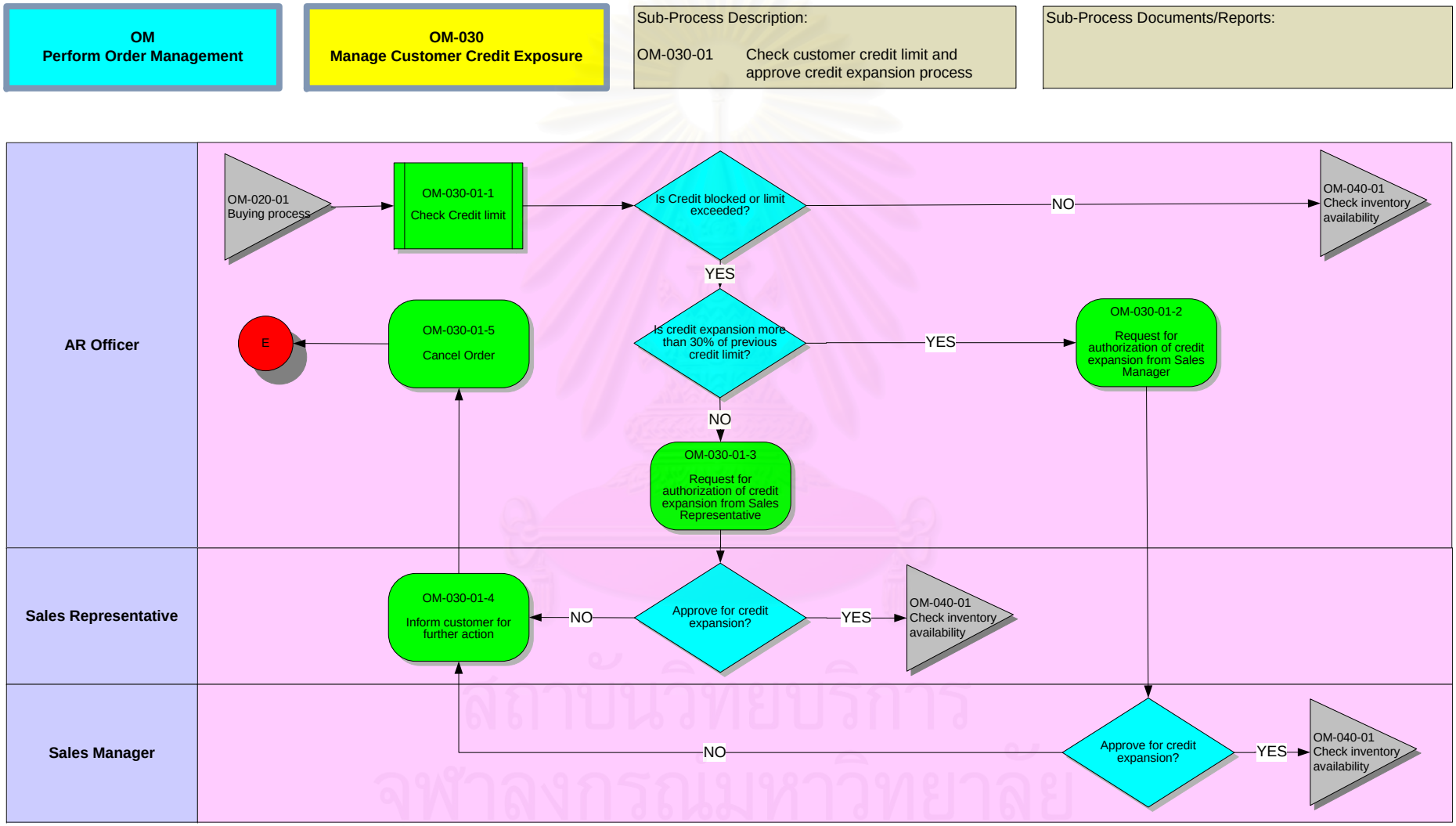


Figure 5.9: New Manage Customer Credit Exposure sub-process flow

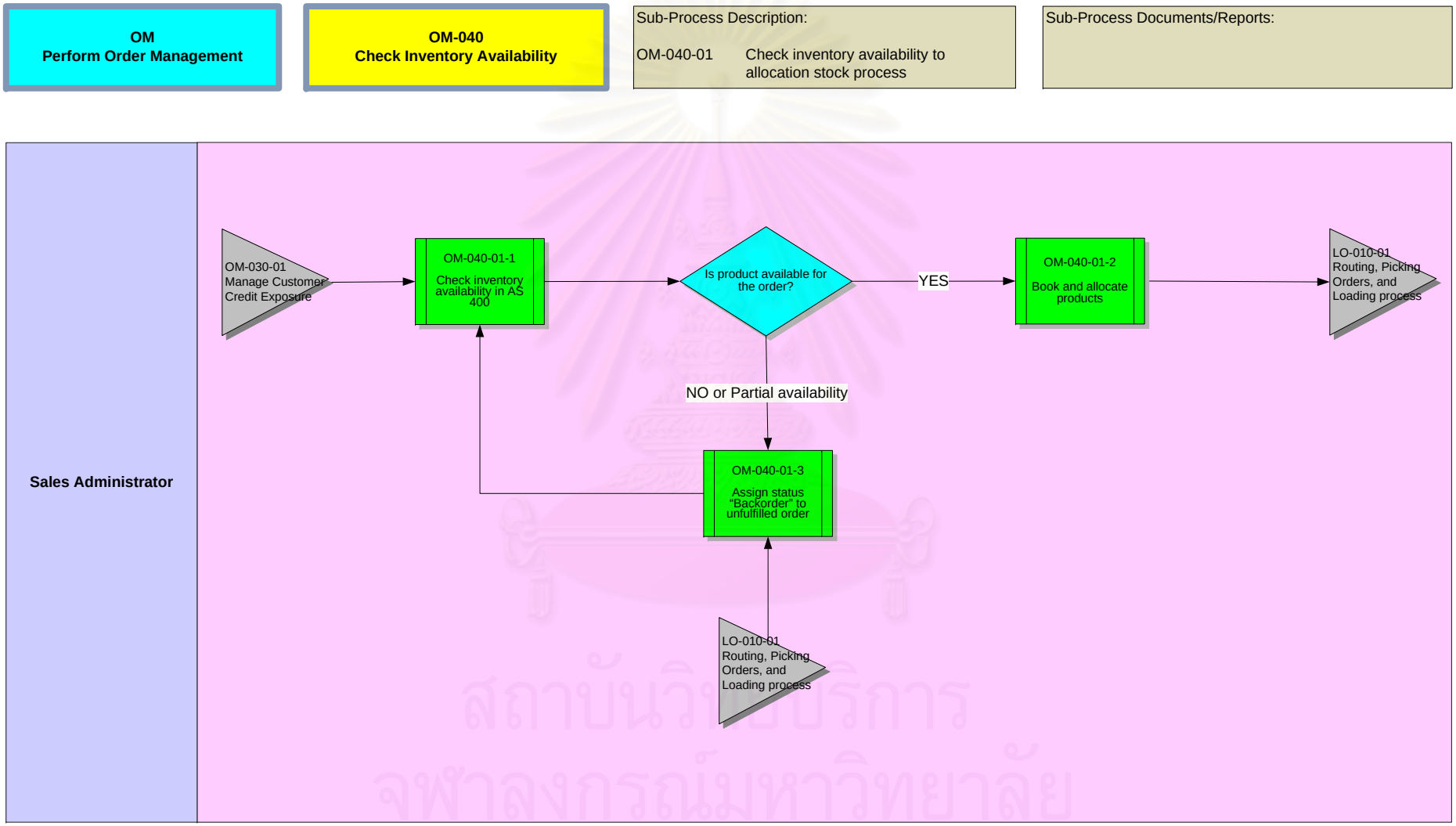


Figure 5.10: New Check Inventory Availability sub-process flow

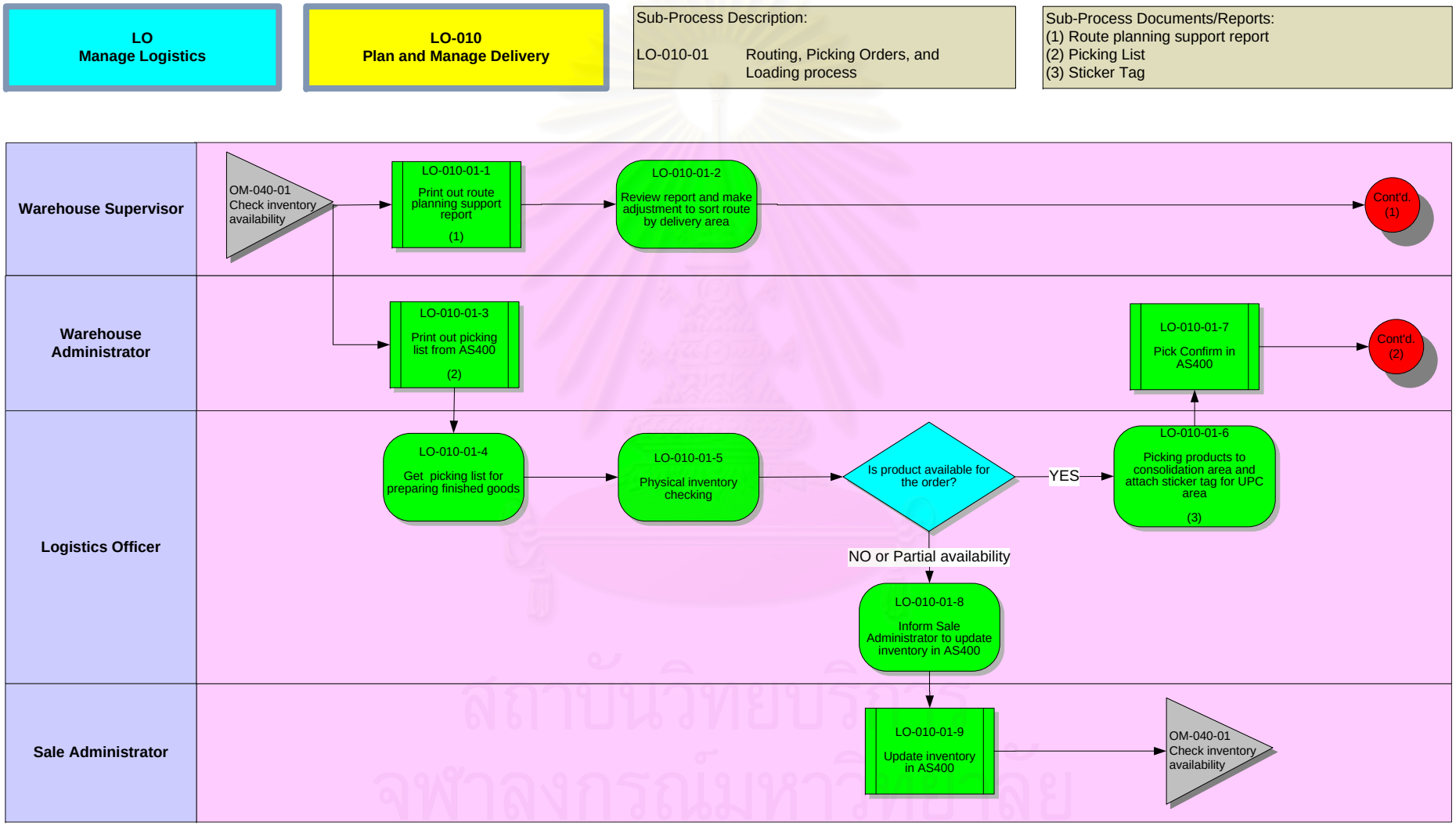


Figure 5.11: New Plan and Manage Delivery sub-process flow (1)

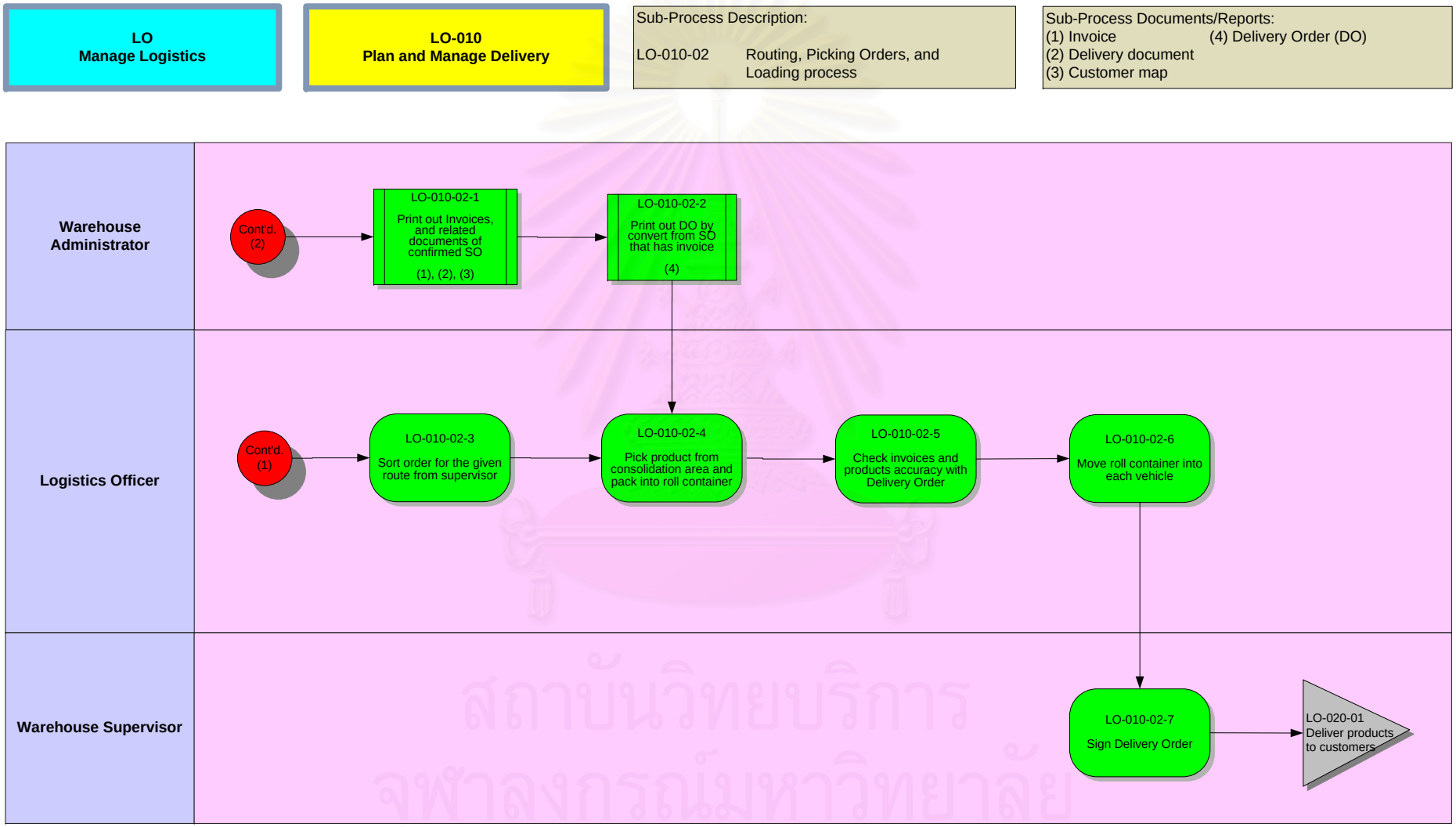


Figure 5.12: New Plan and Manage Delivery sub-process flow (2)

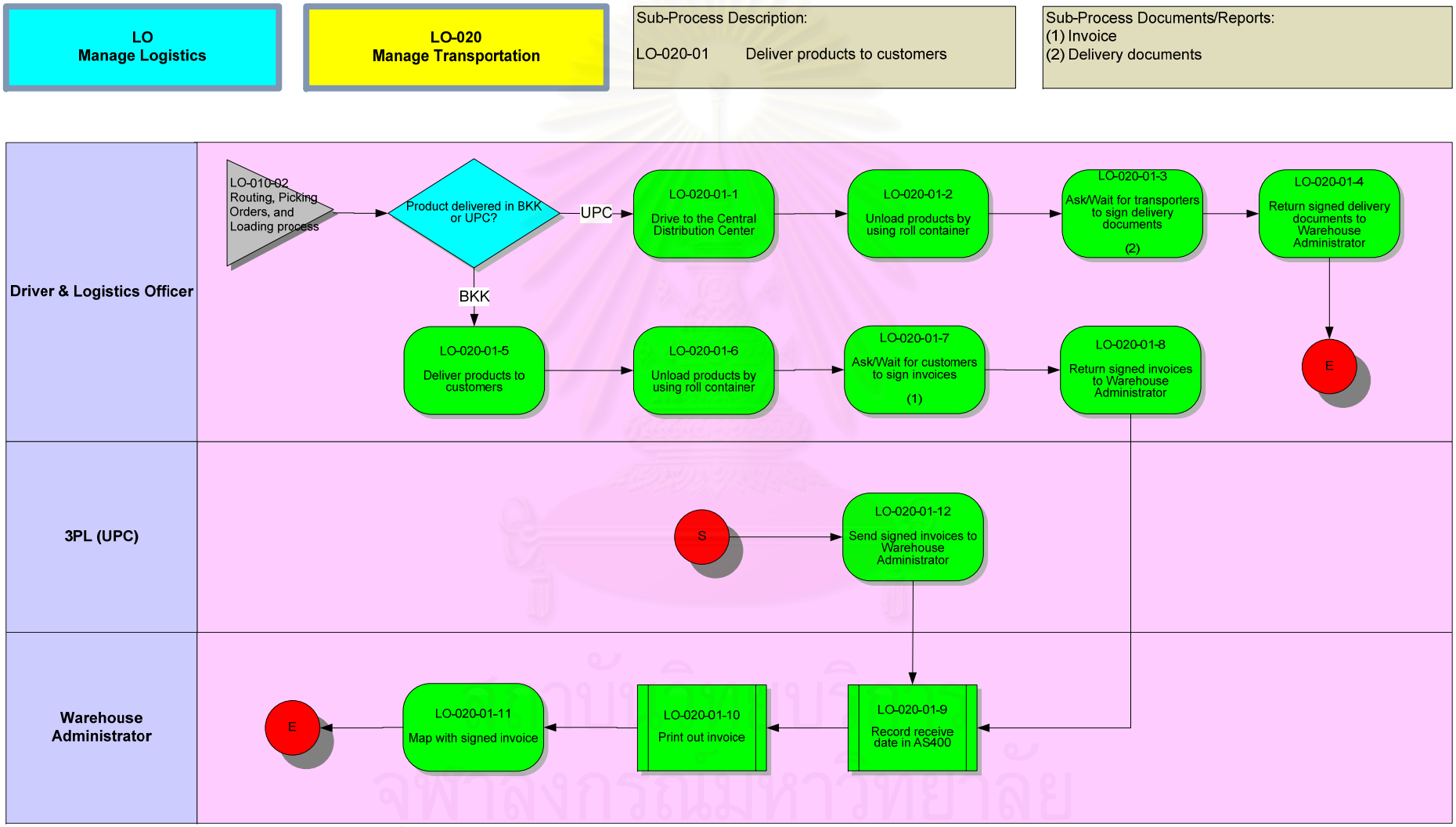


Figure 5.13: New Manage Transportation sub-process flow

1) Sub-process OM-010: Capture Order

In new capture order sub-process, SO pre-printed form will be used to record orders immediately when Sale Administrator receive orders via telephone from both customers and Sale Representatives, while orders via fax are needed to record directly into the pre-printed form. With new customer code, Sale Administrator is able to easily determine order type.

2) Sub-process OM-020: Process Sales Orders

For new process sale orders sub-process, there are still 2 types of order type, which are deposit buying and standard buying. For first time deposit buying process, AR Officer will record the information directly into AS400 without any company form. After contract is agreed, AR Officer will recheck the information and print out the contract for sending to customers. For old deposit buying customers, AR Officer will enter product code and quantity into customization program to calculate the total price for deducting with the old remaining amount. Then, all orders will go through standard buying process.

In new standard buying process, Sale Administrator will only record data from SO pre-printed form into AS400. With new configuration in customer master database, Sale Administrator will only enter customer code, product code, quantity of each item. and required date.

3) Sub-process OM-030: Manage Customer Credit Exposure

After sale orders are created in AS400, the credit limit of all orders will be checked. If that order exceed credit limit within 30% of current credit limit, AR officer will inform Sales Representative to approve the credit expansion for those orders. In the other hand, if that order exceed credit limit more than 30% of current credit limit, Sale Manager will be the person who approve the credit expansion for those orders. In the case that the credit line is not approved, that order must be cancelled.

4) Sub-process OM-040: Check Inventory Availability

Once the order is checked for credit limit, product availability will be checked in AS400. All sale orders will be sorted by customer priority for booking and allocating the products. The “Backorders” status will be assigned to the lines that can not be fulfilled. Once products are available in stock, products will be allocated first to the backorders status. Then, products will be delivered to customers as fast as possible.

5) Sub-process LO-010: Plan and Manage Delivery

After products are booked and allocated, Warehouse Administrator will print out the consolidated picking lists, which are sorted by customer priority and separated into 3 main types of delivery and location; BKK-Internal, BKK-3PL, and UPC. Then, Logistics Officer will get these picking lists to perform batch picking and bring products to separated consolidation areas follow by picking list. Then, the sticker tag will be attached to products in UPC area, which will be delivered by co-loading transporter. After picking products for all orders, Warehouse administrator will perform activity “Pick confirm” in AS400 to confirm status of orders, which are already picked. In this stage, if products are not available in the stock, Logistics Officer will inform Sale Administrator to update the data in AS400 and assign status “backorders” to unfulfilled order lines. At the same time, Warehouse Supervisor will print out route planning support report, which will group orders in the same route together. Then, Warehouse Supervisor will review the report and manually adjust customer orders for better vehicle utilization of each route before sending to Logistics Officers. Next, Logistics Officer will sort orders from the given routes, pick products from consolidation area to pack in roll container, and move to staging area for checking products with DO. After pick confirm, Warehouse Administrator will print out invoice, delivery document, and/or customer map for each customer order depends on type of delivery and location. Then, Delivery Order (DO) will be printed by convert from SO, which already get and print invoice (Order status = “Invoicing”). Invoices and products will be checked with DO before move the roll container into each vehicle. Finally, Warehouse Supervisor will sign every DO as a final check before deliver products to customers.

6) Sub-process LO-020: Manage Transportation

Same as the current process, all products will be delivered to their destination and complete the documents. UPC products will be delivered at central distribution center, then wait for co-loading transporter to sign delivery document and return signed document to Warehouse Administrator. BKK products will be sent directly to locations, which suggested by route planning, then wait for customers to sign invoice and return signed invoice to Warehouse Administrator. Once the signed invoice is return, received date is recorded, original invoice is print out to map with the signed one and end the total process.

However, roll container will be used to speed up all activities in this sub-process. As mentioned in recommendations section, roll container allow Driver and Logistics Officer to unload products faster and easier. It also allows Driver and Logistics Officer to unload products in unspecific areas. These will increase the possibility to make the second trip for each vehicle.

5.3 High Level Recommendations

In this section, all recommendations are prioritized based on impact/benefits to the business and ease of implementation, which will be shown in form of four quadrant priority chart. All recommendations will be re-arranged into new numbering format, which are shown in table below.

Table 5.3: List of recommendations by area

Area	No.	Recommendations
PROCESS	1	Using of SO pre-printed form
	2	Eliminate fill in and recheck Deposit buying form activities
	3	Eliminate Preview stock availability in AS400
	4	Issue contract by AR officer instead of Sale Administrator
	5	Reduce approval process
	6	Eliminate inform customer and revise order activities
	7	Print picking list by Warehouse Administrator

Area	No.	Recommendations
PROCESS	8	Separate consolidation area
	9	Pick products by delivery type and location
	10	Minimize usage of sticker tag
	11	Using of roll container
	12	Relocate products in warehouse
	13	Create Work Instruction for Route and Load planning
POLICY	14	Consolidate order for each customer
	15	Separately receive order between BKK and UPC
	16	Terminate the confirmation policy
	17	Change approval policy that using only one person to approve
	18	Change policy to use Picking List instead of Invoice
	19	Using Backorder policy
	20	Issue Cycle count policy
	21	Establish Contingency Plan for Accident or Natural disasters
	22	Establish Service Level Agreements with 3PL
	23	Set up Key Performance Indicators and Motivation System
SYSTEM	24	Customize program for Deposit buying in AS400
	25	Re-configuration SO screen in AS400
	26	Design new customer code
	27	Assign customer priority
	28	Establish schedule to update database
	29	Using of Backorder menu in Sales function of AS400
	30	Customization program for linking AS400 with warehouse system
	31	Reconfiguration customer master database
	32	Work around AS400 and Customization report for route planning
	33	Customization report for Picking List
	34	Customization program for auto-print Delivery document and Map
	35	Implement Route and Load planning program
PEOPLE	36	Conduct proper training session for new employee
	37	Manage Transition Period
	38	Assign A/R officer to specific account
	39	Make an agreement on people with 3PL

Next, each recommendation will be grouped in category and located in four quadrant priority chart, which describes “Impact to ABC VS Ease of implementation for each recommendation”. The impact to ABC is about benefits, which ABC will gain from the particular recommendation, while ease of implementation is about resources usage, time duration, and complexity to implement each recommendation. After brainstorming session, reengineering team assigns each recommendation into four quadrant priority chart, which is shown in figure below.

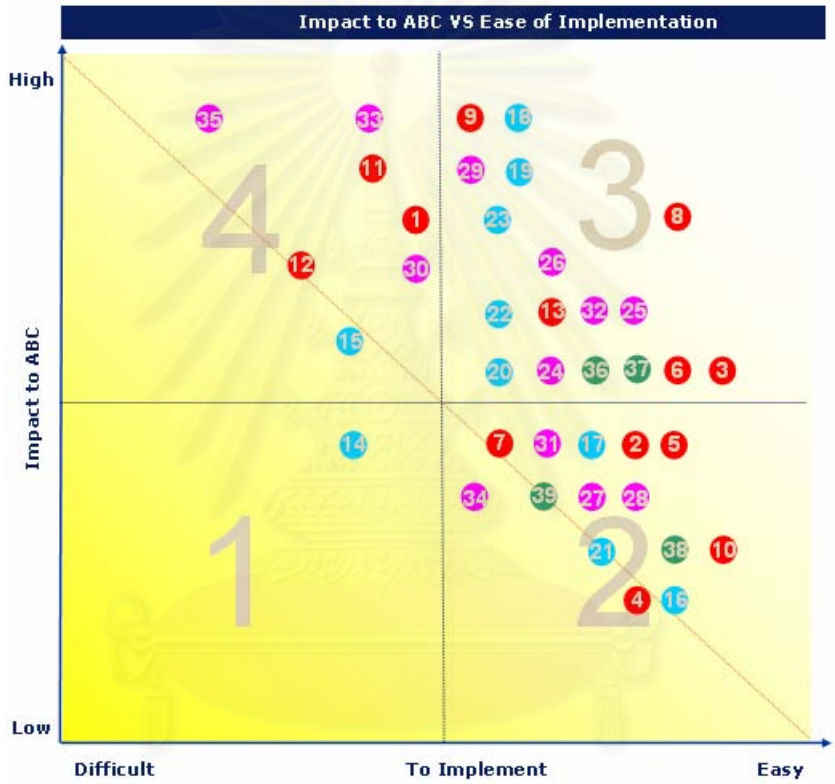


Figure 5.14: Four Quadrant Priority Chart

From figure above, most of recommendations are assigned into quadrant 3, which easy to implement and give high benefit to ABC. For example: Separate consolidation area (8): warehouse only draws the line to separate current consolidation area into 3 areas. This will not only reduce time and human error in picking activities. Issue Cycle count policy (20): there is standard method to perform cycle counting activities. Cycle counting will improve inventory accuracy of the company. Reconfiguration SO screen in AS400 (25): Sale Administrator only correct the configuration in AS400 to derive the default value from customer master database. This will reduce the record time for all sale orders.

Many recommendations are also assigned into quadrant 2, which easy to implement and give quite high benefit to ABC. For example: Eliminate fill in and recheck Deposit buying form activities (2): AR officer only directly record information of deposit buying customer into AS400. This will reduce lead time about 1 hour/day. Reconfiguration customer master database (31): Sale Administrator only correct and/or add customer database in AS400. This information will be used to many customization reports.

Some recommendations are assigned into quadrant 4, which difficult to implement but give high impact to ABC. For example: Implement Route and Load planning program (35): in order to implement this program, ABC requires expert to implement the program, high skills employees, high cost of investment, and appropriate time to implement. However, this program able to automatically sort route, sort order, and optimize transportation cost, which will give many benefits to the company. Using of roll container (11): ABC need to study about the specification of roll container and investigate price from many suppliers before select the proper type of roll container. Roll container will give many benefits to warehouse operations and make Logistics Officers easily perform their jobs.

Finally, only one recommendation is assigned into quadrant 1, which difficult to implement and give quite low benefit to ABC. Consolidate order for each customer (14): customer is one of the factors that difficult to control, while to consolidate their order need good cooperative from them. Because this recommendation required long time but it could reduce only 5-10 orders/day.

Reengineering team will firstly focus on recommendations, which are assign quadrant 3 and 2due to level of ease to implement. Then, recommendations in quadrant 4 and 1 will be implemented. However, some recommendations in quadrant 4, which are the initiatives, have to implement before related recommendations in quadrant 2 and 3 for example: (33) Customization report for Picking List must implement before (9) Pick products by delivery type and location. The implementation plan of each recommendation will be discussed in the next chapter.

CHAPTER VI

IMPLEMENTATION AND RESULTS

6.1 Implementation Plan

In this section, the implementation plan of each recommendation will be illustrated by Project Timeline document. Project Timeline document will show timeline of each recommendation, rational timeline, and responsible party or person, who refer to the project timeline for implementation action and steps.

Reengineering team will establish the total implementation plan for all recommendations. The total implementation plan, which has timeline about 3 months (September to November 2006) for fully implementation, can be divided into 4 sub-implementation plans. Each sub-implementation plan is separated by the responsible party or person, which are Sales, Warehouse-I (Warehouse Section Chief), Warehouse-II (Operations Manager), and Other related departments (A/R, IT, and HR).

Each recommendation will show its total timeline on the top. Then, total timeline will break into each step of the recommendation. The rational timeline presents the reason that why the recommendation takes time or why the recommendation will start using on the particular time. Almost of recommendations will start using before fully launch date, which is on December 1st, 2006. These start dates are called Pre-launch date (Star sign). The time duration from pre-launch date to fully launch date is called preparation period, which is the period for employees to practice and ready for the new process. In the next section, all sub-implementation plans and action steps will be shown and then some details will be explained.

6.1.1 Sub-implementation plan for Sales Department (Leader: Sales Manager)

Work plan for all recommendations																	
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
3	**Eliminate Preview stock availability in AS400**															**Sales**
	- Study new Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	Sales manager, Sales Administrator
	- Start using new process						☆								Start when backorder functions are used	Sales manager, Sales Administrator
6	**Eliminate inform customer and revise order activities**															**Sales**
	- Study new Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	Sales manager, Sales Administrator
	- Start using new process						☆								Start when backorder functions are used	Sales manager, Sales Administrator
16	**Terminate the confirmation policy**															**Top Mgt, Sales**
	- Study new Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	Sales Manager
	- Meeting with Top Management														Make the final decision	Sales Manager
	- Change the policy and announcement															Top Mgt.
	- Announce to customers													☆	Announce to customers after achieve project objective	Sales Manager
18	**Change policy to use Picking List instead of Invoice**															**Top Mgt, Sales**
	- Conduct training class (1) to understand "Picking List" concept														Give the idea of picking list to employees	Sales Manager
	- Meeting with Top Management														Make the final decision	Sales Manager
	- Issue the policy and announcement															Top Mgt
	- Start using new policy											☆			Start when picking list is used	Sales Manager
19	**Using Backorder policy**															**Top Mgt, Sales**
	- Conduct training class (2) to understand "backorders" concept														Explain about meaning of backorders	Sales Manager
	- Meeting with Top Management														Make the final decision	Sales Manager
	- Issue the policy and announcement															Top Mgt
	- Start using new policy						☆								Prepare to start the new process	Sales Manager

Work plan for all recommendations

No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
29	**Using of Backorder menu in Sales function of AS400**															**Sales**
	- Study new Check Inventory Availability (OM-040) sub-process														Give 1 week to study the new sub-process	Sales manager, Sales Administrator
	- Conduct training class (2) to understand "backorders" concept														Explain about meaning of backorders	Sales Manager
	- Study and training to use functions of backorder menu in AS400														Training and testing the new functions	Sale Administrator, Programmer
	- Start using new process														Practice and prepare to start the new process	Sales manager, Sales Administrator
26	**Design new customer code**															**Sales**
	- Study new Capture orders (OM-010) and Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	Sales manager, Sales Administrator
	- Conduct training class (3) to understand concept of new customer code														Give the idea of best practice in part numbering system	Sales Manager
	- Prepare list of customer and current customer code														Get current data from AS400	Sales Administrator
	- Design new customer code														Brainstorming session to find the best code	Sales Manager, Sale Administrator
	- Change customer code in AS400 and announcement															Sale Administrator
	- Start using new customer code														Start after customer priority is assign and SO screen is reconfiguration	Sales Manager
31	**Reconfiguration customer master database**															**Sales, IT**
	- Check current customer database														Get current data from AS400	Programmer
	- Define the data needed														List of data that needed to correct and/or add to customer database	Sales Administrator
	- Collect the necessary data														Collect the data follow by the list	Sales Administrator
	- Correct and/or add data to each customer															Sales Administrator

Work plan for all recommendations

No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
27	**Assign customer priority**			■	■	■	■									**Sales**
	- Prepare list of customer			□											Use the same list, which is used for new code	Sales Administrator
	- Collect the necessary data					□									Get the customer type; Modern Trade, Project, or Official Dealer	Sales Administrator
	- Assign priority into AS400						□									Sales Administrator
25	**Re-configuration SO screen in AS400**						■									**Sales, IT**
	- Check current configuration						□								Get current data from AS400	Programmer
	- Define the new configuration needed						□								List of required data in new configuration	Sales Administrator, Programmer
	- Collect the necessary data						□								Collect the data follow by the list	Sales Administrator
	- Reconfiguration SO screen and test the new configuation screen						□								Testkey in new sales order in AS400	Sales Administrator
1	**Using of SO pre-printed form**						■	■	■	■						**Sales**
	- Study new Capture orders (OM-010) and Process sales order (OM-020) sub-process						□	□							Give 1 week to study the new sub-process	Sales section head
	- Get requirements from Sales dept							□							Get the information to design the SO pre-printed form	Sales section head
	- Design and write the specification of pre-printed form							□	□						Design the form to meet the requirements	Sales section head, Sales Administrator
	- Get an example pre-printed form								□						Create pre-printed form as an example	Sales section head
	- Test the pre-printed form and make modifications								□	□					Using new form, collect the problems, then modify the form	Sales section head, Sales Administrator
	- Approve and announcement to employees									□					Make the final decision	Sales Manager
	- Order and get SO pre-printed form									□	□				Send the final version to print the new form	Sales section head
	- Start using new pre-printed form											☆			Prepare to start to use new form	Sales Manager

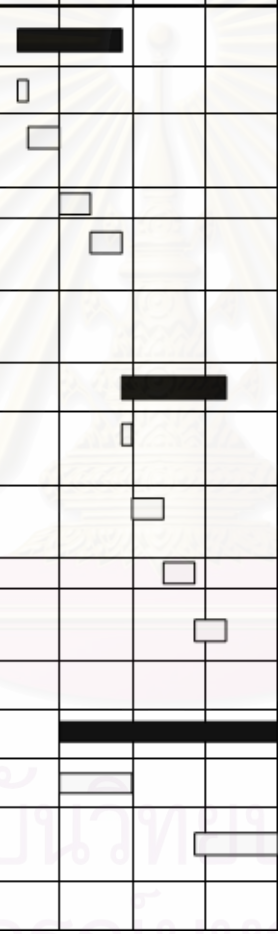
Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
15	**Separately receive order between BKK and UPC**															**Sales**
	- Study new process (OM)														Give 1 week to study the new sub-process	Sales Administrator, Sales Representative
	- Communication with customers to request for cooperative														Continue to convince customers to send order in particular time	Sales Administrator, Sales Representative
14	**Consolidate order for each customer**															**Sales**
	- Study new process (OM)														Give 1 week to study the new sub-process	Sales Administrator, Sales Representative
	- Communication with customers to request for cooperative														Continue to convince customers to consolidate their orders	Sales Administrator, Sales Representative

6.1.2 Sub-implementation plan for Warehouse & Logistics Department I (Leader: Warehouse Section Chief)

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
8	**Separate consolidation area**															**W/H & Logistics**
	- Determine the required area for each group														Calculate the area for each group by using number of orders/day	W/H Section Chief
	- Draw the line for each area															Logistics Officer
10	**Minimize usage of sticker tag**															**W/H & Logistics**
	- Study new Plan and manage delivery sub-process (LO-010)														Give 1 week to study the new sub-process	W/H Section Chief
	- Start using new process											☆			Start when picking list is used	W/H Section Chief

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
32	**Work around AS400 and Customization report for route planning**															**W/H & Logistics, IT**
	- Study new Plan and manage delivery sub-process (LO-010)														Give 1 week to study the new sub-process	W/H Section Chief
	- Define the data needed														List the data that needed to customize the report	W/H Section Chief
	- Collect the necessary data														Collect the data follow by the list	W/H Section Chief
	- Get requirements from W/H & Logistics dept.														Get the information to coding the report	Programmer
	- Design and write the report specification														Design report form and give specification to programmer	W/H Section Chief
	- Coding report program															Programmer
	- Test report and make modifications														Test printing the report and modify the report	W/H Section Chief, Programmer
	- Start using new process											☆			Start at the same time with other W/H recommedations	W/H Section Chief
34	**Customization program for auto-print Delivery document and Map**															**W/H & Logistics, Sales, IT**
	- Get requirements from Sales and W/H & Logistics dept														Get the information to coding the program	Programmer
	- Design and write the progarm specification														Design program and give specification to programmer	W/H Section Chief
	- Coding program															Programmer
	- Test program and make modifications														Test printing invoice for each group of customer and modify the program	W/H Section Chief, Programmer
	- Start using new program											☆			Start at the same time with other W/H recommedations	W/H Section Chief

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
30	**Customization program for linking AS400 with warehouse system**															**W/H& Logistics, Sales, IT**
	- Get requirements from Sales and W/H & Logistics dept														Get the information to coding the program	Programmer
	- Design and write the progarm specification														Design program and give specification to programmer	W/H Section Chief, Sale Administrator
	- Coding program															Programmer
	- Test program and make modifications														Test convert SO to DO and modify the program	W/H Section Chief, Sale Administrator, Programmer
	- Start using new program														Start at the same time with other W/H recommedations	W/H Section Chief
33	**Customization report for Picking List**															**W/H& Logistics, Sales, IT**
	- Get requirements from Sales and W/H & Logistics dept														List the data that needed to customize the report	Programmer
	- Design and write the progarm specification														Design report form and give specification to programmer	W/H Section Chief, Sale Administrator
	- Coding program															Programmer
	- Test program and make modifications														Test printing the report and modify the report	W/H Section Chief, Sale Administrator, Programmer
	- Start using picking list														Start when picking list policy is issued	W/H Section Chief
7	**Print picking list by Warehouse Administrator**															**W/H & Logistics**
	- Study new Plan and manage delivery sub-process (LO-010)														Give 1 week to study the new sub-process	W/H Administrator
	- Test printing														Test printing the report when the program is tested	W/H Administrator
	- Start using new process														Start when picking list policy is issued	W/H Administrator



Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
9	**Pick products by delivery type and location**															**WH & Logistics**
	- Study new Plan and manage delivery sub-process (LO-010)														Give 1 week to study the new sub-process	Logistics Officer
	- Test picking follow picking list														Practice to perform batch picking	Logistics Officer
	- Start using new process														Start when picking list is used	Logistics Officer
13	**Create Work Instruction for Route and Load planning**															**WH & Logistics**
	- Define the topic of route and load planning														List of the topic that use in route and load planning	WH Section Chief
	- Collect the necessary data														Get the data of each topic list	WH Section Chief
	- Writing the work instruction (WI)														Continue input the new tips or methods in WI	WH Section Chief

6.1.3 Sub-implementation plan for Warehouse & Logistics Department II (Leader: Operations Manager)

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
20	**Issue Cycle count policy**															**Top Mgt, WH & Logistics**
	- Conduct training class (4) to understand "Cycle Counting" concept														Explain about cycle counting and the basic methods	Operations Manager
	- Meeting with Top Management														Make the final decision	Operations Manager
	- Issue the policy and announcement															Top Mgt
	- Assign Class (A,B,C,D) to products														Classify all products into 4 classes	WH Administrator
	- Perform cycle counting and make adjustment in AS400														Perform cycle count for each class (2 day/class) and adjust inventory	WH Administrator, Logistics Officer

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
23	**Set up Key Performance Indicators and Motivation System**															**Top Mgt, WH & Logistics, HR**
	- Conduct training class (5) to understand "KPIs & Motivation" concept														Explain about KPIs, Motivation system, and objectives	Operations Manager
	- Meeting with Top Management														Make the final decision	Operations Manager
	- Set up KPIs and Target														Set up KPIs for each functions and targets are agreed by employees	Operations Manager
	- Establish Motivation system														Create reward system for employees who hit the company targets	HR Manager
	- Announcement to employees															Top Mgt
22	**Establish Service Level Agreements with 3PL**															**Top Mgt, WH & Logistics, 3PL**
	- Conduct training class (6) to understand "SLAs" concept														Explain the benefits and objectives of SLAs	Operations Manager
	- Internal meeting between related functions and Top Management														Make the final decision on the topics in SLAs	Operations Manager
	- Meeting between WH & Logistics dept. and 3PL														Make an agreement on targets of SLAs with 3PL	Operations Manager
	- Eatablish SLAs with 3PL														Sign on SLAs	Top Mgt, Operations Manager
39	**Make an agreement on people with 3PL**															**Top Mgt, WH & Logistics, 3PL**
	- Internal meeting between related functions and Top Management														Make the final decision on the 3PL people	Operations Manager
	- Meeting between WH & Logistics dept. and 3PL														Make an agreement on company requirements	Operations Manager
	- Make an agreement with 3PL														Sign on agreement	Top Mgt, Operations Manager
21	**Establish Contingency Plan for Accident or Natural disasters**															**Top Mgt, WH & Logistics**
	- Conduct training class (7) to understand "Contingency plan" concept														Explain the benefits and objectives of contingency plan	Operations Manager
	- Meeting between related functions and Top Management														Make the final decision on the plan	Operations Manager
	- Establish contingency plan and announcement															Operations Manager

Work plan for all recommendations

No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
11	**Using of roll container**	■	■	■	■	■	■	■								**W/H & Logistics**
	- Study new Plan and manage delivery sub-process (LO-010)	▭													Give 1 week to study the new sub-process	W/H Section chief
	- Study the specification of many roll container type.					▭									Study pros and cons of each roll container type	Operations Manager
	- Select the appropriate type and appropriate supplier						▭								Select the best type in term of cost & benefit analysis	Operations Manager
	- Get an example of selected roll container							▭							Request the sample from supplier to test	W/H Section chief
	- Test, approve, and announcment to employees							▭							Final selection on roll container	Operations Manager
	- Start using new process										☆				Start at the same time with other W/H recommedations	W/H Section chief
12	**Relocate products in Warehouse**								■	■	■					**W/H & Logistics**
	- Conduct training class (8) to understand the good warehouse layout								▭						Explain the benefits, which will gain from good W/H layout	Operations Manager
	- Study about methods and designs of good warehouse layout								▭						Select the best method to design the new layout	Operations Manager
	- Review current products location									▭					Review the blue print of current layout	Operations Manager
	- Collect the necessary data									▭					Get the data that related on the selected design method	W/H Administrator
	- Design and propose new product location										▭				Design the new layout and propose to Top Mgt	Operations Manager
	- Approve the new layout										▭					Top Mgt
	- Relocation products in warehouse											▭			Move products follow to the new layout	Operations Manager
	- Start using new product location											☆			Using new layout after finish relocation	Operations Manager

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
35	**Implement Route and Load planning program**															**Top Mgt, WH & Logistics, Sales, IT**
	- Give pre-requirement to many implementors														Ask the information of software that can meet company requirements	Operations Manager
	- Software selection														Request for software demonstration and select the best fit in term of cost & benefit analysis	Top Mgt, Operations Manager, IT Manager
	- Implementor selection														Select the potentail implementor in term of cost & benefit analysis	Top Mgt, Operations Manager, IT Manager
	- Get requirements from Sales and WH & Logistics dept														Let's software consultant to get company requirements	IT Manager
	- Design work flow process														Assist in new process design after implement	Operations Manager, IT Manager
	- Training class for new software														Training to use features and functions of new software	IT Manager
	- Test program, make modification, and cutomization program														Test the company case to modify work flow and customize the program	Operations Manager, IT Manager, Programmer
	- Start using the new program											☆			Start at the same time with other WH recommedations	Operations Manager, IT Manager

6.1.4 Sub-implementation plan for A/R, IT and HR Department (Leader: Related Managers and Section Chief)

Work plan for all recommendations																
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
2	**Eliminate fill in and recheck Deposit buying form activities**															**A/R**
	- Study new Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	AR Officer
	- Start using new process											☆			Start at the same time with other A/R recommedations	AR Officer
24	**Customize program for Deposit buying in AS400**															**A/R, IT**
	- Get requirements from AR dept.														Get the information to coding the program	Programmer
	- Design and write the progarm specification														Design program and give specification to programmer	AR Officer, Programmer
	- Coding program															Programmer
	- Test program and make modifications														Test input the new sales order and check the results accuracy	AR Officer, Programmer
	- Start using new program											☆			Start at the same time with other A/R recommedations	AR Officer
4	**Issue contract by AR officer instead of Sale Administrator**															**A/R**
	- Study new Process sales order (OM-020) sub-process														Give 1 week to study the new sub-process	AR Officer
	- Test program and make modifications														Test printing the contract from AS400 and modify contact form	AR Officer, Programmer
	- Start using new process											☆			Start at the same time with other A/R recommedations	AR Officer
17	**Change approval policy that using only one person to approve**															**Top Mgt, A/R**
	- Study new Manage customer credit exposure (OM-030) sub-process														Give 1 week to study the new sub-process	AR Officer
	- Meeting with Top Management														Make the final decision	AR Section Chief
	- Change the policy and announcement															Top Mgt

Work plan for all recommendations																	
No.	Description	Implementation Timeline													Timeline rational	Responsible party/person
		SEP				OCT				NOV				DEC		
		1	2	3	4	1	2	3	4	1	2	3	4	1		
5	**Reduce approval process**										■					**A/R**
	- Study new Manage customer credit exposure (OM-030) sub-process										□				Give 1 week to study the new sub-process	AR Officer
	- Start using new process												☆		Start at the same time with other A/R recommedations	AR Officer
38	**Assign A/R officer to specific account**										■	■				**A/R**
	- Study new Manage customer credit exposure (OM-030) sub-process										□				Give 1 week to study the new sub-process	AR Officer
	- Assign A/R officer											□			Assign AR officer to specific account and specfic manager	AR Section Chief
	- Start using new process												☆		Start at the same time with other A/R recommedations	
28	**Establish schedule to update database**										■	■	■			**IT**
	- Meeting among related functions										□				Announce to each department about updating database	IT Manager
	- Create schedule to update database for each department											□			Plan the time to update for each database	IT Manager
	- Update all databases												□			Programmer
36	**Conduct proper training session for new employee**	■	■	■												**HR, All Section Head**
	- Conduct training class (9) to understand "Standard training structure" concept	□													Explain the benefits, which will gain from training structure	HR Manager
	- Meeting between HR and all section heads	□													Explain how to create training structure	HR Manager
	- Create standard training structure of each department and send to HR		□													All section heads
	- Make modification and approve			□											Recheck and modify the training structure with section head	HR Manager
	- Announcement to employees				□											HR Manager
37	**Manage Transition Period**	■	■	■												**HR, All Section Head**
	- Conduct training class (10) to understand "Manage transition period" concept	□													Explain the benefits, which will gain from manage transition period	HR Manager
	- Meeting between HR and all section heads	□													Explain about the period before resign	HR Manager
	- Announcement to employees			□												HR Manager

From all sub-implementation plan above, all leaders give 1 week for their employees to study the new sub-process before starting to implement the recommendation. Additionally, all leaders have conducted about 10 training classes, which will give an idea to employee for more understanding, for the new concepts and new policies which will be used in the new sub-processes. These will make the project smoothly implement and minimize the problems during implementation.

In sales sub-implementation plan, some recommendations can start using before fully implementation for example Sale Administrator can eliminate the Preview stock (3), and Inform customers & Revise order activities (6) immediately after backorders policy and backorders menu are used. In the other hand, some recommendations have to wait for other departments to finish their works before start using the new things for example Picking list policy (18) will be used when all recommendations about picking list have implemented or Terminate the confirmation policy (16) can be done after fully implementation and project objectives are achieved.

For warehouse sub-implementation plan, this is the biggest of the project. Thus, sub-implementation plan will be divided into 2 plans, which are W/H-I plan and W/H-II plan. Warehouse Section Chief is a leader for W/H-I plan, while Operations Manager is a leader for W/H-II plan. Almost of recommendations in W/H-I plan are about operations in warehouse for example Separate consolidation area (8), Minimize usage of sticker tag (10), Create Work Instruction for Route and Load planning (13), and other customization programs to support warehouse operations such as Program for linking AS400 with warehouse system (30), Route planning report (32), and Picking list report (33).

For W/H-II plan, almost of recommendations is about policy and performance management topic for example Cycle count policy (20), Establish contingency plan (21), Establish SLAs (22), and Set up KPIs (23). Moreover, there are 3 important recommendations, which are Using of roll container (11), Relocate products in Warehouse (12), and Implement Route and Load planning program (35), include in this plan. These 3 recommendations required high skills and knowledge people, high investment cost, and much time to implement.

Finally for other sub-implementation plan, recommendations in this plan are about A/R, IT, and HR departments. Recommendations for A/R section are about eliminate non-value added activities in Process Sales Order sub-process (OM-020) and Manage Customer Credit Exposure sub-process for example Eliminate fill in and recheck Deposit buying form activities (2), Reduce approval process (5). For IT section, IT manager will establish schedule to update all databases (28) in the company to improve the accuracy of information, which is used in the process. In the last section, HR manager has responsible for Conduct proper training session for new employee (36) and Manage transition period (37) with cooperative by related section chiefs to improve capabilities of new employee to keep the company smoothly run the business.

From the implementation plan, some action steps of related recommendation can be done simultaneously for example Sale Administrator can prepare the customers list for both Design customer code (26) and Assign customer priority (27), Warehouse Administrator can test printing the picking list (7) when Warehouse Section Chief and Programmer test the customized picking list program (33). Moreover, each sub-implementation plan has preparation period before fully launch the project. This period will make employees more familiar with the new process before fully operate. Almost of pre-launch date of sales recommendations is on the second week of October, while Pre-launch date of W/H recommendation and A/R recommendation is 2 week and 1 week before launch date respectively. However, ABC has to inform all customers before changing the activities or the processes on each pre-launch date. This will make customers have less confused on some changes. Additionally, the company must inform and explain the project to all customers about 1 month before launch date. This will give time for customer to prepare themselves to ready for the fully change on the launch date, and also minimize problems when the new process is operated.

6.2 Problems during implementation

In this section, some problems during implementation the new process will be discussed. The problems are collected by the reengineering members, who work in each sub-implementation plan. Thus, all problems will be divided into 4 parts depends on each sub-implementation.

6.2.1 Problems on sales sub-implementation plan

There are not many problems during implementation for the sales plan because almost of recommendations are easy to implement. The new order management process is also easily understood. Employees only require time to practice and study on how to use the new SO pre-printed form, and backorders menu, which has many new features and functions for them. The new customer codes are easily designed after employees take the training class and understand the concept and benefits of the new codes. However, it is too difficult for Sale Administrators to reconfigure the system by themselves. They require IT people to stay together when reconfigure AS400.

Moreover, the main problem on sales plan is about customers. Many customers do not want to change their behavior when order products. They want to order products at any quantity and any time when they want. Thus, Consolidate order for each customer (14) and Separately receive order between BKK and UPC (15), which are directly relate with customers, might not 100% successfully implement in a short period. However, this problem is already predicted. Therefore, the company has given the whole 3 months period for Sale Administrator to keep convincing customers and asking for cooperative from them.

6.2.2 Problems on W/H-I sub-implementation plan

For the W/H-I side, there are also not many problems during implementation because there are only support activities, which are Print picking list by Warehouse Administrator (7), Separate consolidation area (8), and Minimize usage of sticker tag (10). However, Logistics Officers need time to practice the new picking method

called batch picking (9), which will be used with new picking list. Moreover, Warehouse Section Chief also requires time to complete all topics in WI for Route and Load planning (13).

The rest recommendations are about customization programs. Thus, most of problems are about lack of requirements, unclear design and program specifications, wrong report format, wrong information shown in the report, and bug in the programs. So, ABC has outsourced the expert team from outside to take responsibility for all customization programs, while internal programmers work as an assistant and coordinator of this team.

6.2.3 Problems on W/H-II sub-implementation plan

This is the part that has many problems during implementing this project. Most of the problems come from 3 recommendations, which are Using of roll container (11), Relocate products in Warehouse (12), and Implement Route and Load planning program (35). To study, select the appropriate type, and select supplier of roll container is time consuming process. Operation Manager uses more than 2 weeks for these steps. Moreover, the material of the selected type is not strong enough when the sample has been sent to the company. In order to change the material, the roll container price will increase about 50%. Thus, Operation Manager has decided to select the appropriate type and select supplier of roll container again. Finally, Operations Manager can select the most appropriate choice, but the roll container comes to the company only 3 day before launch date. This will make Logistics Officer could not well prepare and practice for using new material handling equipment.

After Operations Manager has proposed the new design of warehouse layout, there are many requirements in order to change to new designed such as new type of storage rack and some semi-auto material handling equipment, which require high investment cost. Thus, top management has decided to postpone this recommendation to the next phase. However, Operations Manager is assigned to repair all of product

labels in the warehouse and bring the misplace products back to their places within the same timeline.

For implementation route and load planning program, this recommendation is in the same situation with previous recommendation. Due to the high investment cost for both program cost and implementation cost, top management has decided to postpone this recommendation to study again in the next phase also. Additionally, the program required at least 4-6 months to implement. However, this problem is also predicted. Therefore, Create Work Instruction for Route and Load planning (13) and Work around AS400 and Customization report for route planning (32) are recommended as a short term plan to support route and load planning activities.

6.2.4 Problems on A/R, IT and HR sub-implementation plan

This plan is the easiest plan in this project. Most of recommendations can be done by internal employees except Customize program for Deposit buying in AS400 (24), which the company has given the expert team from outside to take responsibility for all customization programs. Thus, there is no problem in this sub-implementation plan

From investigation of reengineering team, all sub-implementation plans have the same problem on people who responsible for each recommendation. These people always busy with their routine jobs. They have not enough time to meeting with other related party. These will make each recommendation does not finish on time. However, all recommendations have finished within 3 month period, except Create Work Instruction for Route and Load planning (13) and Work around AS400 and Customization report for route planning (32), which are postpone to the next phase. In the next section, results after implementation these recommendations will be discussed and compared with the old order-to-delivery process.

6.3 Results

In this section, results of implement the new process will be investigated. This will be done by comparing various before and after implementation results for example the

total number of activities of order-to-delivery process, delivery lead time of order-to-delivery process, the number of rejected orders, the number of complaint from customer survey results, and other related information.

6.3.1 Comparison on total number of activities of delivery-to-order process

The order-to-delivery process has been reengineered to improve the efficiency by reduce non-value added activities from the process. The comparison of results between before-after implement the new process on total number of activities is done by adds up every activities of all sub-process of order-to-delivery process. The comparison on the total number of activities result between before and after the implementation is shown in table below.

Table 6.1: Comparison on total number of activities of order-to-delivery process

Sub-process	No.	As-Is Process	No.	To-Be Process
OM-010	1	Receive customer order via fax	1	Receive orders (PO) via Fax
	2	Receive customer order via telephone	2	Receive orders via Telephone and fill in SO pre-printed form
	3	Receive customer order from sales	3	Receive orders from sales rep. and fill in SO pre-printed form
	4	Determine Order Type	4	Fill in SO pre-printed form
			5	Determine Order Type by customer code
OM-020	5	Fill Deposit buying form	6	Enter new order into AS400 to calculate remaining amount
	6	Receive for recheck and approval	7	Record SO in AS400
	7	Record in AS400	8	Record into AS400
	8	Issue the contract	9	Print out contract from AS400 and send to customers
	9	Keep the record for reference	10	Keep the record for references and inform Sale Representative
	10	Inform customer	11	Inform customers
	11	Deduct amount from previous agreement		
	12	Fill in SO form		
	13	Preview stock availability		
	14	Confirm Quantity and delivery date with Customer		
	15	In put in AS400		
	16	Inform Sale Rep		
	17	Inform and get feed back from customers		

Sub-process	No.	As-Is Process	No.	To-Be Process
OM-020	18	Revise SO form		
	19	Cancel order		
OM-030	20	Check credit limit	12	Check credit limit
	21	Record as invoice	13	Request for authorization of credit expansion from Sales Mgr
	22	Inform Sale Rep	14	Request for authorization of credit expansion from Sales Rep
	23	Request for authorization of credit expansion from Sale Rep	15	Inform customer for further action
	24	Request for authorization of credit expansion from Sale Mgr	16	Cancel Order
	25	Inform customer for further action		
	26	Cancel Order		
OM-040	27	Check inventory availability in AS400	17	Check inventory availability in AS 400
	28	Book and allocate products	18	Book and allocate products
	29	Print invoice	19	Assign status “Backorder” to unfulfilled order
	30	Send invoice to warehouse for picking		
	31	Inform Sale Rep		
	32	Inform customers		
	33	Revise SO and Invoice		
	34	Cancel Order		
LO-010	35	Sort Type of delivery service needed	20	Print out route planning support report
	36	Prepare Delivery documents for 3PL	21	Review report and make adjustment to sort route by delivery area
	37	Sort route by delivery area	22	Print out picking list from AS400
	38	Get the processed invoice for preparing FG	23	Get picking list for preparing finished goods
	39	Physical inventory checking	24	Physical inventory checking
	40	Pick product according to invoices	25	Picking products to consolidate area and attach sticker tag for UPC area
	41	Sort order within routing	26	Pick Confirm in AS400
	42	inform customer	27	Inform Sale Administrator to update inventory in AS400
	43	Cancel Order	28	Update inventory in AS400
	44	Record delivery route for each vehicle	29	Print out Invoices, and related documents of confirmed SO
	45	Print out Delivery form	30	Print out DO by convert from SO that has invoice
	46	Pick product from consolidate area and arrange product for each vehicle	31	Sort order for the given route from supervisor
	47	Attach sticker Tag	32	Pick product from consolidation area and pack into roll container

Sub-process	No.	As-Is Process	No.	To-Be Process
LO-010	48	Check invoice and products accuracy with Delivery form	33	Check invoices and products accuracy with Delivery Order
	49	Load products into vehicle	34	Move roll container into each vehicle
	50	Sign Delivery form	35	Sign Delivery form
LO-020	51	Drive to the central DC	36	Drive to the central DC
	52	Unload Product	37	Unload products by roll container
	53	Ask/Wait for transporters to sign delivery documents	38	Ask/Wait for transporters to sign delivery documents
	54	Return signed Delivery documents to W/H administrator	39	Return signed Delivery documents to W/H administrator
	55	Deliver product to customer	40	Deliver product to customer
	56	Unload Product	41	Unload products by roll container
	57	Ask/Wait for customers to sign delivery documents	42	Ask/Wait for customers to sign delivery documents
	58	Return signed invoices to W/H administrator	43	Return signed invoices to W/H administrator
	59	Record receive date in AS400	44	Record receive date in AS400
	60	Print out invoice	45	Print out invoice
	61	Map with signed invoice	46	Map with signed invoice
	62	Return signed invoices to W/H administrator	47	Return signed invoices to W/H administrator
Total Activities		**62**		**47**

From table 6.1, the total activities of order-to-delivery process of As-Is and To-Be process are 62 activities and 47 activities respectively. Therefore, it could be observed that non-value added activities in order-to-delivery process have reduced approximately 24% after implement the new process.

6.3.2 Comparison on delivery lead time of delivery-to-order process

The main objective of this reengineering project is to reduce delivery lead time to customers. The comparison of results between before-after implement the new process on delivery lead time is done by measuring the time taken for an order to be process from the time where Sales Administrator receives orders from a customer through the point where products are received by customers. The comparison on the delivery lead time result of before and after the implementation will be shown in many types of information.

1) **Calculated average time from each activity:** As mentioned in chapter 4, the calculation comes from the average 255 orders/day, and then orders are separated into many options of each sub-process. Thus, the same information will be used to calculate the average time for To-Be process. The comparison on the average delivery lead time result between before and after the implementation is shown in table below.

Table 6.2: Comparison on calculated average delivery lead time

Sub-process	As-Is Process		To-Be Process**	
	Time (Min.)	Time (Hr.)	Time (Min.)	Time (Hr.)
OM-010	95.66	1.59	45.30	0.76
OM-020	251.63	4.19	54.78	0.91
OM-030	61.41	1.02	26.66	0.44
OM-040	158.28	2.64	84.86	1.41
LO-010	304.17	5.07	132.40	2.21
LO-020	284.31	4.74	215.94	3.63
Total	**1155.47**	**19.26**	**559.94**	**9.33**

**Source: Time measurement for each activity from 5 Feb 2007 to 16 Feb 2007 done by reengineering team

From table 6.2, the average total lead time of the whole process of As-Is and To-Be process are 19.26 hr. and 9.33 hr. respectively (See Appendix C). Since the total working time of ABC is approximately 9 hour/day (Normal + OT), the average total lead time of both As-Is process and To-Be process are 2 days and 1 day respectively. Therefore, it could be observed that delivery lead time of order-to-delivery process have reduced approximately 47% after implement the new process.

2) **Raw data form AS400 for 3 months period:** As discussed in chapter 4, the raw data from AS400 for 3 months period (20,016 orders) is analyzed. However, about 13,478 orders are BKK orders, while the rest is UPC orders. The comparison result on raw data will use only BKK orders, due to UPC orders also depend on co-loading transporter, who have worked for ABC customers. Therefore, ABC can control only from Sales Administrator receives orders customer to the point where products are delivered to those co-loading transporters at central DC.

However, co-loading transporters will deliver products to customer within 1-2 days. The comparison on the delivery lead time from raw data result between before and after the implementation is shown in table below.

Table 6.3: Comparison on delivery lead time in BKK from raw data in AS400 for 3 month period

Delivery lead time (Day)	As-Is Process		To-Be Process**	
	# of orders in BKK	%	# of orders in BKK	%
0.50-0.75	0	0.00%	131	0.89%
0.75-1.00	0	0.00%	5,008	34.05 %
1.00-1.25	40	0.29%	7,917	51.10%
1.25-1.50	90	0.67%	1,314	8.93%
1.50-1.75	245	1.81%	213	1.45%
1.75-2.00	3,947	29.29%	126	0.86%
2.00-2.25	8,019	59.50%	0	0.00%
2.25-2.50	738	5.48%	0	0.00%
2.50-2.75	312	2.32%	0	0.00%
2.75-3.00	87	0.65%	0	0.00%
Total	**13,478**	**100%**	**14,709**	**100%**
Avg. delivery lead time	**2.06 days**		**1.07 days**	

**Source: Actual delivery leads time in BKK from Dec2006 to Feb 2007 based on data in AS400 done by Sales Department

From table 6.3, the data is converted to graph, Figure 6.1, for ease of understanding.

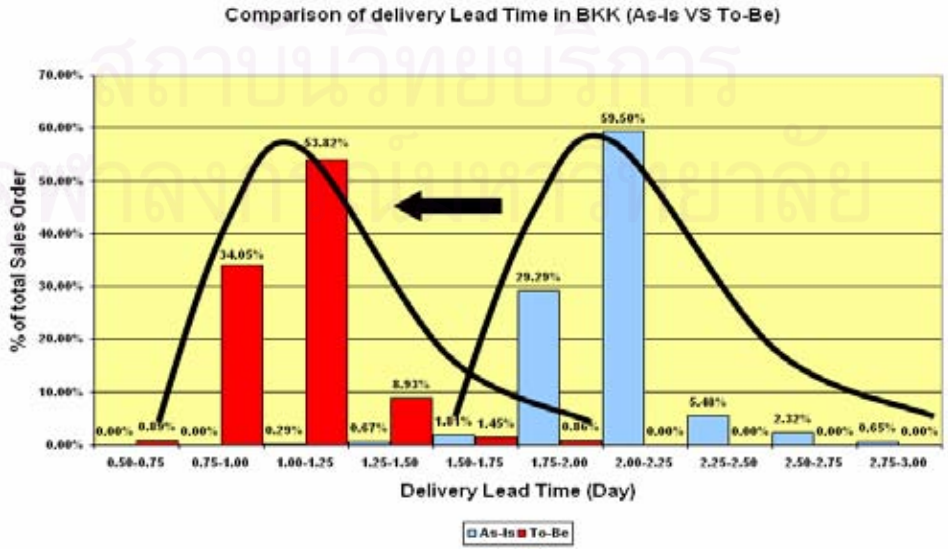


Figure 6.1: Graph of Comparison on delivery lead time in BKK from raw data in AS400

The total number of raw data in AS400 for 3 month period (new process) is 21,953 orders. About 14,709 orders are BKK orders, while the rest is UPC orders. From table 6.3, the average delivery lead time from AS400 for 3 month period of As-Is and To-Be process are 2.06 days and 1.07 days respectively. Figure 6.1 graphically show the trend line of delivery lead time is shifted to the left: after using new process, delivery lead time is reduced. Therefore, it could be observed that delivery lead time of order-to-delivery process have reduced approximately 48% after implement the new process.

6.3.3 Comparison on number of rejected order

Rejected order is one of the main issues that ABC needs to minimize. The number of rejected order of the company is quite high when compare with major competitors. As discussed in chapter 4, most of the rejected orders come from incorrect product and/or quantity, incorrect document, and wrong delivery place. The comparison of results between before-after implement the new process on number of rejected order is done by collecting the number of sales order, which has rejected order lines, from AS400 for 3 month period. The comparison on the total number of rejected order between before and after the implementation is shown in table below.

Table 6.4: Comparison on sales order with rejected line from raw data in AS400 for 3 month period

Region	As-Is Process*			To-Be Process**		
	# of SO	# of SO with rejected line	%	# of SO	# of SO with rejected line	%
BKK	13,478	917	6.80%	14,709	453	3.08%
Central/East/West	1,229	68	5.53%	1,449	31	2.14%
North	516	27	5.23%	462	12	2.60%
Northeast	3,941	265	6.72%	4,510	134	2.97%
South	852	49	5.75%	823	19	2.31%
Total	**20,016**	**1,326**	**6.62%**	**21,953**	**649**	**2.96%**

*Source: Actual number of rejected order line from April 2006 to June 2006 based on data in AS400 done by Sales Department

**Source: Actual number of rejected order line from Dec 2006 to Feb 2007 based on data in AS400 done by Sales Department

From table 6.4, the data is converted to graph by region, Figure 6.2, for ease of understanding.

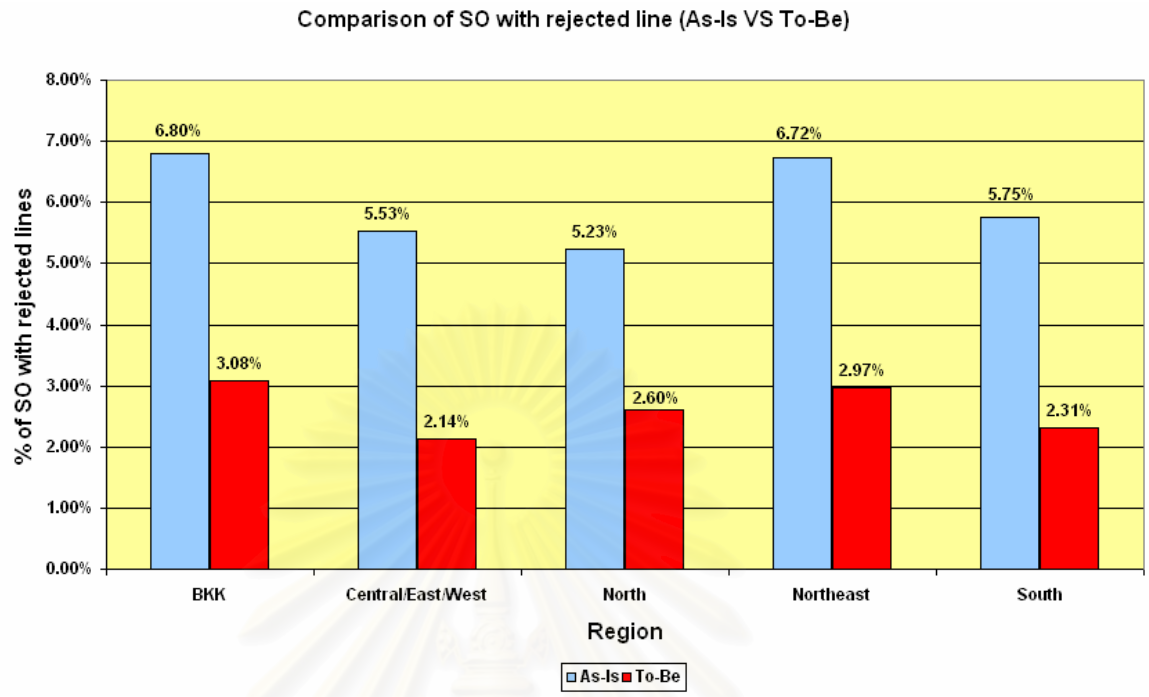


Figure 6.2: Graph of Comparison on SO with rejected order line by region

From table 6.4, the total percentage of sales order, which has rejected order lines from AS400 for 3 month period of As-Is and To-Be process are 6.62 % and 2.96 % respectively. Figure 6.2 graphically show that the percentage of sales order with rejected order is reduced in all regions. Therefore, it could be observed that number of rejected orders are reduced approximately 51% after reduce manual activities in the new process.

6.3.4 Comparison on customer's complaint

ABC performs "Customer Satisfaction Survey 2007" on the third month after implement the new process. The comparison of results between before-after implement the new process on customer survey is done by using the same survey documents (Customer Satisfaction Survey 2005) with the same group of 800 customers. The comparison on customer's complaint between before and after the implementation is shown in table below.

Table 6.5: Comparison on number of complaint between Customer Survey 2005 and 2007

Complaints	2005 Survey		2007 Survey**	
	Count	%	Count	%
No problem	448	56.00%	639	79.88%
Incorrect product and/or quantity	51	6.38%	23	2.88%
Incorrect document	31	3.88%	17	2.12%
Delay delivery	267	33.38%	93	11.63%
Damaged delivery	9	1.13%	3	0.38%
Poor delivery service	19	2.37%	12	1.50%
Poor office service	5	0.63%	9	**1.12%**
Inflexibility	12	1.50%	10	1.25%
Lack of sales promotion and support	15	1.88%	24	**3.00%**
Incorrect billing	11	1.37%	8	1.00%
Wrong delivery place	26	3.25%	12	1.50%

**Source: Customer Satisfaction Survey 2007 (March 2007) done by customer service department

From table 6.5, overall customer satisfaction of the company after implement the new process is better. Even if the complaint on delay delivery is reduced from 33.38% to 11.63%, it is still in the first place of the complaint. Thus, the company needs to do continuous improvement on order-to delivery process. Incorrect product and/or quantity, and incorrect document issues are also reduce from 10.25% to 5%. Moreover, there are 2 issues, which are Poor office service and Lack of sales promotion and support, get more complaint. Thus, the company has to find the root causes and solve them as soon as possible. However, it could be observed that the company customer satisfaction is increased after implement the new process.

6.3.5 Comparison on Capability Maturity Model

As mentioned in chapter 4, Capability Maturity Model (CMM) of the new process (rectangular) will be compared with the old capabilities (circle) and the target setting (star). The comparison of results current, target, and new capabilities is done by using the same CMM framework, which is used in chapter 4. The comparison on CMM is shown in table below.

Table 6.6: Comparison on Capabilities Maturity Model of ABC

Related Sub-process	Capabilities	1 Lagging	2 Developing	3 Advanced	4 Leading
OM-010 OM-030	Capture Orders		● ■		
OM-020	Enter Orders	●	■		
OM-030	Bill and Collect Revenue		●	■	
OM-020 OM-040	Plan Production and Delivery for Customers	●	■		
OM-020	Process Orders		● ■		
OM-040 LO-010	Manage Distribution Center Operations (Technology)	●	■		
LO-010	Manage Order Assembly/Packaging (Process)	●	■ ★		
LO-010	Manage Order Assembly/Packaging (Technology)	●	★	■	
LO-010	Manage Packing and Packaging (Conveyance)	●	■		
LO-010	Manage Packing and Packaging (Process)	●	■ ★		
LO-010	Product Placement and Distribution Center Configuration	●	■ ★		
LO-010	Manage Transportation Cost		● ■	★	
LO-010	Order Transportation Service	■	★		
LO-010	Schedule Carriers		●	■	
LO-010 LO-020	Create Shipping Documents	●		■	

Remark: If the new capabilities are in the same level of old or target, the circle or star sign will be replaced by rectangular sign

From table 6.6, almost of capabilities are improved after implement the new process. However, some capabilities are not reached the target. This might because ABC does not implement all recommendations, especially Relocate products in warehouse (12), and Implement Route and Load planning program (35). Details of each capability of new process will be discussed below.

1) **Capture Order:** Since there are many reconfiguration for both customer master database and SO screen in AS400, Sale Administrator has ability to verify customer data, price, credit at order receipt and able to perform a search to match customer needs to products. Thus, this capability is located in developing level.

2) **Enter Orders:** With new configuration in AS400, Sale Administrator use of customer profile to speed up the key-in orders activities. Moreover, AR Officer able to check customer credit, since sales order is entered in the system. Therefore, this capability is located in developing level.

3) **Bill and Collect Revenue:** For the new process, invoices can be printed by semi-auto system by new customization program that link between AS400 and warehouse system. Moreover, automatic pricing structure and AR aging report are already used before implement the new process. Thus, this capability is located between developing and advanced level.

4) **Plan Production and Delivery for Customers:** Backorders menu allow inventory information to link with sale orders information. Not only the standard lead time can be quote when products are not available in the stock, but also the promised date for those orders are automatically calculated. Therefore, this capability is located in developing level.

5) **Process Orders:** Since non-value added activities are minimized from the old process, there are less paper works and more manage orders in AS400 instead. Some order status information, which is in AS400, already available to customer up on request. Thus, this capability is located in developing level.

6) **Manage Distribution Center Operations (Technology):** Since the new process has the customization program that linkage between AS400 and warehouse system, Warehouse Administrator can perform most of warehouse transactions, which are receiving, storing, and shipping in semi-auto environment. So, this capability is located between lagging and developing level.

7) **Manage Order Assembly/Packaging (Process):** Since the new warehouse design and layout are postponed, there is no automation system to support the operation in warehouse. However, ABC starts using roll container as a new material handling equipment, which very useful in many warehouse operations. So, this capability is located between lagging and developing level.

8) **Manage Order Assembly/Packaging (Technology):** In the new process, picking list is used instead of invoices in order to pick products form warehouse. With the new customization program, picking list report will be printed and sorted by priority, zone, or any other parameters by the system. Therefore, this capability is located between developing and advanced level.

9) **Manage Packing and Packaging (Conveyance):** Roll container is used as a new material handling equipment to support warehouse operation, especially for picking and packing activities So, this capability is located in developing level.

10) **Manage Packing and Packaging (Process):** Same reason as Manage Order Assembly/ Packaging (Process), roll container is only the new thing, which is used to support operations in warehouse. Thus, this capability is located between lagging and developing level.

11) **Product Placement and Distribution Center Configuration:** Since Relocate products in warehouse recommendation (12) does not be implement, the old problems (table 4.7) still happens. However, to repair all of product labels and bring the misplace products back to their places could reduce those problems. Moreover, the new consolidation area is managed by separated into specific location and delivery type. So, this capability is located between lagging and developing level.

12) **Manage Transportation Cost:** In order to improve vehicle utilization, ABC has customized the report to support route and load planning activities. This report will speed up the decision making on planning activities. Moreover, ABC has SLAs about transportation cost performance with 3PL transporters and using of co-loading transporter for cost saving issue. However, this capability is not

reached the target, because Route and Load planning program is not implemented. Thus, this capability is located in developing level.

13) **Order Transportation services:** Since Route and Load planning program is not implemented and ABC does not have any options to improve in this area, this capability still in lagging level.

14) **Schedule Carriers:** In the new process, SLAs are used to manage and monitor the performance of 3PL transporters. However, Route and Load planning program is not implemented. Warehouse Supervisor still takes responsible for planning activities. Therefore, this capability is located between developing and advanced level.

15) **Create Shipping Documents:** Since, customization program to link AS400 with warehouse system and customization program for auto-print Delivery document and Map is implemented. Warehouse Administrator able to convert delivery order form sales order and able to print delivery document, map, and invoices simultaneously. So, this capability is located between developing and advanced level.

From table 6.5 and details above, it could be observed that the capabilities of ABC are improved in many areas after implement the new process.

6.3.6 Comparison on Total Logistics Costs

In order to improve delivery performance, operations cost must be considered also. The comparison of results between before-after implement the new process on total logistics costs is done by sum up the related cost elements in logistics activities of the company. The comparison on total logistics cost between before-after implementation is shown in table below.

Table 6.7: Comparison on total logistics cost of ABC

Month/Cost Element	As-Is Process		To-Be Process		
	Oct 2006	Nov 2006	Dec 2006	Jan 2007	Feb 2007
Salary	2,970,000	2,970,000	2,970,000	3,163,050	3,163,050
Insurance	120,000	120,000	120,000	120,000	120,000
Depreciation	300,000	300,000	300,000	300,000	300,000
Maintenance	152,000	187,200	174,800	189,750	194,700
Overtime	603,800	663,200	544,400	518,200	465,000
Fuel	1,015,980	1,127,945	1,168,895	1,263,830	1,277,930
Miscellaneous	277,600	285,955	274,290	266,480	261,790
Total (Baht)	**5,439,380**	**5,654,300**	**5,552,385**	**5,821,310**	**5,782,470**

Source: Actual logistics cost from Oct 2006 to Feb 2007 done by Financial Department

From table above, there are seven cost elements, which are used to calculate the total logistics cost. Salary, Insurance cost, and Depreciation cost are fixed cost, while the rest are variable cost. As a results, the total logistics cost of the company tends to be higher due to higher salary from annual salary adjustment, higher fuel cost from the high fuel price situation, and higher maintenance cost from higher price of spare parts of both machine and vehicles. However, these five elements are not related with the operations efficiency.

In the other hand, the overtime cost and miscellaneous cost; paper, sticker tag, factory supply, which related with operations efficiency, are continuously reduced. Therefore, it could be observed that the operations efficiency related costs are reduced approximately 15% after implement the new process.

6.3.7 Comparison on Costs & Benefits

In order to perform any kinds of project, the investment cost is required. The amount cost reduction is used to measure the successful of the project. However, there are some intangible benefits, which are customer satisfaction, customer loyalty, and sales opportunity, can not be measured by amount of money. This project has consumed moderately investment cost in roll container, SO pre-printed form, and customization

programs. As mention earlier, delivery performance is an order-winning in paint industry. After the project is successfully implemented, delivery lead time is reduced to acceptable rate. As results in lower customer complaints in many issues, especially for delay delivery, incorrect products and/or quantity, and incorrect documents, it could be observed that the customer satisfaction is increased

Moreover, the lower number of rejected orders shows that employees can operate their job better, which will make current customers more confident in the company. This will increase the customer loyalty to the company. Finally, faster delivery lead time, which is in standard rate with major competitors, not only reduce the opportunity lost from late delivery, but also increase sales opportunity from repeat orders of new customer.

From many benefits above, it could be observed that it would be worthwhile to invest and implement this project.

CHAPTER VII

CONCLUSION AND FURTHER STUDY

7.1 Conclusion

Delivery performance is one of important order-winning of the company to gain the competitive advantage in the business. The main objective of this thesis is to reduce delivery lead time of order-to-delivery process in a paint factory. Since the delivery lead time of the company is longer than industrial standard, due to there are many non-value added activities or waste (Muda) in the process. Therefore, the company had decided to use Business Process Reengineering (BPR) to solve the mentioned problem. After many literatures and research papers have reviewed, the appropriate BPR framework for this thesis has been established. Some theories about BPR and waste (Muda) have been considered in order to reduce deliver lead time and minimize non-valued added activities of order-to-delivery process. To perform this project, BPR framework provides guideline and step, which are shown as follow:

1) **Company and literature study:** ABC current situations and the surrounding environments had been analyzed by analysis tools, which are SWOT, PEST and Porter's 5 forces. Section 4.2 of this thesis shows the result of company analysis.

2) **Understanding the project:** Before starting BPR project, top management has to recognize for the change and commit to fully support the project. Then, all related employees have to fully understand the project and its benefits.

3) **Initiating the project:** After all related people understand about BPR project and the order-to-delivery process has been selected. The ABC reengineering team, which can be seen in figure 4.2, had been set as a key person to response the project. The team was required to find solutions or recommendations, which could reduce delivery lead time of the selected process. The measurable target of the

project was delivery lead time in BKK should not exceed the industry standard or 1 day.

4) **Programming the project:** As-Is process had been established to present the current processes and sub-processes, which can be seen from figure 4.5 to 4.12. Then, each team member collected data from each responsible area by interviewing all related employees for each process and sub-process or reviewing their process documents. Next, fish bone diagram was used to analyze each sub-process to find the root cause of problems. The route causes of each sub-process were classified into 4 categories, which are Process, Policy, System, and People. Figure 4.14 to 4.20 showed the cause and effect of each inefficient sub-process. Finally, the current capabilities of ABC had been evaluate by Capability Maturity Model (CMM). The target of each capability after implement the project was also set in the same framework.

5) **Transforming the project:** After list of problems had been identified, the brainstorm session to find the solutions or recommendation was conducted. Solutions or recommendations were also classified into the same 4 categories. Then, To-Be process, which can be seen from figure 5.7 to 5.13, were designed by applying the recommendation to As-Is process. Then, all recommendations had been prioritized based on impact/benefits to the business and ease of implementation, which showed in figure 5.14: Four quadrant priority chart.

6) **Implementing the project:** The implementation plan was established after To-Be process had been designed and a recommendation had been prioritized. In this thesis, implementation plan was divided into 4 sub-implementation plans by responsible party or person, which can be seen in section 6.1.1 to 6.1.4. Finally, problems during implementation of each sub-implementation plan were discussed. There are 2 important recommendations were not implemented due to problems on time and investment cost.

7) **Evaluating the project:** After the project has been implemented, the project was evaluated by comparing various before and after implementation results, which

are total number of activities of order-to-delivery process, delivery lead time of order-to-delivery process, the number of rejected orders, the number of complaint from customer survey results, and the level of capabilities in Capability Maturity Model. These results were shown in section 6.3.

From the results, the project was quite successfully implemented. All of the comparison results of new process were better than the old process. Results from section 6.3 are summarized below.

- Non-value added activities were reduced approximately 24%
- Delivery lead time from both calculation and raw data in AS400 were reduced approximately 48%
- Number of rejected orders were reduced approximately 51%
- Numbers of complaints were reduced in almost of issues, especially delay delivery was reduced from 33.38% to 11.64% and Incorrect product and/or quantity, and incorrect document issues are also reduce from 10.25% to 5%
- Overall ABC capabilities were improved into better level.
- Although the total logistics cost is higher, the operations efficiency related costs are reduced approximately 15%
- As the company gets many intangible benefits from the project, it would be worthwhile to invest and implement this project.

From results above, the new order-to-delivery process is more efficient and less lead time than the old process. However, the delivery lead time of the new process is a little bit longer than the project objective. This might because some recommendations, which have high benefits to the project, were not implemented. Since the results are acceptable by top management and reengineering team, the remaining recommendations will be postponed into next phase.

Additionally, results of many BPR projects are better when the time has passed. This is because after employees have more experiences in the new process, they can perform their job faster and better, which means the time required to perform a task decreases as the task is repeated. In the other word, many BPR projects have a

"Learning Curve" or the employee performance will increase direct-change to time spent. Some information has been collected to draw some graphs to show the learning curve of this project. Below two examples graphically, figure 7.1 and 7.2, show the learning curve on delivery lead time and learning curve on overtime spent after implementation the new process. The information has been presented in weekly period of time.

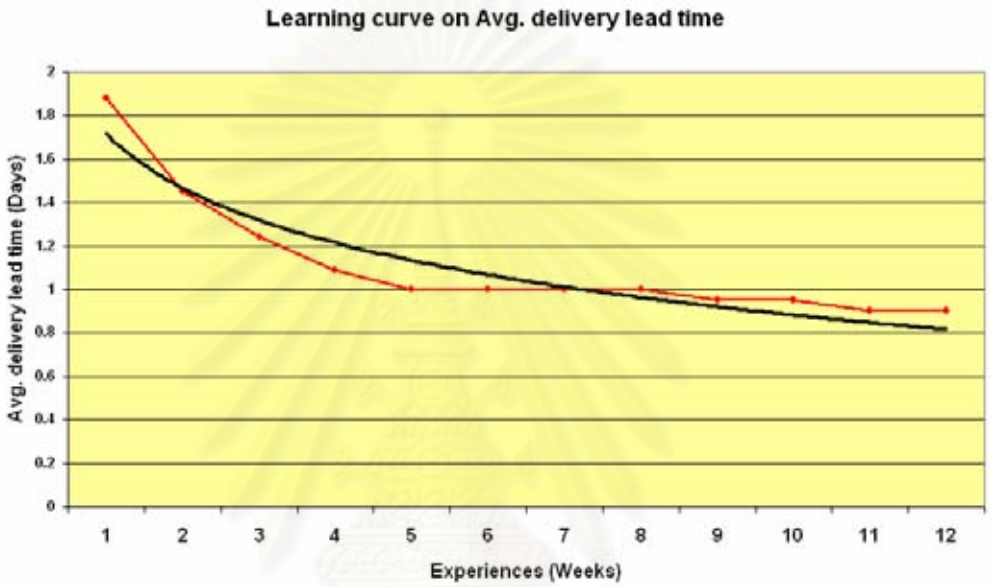


Figure 7.1: Learning Curve on Avg. delivery lead time during 3 months period after implementation

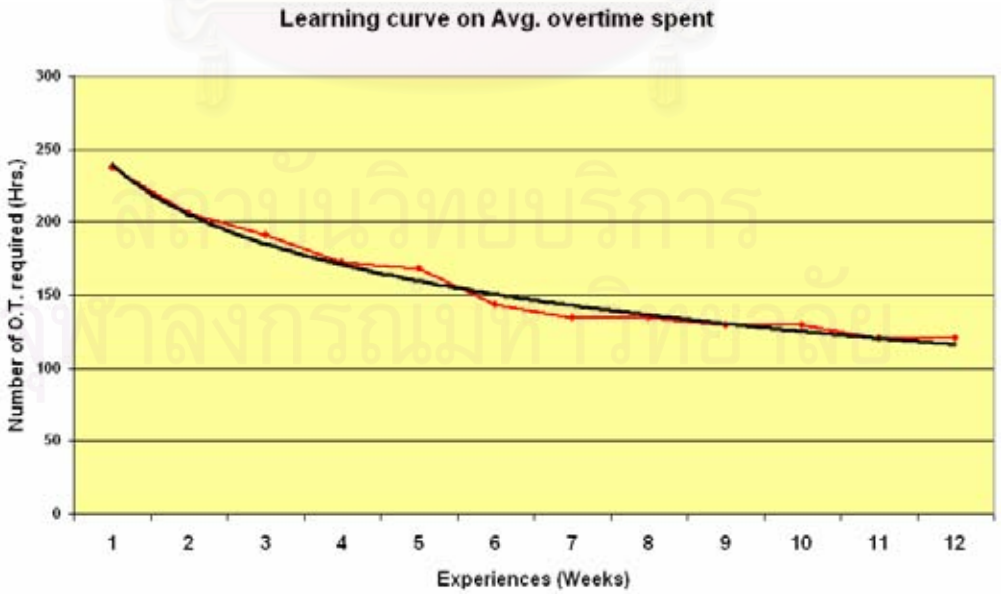


Figure 7.2: Learning Curve on O.T spent during 3 months period after implementation

From figures above, the weekly average delivery lead times of new order-to-delivery process during 3 months period after implementation are continuously reduced, when employees have more experiences in the new process. Moreover, the overtime spent in the same period is also continuously reduced, when employees perform the same activities. In the future, if the delivery lead time, overtime spent, and other issues are stop improving, new solutions or recommendations would be proposed to redesign for improving the existing processes.

7.2 Recommendations

This thesis is present the appropriate framework and methodology to perform Business Process Reengineering (BPR) project. The analysis tools for each step of BPR projects are provided. The recommendations to reengineer the order-to-delivery cycle are also proposed. However, some recommendations on this thesis as follow:

- The framework and methodology for BPR project, which are proposed in this thesis, are standard methods. Therefore, this methodology could be applied to use with other BPR projects of the company. Moreover, some recommendations could be applied to use with other related industry, especially for non-food products with make-to-stock production type.

- Implementation plan should be more realistic, since many recommendations in the proposed implementation plan can not finish on time. Reengineering team and related people should better manage their time for both routine job and project job, since the routine job is always an excuse when meeting session, training class, and collection data period can not perform on the specific time.

- In order to design To-Be process, redundancy activities or double works are eliminated to improve efficiency of the process. However, some redundancy works are used to recheck the correctness of previous activities. Although the new process could solve the problems of the old process, but it could create the new problems. Therefore, all employees who have worked in the new

process have to often investigate the problems that might come from the new process, and then inform their managers to further investigation to find the appropriate solutions.

- From the results on number of complaint from new customer survey, the numbers of complaint for some issues, which are not related with the project, are increased. This means when people in the company concentrate on some problems, they pay less attention on some other issues. Therefore, the company should carefully take care on other parts of the company when trying to improve the selected part.

7.3 Further Study

Since some recommendations are not implemented in this phase, results of this project are very difficult to achieve the goal objectives or require longer time to achieve the goal objectives. Therefore, the possible further study would be about to design for new warehouse layout and to implement route and load planning program, which are the topics in the next phase of the company projects for improving the efficiency in logistics areas.

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APPENDICES

APPENDIX A

Company Analysis

1. SWOT Analysis

The company's strengths and weaknesses analysis are from the internal perspective and the opportunities and threats are from external perspective analysis.

Strengths	Weaknesses
• Well established company with 27 years of experience in the paint industry • Well-known brand name and has good reputation among distributors and customers • Certified by Thailand Industry Standard Institute (TISI)	• Long delivery lead time when compared to industry standard • High inventory holding and opportunity lost cost due to poor demand forecast • High complaints during product shortage period • Weak internal communication • Relatively low market share at 7% • No differentiation in product and service
Opportunities	**Threats**
• Continuous growth in the property sector • Expansion of paint market due to high demand • Opportunity for international expansion in South East Asia • Strong purchasing power in property sector	• Intense competition from both established brand and new entrants • High R&D spending from market leaders • Expectation of economic bubble burst • High capital required to dramatically improve current technology

2. PEST Analysis

PEST analysis is concerned with the environmental influence on the business. This framework is used to auditing the macroenvironment of the company. PEST stands for Political, Economic, Social and Technological factors.

P-Political Factor	**E-Economic Factor**
• Uncertainty in political environment arise from the coup, temporary government and the coming government • Unclear direction of property sector especially in “Baan Ur-R-Thorn” project initiated by Thaksin government • Unclear strategy and policy of interest and loan rate	• Strong GDP growth for the past few years • Expected growth in GDP but at lower rate • Relatively interest and loan rate • Relatively low confidence level in foreign direct investment
S-Social Factor	**T-Technology Factor**
• More concern on living standard • Trend to move out from parent’s house at younger rate • Couples tend to live in condominium • People buy asset for investment purpose • Strong “Do-It-Yourself” (DIY) concept from Western countries create new segment for self-tinted paint sector	• Tinting machine open up new market e.g. replacing some material for internal decoration • High competition due to the emergence and reduction of cost of resource planning software and customer relationship management (CRM) software

3. Porter's 5 Forces Analysis

Porter's 5 Forces is used to identify the nature or the force fields and characteristic of the market that ABC Paint Co., Ltd is operated. Five forces are Threat of new entrants, Bargaining power of supplier, Bargaining power of customers, Intensity of rivalry and Threat of substitutes product. The negative forces and positive forces of each field will be identified below.

1) Threat of new entrants: MEDIUM

Negative forces	Positive Forces
• Relatively low capital for initial investment • Profit level is relatively high , hence, attractive to new entrants • Low switching cost due to product is close to commodity • Require low technology to manufacture	• Brand equity is costly and difficult to establish • Economies of scale in production and distribution • Distribution channel is hard to penetrate for new entrants • Low change for bidding in government project for new entrants

2) Bargaining power of supplier: HIGH

Negative forces	Positive Forces
• Concentrate chemical suppliers who provide most of raw material even though chemical is almost commodity • High switching cost for ABC due to change in chemical property affect formulation and quality of end products • ABC is minor source of revenue to those suppliers	• Unlikely to backward integrate due to low synergy expected • Paint industry in Thailand required strong connection and relationship, hence, suppliers are unlikely to do forward integrate

3) Bargaining power of customers: MEDIUM

Negative forces	Positive Forces
• Relatively low switching cost • Product are almost commodity • Tend to choose international brand	• Well known brand • ABC pricing strategy

4) Intensity of rivalry: MODERATELY HIGH

Negative forces	Positive Forces
• Low switching cost from buyers/customers point of view since product is an almost commodity product • Service is not clearly distinguish among competitors • Few large company dominates 80% of the market and are well known among customers	• Customers are price sensitive and ABC is able to provide paint at low price • Bidding government product require network and connects which ABC has

5) Threat of substitutes product: LOW

Negative forces	Positive Forces
• New technology create new type of substitutes such as color cement, artificial wood	• Substitutes materials are far more expensive • Needs of paint

APPENDIX B

Best Part Numbering System by BPIC

Current best practice, when using a computer planning system, is for the part number to be non-significant (not descriptive), all numeric and as short as possible to accommodate the largest number of parts envisaged. I have listed below 12 good reasons for this approach.

1. The part number is entered many times daily. A descriptive part number is re-entering the description which is already held by the system so is double entry and a waste of time and effort.

2. Descriptive part numbers frequently contain alpha (letters) as well as numeric characters which are in different parts of the key board so cause a disproportionate increase in entry time. If alpha characters are case sensitive the entry time (and aggravation) increases again.

3. Long part numbers often have to have spacing characters such as hyphens and slashes to make them readable which add to the entry cost.

4. The more characters that are entered the greater the chance of errors. People can remember up to 6 characters easily (e.g. a telephone number) after that errors increase.

5. People can guess descriptive part numbers but, because they are close, errors are harder to spot. An error in a non-significant part number is more obvious.

6. The increasing use of bar codes is another incentive for a short part number. Short bar codes are easier to read and the equipment is cheaper and smaller. Alpha numeric bar codes are over twice the length of numeric bar codes.

7. All new employees need training in a significant part numbering system. In practice it is rare that everyone really understand the part numbering systems eliminating any advantage. If "wrong" part numbers are created, parts change their use, have multiple use or are inherited from other sites or companies,

descriptive part numbers just add to the confusion. Incorrect significance in part numbers is expensive double trouble.

8. Most systems have part type, classification or codes which are quicker and easier to use to find a type of part and for reports than a descriptive part number. In addition, if there are strict rules for the layout of the description field (see note below), it is more flexible and efficient to find a part using the description field than by using a description coded into the part number.

9. Even significant part numbers still have to be unique which means adding a non-significant element or adding extensions to the part numbers as and when new product variations are introduced. If the part numbering system is updated, do you update all the old part numbers or allow them to be incorrect?

10. New significant part numbers have to be created manually whilst non-significant part numbers can be allocated by the system which saves time and administration costs.

11. If absolutely necessary, sales catalogues can carry on using the old part numbering system. Systems can convert the short, numeric "internal" part number to a sales number for invoicing etc. New products should adopt the new codes from the start (your customers are more interested in your description and specification than your part number). It is also possible to convert suppliers part numbers to the internal number.

12. Finally, for the dinosaurs who will not change (people do get very attached to their antiquated but familiar part numbering systems) the old part number can be stored in an "external" field for them to use. In practice people very soon get used to the new part numbers.

Some people advocate the use of check digits after the part number. In practice, most planning systems will display the description after a part number has been entered and the vast majority of people will check the description before proceeding. Check digits do not therefore justify the extra digit in planning applications.

Source: Phil Robinson - www.bpic.co.uk

APPENDIX C

1. Calculated Time (As-Is process)

1.1 Capture Orders (OM-010)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	255				
Case 1	44	112	112	12544.00	96	1.59
Case 2	17	43	43	1849.00		
Case 3	39	100	100	10000.00		
				24393.00		

1) Fax

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-010-01-1	Receive customer order via fax	Sale Admin	2	1.00	56	0.93
OM-010-01-4	Determine Order Type	Sale Admin	2	1.00	56	0.93
					112	1.87

2) Telephone

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total time (min)	Total Time (HR)
OM-010-01-2	Receive customer order via phone	Sale Admin	2	1.00	22	0.36
OM-010-01-4	Determine Order Type	Sale Admin	2	1.00	22	0.36
					43	0.72

3) Sale Representative

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total time (min)	Total Time (HR)
OM-010-01-3	Receive customer order from sales	Sale Admin	2	1.00	50	0.83
OM-010-01-4	Determine Order Type	Sale Admin	2	1.00	50	0.83
					100	1.67

1.2 Process Sales Orders (OM-020)

1.2.1 Deposit Buying (OM-020A)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	153				
Case 1.1	9.5	14	98.00	1372.00	132.93	2.22
Case 1.2	0.5	1	5.84	4.47		
Case 2	90	138	137.70	18961.29		
				20337.76		

1.1) First time or new contact of deposit buying: agree

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020A-01-1	Fill Deposit buying form	AR Officer	1	2.5	35.00	0.58
OM-020A-01-2	Receive for recheck and approval	AR Officer	1	2	28.00	0.47
OM-020A-01-3	Record in AS400	AR Officer	1	2	28.00	0.47
OM-020A-01-4	Issue the contract	Sale Admin	6	3	7.00	0.12
					98.00	**1.63**

1.2) First time or new contact of deposit buying: disagree

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020A-01-1	Fill Deposit buying form	AR Officer	1	2.5	1.91	0.03
OM-020A-01-2	Receive for recheck and approval	AR Officer	1	2	1.53	0.03
OM-020A-01-3	Record in AS400	AR Officer	1	2	1.53	0.03
OM-020A-01-5	Keep the record for reference and inform Sale Rep	AR Officer	1	1	0.77	0.01
OM-020A-01-6	Inform customer	Sale Rep	36	5	0.11	0.00
					5.84	**0.10**

2) Not First time or new contact of deposit buying

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020A-01-7	Deduct amount from previous agreement	AR Officer	3	3	137.70	2.30
					137.70	**2.30**

1.2.2 Standard buying-1 (OM-020B-1)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	153				
Case 1	90	138	218.03	30022.04	198.36	3.31
Case 2.1	9.5	14	23.33	326.67		
Case 2.2	0.5	1	0.88	0.61		
				30349.32		

1) Stock availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	68.85	1.15
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	45.90	0.77
OM-020B-01-3	Confirm Quantity and delivery date with Customer	Sale Admin	6	2	45.90	0.77
OM-020B-01-4	Input in AS400	Sale Admin	6	2.5	57.38	0.96
					218.03	**3.63**

2.1) No Stock availability: Revise

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	7.00	0.12
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	4.67	0.08
OM-020B-01-5	Inform Sale Rep	Sale Admin	6	1	2.33	0.04
OM-020B-01-6	Inform and get feed back from customers	Sale Rep	36	3	1.17	0.02
OM-020B-01-7	Revise SO form	Sale Admin	6	1	2.33	0.04
OM-020B-01-4	Input in AS400	Sale Admin	6	2.5	5.83	0.10
					23.33	**0.39**

2.2) No Stock availability: Cancel

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	0.35	0.01
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	0.23	0.00
OM-020B-01-5	Inform Sale Rep	Sale Admin	6	1	0.12	0.00
OM-020B-01-6	Inform and get feed back from customers	Sale Rep	36	3	0.06	0.00
OM-020B-01-8	Cancel order	Sale Admin	6	1	0.12	0.00
					0.88	**0.01**

1.2.3 Standard buying-2 (OM-020B-2)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	102				
Case 1	90	92	145.35	13343.13	132.15	2.20
Case 2.1	9.5	9	15.00	135.00		
Case 2.2	0.5	1	1.25	1.25		
				13479.38		

1) Stock availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	45.90	0.77
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	30.60	0.51
OM-020B-01-3	Confirm Quantity and delivery date with Customer	Sale Admin	6	2	30.60	0.51
OM-020B-01-4	Input in AS400	Sale Admin	6	2.5	38.25	0.64
					145.35	**2.42**

2.1) No Stock availability: Revise

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	4.50	0.08
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	3.00	0.05
OM-020B-01-5	Inform Sale Rep	Sale Admin	6	1	1.50	0.03
OM-020B-01-6	Inform and get feed back from customers	Sale Rep	36	3	0.75	0.01
OM-020B-01-7	Revise SO form	Sale Admin	6	1	1.50	0.03
OM-020B-01-4	Input in AS400	Sale Admin	6	2.5	3.75	0.06
					15.00	**0.25**

2.2) No Stock availability: Cancel

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020B-01-1	Fill in SO form	Sale Admin	6	3	0.50	0.01
OM-020B-01-2	Preview stock availability	Sale Admin	6	2	0.33	0.01
OM-020B-01-5	Inform Sale Rep	Sale Admin	6	1	0.17	0.00
OM-020B-01-6	Inform and get feed back from customers	Sale Rep	36	3	0.08	0.00
OM-020B-01-8	Cancel order	Sale Admin	6	1	0.17	0.00
					1.25	**0.02**

1.3 Manage Customer Credit Exposure (OM-030)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	253				
Case 1	90	228	57.00	12996.00	61.41	1.02
Case 2.1	9.5	24	105.67	2536.00		
Case 2.2	0.5	1	4.37	4.37		
				15536.37		

1) Credit not exceed Limit

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	28.50	0.48
OM-030-01-2	Record as invoice	AR Officer	4	0.5	28.50	0.48
					57.00	**0.95**

2.1) Credit exceeds Limit: Approved

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	3.00	0.05
OM-030-01-3	Inform Sale Rep	AR Officer	4	0.5	3.00	0.05
OM-030-01-4	Request for authorization of credit expansion from Sale Rep	AR Officer	4	0.5	3.00	0.05
	Approve (1)	Sale Rep	36	5	3.33	0.06
OM-030-01-5	Request for authorization of credit expansion from Sale Mgr	Sale Rep	36	0.5	0.33	0.01
	Approve (2)	Sale Mgr	4	15	90.00	1.50
OM-030-01-2	Record as invoice	AR Officer	4	0.5	3.00	0.05
					105.67	**1.76**

2.2) Credit exceeds Limit: Not Approved

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	0.13	0.00
OM-030-01-3	Inform Sale Rep	AR Officer	4	0.5	0.13	0.00
OM-030-01-4	Request for authorization of credit expansion from Sale Rep	AR Officer	4	0.5	0.13	0.00
	Approve (1)	Sale Rep	36	5	0.14	0.00
OM-030-01-5	Request for authorization of credit expansion from Sale Mgr	Sale Rep	36	0.5	0.01	0.00
	Approve (2)	Sale Mgr	4	15	3.75	0.06
OM-030-01-6	Inform customer for further action	Sale Rep	36	1.5	0.04	0.00
OM-030-01-7	Cancel Order	AR Officer	4	0.2	0.05	0.00
					4.37	**0.07**

1.4 Check Inventory Availability (OM-040)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	252				
Case 1	80	202	181.80	36723.60	158.28	2.64
Case 2.1	19	48	65.87	3161.60		
Case 2.2	1	2	1.18	2.36		
				39887.56		

1) Product availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-040-01-1	Check inventory availability in AS400	Sale Admin	6	2	67.33	1.12
OM-040-01-2	Book and allocate products	Sale Admin	6	1	33.67	0.56
OM-040-01-3	Print invoice	Sale Admin	6	1	33.67	0.56
OM-040-01-4	Send invoice to warehouse for picking	Sale Admin	6	1.4	47.13	0.79
					181.80	**3.03**

2.1) Product not availability or partial availability: Accept

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-040-01-1	Check inventory availability in AS400	Sale Admin	6	2	16.00	0.27
OM-040-01-5	Inform Sale Rep	Sale Admin	6	1	8.00	0.13
OM-040-01-6	Inform customers	Sale Rep	36	2	2.67	0.04
OM-040-01-7	Revise SO and Invoice	Sale Admin	6	1.5	12.00	0.20
OM-040-01-2	Book and allocate products	Sale Admin	6	1	8.00	0.13
OM-040-01-3	Print invoice	Sale Admin	6	1	8.00	0.13
OM-040-01-4	Send invoice to warehouse for picking	Sale Admin	6	1.4	11.20	0.19
					65.87	**1.10**

2.2) Product not availability or partial availability: Cancel

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-040-01-1	Check inventory availability in AS400	Sale Admin	6	2	0.67	0.01
OM-040-01-5	Inform Sale Rep	Sale Admin	6	1	0.33	0.01
OM-040-01-6	Inform customers	Sale Rep	36	2	0.11	0.00
OM-040-01-8	Cancel Order	Sale Admin	6	0.2	0.07	0.00
					1.18	**0.02**

1.5 Plan and Manage Delivery (LO-010) Part 1

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	250				
Case 1.1	1.5	4	7.60	30.40	170.98	2.85
Case 1.2	13.5	34	60.07	2042.27		
Case 2.1	8.5	21	25.90	543.90		
Case 2.2	76.5	191	210.10	40129.10		
				42745.67		

1.1) Deliver by 3PL but not availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-01-1	Sort Type of delivery service needed	W/H Admin	3	0.5	0.67	0.01
LO-010-01-2	Prepare Delivery documents for 3PL	W/H Admin	3	2	2.67	0.04
LO-010-01-3	Sort route by delivery area	W/H Sup	2	1	2.00	0.03
LO-010-01-4	Get the processed invoice for preparing FG	Logistics officer	30	1	0.13	0.00
LO-010-01-5	Physical inventory checking	Logistics officer	30	5	0.67	0.01
LO-010-01-8	inform customer	Sale Admin	6	2	1.33	0.02
LO-010-01-9	Cancel Order	Sale Admin	6	0.2	0.13	0.00
					7.60	**0.13**

1.2) Deliver by 3PL and availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-01-1	Sort Type of delivery service needed	W/H Admin	3	0.5	5.67	0.09
LO-010-01-2	Prepare Delivery documents for 3PL	W/H Admin	3	2	22.67	0.38
LO-010-01-3	Sort route by delivery area	W/H Sup	2	1	17.00	0.28
LO-010-01-4	Get the processed invoice for preparing FG	Logistics officer	30	1	1.13	0.02
LO-010-01-5	Physical inventory checking	Logistics officer	30	5	5.67	0.09
LO-010-01-6	Pick product according to invoices	Logistics officer	30	5	5.67	0.09
LO-010-01-7	Sort order within routing	Logistics officer	30	2	2.27	0.04
					60.07	**1.00**

2.1) Deliver by ABC but not availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-01-1	Sort Type of delivery service needed	W/H Admin	3	0.5	3.50	0.06
LO-010-01-3	Sort route by delivery area	W/H Admin	2	1	10.50	0.18
LO-010-01-4	Get the processed invoice for preparing FG	Logistics officer	30	1	0.70	0.01
LO-010-01-5	Physical inventory checking	Logistics officer	30	5	3.50	0.06
LO-010-01-8	inform customer	Sale Admin	6	2	7.00	0.12
LO-010-01-9	Cancel Order	Sale Admin	6	0.2	0.70	0.01
					25.90	**0.43**

2.2) Deliver by ABC and availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-01-1	Sort Type of delivery service needed	W/H Admin	3	0.5	31.83	0.53
LO-010-01-3	Sort route by delivery area	W/H Sup	2	1	95.50	1.59
LO-010-01-4	Get the processed invoice for preparing FG	Logistics officer	30	1	6.37	0.11
LO-010-01-5	Physical inventory checking	Logistics officer	30	5	31.83	0.53
LO-010-01-6	Pick product according to invoices	Logistics officer	30	5	31.83	0.53
LO-010-01-7	Sort order within routing	Logistics officer	30	2	12.73	0.21
					210.10	**3.50**

1.6 Plan and Manage Delivery (LO-010) Part 2

	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
Total order	**100**	**225**				
Case 1	**48**	**108**	**129.60**	**13996.8**	**133.19**	**2.22**
Case 2	**52**	**117**	**136.50**	**15970.5**		
				29967.3		

1) Deliver by 3PL or to UPC

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-02-1	Record delivery route for each vehicle	W/H Admin	3	1.2	43.20	0.72
LO-010-02-2	Print out Delivery form	W/H Admin	3	0.5	18.00	0.30
LO-010-02-3	Pick product from consolidation area and arrange products for each vehicle	Logistics officer	30	5	18.00	0.30
LO-010-02-4	Attach sticker Tag	Logistics officer	6	0.2	3.60	0.06
LO-010-02-5	Check invoice and products accuracy with Delivery form	Logistics officer	30	2	7.20	0.12
LO-010-02-6	Load products into vehicle	Logistics officer	30	5	18.00	0.30
LO-010-02-7	Sign Delivery form	W/H Sup	1	0.2	21.60	0.36
					129.60	**2.16**

2) Deliver by ABC

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-02-1	Record delivery route for each vehicle	W/H Admin	3	1.2	46.80	0.78
LO-010-02-2	Print out Delivery form	W/H Admin	3	0.5	19.50	0.33
LO-010-02-3	Pick product from consolidation area and arrange products for each vehicle	Logistics officer	30	5	19.50	0.33
LO-010-02-5	Check invoice and products accuracy with Delivery form	Logistics officer	30	2	7.80	0.13
LO-010-02-6	Load products into vehicle	Logistics officer	30	5	19.50	0.33
LO-010-02-7	Sign Delivery form	W/H Sup	1	0.2	23.40	0.39
					136.50	**2.28**

1.7 Manage Transportation (LO-020)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	225				
Case 1	33	74	397.75	29433.50	284.31	4.74
Case 2	67	151	228.72	34536.81		
				63970.31		

1) Deliver to UPC

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-020-01-1	Drive to the central DC	Driver/ Logistics officer	4	5	92.50	1.54
LO-020-01-2	Unload Product	Driver/ Logistics officer	4	15	277.50	4.63
LO-020-01-3	Ask/Wait for transporters to sign delivery documents	Driver/ Logistics officer	4	1.5	27.75	0.46
					397.75	**6.63**

2) Deliver in BKK

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-020-01-5	Deliver product to customer	Driver/ Logistics officer	34	35	155.44	2.59
LO-020-01-6	Unload Product	Driver/ Logistics officer	34	15	66.62	1.11
LO-020-01-7	Ask/Wait for customers to sign delivery documents	Driver/ Logistics officer	34	1.5	6.66	0.11
					228.72	**3.81**

1.8 Summary

Sub process	Avg. Time (min)	Avg. Time (Hr)	Day
OM-010	95.66	1.59	
OM-020	251.63	4.19	
OM-030	61.41	1.02	
OM-040	158.28	2.64	
LO-010	304.17	5.07	
LO-020	284.31	4.74	
Total	**1155.47**	**19.26**	**2.14**

2. Calculated Time (To-Be process)

2.1 Capture Orders (OM-010)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	255				
Case 1	44	112	48	5331.20	45	0.76
Case 2	17	43	23	970.73		
Case 3	39	100	53	5250.00		
				11551.93		

1) Fax

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-010-01-1	Receive orders (PO) via Fax	Sale Admin	2	0.30	17	0.28
OM-010-01-4	Fill in SO pre-printed form	Sale Admin	2	0.50	28	0.47
OM-010-01-5	Determine Order Type by customer code	Sale Admin	2	0.05	3	0.05
					48	**0.79**

2) Telephone

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-010-01-2	Receive orders via Telephone and fill in SO pre-printed form	Sale Admin	2	1.00	22	0.36
OM-010-01-5	Determine Order Type by customer code	Sale Admin	2	0.05	1	0.02
					23	**0.38**

3) Sales Representative

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-010-01-3	Receive orders from sales rep. and fill in SO pre-printed form	Sale Admin	2	1.00	50	0.83
OM-010-01-5	Determine Order Type by customer code	Sale Admin	2	0.05	3	0.04
					53	**0.88**

2.2 Process Sales Orders (OM-020)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	255				
Case 1.1	5.7	14	36.17	506.33	54.78	0.91
Case 1.2	0.3	1	2.40	1.84		
Case 2	54	138	97.75	13460.18		
Case 3	40	102	28.90	2947.80		
				13968.35		

1.1) First time or new contact of deposit buying: agree

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020-01-3	Record into AS400	AR Officer	1	2	28.00	0.47
OM-020-01-4	Print out contract from AS400 and send to customers	AR Officer	1	0.3	4.20	0.07
OM-020-01-2	Record SO in AS400	Sale Admin	6	1.7	3.97	0.07
					36.17	**0.60**

1.2) First time or new contact of deposit buying: disagree

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020A-01-3	Record in AS400	AR Officer	1	2	1.53	0.03
OM-020A-01-5	Keep the record for reference and inform Sale Rep	AR Officer	1	1	0.77	0.01
OM-020A-01-6	Inform customer	Sale Rep	36	5	0.11	0.00
					2.40	**0.04**

2) Not First time or new contact of deposit buying

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020-01-1	Enter new order into AS400 to calculate remaining amount	AR Officer	3	1.5	68.85	1.15
OM-020-01-2	Record SO in AS400	Sale Admin	6	1.7	28.90	0.48
					97.75	**1.63**

3) Standard buying

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-020-01-2	Record SO in AS400	Sale Admin	6	1.7	28.90	0.48
					28.90	**0.48**

2.3 Manage Customer Credit Exposure (OM-030)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	254				
1	90	229	28.63	6555.13	26.66	0.44
2.1	9.5	24	9.00	216.00		
2.2	0.5	1	0.47	0.47		
				6771.59		

1) Credit not exceed Limit

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	28.63	0.48
					28.63	**0.48**

2.1) Credit exceeds Limit: Approved

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	3.00	0.05
OM-030-01-2 or OM-030-01-3	Request for authorization of credit expansion from Sale Rep or Sale Mgr	AR Officer	4	0.5	3.00	0.05
	Approve	Sale Mgr or Sale Rep	40	5	3.00	0.05
					9.00	**0.15**

2.2) Credit exceeds Limit: Not Approved

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-030-01-1	Check credit limit	AR Officer	4	0.5	0.13	0.00
OM-030-01-2 or OM-030-01-3	Request for authorization of credit expansion from Sale Rep or Sale Mgr	AR Officer	4	0.5	0.13	0.00
	Approve	Sale Mgr or Sale Rep	40	5	0.13	0.00
OM-030-01-4	Inform customer for further action	Sale Rep	36	1.5	0.04	0.00
OM-030-01-5	Cancel Order	AR Officer	4	0.2	0.05	0.00
					0.47	**0.01**

2.4 Check Inventory Availability (OM-040)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	253				
1	80	202	202	101.00	84.86	1.41
2.1	20	51	51	21.08		

1) Product availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-040-01-1	Check inventory availability in AS400	Sale Admin	6	2	67.33	1.12
OM-040-01-2	Book and allocate products	Sale Admin	6	1	33.67	0.56
					101.00	**1.68**

2) Product not availability or partial availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
OM-040-01-1	Check inventory availability in AS400	Sale Admin	6	2	16.87	0.28
OM-040-01-3	Assign status “Backorder” to unfulfilled order	Sale Admin	6	0.5	4.22	0.07
					21.08	**0.35**

2.5 Plan and Manage Delivery (LO-010) Part 1

	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
Total order	**100**	**253**				
Case 1	**100**	**253**	**42.17**	**10668.17**	**42.17**	**0.70**
				10668.17		

Activities	Description	Person in Charge	Remark
LO-010-01-1	Print out route planning support report	W/H Sup	Parallel work
LO-010-01-2	Review report and make adjustment to sort route by delivery area	W/H Sup	Parallel work

1) Product not availability

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-01-3	Print out picking list from AS400	W/H Admin	3	0.05	4.22	0.07
LO-010-01-4	Get picking list for preparing finished goods	Logistics officer	6	0.1	4.22	0.07
LO-010-01-5	Physical inventory checking	Logistics officer	30	1.5	12.65	0.21
LO-010-01-6	Picking products to consolidation area and attach sticker tag for UPC area	Logistics officer	30	1.5	12.65	0.21
LO-010-01-7	Pick Confirm in AS400	W/H Admin	3	0.1	8.43	0.14
					42.17	**0.70**

Activities	Description	Person in Charge	Remark
LO-010-01-8	Inform Sale Administrator to update inventory in AS400	Logistics officer	Parallel work
LO-010-01-9	Update inventory in AS400	Sale Admin	Parallel work

2.6 Plan and Manage Delivery (LO-010) Part 2

	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
Total order	**100**	**253**				
Case 1	**100**	**253**	**90.24**	**22829.87**	**90.24**	**1.50**
				22829.87		

Activities	Description	Person in Charge	Remark
LO-010-02-1	Print out Invoices, and related documents of confirmed SO	W/H Administrator	Parallel work

1) Loading into vehicles

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-010-02-2	Print out DO by convert from SO that has invoice	W/H Admin	3	0.3	25.30	0.42
LO-010-02-3	Sort order for the given route from supervisor	Logistics officer	30	1	8.43	0.14
LO-010-02-4	Pick product from consolidation area and pack into roll container	Logistics officer	30	3	25.30	0.42
LO-010-02-5	Check invoices and products accuracy with Delivery Order	Logistics officer	30	1	8.43	0.14
LO-010-02-6	Move roll container into each vehicle	Logistics officer	30	1.2	10.12	0.17
LO-010-02-7	Sign Delivery form	W/H Sup	2	0.1	12.65	0.21
					90.24	**1.50**

2.7 Manage Transportation (LO-020)

Total order	%	Qty	Time	Time * Qty	Process Avg. Time (min)	Process Avg. Time (Hr)
	100	253				
1	33	83	217.88	18083.63	215.94	3.60
2	67	170	215.00	36550.00		
				54633.63		

1) Deliver to UPC

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-020-01-1	Drive to the central DC	Driver/Logistics officer	4	5	103.75	1.73
LO-020-01-2	Unload Product by roll container	Driver/Logistics officer	4	4	83.00	1.38
LO-020-01-3	Ask/Wait for transporters to sign delivery documents	Driver/Logistics officer	4	1.5	31.13	0.52
					217.88	**3.63**

2) Deliver in BKK

Activities	Description	Person in Charge	People (Qty)	Time/ Order	Total Time (Min)	Total Time (HR)
LO-020-01-5	Deliver product to customer	Driver/Logistics officer	34	35	175.00	2.92
LO-020-01-6	Unload Product by roll container	Driver/Logistics officer	34	6.5	32.50	0.54
LO-020-01-7	Ask/Wait for customers to sign delivery documents	Driver/Logistics officer	34	1.5	7.50	0.13
					215.00	**3.58**

2.8 Summary

Sub process	Avg. Time (min)	Avg. Time (Hr)	Day
OM-010	45.30	0.76	
OM-020	54.78	0.91	
OM-030	26.66	0.44	
OM-040	84.86	1.41	
LO-010	132.40	2.21	
LO-020	215.94	3.60	
Total	**559.94**	**9.33**	**1.04**

APPENDIX D

Detail of Capability Maturity Model

1. Fulfill Customer Orders

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Bill and Collect Revenue	Manual invoicing after shipment. Pricing, terms, quantities must be checked for accuracybefore invoice is issued. Manual control logs for shipping /invoicing are used to ensure all shipments are invoiced.	Quantity & pricing input after shipment to generate the invoice. Pricing structure and controls are not tightly managed. Accounts receivable aging is used to pursue open receivables greater than a specified limit.	Integrated with shipment for automatic invoicing. Pricing is fullyautomated. Cycle time is short. Accounts receivable function proactivelyworks with customers to insure upfront setup for efficient and timelypayment.	Invoices sent EDI or not at all. Pricing and customer service responsible for setup of information to insure fast payment. Payments are automaticallytransferred upon trigger events, such as confirmation of receipt or usage. Customer payments are consistentlyreceived within payment terms and little on-going effort is needed to manage specific transaction payments.		
Capture Orders	Mail, Fax, and phone receipt. Paper intensive process. Customer must know catalogue numbers (SKUs) or the customer service personnel must remember what the customer orders.	Manually entered and some linkages internally. Can verify customer data, price, credit at order receipt and can perform a search to match customer needs to products.	Received via EDI; no manual steps required. Open quotes, order configurations, and customer preferences maintained.	Received via Internet or EDI with integration to all appropriate internal processes. Planned orders based on customer inventory levels and forecast. Customer releases orders against a blanket contract. Customer demand is collaboratively planned (volumes, promotions)		

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Bill and Collect Revenue	Manual invoicing after shipment. Pricing, terms, quantities must be checked for accuracy before invoice is issued. Manual control logs for shipping / invoicing are used to ensure all shipments are invoiced.	Quantity & pricing input after shipment to generate the invoice. Pricing structure and controls are not tightly managed. Accounts receivable aging is used to pursue open receivables greater than a specified limit.	Integrated with shipment for automatic invoicing. Pricing is fully automated. Cycle time is short. Accounts receivable function proactively works with customers to insure upfront setup for efficient and timely payment.	Invoices sent EDI or not at all. Pricing and customer service responsible for setup of information to insure fast payment. Payments are automatically transferred upon trigger events, such as confirmation of receipt or usage. Customer payments are consistently received within payment terms and little on-going effort is needed to manage specific transaction payments.		
Manage Order Assembly / Packaging (Process)	Orders are manually picked from a large stock of finished goods inventory.	Some level of automation to supporting picking, conveyors, flow racks for order staging or assembly.	Substantial use of technology and material handling/conveyor systems to assist in order assembly. High level of order accuracy is achieved.	Products are built / assembled to order. Packaging is order specific. Very low finished goods inventory is maintained.		
Manage Order Assembly / Packaging (Technology)	Pick lists are manually prepared / faxed to the warehouse. Distribution Center is responsible for sorting / organizing / prioritizing and directing pick activities. High reliance on verbal communications / faxes to manage rush orders	Pick lists are generated by system and printed in the warehouse by Ship Date/Request Date and Customer Order Number. Picks are staged and manually verified before loading. Some reliance on verbal communications or faxes to manage rush orders.	Pick lists are generated by the system, sorted by priority / zone. Wave picking is used to minimize travel paths and shorten pick cycle times. Orders are staged and SKU's are verified using bar code / RF technology before loading.	Pick lists are generated by the system, sorted by priority / zone. Wave picking is used to minimize travel paths and shorten pick cycle times. All picks are immediately confirmed using bar code / RF technology to compare SKU & pick location. Additional levels of automation used to verify pick accuracy, such as matching total order weight against standard.		
Plan Production and Delivery for Customers	Standard lead times utilized. Usually cannot provide a specific ship date without investigation and a return call.	Order Entry and inventory availability linked for promising. When inventory is not available, a standard lead time is quoted.	Order status available. Customer service personnel can use plans/forecasts to provide a shipment commitment during the initial phone call.	Direct linkages to adjust plans to meet customer needs. Main focus is to improve customer's material flow, inventory, and merchandising efforts. Information is available on-line to examine future item availability (available-to-promise / capable-to-promise)		

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Process Orders	Excessive order processing times, high administrative and processing costs. High reliance on order paperwork to be copied & distributed to each functional department.	Some order status information available to customers upon request. Periodic manual review of open orders, excessive expediting. System is relied upon for managing orders, less reliance on paper copies.	Automated order processing and inventory management; EDI receipt of orders with linkages to all internal processes. Generate bill of materials, routings, and engineering requirements for production planning and inventory management, and provide information to invoicing module	Close alignment and coordination of customer service functions as teams; "one" voice to customer (order entry & fulfillment, credit & collections, billing, cash application and technical assistance). Low order processing costs as a percent of sales. Order status / shipment status provided to customer upon demand		

2. Manage Warehouse Operations

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Manage Distribution Center Operations (Technology)	Information exchange with corporate office, suppliers, customers limited to telephone, fax, mail. DC has limited batch accounting and inventory control systems. Manual receiving, storing, and shipment transactions. Manual time cards, labor scheduling, and performance tracking.	Internal use of EDI. ASN received from suppliers. Standard DC/Warehouse software package. Fixed slot bin locations. Manual receiving, movement, shipment transactions. Automated time clocks. Stand alone PC application for labor scheduling and performance reporting.	Standardized applications and networks for all DCs. Integrated DC operational system, including, Inventory Management, Time Clock, Labor Scheduling, Load Management, Performance Measurements. Real-time updates locally, interfaces to corporate systems. Integration with supply points, carriers, and customers via EDI or Internet.	Standard hardware / software. Fully integrated distribution systems connecting corporate, suppliers, carriers, customers. EDI, inventory management, random (dynamic) bin locations, RF and bar code technology, automated time reporting and labor scheduling, dock scheduling, fleet management, maintenance management, DRP.		
Manage Distribution Center Operations (Inventory Management)	Unclear labor management/labor standards. Mismatch between equipment/people capabilities and requirements (pallet trucks vs pickers)	Excessive replenishment activity. Expediting and unplanned shipments/deliveries are common. Significant amount of re-packaging/re-handling	Minimal lost, damaged, obsolete or expired inventory write-offs. Low number of stock outs/high order fill rates. High inventory accuracy. Formal cycle counting program	Visibility to upcoming orders and planning supports expected order load, scheduling of dock times, scheduling of labor		
Manage Packing and Packaging (Conveyance)	Manual pick and pack with significant staging.	Conveyors or rack flow pick/pack. May use pick to lights.	Pick/pack to order with few transactions and no staging.	Highly automated and controlled for order driven pick/pack/ship.		

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Manage Packing and Packaging (Process)	Orders are manually picked from a large stock of finished goods inventory.	Some level of automation, conveyors and/or flow rack used to assist in order assembly. Some staging.	Substantial use of technology and automation to assist in order assembly and improve order accuracy.	Products are manufactured or assembled to order allowing automatic packaging and resulting in very low finished goods inventory.		
Product Placement and Distribution Center Configuration	Use of overflow storage areas (aisles, outside), or conversely, excessive number of empty slots. Product placement is not disciplined, forcing frequent searches to locate material within the warehouse.	Design and size of special zones such as docks, yard, and staging area do not effectively support the operational needs of each distribution center. Efficiency, throughput of DC is negatively affected by physical layout and utilization of space.	Product placement is periodically reviewed. Product characteristics (volume, velocity) are assessed to minimize overall pick and putaway times	Clear policy and enforcement of primary/secondary locations, random/fixed locations. Decreasing overall warehouse cost as a percent of sales. Space is dynamically allocated by the system based on product cube / weight / velocity information. Capacity utilization and throughput statistics are continously monitored.		

3. Manage Transportation

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Create Shipping Documents	Shipping documentation is manually prepared. Order data is re-keyed to stand-alone systems to generate shipping documents.	Shipping documentation is prepared through a stand-alone freight system. Some standard customer information is stored, but a significant amount of redundant data entry is required.	Shipping documentation is supported by an integrated ERP system. No redundant data entry is required. Customs documentation is created off-line, with a stand-alone system.	Shipping documentation is fully integrated, including customs documentation for international shipments. Landed cost analysis is supported by solutions.		
Fulfill Transportation	Shipping and transportation practices only known by a few. Customer requirements not well documented. Inconsistent performance to customer requirements and preferences. Numerous carriers utilized in order to respond to the daily emergencies.	Customer logistics requirements are documented and visible. Manual processes supersede automated systems flows to achieve compliance. Service is acceptable, however, there are numerous emergencies and high degree of effort required.	Released orders and finished inventory levels drive a short term shipping schedule. Some carriers are scheduled to the shipment plan while the remainder are called as orders are readied. Major shipping routes are covered with some carrier contracts.	Production schedules and customer order requirements are used to develop a shipping plan for : carrier scheduling, personnel planning, and customer support. Few carriers provide service based on contracted rates. Preferences are known and met.		

Activity	Stage 1	Stage 2	Stage 3	Stage 4	Evaluation	Target
Manage Transportation Costs	Carrier selection is done locally without clear goalsetting. No metrics of cost items in use or management reporting. No specification of equipment types and call-off times. No transportation network analysis.	Stand-alone systems (spreadsheets) are used to schedule carriers. Freight rate tables and calculations are automated. Expedition management is rewarded on transportation cost performance. Cost savings by co-loading, cross-docking, subdepots etc.	Carrier scheduling is supported by software that allows user to consolidate multiple orders to fill a truck/ship. Planner has visibility to planned shipments over a defined planning horizon. Transportation network is analysed to generate savings in locations/ fleets etc. Concern-wide use of best performing and lowest cost carriers per shipment.	Transportation network is frequently analysed to align with business strategy. Integral optimization of service level, warehousing and/or production costs and transportation costs are supported by TMS and SCP solutions.		
Order Transportation Services	Little or no EDI. Communications limited to telephone and mail services. Some use of faxes. Reliance on manual paperwork.	Heavy reliance on faxes. Significant re-keying of data. Limited information exchange with other systems, batch interfaces. Some experimentation with ASN	Significant system integration (local and corporate systems). Heavy reliance on EDI. Transaction sets include PO, Invoice, ASN. Full integration with ERP systems	Interfaces with service providers using dedicated middleware or private exchanges or IT logistics providers. Automated Management reporting on performance and SC metrics. Integration of WMS, CRM, TMS and ERP leading to adaptive and cost-efficient fulfilment in accordance with business strategy.		
Schedule Carriers	Significant rush orders in a telephone and paperwork intensive process. Carriers called after shipment pick is underway or confirmed that it will be complete. Unclear and fragmented responsibilies concerning carrier selection and contracting.	Delegated expedition and carrier contracting responsibilities. Some carrier contracts. Planning and control reliant on experienced personnel. Customer dictated shipment verification processes and systems. Sales order taking may schedule deliveries without approvement of expedition.	Carriers are coordinated with a reliable near term shipping schedule. Process is fairly automated and integrated to other processes. Service level agreements are in place and monitored. Tendering is used for carrier contracting.	Strategic carrier management with contracts for most shipments, backed by performance metrics based on SLA's. Data sharing with carriers to manage flow and increase saving opportunities that are shared. Tendering is done for all transportation modes. Tendering is supported by transport type specific modules.		

BIOGRAPHY

Mr. Chaow Limpiwattakee was born on December 2nd, 1979 in Chiangmai, Thailand. He graduated from Sirindhorn International Institute of Technology, Thammasat University in 2000 with a Bachelor degree in Industrial Engineering. In the same year, he started early job as a production engineer in a well-know glass manufacturer company. In 2004, he joined a leader retailer department store as a project engineer in Logistics and Supply Chain department. As he realized the needs for engineering management disciplines, he then went to become a post graduate student in Engineering Business Management at Regional Centre for Manufacturing System Engineering, Chulalongkorn University of Thailand and University of Warwick from England. Currently, he works as a consultant at the multinational consulting firm.