



IMPLEMENTING ENTERPRISE RESOURCE PLANNING IN
THE PURCHASING DEPARTMENT OF A PACKAGE
MANUFACTURER

By

Vongsakorn Phantratanamongkol

A Final Report of the Six-Credit Course
SCM 2202 Graduate Project

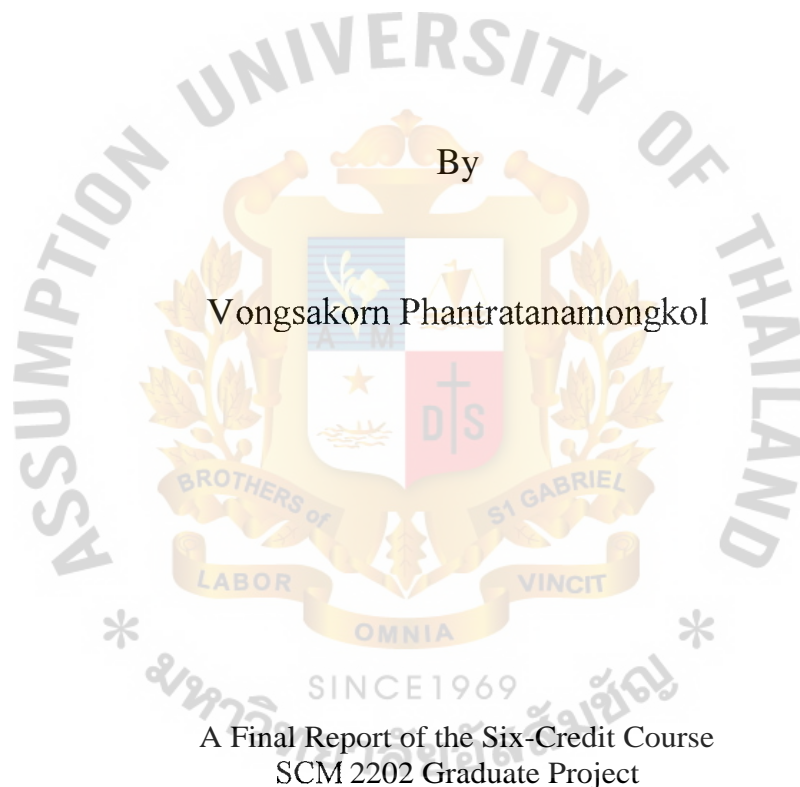
Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT

Martin de Tours School of Management
Assumption University
Bangkok, Thailand

May 2013

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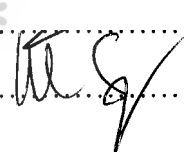
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Master of Science in Supply Chain Management
Assumption University

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Declaration of Authorship Form

I, Vongsakorn Phantratanamongkol,

declare that this thesis/project and the work presented in it are my own and has been generated by me as the result of my own original research on

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Vongsakorn Phantratanamongkol

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May 2013

ABSTRACT

ABC Company Limited is one of the companies that has wanted to modernize its company by implementing an Enterprise Resource Planning (ERP) system for its company after successfully deploying the Finance and Accounting software module under the name MACS.

This research was conducted to explore the merits and shortcomings of the implementation of the ERP system for ABC Company's purchasing department. The research was conducted with primary and secondary data to identify the inefficiencies of current working process flow in purchasing department which was identified through two major causes of human errors from manual input processes and disorganized database which has caused wide ranging issues from inventory planning to delivery planning. The new design of work process would totally eliminate the redundant work process from nine processes to five processes through the use of Enproduction system software. The purchase order currently uses thirty minutes of operations time per issuance, which could be effectively decreased to fifteen minutes. Additionally, the Enproduction project objective was to explore the advantages and disadvantages of ERP system which result positive outweigh the negatives in increased efficiency through reduced operation time for purchasing orders, decreasing operation cost and providing integrated database into the centralized database.

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CHAPTER I

GENERALITIES OF THE STUDY

1.1 Background of the Study

ABC Company Limited, established in 1991, is a Thailand-based manufacturer of squeezable tubes located in Wellgrow Industrial Estate. Its tube products are mainly used in the Fast Moving Consumer Products (FMCG) industry both domestically and in Asia Pacific. In the past few years, ABC sales have grown dramatically resulting in the increase of personnel in all departments by 10%. While the Company has increased its manufacturing capability and technology through the introduction of new machinery, its administrative processes and procedures in supporting the surge in sales has not been changed. The ineffective working performance is, therefore, illustrated. Some delay problems occurred due to inefficient document flow, inadequate raw materials resulting from no clear re-order point, and so on. Consequently, the Company has experienced the inefficient product delivery that leads to higher logistics costs and declining in customer satisfaction. To solve these problems, the Company plans to use technology of Enterprise Resource Planning software with an expectation that it would help address the following problems:

1. Material Requirements Planning (MRP) Module – aids in generating production plans from the sales analysis module and analyzes stock balance, raw material quantity and bill of materials and forecasts the amount of raw materials needed for future production.
2. Purchase Analysis Module – links up with both sales analysis and MRP modules which support purchasing and approval processes and also aids in managing supplier delivery time.
3. Capacity and Scheduling Module – helps calculate capacity requirements with current capacity and sequences each production order in minutes and hours.

4. Shop Floor Control Module – controls production in a production lines with many detailed features such as bill of materials and routing can be varied according to production schedules.
5. Job Costing Module – focuses on cost calculation which is divided into production and direct labor costs and also allocates overhead such as depreciation, electricity, and so on to finish goods.
6. Inventory Management Module – controls store movement transactions such as transferring, adjusting, issuing and receiving. It supports both first in first out (FIFO) and an average costing method for raw materials as well as budgeting for each item and inspection.
7. Machine Maintenance Module – defines non-production time for each machine and keeps track of maintenance and repair history. It can also be used to create a machine maintenance plan.

1.2 Statement of the Problem

In the past, the company has always followed a traditional management approach. Microsoft Excel was normally used. In late 2011, however, the company's Chief Executive Officer (CEO) decided that to drive the company forward and increase competitiveness, the use of Enterprise Resource Planning (ERP) software to streamline business processes would be needed. The Company initially implemented an accounting system by the name of MACS for its finance and accounting department. MACS is an enterprise ERP system that can link up with other software modules to provide a complete enterprise solution. Even though the Finance and Accounting Department could earn benefits from this program, it seems to be limited for other departments especially purchasing department.

The purchasing department employs 12 people that are responsible to procure over 500 items each year for both raw materials and machinery parts. The purchasing department ensures raw materials up to standard at the right price for on-time delivery of finished products to customers. The department covers purchase requisition after the approval of sales order from customers, purchase orders, material budgeting, and

material delivery planning. Currently, the purchasing department is facing inefficiencies and delays in supply due to the following reasons:

1. Purchase orders are not integrated with the current accounting system (MACS) and are also not linked to the MRP system; therefore, there is need to check inventory on a daily basis;
2. Outstanding budget for each particular raw material was not clearly set up in the system; as a result, it is hard to manage;
3. A purchase requisition process to purchase order needs to be manually done to issue a PO, so it takes up a lot of time for numerous variations of raw materials to be purchased; and
4. Material delivery planning currently cannot be done; therefore, it makes the planning of production difficult.

To manage these problems, the Company plans to use the new ERP software program, namely "Enproduction", on the expectation that the implementation of this program in the purchasing department will help alleviate these issues.

Enproduction is MRP II software that was developed in 2003 by Envision Consulting to serve organizations that need software solutions for the scope of manufacturing functions. Functions include Sales Order, Bill of materials explosion, Auto purchase order, Capacity and scheduling, and Stock Management (Envision, 2012). The Enproduction software is also designed to integrate with MACS for reporting and analyzing purposes. This study is meant to find out the pros and cons of the Purchase Analysis module of Enproduction as well as the tangible effects in operations such as decreased work processes, decreased man power, penalty cost savings and overtime costs. The question to be answered in this study is *"Should Enproduction ERP software be applied to improve the working processes of the Purchasing Department of the ABC Company?"*

1.3 Research Objectives

1. To identify the inefficiencies of current working process flow in purchasing department.
2. To design the new working process of the purchasing department based on the Enproduction Software.
3. To determine the possible advantages and disadvantages of the Enproduction System.

1.4 Scope of the Research

This research is conducted to explore the impending implementation of Enterprise Resource Planning (ERP) system of ABC Company Limited specifically in the purchasing department. Research is conducted through primary and secondary methods where the purchasing department section head and department personnel are interviewed to gain first hand insights into operations issues in the department with a focus on purchase requisitions and purchase orders, material budgeting and material delivery planning. Additionally, identification of possible challenges and benefits of ERP implementation in the department is conducted. Due to the large scale implementation of this project, other parts of ERP implementation such as finance and accounting, logistics, and manufacturing are omitted.

1.5 Significance of the Research

This research project serves as a guideline for operations management to find the gap between their current business processes and how the ERP system can help to reduce costs and improve work processes in the organization. To understand the ERP implementation process in Thailand, which encompasses not only technical implementation, but also more importantly managerial implications that could result in the success or failure of an ERP implementation project, it is essential to conduct this study. Additionally, this research would help SMEs in Thailand understand the potential advantages and risk factors of implementing ERP solutions which would in turn help them in selecting the ERP solution that best fits their needs. It is expected from this study that the purchasing department of ABC will benefit from this ERP implementation through decreasing work processes, increasing control and accountability, and enabling better management of operations.

1.6 Limitations of the Research

As the focus of the study is on the purchasing department, the whole picture of the project is not presented. Additionally, due to ABC's early stage in information technology investing, the ERP system implemented here is more focused towards MRP; therefore, the engaged one does not cover the full scope of ERP.

Secondary information regarding implementation of ERP solutions in Asia and particularly in Thailand was limited due to the nature of the industry which would usually keep customer names, projects and cases confidential rather than exposing them to the public.

1.7 Definition of Terms

| | |
|---------------------------------------|---|
| Envision Consulting | Software Company that develops MACS and Enproduction MRPII software |
| Enterprise Resource Planning (ERP) | Software system that integrates and manages information of all business functions of an organization |
| Inventory management module | Module of Enproduction used to control store movement transactions such as transferring, adjusting, issuing and receiving |
| Job costing module | Module of Enproduction that focuses on cost calculation which is divided into production and direct labor costs and also allocates overhead |
| MACS | Module of Enproduction that focuses on finance and accounting functions |
| Materials Requirements Planning (MRP) | Software developed to plan product and parts requirements according to master production schedules |
| Materials Resource Planning (MRPII) | Software developed to optimize manufacturing processes by harmonizing materials with production requirements |
| Purchase Analysis module | Module of Enproduction that links up with both sales analysis and MRP modules which support purchasing and approval processes |
| Purchase order | Written sales contract between a seller and a buyer with details of merchandises or services to be rendered to a buyer |
| Purchase requisition | Document issued internally to purchasing department to order products and services |

CHAPTER II

REVIEW OF RELATED LITERATURE

2.1 Introduction

The focus of the literature review is threefold. The first part of the literature review focuses on the ERP and MRP definition and characteristics as well as the advantages and disadvantages including risks involved in implementing an ERP solution. The second section focuses on ERP implementation phases and strategies. The third section explores the Enproduction software and the advantages and disadvantages of using this software.

2.2 Enterprise Resource Planning (ERP) Definition and Characteristics

O'Leary (2000) defines Enterprise Resource Planning (ERP) system as a powerful software package that enables businesses to integrate a variety of disparate functions. ERP has altered the landscape of work functions such as manufacturing, accounting as well as finance and sales, and has effectively blurred the lines between IT and users. In 1970s Material Requirements Planning (MRP) was developed to plan product and part requirements according to master production schedules (Hossain, Patrick, & Rashid, 2002). Manufacturing Resources Planning (MRP II) soon followed in 1980s with a focus on optimization of manufacturing processes by harmonizing materials with production requirements (Leon, 2008). Based on these advancements, ERP systems integrated business processes widely ranging from finance and accounting, human resource management, manufacturing, customer relationship management, inventory management and distribution across the enterprise (Hossain et al., 2002).

Garg and Venkitakrishnan (2003) state that relevant, up-to-date, integrated and uniform information is essential to the existence of an enterprise; as a result, ERP

brings about clear benefits of smooth flow of information throughout the organization and workflow integrates business processes. Tangible benefits by various industries include reduction of lead time, increase of inventory turns, better customer satisfaction, increased flexibility, improved resource utility, improved information accuracy and improved decision-making capability (Garg & Venkitakrishnan, 2003). Hossain et al. (2002) mentions that more than 60 percent of Fortune 1000 companies have installed or are planning to implement ERP systems to support both front end and back end business functions. Additionally, Escalle, Cotteleer, and Austin (1999) mention that ERP expenses could be as high as 2-3 percent of sales.

Traditionally, organizations developed specific applications for each business function, such as planning, inventory, and general ledger, which results in each system being independent on its own without integration of information (Garg & Venkitakrishnan, 2003). MRP and MRP II addresses manufacturing requirements of an organization, but ERP addresses the entire organization and thus helps to integrate information and eliminates redundant and inconsistent data to improve business processes and functions (Garg & Venkitakrishnan, 2003).

According to Berghout and Remenyi (2003), infrastructure and ERP project implementation management seem to be the obstacles for implementation. Berghout and Remenyi (2003) state that management commitment of top executives in Thailand play an important role in the success of ERP implementation.

Leon (2008) suggests that information technology is changing the way we conduct business and ERP has become an integral part of that change. Monk and Wagner (2009) state that today, business are more focused on business processes that integrate and link functional areas of business, namely, marketing and sales, supply chain management, accounting and finance, and human resources. ERP software is essential in linking up information between functional areas of the company. Glenn (2008) defines Enterprise Resource Planning (ERP) as a system that provides information within an enterprise and handles planning, processes and accounting functions across functional areas. While Madu and Kuei (2004) state that resource planning implies

optimization, but in reality it is more about enterprise management. The main objective of ERP is to create an integrated system where all functional units of a company or enterprise are integrated into a single computer system that serves various needs. On the other hand, Leon (2008) says that ERP means the concepts and techniques for integrated management of businesses as a whole from the viewpoint of the effective use of management resources to improve efficiency of enterprise management. The ERP software is a reflection of the business processes of an enterprise such as manufacturing and accounting tasks. The success of the software mainly depends on the connection between different functions of an organization to integrate processes seamlessly (Leon, 2008). ERP systems can be characterized as a standardized application software suitable for any type of corporation and they offer a range of functionalities that cover most computing needs for managing enterprises (Rothlin, 2010). They are semi-finished in that companies do not usually develop the software in-house but have consultants and implementers customize the system to their specific needs. In an implementation project, the business requirements of the organization need to be identified and planned, and later on mapped in the ERP software, and other modules and legacy applications need to be integrated into the whole system, to cover all business processes of the organization (Rothlin, 2010).

Glenn (2008) purports that ERP provides a single database or unified system for various software modules of the company widely ranging from:

1. Manufacturing system – Consists of manufacturing flow, manufacturing projects, manufacturing processes, scheduling, bill of materials, capacity, and quality control
2. Supply chain management systems - Consists of order entry, purchasing, planning, scheduling, and inspection
3. Financial system – Consists of general ledgers, receivable/ payable accounts, cash management, and also finance and cash flow analysis
4. Human resources system – Consists of payroll, training, time and attendance, roistering, benefits, and performance assessment

5. Customer relationship management – Includes sales, marketing, commissions, customer contact, and customer support

Sankar and Rau (2006) mention that since the 1990s, many ERP vendors have emerged in this highly competitive market place, and led to increased global revenues from millions of dollars to billions of dollars in the last few years. Additionally, the ERP software business is dominated mostly by large players with the top 10 vendors commanding a 50% market share. SAP is the largest ERP vendor while other players in the market include Oracle, PeopleSoft, and Microsoft (Sankar & Rau, 2006). Hossain et al. (2002) state that in the 1990s when ERP vendors sold mainly to large corporations usually in the Fortune 500 and since 2000, growth has moved towards mid-market and small-and-medium sized businesses. Ray (2011) says that ERP vendors usually provide industry specific solutions for large enterprises.

An ERP system not only integrates many organizational processes, but also has to have key attributes to make the solution work (Sharma, 2004). Among other characteristics, the key attributes to ERP solutions are as follows:

1. Flexibility – ERP solutions should be flexible to respond the changing needs of an enterprise. The client server technology enables ERP to run across various databases.
2. Modular & Open – Having an open system structure means business modules can be integrated or removed when needed without affecting other modules. Additionally, the systems should also support different types of hardware platforms and support third party add-ons.
3. Comprehensive – The ERP system should support various business functions for different types of organizations.
4. Beyond the company – The ERP system should not be restricted within the organization but also has the compatibility to connect through on-line channels to other business entities, both within the organization as well as other entities.

5. Best business practices – Best business processes and practices should be incorporated in the ERP package to enable the use of such processes by clients.
6. Simulation of Reality – The ERP system should be able to simulate the reality of business processes and concede accountability to users controlling the system.

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In terms of users of ERP, this has evolved greatly from the past where IT department managers were responsible for most of the integration and software coding that was done (O'Leary, 2000). Nowadays, users of the ERP systems are more geared towards functional specialists or operators that know the business rules and functions of the specific department. Additionally, the use of ERP has also blurred the line between departments where it is used to be only that personnel from a certain department would be responsible for business functions within that department, such as finance, sales, marketing, and accounting (O'Leary, 2000). The integration of these functions via ERP reduces costs, improves relationships and increases efficiencies with many stakeholders within the company that also increases the number of cross-function users which could improve the overall use of the ERP system.

2.3 MRP and MRP II

Monk and Wagner (2009) explain that the roots of ERP come from MRP software, which allowed managers to plan productions and raw material requirements by working with sales forecast. Through the forecast, operation managers can plan a production schedule that meets the demands and calculates raw materials for productions according to purchase orders. This was initially called MRP.

Sankar and Rau (2006) mention that MRP uses a set of processes that takes into account inventory data, account bills of material data, and master production schedules to predict and forecast requirements of raw materials. The idea behind this is to subdivide a finished product into components, and for every component, a time schedule is developed. Based on the list, necessary information required for

productions of the product could be obtained in a short time. The subcomponents could be tracked down and obtained to support on-time productions. Additionally, a critical time path could be defined and orders could be organized to prevent delays in receipt of materials (Sankar & Rau, 2006). To sum up, MRP reduces levels of inventory, product times by avoiding delays and improving coordination, and increases overall efficiency.

With technology advancements in information technology coupled with increased requirements, Hossain (2002) states that MRP has no longer been sufficient. Thus Manufacturing Resource Planning (MPR II) has become an extension to MRP through advancements in softwares to optimize MRP through extending MRP with distribution management, project management, human resources and engineering. Sankar and Rau (2006) purports that MRP II was designed to carry out effective planning of all resource in a manufacturing company which is in the scope of this research on ABC.

2.4 Benefits and Risks of ERP

This section aims to find the benefits of using ERP as well as the disadvantages and the risks associated with using such software. Leon (2008) suggests that ERP software vendors need to deliver a viable return on investment (ROI) to justify the investment of such systems to the customer and while many vendors have constructed comprehensive ROI models, they are usually inaccurate to measure the total value of the enterprise software investment that could include hidden costs not initially covered. Additionally, these ROI models are usually quantitative in nature and many times to not measure qualitative success or intangible benefits of the system (Leon, 2008).

While there are many studies conducted with regards to the benefits and risks/ disadvantages associated with ERP usage, scholars have agreed on the general idea of this subject into quantifiable benefits and intangible benefits.

Tangible benefits of ERP that can be counted and measured are made up of the following elements:

1. Reduced inventory and inventory carrying costs – Many users of ERP involved in manufacturing usually find ways to reduce inventory. Savings in this category could also significantly given positive effects of inventory reduction including increased cash flow and lowered costs.
2. Reduced manpower costs – Improved practices both in sales, management, manufacturing and administration translate to fewer shortages and reduce tasks over time. Typical labor savings form a comprehensive ERP system which is equal to an approximate 10% reduction (Leon, 2008).
3. Reduced raw material costs – Efficient procurement enables better planning and effectively better negotiated terms with vendors, resulting in an approximate cost reduction of 5% or more (Leon, 2008).
4. Improved sales and service – Better sales and production integration tend to lead to increased sales as improvements in managing customer relationship, lead times, and also increased customer satisfaction would lead to future orders.
5. Efficient financial management – Better credit and collection terms effectively reduce days receivable and could potentially increase days payable, giving additional cash flow availability.

The intangible benefits of ERP:

1. Accounting and administration – ERP helps reduce redundant data entry and duplicated files. With reporting and monitoring mechanisms, the system can help personnels through alert functions that lead to corrective actions. Invoices can also be based on actual shipments without duplication of data, which help speed invoice processes. Integrated and automated back-office reports ensures up-to-date accounting and financial information that helps gauging of budget versus real numbers. Additionally, cash planning and financial projections through this integration help bring about fast decision making by management.

2. Product and Process Design – Engineering functions in product and process designs can make use of ERP through greater control in engineering and process changes. For example, analytical tools and diagnosing impact of changes to raw materials can be checked and analyzed. Lead-time reduction can also be analyzed and effectively taken care of through configurations.
3. Production and Material Management – Schedules for production can be prioritized through the use of ERP. Projection of present and future requirements as well as changes in demand or supply can be integrated into ERP to identify impact on production, purchasing and sales. Through this use, ERP can minimize challenges and issues related to productions and materials.
4. Sales – Value added features such as custom product quotations can improve speed and accuracy which result in shorter lead times and better customer satisfaction and also reduce time for customer service personnel.
5. MIS function – ERP system implemented as an integrated system can bring about growth through the applications built on top of a single database. Functional enhancements and business process mapping can also be implemented at less time and possibly cost once a platform is set.

Through the use of Enproduction system within ABC, there are both tangible and intangible benefits that can be measured and verified. Other factors in implementing ERP systems that should be considered, according to Leon (2008), include implementation costs, production and business transaction costs, reporting costs, personnel costs, business process change and enhancement costs and finally customer and partner supports.

With clear tangible benefits, there are also disadvantages that are discussed by Nah (2002) who mentions that ERP implementation can be time consuming, expensive, conformity of modules, ERP vendor dependence, too many features and complexities, and future compatibilities.

Sankar and Rau (2006) mention that the risk factors of ERP implementation are mainly categorized as people, process, and technology. These risk factors are included

in the primary research conducted with ABC's personnel by the author. Ray (2011), on the other hand, categorizes risks and challenges in using ERP software as challenges during ERP implementation, challenges for ongoing maintenance and operation of ERP systems, and lastly challenges of managing people.

Leon (2008) also classifies risks in ERP as people, process and technology. People issues are the most important, as the success of the ERP system crucially depends on management, employees, consultants and vendors. ERP implementation always involves change and with human nature to resist change, cooperation from every stakeholder is the most essential (O'Leary, 2000). The main people issues are listed as follows:

1. Change management – This includes managing change of personnel for job function change, redundancy, and work process change.
2. Internal staff adequacy – A large number of people are needed both in the organization and outside with the necessary skills to carry out the task both pre and post implementations.
3. Project team – Implementation team members need to be the best team management.
4. Training – It is needed for all users to make the best use of the ERP system and is essential for the success of the implementation and is used thereafter.
5. Employee re-location and re-training – New processes result in new job descriptions and workflows. This change needs to be managed through re-location and re-training of personnel.
6. Staffing/ turnover – Turnover is inevitable before, during and after implementation and skilled personnel are needed to ensure smooth transitions.
7. Top management support – Management support is the most essential to the success of the implementation due to huge resources needed in the processes.
8. Consultants – They are needed to be assigned as liaison officers/ senior officers for the customer company that can coordinate between consultants and the implementation team so the consultants can understand the inner-working of the company before any changes are carried out.

9. Discipline – Management and employee discipline is essential both to learn and implement and later on to practice what is learned.
10. Resistance to change – A management team needs to minimize resistance to change from employees through educating them on the benefits and merits of ERP.

ERP implementation usually introduces various business processes and makes a number of existing work flows redundant. Managing the implementation of these processes will lead to the success of the implementation. The key areas of concern process risks are as follows:

1. Program management – ERP focuses on transactions between business functions and operations such as procurement planning, material management and commercial functions. The management of one database with all these processes and information is important to the success of implementation.
2. Business process reengineering (BPR) – Changes and improvements through BPR need to be addressed on issues such as organizational structure change, management systems, performance measurements, training, and information technology usage either before or during ERP implementation.
3. Stage transition – Transition of responsibilities after the system 'goes-live' needs to be addressed. Usually the people that implement the system might not be the people who will manage the system after it is completed.
4. Benefit realization – Implementing a successful business needs not to translate into a success in operations with true benefits realized. Operations of the system need to be executed effectively through management support, personnel participation, employee training, and making full use of the system.

Technology advancements have pushed ERP systems to change at a fast pace (Glenn, 2008). Organizations that have implemented ERP systems need to keep up with the latest advancements in ERP systems for future compatibility. The key risks involved in ERP technology are as follows:

1. Software functionality -- Functionality of the software needs to be considered as when ERP systems are designed to carry out all business process functions, it is usually not very practical to install all functionalities as redundant and this could result in system failures.
2. Technological obsolescence – ERP systems are ever changing; thus, organizations should only choose the systems and functions of the system that would provide the greatest return on investment.
3. Application portfolio management – The organization should only use the applications that will be used by the company and since 80% of IT human capital is used to maintain applications and supporting infrastructure, the right selection and management of applications should be conducted.
4. Enhancement/ upgrades – Upgrades are essential for keeping the ERP system at its optimal functionality. The risk of the vendor shutting down or stopping support for the system is a possible threat that needs to be managed through contracts and legal measures.

2.5 ERP Implementation Strategies

Implementation strategies play an integral part in defining how implementation should be conducted according to Sankar and Rau's (2006), three possible implementation strategies step-by-step, big-bang, and roll-out.

2.5.1 Step-by-Step

Sankar and Rau (2006) suggests that step-by-step implementation strategy allows the organization to implement the ERP system in steps and is also widely known as modular conversion where modules are implemented one at a time. Another name for this strategy is called 'phased by module' which is preferred for large products, as the enterprise implementing the system need not carry the total upfront cost of the system. Additionally, the project team gains implementation skills and knowledge that is transferrable to future projects thus reducing complexity of implementation. Disadvantages of step-by-step implementation include longer total implementation

and deployment time as well as increased total costs. Most ERP vendors offer the choice of step-by-step implementation through selling separate application modules to customers according to requirements.

2.5.2 Big-Bang

Bagranoff, Simkin, and Strand (2005) describe the big-bang implementation strategy as a direct conversion strategy through a single operation. Accordingly, this strategy is preferred under these circumstances:

1. Legacy system has so many issues paralleled a conversion which serves no purpose.
2. New ERP system is the modification of the legacy system with minor changes.
3. New ERP system is entirely different from the legacy system, making comparisons pointless.
4. New ERP system adds new functionality, and in a way, there is no actual 'replacement'.

Madu and Kuei (2004) suggest that the big-bang implementation strategy can be tedious due to the preparation needed by all parties to ensure a successful deployment including implementation team, consultants, and all users.

2.5.3 Roll-Out

ERP roll-out implementation strategy works when the organization implements the system for one area of the company and subsequently rolls it out to other areas. One example could be the ERP implementation on government organizations, which have small to large sizes. It is usually easier to implement the solution on a smaller site or organization and later on roll it out to larger size organizations. This strategy ensures that the organization will have a uniform system. Another advantage of roll-out is the experience that the implementation team will have after the first initial process. The

disadvantage of this strategy is that not all areas in the organization follow the same process and thus specific details of each process might be overlooked.

The strategy to be used for each different organization has its merits and pitfalls. Thus, it really depends which strategy is the most suitable for which type of organization. For ABC, the strategy chosen for implementation is step-by-step due to complexities involved in each department as well as the implementation team's inexperience in implementing the large scale software for being used in manufacturing and sales.

2.6 ERP Objectives and Implementation Phases

This section serves to explain the objectives of ERP implementation or the characteristics that have high impact on success of the project and also the ERP phases known as a lifecycle and how the events are sequenced. According to Ray (2011), the objectives of ERP implementation lie in the following elements:

1. Speed – The amount of time the company uses for ERP implementation that the planned implementation time may be very different from the actual implementation time.
2. Scope – Functional and technical characteristics the company wants to implement.
3. Resources – People, software, hardware, technical support, implementation team, consultants and other resources are needed to carry out implementation.
4. Risk – Factors affecting the success of the implementation could be measured by other factors such as user acceptance and return on investment.
5. Complexity – Degree of difficulty of implementing, operating and maintaining the system.
6. Benefits – Extents that the company will fully utilize the functionality of the ERP system. The best systems will integrate information around business processes and organizational procedures which will result in improved processes leading to improve brand value and customer satisfaction.

All these objectives are interrelated and should be monitored closely. For example, an ERP system that needs to be implemented with speed in mind could result in heightened risks and less benefits if not managed well. The relationships and interdependencies of these ERP objectives need to be taken into account before implementation.

Implementation life cycles or phases are the processes in ERP implementation. While not all organizations follow these phases, most follow this route. The phases of ERP implementation, according to Leon (2008), are as follows:

1. Pre-evaluation screening
2. Package evaluation
3. Project planning phase
4. Gap analysis
5. Reengineering
6. Customization
7. Implementation team training
8. Testing
9. Going Live
10. End-user training
11. Post-implementation

2.7 Enproduction System

This section focuses on the Enproduction System, which is an MRP system to be integrated with MACS, an accounting and finance module where both the Enproduction and MACS will become part of a greater ERP system. The Enproduction software is a product of Envision Consulting Company Limited, an ERP vendor company who is also a provider of MACS finance and accounting solutions. ABC initial step implemented the MACS program in 2005 with considerable success, but there were still some challenges with human errors, redundant parts of the program that were not utilized, inefficiency of end users who

do not truly understand the use of MACS and other specific problems that prevented ABC from full benefit of MACS. Both Envision Consulting and ABC aim to use these lessons learned from the implementation of MACS to the better implement Enproduction.

2.7.1 Definition and Scope

Enproduction is a MRPII software that was developed in 2003 by Envision Consulting to serve organizations that needed software solutions for the scope of manufacturing functions. Functions that are covered include sales order, bill of materials explosion, auto purchase order, capacity and scheduling, and stock management (Envision, 2012). The Enproduction software is also designed to integrate with MACS for reporting and analyzing purposes. The modules within Enproduction can be categorized as follows:

1. Sales Analysis Module
2. Material Requirements Planning (MRP) Purchase Analysis Module
3. Capacity and Scheduling Module
4. Shop Floor Control Module
5. Job Costing Module
6. Inventory Management Module
7. Machine Maintenance Module

The scope of initial implementation at ABC by Envision Consulting will cover Purchase Analysis Module for the purchasing department.

*2.7.2 Advantages and Disadvantages of **Enproduction** System*

There are currently many ERP solutions in the industry with the largest 10 vendors commanding a 50% market share. SAP is the largest ERP vendor while other players in the market include Oracle, PeopleSoft, and Microsoft (Sankar & Rau, 2006). While these major players provide the industry practices in the manufacturing business, the

management team at ABC decided to choose Enproduction due largely to the specific advantages of the software as well as the benefits specific to the implementation of the system.

Advantages and Benefits of Enproduction System

The advantages of Enproduction over other vendors are as follows:

1. Price – Enproduction is developed by a Thai company – Envision Consulting – with the use of Microsoft.net; therefore, pricing of the ERP system is much cheaper than those of multinational corporations such as SAP and Oracle.
2. Familiarity of ERP consultants with ABC's business processes through the implementation of MACS – Envision's consultants have been working with the financial and accounting department of ABC, so they know the culture, people and working style of these personnel that make it easier to work with ABC on the Enproduction implementation.
3. Easy integration of Enproduction with MACS – Both Enproduction and MACS use Microsoft.net software to develop and also have the same set of programmers conducting the software coding. Thus, the integration of the two systems is easier.
4. Ability to customize business processes of ABC – ABC's business processes are different from the best practice processes which are present in major ERP software such as SAP and Oracle. The fact that ABC has its own set of processes that is hard to change due to the fact that many factors make the flexibility of Enproduction the best solution in implementing the system to map ABC's business processes.
5. Familiarity of IT administrator and end users with the system – Both IT administrator and end users at ABC are familiar to the major functionalities of MACS; as a result, it becomes easier to train the administrators and end users with Enproduction.

6. Minimal system training for core implementation team – Core implementation team also knows the functionality of products from Envision and thus will be able to work better to implement the Enproduction software.

2.8 Summary

This chapter focuses on defining ERP and MRP, and outlines the history and usage of each solution. Typical systems of ERP are made up of manufacturing systems, supply chain management systems, financial systems, human resources systems and customer relationship management. The tangible advantages of ERP implementation include reduced inventory and carrying costs, reduced manpower costs, reduced raw material costs, improved sales and services, and efficient financial management. Implementing the ERP system, it is important to consider change management of personnel and work processes, a strong project team, sufficient training, employee relocation as needed, top management supports, a strong consultant team, management and employees' disciplines and finally minimizing resistance to change. The key areas concerned the process risks are program management, business process reengineering, stage transition, and benefit realization. There are a number of ways to implement ERP solutions, from step-by-step which allows modules to be implemented at a time, big-bang which a direct implementation strategy through a single operation, and roll-out where the company implements the system for one area of the company and subsequently rolls out to other areas.

Enproduction software is MRPII software that was created by Envision Consulting. ABC Company has used the MACS financial and accounting system by Envision Consulting and therefore the use of Enproduction has its benefits of easy integration with MAC5. Other benefits include a relatively lower price than ERP systems from multinational companies, familiarity of Envision's consultants with ABC's business processes, flexibility in integration of Enproduction with MAC5, ability to customize business process flows of ABC, familiarity of ABC's IT administrator with Envision's software, and finally a minimal training system needed for a core implementation team.

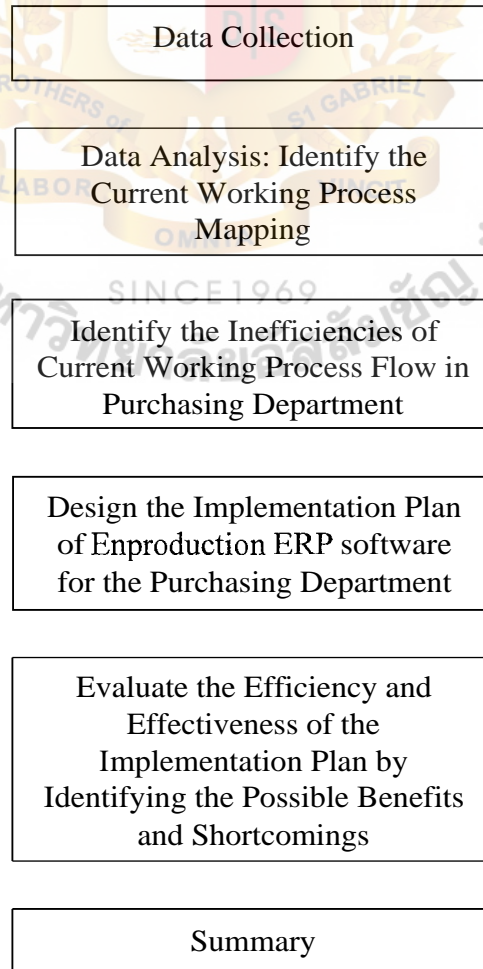
CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Design & Process

The research were conducted to find the current working process of the purchasing department through the use of data collection, data analysis, to identify the inefficiencies of working process flow in the department, to design implementation plan of Enproduction ERP software and finally to evaluate the efficiency and effectiveness of the implementation plan by identifying both advantages and disadvantages of this implementation.

Figure 3.1: Research Process



3.2 Required Data

Data to be obtained from purchasing department in order to collect working processes and analysis inefficiencies of current working process flow in the purchasing department are made up of the list below.

Table 3.1: Data Collection

| Data to be Obtained | Data Source | Data Collection Method |
|---|-----------------------|-------------------------------|
| Sales order in 2012/ Financial Highlights of ABC in 2012 | Sales Department | Documentary Review |
| All purchases made in 2012 | Purchasing Department | Documentary Review |
| Flow of purchase requisition | Purchasing Department | Interview |
| Flow of purchase orders | Purchasing Department | Interview |
| Operations time for each purchase order | Purchasing Department | Interview/ Documentary Review |
| Operations time for checking inventory on daily basis before issuing purchase order | Purchasing Department | Interview/ Documentary Review |
| Flow of raw material delivery planning | Purchasing Department | Interview |
| Flow of purchasing data between purchasing department and warehouse department | Purchasing Department | Interview |
| Flow of data entry for current work process | Purchasing Department | Interview |
| Materials planning report 2012 | Purchasing Department | Documentary review |
| Purchase requisition/ order report 2012 | Purchasing Department | Documentary review |
| Inventory report 2012 | Warehouse Department | Documentary review |

Source: Purchasing Department of ABC Company

3.3 Data Collection Method

3.3.1 Documentary Reviews

A documentary review utilizes secondary information such as documents to provide facts to support a viewpoint or an argument. The documents obtained are then assessed and analyzed to find information that would either support or counter the viewpoint. The document review for this dissertation starts off with obtaining information from both the sales, purchasing and warehouse department ranging from sales orders in 2012, purchase requisitions in 2012, purchase orders in 2012, inventory report 2012, and materials planning report 2012.

These documents are to be reviewed and assessed to find out the following data:

1. Sales order in 2012 – How many sales transactions are made and what the volumes are.
2. Purchase requisitions in 2012 – How many purchase requisitions are made each year and how they are grouped together.
3. Purchase orders in 2012 -- How many purchase orders are made in 2012 and how many purchase requisitions are grouped into a purchase order.
4. Operations time for purchasing processes – The bottleneck of each purchasing process.
5. Operations time for checking inventory before placing purchase orders — Redundant time of inventory checking to place purchase order.

These documents are then assessed and analyzed to find out the inefficiencies and bottlenecks in the purchasing department for further review.

3.3.2 Interview

Primary data are collected via interviews with a purchasing department manager to obtain qualitative data through specific questions to gain insights into work flow and processes as well as their pitfalls leading to redundant processes, ineffective inventory stocking, and delayed delivery of products. The scope of the interview covers the working processes within the purchasing department and its workflow across to sales department, accounting department and warehouse department.

The main questions are as follows:

1. How many individuals do you have in your department?
2. What are their roles and responsibilities?
3. Please describe the current work flow process of purchase requisition and purchase order for
 - a. Raw materials
 - b. Spare parts for machinery
 - c. Miscellaneous items
4. In your view, what are the pitfalls of the current work flow process for purchase requisition and purchase order?
5. How many individual raw material types are purchased each year?
6. Please describe the workflow of raw material delivery planning?
7. In your view, what are the pitfalls of the current raw material delivery planning?
8. Please describe the flow of purchasing data between purchasing department and warehouse department.
9. In your view, what are the pitfalls of the current process?

3.4 Data Analysis Plan

After primary and secondary data are obtained through documentary reviews and interviews, data analysis is conducted to map out the current work process in the

purchasing department as well as the bottleneck and the shortcomings of the current process to propose a new process.

Operation time, process flow, and process sequence are gauged and mapped to check the possibility for process improvement through the implementation of the Enproduction ERP Software.

Each bottleneck and shortcomings in the purchase order process are thoroughly analyzed to find the key improvement points and reengineering of the work processes is reviewed.

3.5 Design of the Implementation Plan of the Enproduction ERP Software

The Enproduction System is to follow the following planning and phases mentioned by Leon (2008), and has been reviewed in section 2.6. The process of the implementation plan is expected to last 6 months from launch.

1. Project planning phase -- The project team made up of core team and consultants is set up and a detailed scope of the project, but not limited to project vision/ mission, is created. Additionally, the implementation strategy and methodology, standard, governance, project planning and resource planning are conducted. Lastly, the Envision consultants provide overview to senior management.
2. Gap analysis -- Gap identification and analysis between what the current business processes are and the processes or business rules that are best practices or those that are available in the Enproduction system. Bridging the gap between what the company's current business processes are and those of the best practices need to be identified, analyzed and modified as needed.
3. Reengineering -- Business process reengineering or changing the way certain business processes of different business functions needs to be conducted to develop and find the right business requirements. Detailed requirements and

process modeling of the business rules to be developed are explored by Enproduction consultants.

4. Customization – Configuration and customization of the Enproduction system to balance between best practices and the business processes that are specific to ABC Company.
5. Implementation team training – Training of the implementation project team is an essential part of this process as it is the one to configure the system to meet the organization's needs.
6. Testing – After the implementation is completed in phases, testing of business rules in the Enproduction software system is conducted for any bug fixes, process realignment and other Enproduction configuration issues.
7. Going Live – After the Enproduction implementation was completed and system testing is completed, 'going live' or putting the Enproduction software online for use is conducted.
8. End-user training – Training which is conducted for end-users who are individuals operating and feeding data into the Enproduction system. This is a crucial step as without adequate training, the benefits of the software are not realized.
9. Post-implementation – Support team, maintenance and updates of Enproduction system by Envision and planning for further phases if applicable by consultants are explored. Additionally, measuring of performance improvement and benefits are also conducted.

3.6 Possible Outcomes of the Proposed Implementation Plan

To evaluate the implementation plan, the Enproduction software should deliver the desired benefits to ABC Company. To prove that Enproduction works, after accessing all the pitfalls and inefficiencies of the purchasing department, an implementation plan with the use of Enproduction is mapped out to achieve the desired affects. The expected outcomes of the this implementation plan depends on many factors, widely ranging from the Enproduction program itself, to consultants and the implementation team, and finally the end users of the program itself. It is expected for the

implementation to take up six months in total. The desired results need to be tangible through the use of the Enproduction software with decrease in work processes, operation time, and bottlenecks as stipulated below.

1. Decrease redundant work processes such as purchase requisition to purchase order.
2. Decrease costs of personnel, paper and printer usage (through paperless administrative processes).
3. Decrease erroneous transactions.
4. Decrease duplication of data entry into Microsoft excel and MACS.
5. Integrate sales, purchasing, and warehouse together with accounting for faster operations.
6. Augment ABC's workforce to meet professional/ international standards.
7. Decrease training time for new personnel due to work task decrease.
8. Decrease inefficiency in raw material inventory (over and undersupply of raw materials needed for production).
9. Decrease lead time of production through better raw material planning.

3.7 Summary

This chapter focuses on research methodology with the initial phase going through data collection of primary and secondary data. Secondary data are explored and obtained from relevant departments such as sales, purchase and warehouse departments for figures including sales order, purchase requisitions and orders and so on. The primary data are obtained through interviews with the purchasing manager to gain insights into work flow processes of the department and also pitfalls of the current processes. The root causes of working problem in the department are then identified through the work flow. The implementation plan is conducted to ensure the success of the implementation. Finally, effectiveness of the Enproduction software is assessed and found that there were potential shortcomings of this project.

CHAPTER IV

PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

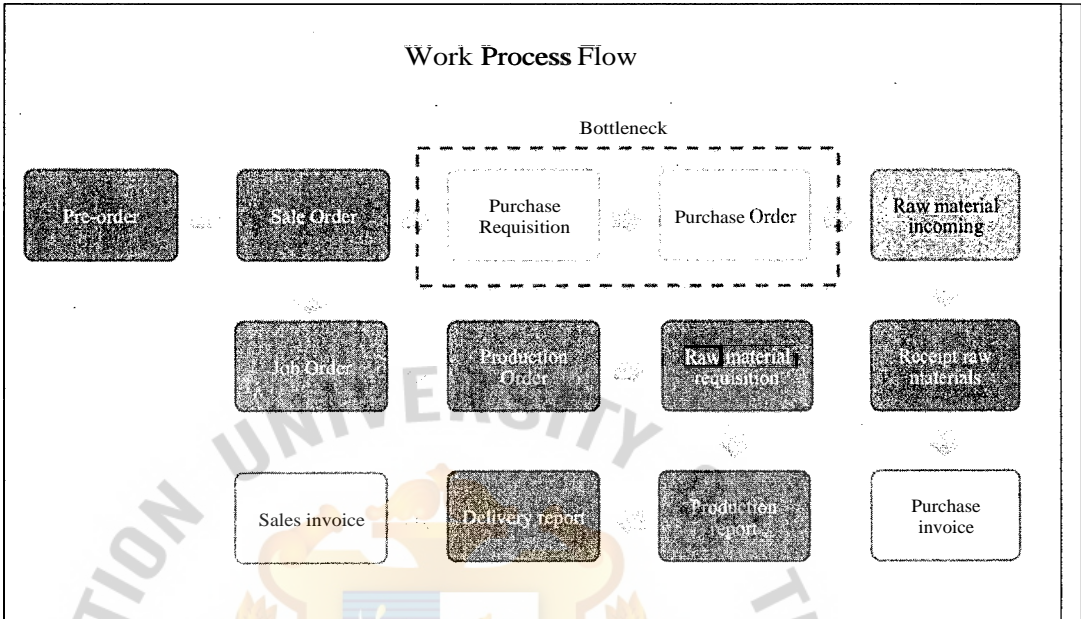
This chapter has four parts in total and starts of with reviewing the current problems and process mapping. The study reveals the bottleneck problem in the purchase requisition to purchase order processes. The major issues associated with the purchase order process are the manual processes and decentralized database that need to be rectified. The implementation Enproduction is proposed in the next section and the expected outcomes are shown in the last session.

4.1 The Flow and Current Problems of the Purchasing Process

The process flow of the purchasing process could be identified based on the qualitative data obtained from the interviews with the purchasing department of ABC Company. The purchasing department is divided into three main sections – raw material purchasing, general purchasing, maintenance parts purchasing sections. There are six, one and five working people in each section, respectively. The raw material purchasing section focuses on ensuring adequate supply and on-time delivery of raw materials to be used in the production process. The general purchasing section focuses on procurement of miscellaneous items such as office supplies. The maintenance parts purchasing section, made up of five purchasing individuals, procure parts and consumable materials such as lubricants for the production machines.

The current working process of the purchase department is depicted in Figure 4.1.

Figure 4.1: Work Process Flow



Source: Purchasing Department of ABC Company

The work process flow with regard to the purchasing department begins when the Sales executives issue a sales order. However, the purchasing, planning and logistics works are planned in the next stage without checking of the availability of raw material inventory. Sales order is issued when raw material is needed. Purchase requisition is calculated and subsequently purchase requisition is grouped to make purchase order.

The current problem of the department stems from three main issues:

1. There are 3 inventory databases – for planning, purchasing and warehouse departments, which increases risk of erroneous data and discrepancies in inventory.
2. Long processing time of 30 minutes for purchasing order issuance through complicated process with risk factors including erroneous data entry and many manual and automatic processes.

3. Purchase order is not integrated with current accounting system (MACS) resulting in many manual processes.

Table 4.1 demonstrates the major processes within the purchasing department depicting them according to manual and automatic. As of current, the automatic processes are those that are operated in the MACS accounting system.

Table 4.1: Processes within Purchasing Department

| No. | Process | Status |
|-----|---|-----------|
| 1 | Raw material usage calculation | Manual |
| 2 | Report of master batch and plastic purchase | Manual |
| 3 | Report of raw material calculation for order planning | Manual |
| 4 | Record Purchase Requisition (PR) | Automatic |
| 5 | Record Purchase Order (PO) | Automatic |
| 6 | Print out PR | Manual |
| 7 | Print out PO | Manual |
| 8 | Report of purchase pending order report | Manual |
| 9 | Report of raw material delivery plan from vendor | Manual |

Source: Purchasing Department of ABC Company

The purchasing manager mentioned that the current processes that management set out for the purchasing department was correct and workable were the personnel followed the procedures. However, due to many manual processes that needed to be input in excel and verified within MACS and due to many databases, the purchase order process produced many errors.

According to documentary reviews, out of a total of 1,545 purchase orders issued in 2012, there were a total of 225 orders that needed revisions due to human errors or around 14.6 percent of the total purchase orders. Out of this 225 purchase orders, revisions from errors in checking raw material inventory were from 87 cases, errors in manufacturing formula were from 43 cases, raw material calculation for purchasing after checking availability were from 95 cases.

The purchasing manager purported that to alleviate the operations time in issuing purchase orders and to minimize erroneous data, a single database and automation of purchase order processes should be in place. He mentioned that the use of an ERP system connected to MACS would help solve these issues and also decreased the use of man power by 1 or 2 persons.

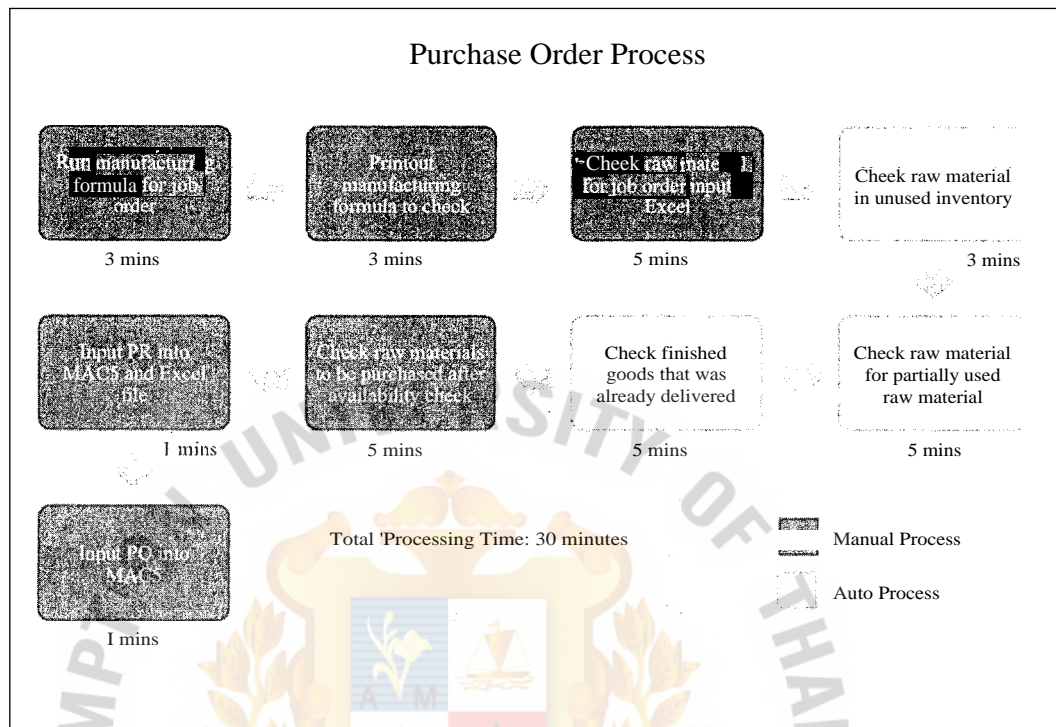
Reviewing purchase order process documents and historical operation times, it was revealed that to churn out each purchase order took approximately 30 minutes. The purchase order process began after the sales order was approved from the customer service department with processes as shown in Table 4.2 and Figure 4.2 below:

Table 4.2: Purchase Order Process and Operation Time

| No. | Process | Time (minute) | Status | Remarks |
|-----|--|---------------|-----------|--|
| 1 | Run manufacturing formula for 1 job order | 3 | Manual | Operator manually inputs manufacturing batch into MAC-5 to get the manufacturing formula |
| 2 | Print out manufacturing formula to check | 3 | Manual | |
| 3 | Check raw material for each job order to input order in excel file | 5 | Manual | |
| 4 | Check raw material in inventory that is unused | 3 | Automatic | In inventory excel file in purchasing department |
| 5 | Check raw material that was partially used in prior orders for exact inventory | 5 | Automatic | In inventory excel file in purchasing department |
| 6 | Check finished goods that is already delivered to calculate exact inventory | 5 | Automatic | In inventory excel file in purchasing department |
| 7 | Calculate raw materials to be purchased after checking availability | 5 | Manual | Excel |
| 8 | Input Purchase Requisition into MACS and into excel file | 1 | Manual | Currently MACS allows a maximum of 5 purchase requisitions per each purchase order |
| 9 | Input Purchase order into MACS | 1 | Manual | |
| | TOTAL PROCESS TIME | 30 | | |

Source: Purchasing Department of ABC Company

Figure 4.2: Purchase Order Process



Source: Purchasing Department of ABC Company

From both qualitative information and quantitative information obtained through interviews and document reviews, it is evident that the inefficiencies and erroneous transactions of working process in the purchasing department come mainly from the following causes:

1. Processing time for purchase order is unacceptable at 30 minutes per document.

Considering the number of purchase order of 1,545 orders per annum in 2012, and on average 30 minutes elapsed time per purchase order, a total of 46,350 minutes or 773 hours per year is used to process these orders. Assuming 52 workweeks multiplied by 5 working days equals 260 days. This subtracted by 37 national holidays and 20 average personnel holidays would be approximately 200 working days. Dividing 773 hours per year by 200 working days equals 3.9 hours per day just to issue purchase orders. There are 8 working hours per day and therefore 4 hours per day of purchase order issuance translates into an approximate half man-day.

Closely analyzing the manual purchase order, it is apparent that the purchase officer to process the purchase order uses 18 minutes manually. However, a closer look into the processes that are conducted automatically in the MACS system shows that there are checks of raw materials from new batched and used batched and also those of finished goods so the processing time of 12 minutes could possibly be lowered.

2. Many databases for inventory management causes in errors and miscalculations.

The disorganized database for purchasing, inventory and planning department results in erroneous transactions due to personnel in each department following their own inventory database. Evidence is in the error in purchasing orders, which are out of a total of 225 erroneous purchase orders; 87 cases are from checking raw material inventory and 95 cases are from raw material calculation for purchasing after checking availability. These two cases are approximately 81 percent of all errors from issuing purchase orders.

This disorganized database also results in the need for the purchasing department to check for raw materials from new batches, used batches and also finished goods inventory. With a centralized database, the need to check raw materials and finished goods will be minimized and the process time will be lessened.

4.2 Enproduction Implementation Plan

According to the discussions with Envision's consultants and the ABC Company's purchasing manager, it can be concluded that the timing for the project should take up approximately 6 months on the condition that everything goes according to plan. The pre-evaluation screening and package evaluation are forgone in this case and they are out of scope for this research as the advantages of Enproduction such as price, flexibility, and familiarity of consultants with the Company's work processes are pre-evaluated. The implementation of Enproduction is designed based on the recommendations of Leon (2008) in nine stages: 1) Project planning phase; 2) Gap analysis; 3) Reengineering; 4) Customization; 5) Implementation team training; 6)

Testing; 7) Going Live; 8) End-user training; and 9) Post-implementation. The details are discussed in the following sections.

4.2.1 Project Planning Phase

The Envision team and ABC Company's steering committees, made up of ABC's top management and implementation team, are to underline the following key objectives of this project:

1. Decrease purchase order operations time.
2. Decrease erroneous purchasing order transactions through centralizing inventory database.

The implementation strategy to be used is a step-by-step strategy, through the bigger MRP scheme, which spans accounting, finance, sales and marketing departments; however, the purchasing department is implemented first.

Envision is to send two consultants to implement this phase and the purchasing department asks two personnel to join this implementation team from a requirements perspective and work closely with the purchasing department manager. After evaluating the scope of the implementation plan, strategy and advantages and implications, the implementation team provides the implementation plan and timeline.

4.2.2 Gap Analysis

The Gap analysis comes after the project planning phase is completed. In this phase the current processes are matched to the Enproduction system to find out which process can be directly implemented and which needs to be adjusted or modified. The current process flow for purchase order follows both automatic and manual work processes. As evident in table 4.2, the raw material to be used in a certain job order is checked in 4 major processes: 1) checking the raw material usage from job orders itself; 2) checking unused raw materials; 3) checking partially used raw materials; and

4) checking finished goods. These four processes can be automated as a single process in the Enproduction program.

This can be implemented through the centralizing of the inventory database for the planning, warehouse and purchasing departments. The Enproduction program allows the centralization of the inventory through data migration of the most accurate database.

4.2.3 Reengineering

There are a number of business processes that are needed to be reengineered. First of all, current two purchasing officers are in charge of carrying out purchase requisition and purchase order processes. With the implementation of the Enproduction program, one purchasing officer's work instruction will be moved from issuing purchase orders to for final checking for approval. This is due to the fact that the purchase requisition and purchase order process time will be improved with Enproduction and therefore one personnel should be allocated to check the final purchase order for an approval to avoid any errors. This process change could substantially decrease a number of erroneous purchase orders.

With regard to the inventory checking, due to the centralized inventory database, planning and warehouse departments will also be able take out the cross checking of inventory with other departments.

The processes that will be reengineered and implemented into Enproduction are as follows:

1. Manufacturing formula check automation – This process is automated instead of manually checking to minimize any formula errors from the start.
2. Raw material check automation – Both unused and used raw materials are automatically checked in one process rather than two separate processes to lower operation time.

3. Finished goods check automation – Finished goods is checked in one centralized inventory database.
4. Raw material calculation automation – The calculation of raw materials to be ordered is to be automated from currently manually done to increase efficiency and also to minimize human errors of data entry.
5. Purchase requisition input increase – Currently MACS only allows for a maximum of 5 purchase requisitions per purchase order. The Enproduction system allows an increase from 5 to 10 purchase requisitions per order.
6. Purchase order printing automation – Currently each purchase order needs to be chosen and printed out. The Enproduction allows automatic printing of purchase orders upon approval.
7. Centralized inventory database in Enproduction – This process allows less errors in inventory checking through disorderly inventory database, which resulted in 182 erroneous purchase order cases.

4.2.4 Customization

Customization of ABC Company's purchase order work processes are kept at minimum due to the Enproduction system that already has functions that are flexible enough for the need of ABC. The areas that would need most customization are as follows:

1. Reports of purchasing department customization

Currently, the four reports that are manually calculated in Microsoft excel are as follows:

- a. Report of master batch and plastic purchase
- b. Report of raw material calculation for order planning
- c. Report of purchase pending order report
- d. Report of raw material delivery plan from vendor

These reports would be customized in the Enproduction system so that they can be viewed and retrieved on demand rather than having the need to calculate for every report.

2. Product units customization

There are a total of 8 main raw materials (plastic pellets, master batch, foil, printing ink, varnish, packaging, cap, label) that need to be ordered. The ordering unit for each raw material is not available in Enproduction and needs to be customized to be able to input each unit into the system.

3. Purchase requisition maximum amount of customization

Currently, the maximum number of purchase requisitions for each purchase order is 5. Enproduction can customize this number to a maximum of 10 purchase requisitions for each purchase order.

4.2.5 Implementation Team Training

The Envision consultants will train the 6 purchasing officers involved in raw materials purchasing to configure the system according to their requirements. These processes include customization of the system and also the migration of data from Microsoft Excel, which is currently used into Enproduction.

4.2.6 Testing

Testing by both the Envisions team and also ABC's six purchasing officers are conducted to check for wrong processes or any bugs in the system. These processes are as follows:

1. Purchase order process realignment is needed to ensure smooth flow of the Enproduction system.
2. Configuration issues of users and security are needed to be checked and finalized.
3. Testing of all business rules, processes, reports and print outs are rechecked to ensure integrity of the system.

4.2.7 Going Live

Through testing for approximately 5 weeks and rectifying bugs, if any, the system can then 'Go Live' which signifies the actual usage of the system and ceases using the old processes and systems.

4.2.8 End-user training

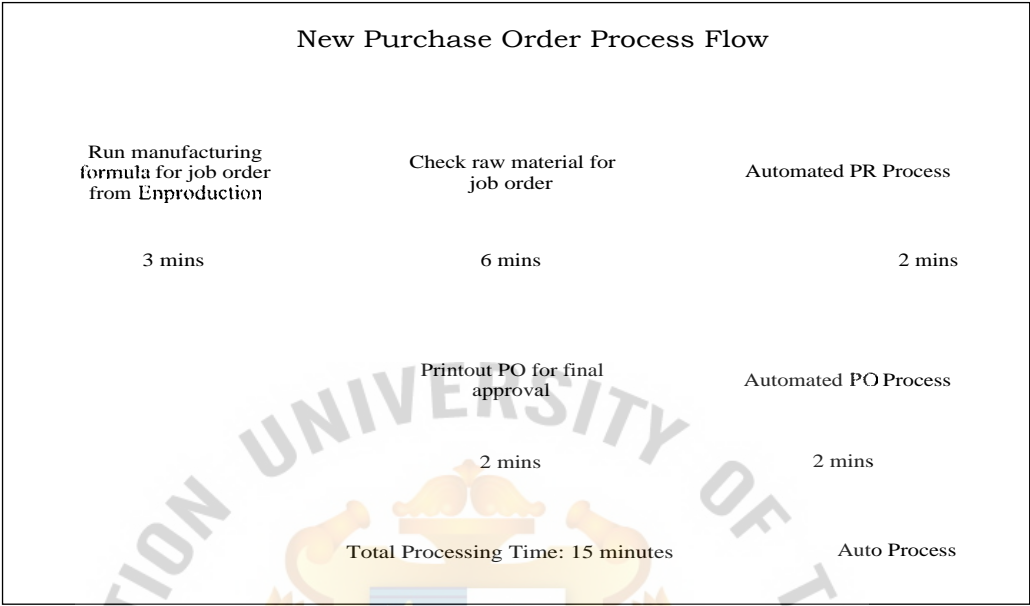
Training is conducted for all 6 purchasing department officers who are directly involved in the raw material procurement. Although all are involved in the purchase order issuance, 2 will be the main personnel involved in the operation and feeding data into the Enproduction system and their knowledge will be trained and tested.

4.2.9 Post-implementation

Post implementation, the gauging of the performance improvement and the benefits of the Enproduction system are determined. The decrease of operation time and erroneous data before and after the implementation of the Enproduction system will be considered. Additionally, the cost savings, if any, will be measured to find a payback period of the system. Additionally, the maintenance and updates of the software by the Envision team will also be applied in this case. Lastly, as this implementation follows the step-by-step approach, after implementing for the purchasing department, other future phases will also be explored accordingly.

The proposed new process flow of the purchase order process after the implementation is shown in Figure 4.3 and the implementation timeline is illustrated in Figure 4.4.

Figure 4.3: Proposed Purchase Order Process



Source: Analyzed based on the Company's data

Figure 4.4: Enproduction System Implementation Timeline

| Activities | Resp. | Jun-13 | | Jul-13 | | Aug-13 | | Sep-13 | | Oct-13 | | Nov-13 | |
|--|-------------------------------|--------|----|--------|----|--------|----|--------|----|--------|----|--------|----|
| | | w1 | w2 | w3 | w4 | w1 | w2 | w3 | w4 | w1 | w2 | w3 | w4 |
| 1 Project Planning <i>Review Objectives, implementation strategy</i> | Envision/ Purchasing dept. | | | | | | | | | | | | |
| 2 Gap Analysis, <i>Analyze gap between requirements and Enproduction system</i> | Envision | | | | | | | | | | | | |
| 3 Reengineering <i>Manufacturing formula check automation Raw material check automation Finished goods check automation Raw material calculation automation PR input increase. PO printing automation Centralize inventory database in Enproduction</i> | Envision | | | | | | | | | | | | |
| 4 Customization <i>Reports of purchasing dept. customization Product units customization PR maximum amount</i> | Envision | | | | | | | | | | | | |
| 5 Testing <i>Process function testing for bug and rectifying</i> | Envision/ Purchasing dept. | | | | | | | | | | | | |
| 6 Going Live <i>Replace Current system with Enproduction system</i> | Envision | | | | | | | | | | | | |
| 7 User Training <i>Train 3 main user of Enproduction system</i> | Envision | | | | | | | | | | | | |
| 8 Post Implementation <i>Gauge and analyze benefit, shortcomings</i> | Envision | | | | | | | | | | | | |

Source: Analyzed based on the Company's data

According to Envision's quotation document furnished to ABC Company, the quotes are displayed for the implementation and MRP software licensing shown in Table 4.3

Table 4.3: Enproduction MRP Software Total Cost

| No. | Module | User/ Module | | Amount (Baht) | Total |
|-----|-------------------|--------------|--------------|---------------|----------------|
| | | User | Price (Baht) | | |
| 1. | MRP | 3 Users | 32,000 | 96,000 | 96,000 |
| 2. | Purchase Analysis | 3 Users | 32,000 | 96,000 | 96,000 |
| | TOTAL | | | | 192,000 |

Source: Analyzed based on the Company's data

4.3 Implementation of Expected Results

Thorough the implementation of Enproduction MRP system, it is expected that all processes in conducting the purchase order would be fully automated. The expected results are listed below.

4.3.1 Decrease Redundant Work Processes

The newly proposed purchase order work process would effectively decrease operations time from 30 minutes to 15 minutes; as a result the redundant work processes would also be reduced. Nine processes as depicted in figure 4.2 would be replaced with 5 processes in figure 4.3. The redundant processes of checking raw materials and finished goods in many different processes would be eliminated. Purchase requisition and purchase order printing would also be automated.

4.3.2 Decrease Costs

According to the implementation cost of 192,000 baht, if the use of Enproduction can theoretically reduce the operations time by half, it would effectively reduce cost of personnel, paper and printer use through paperless administrative processes. By this,

the daily man-hour from 4 hours per day would be reduced to 2 hours per day from processing time for 1,545 purchase orders issued in 2012.

The average cost of a purchasing department officer is 30,000 baht per month; for 20 working days would be 1,500 baht per day for 8 hours of work or 750 baht for 4 hours of work.

To save 2 hours of work in processing purchase orders per day would equal to 375 baht per day multiplied by 200 days is 75,000 baht. To break even from the cost of implementation and licensing fee would take 2.56 years. This is on personnel cost alone. If erroneous data and damages resulting from the manual operations were taken into account, the merits of Enproduction software would be even greater.

As for paper and printer use, the average of 4 purchase requisitions is for the 1,545 purchase orders equals to 6,180 sheets of paper saved if purchase requisition is not needed for printing. Considering that a laser printer cartridge prints out 2,000 pages, 3 cartridges would be saved per annum.

4.3.3 Decrease Erroneous Transactions

The disorganized database for purchasing and manual processes resulted in 225 erroneous purchase orders or 14.6%. Out of this, 87 came from checking raw material inventory made and 95 cases came from raw material calculation for purchasing after checking. With the centralized database, it is likely that the 87 errors would be eliminated. The allocation of personnel to check for raw material calculation should also substantially reduce 95 erroneous cases. The result of having automatic process and centralized database can decrease 100% of erroneous transactions.

4.3.4 Decrease Duplication of Data Entry

Through Enproduction implementation, the manual processes to input into excel would be changed to input only into Enproduction. Processes that are currently going

through excel – checking unused raw material, checking raw material partially used, calculation of raw materials to be purchased after checking availability, and input purchase requisition would now only be input and processed in Enproduction. This would not only reduce duplication of data entry, but would also effectively decrease errors due to less input into different database and programs which would translate into less human errors.

4.3.5 Integrate Faster Operations

Implementing the Enproduction on a step-by-step basis would ultimately integrate sales, purchasing, warehouse and accounting departments together through the use of database centralization. This would be realized initially through centralizing the inventory database. This advancement could help the purchasing department, and inventory and planning departments, as centralizing of the inventory database for both raw materials and finished goods would alleviate the manual checking in excel for the purchasing department as well as the manual checking for other departments.

4.3.6 Augment ABC's Workforce to Meet International Standards

The use of an ERP system would naturally increase ABC workforce's professionalism and sharpness in working to the best practice of multinational companies through Enproduction's experience in dealing and implementing with these parties. The use of ERP will also make the purchasing department's officers realize the value of efficiency and time management to increase productivity.

4.3.7 Decrease Training Time

With the reengineered process, the tasks needed would be decreased from 9 to 5 processes. The new process would decrease the tasks of the purchasing officer for purchase order issuance with more time to focus on checking the correctness of the orders. This effectively decreases the time of new personnel training.

4.3.8 Decrease Inefficiency in Raw Material Inventory

Centralized database means less errors of auditing and counting raw material inventory from many databases in different departments. The task of the warehouse department to be in charge of raw material inventory would also put ownership and responsibility on one party.

4.3.9 Decrease Lead Time of Production

For better management of raw materials through a centralized database, lead time of production would be decreased due to better raw material planning and faster execution of purchase orders to suppliers.

The summary of all the expected results is listed in the table 4.4 below:

Table 4.4: Summary of Expected Results

| No. | Subject | Expected Results |
|-----|---|--|
| 1 | Redundant work processes | Decrease from 9 to 5 processes, Decrease 50% operations time to 15 minutes |
| 2 | Decrease costs | Personnel cost savings – 75,000 baht per year/ 6,180 sheets of paper/ 3 laser cartridges |
| 3 | Decrease erroneous transactions | Decrease 100% from 255 to 0 |
| 4 | Duplication of data entry | Eliminate 4 processes of duplicate data entry |
| 5 | Integrate faster operations | Integrate the database of planning, warehouse and purchase departments |
| 6 | Augment ABC's workforce to meet international standards | Increase skills, knowledge and efficiency with ERP system |
| 7 | Decrease training time | Decrease significantly from 9 to 5 processes |
| 8 | Decrease inefficiency in raw material inventory | Ownership of inventory tracking to warehouse department from all three departments |
| 9 | Decrease lead time of production | Faster execution of purchase order to suppliers and better inventory planning leads to faster lead times |

4.4 Summary

This chapter focuses on the data collection – quantitative and qualitative data. Qualitative data are obtained through the interview with the ABC Company's purchasing department manager where managerial views of the current processes and pitfalls were reviewed and discussed. The quantitative data are obtained through document reviews including financial data and also operational data. Through the data collection, there are more than 1,500 purchase orders issued every year and to issue a purchase order wastes around 30 minutes. Additionally, another pitfall is the decentralizing of the inventory databases, which also gives too many errors in the inventory review. The use of excel in checking and inputting data for the inventory of new raw material batches, partly used materials and finished goods are prone to human errors. It is, therefore, suggested that the use of Enproduction MRP system would help alleviate these two issues. This chapter then touches the implementation plan of Endproduction which has a timeline of approximately 6 months through many phases and it is expected that, through this implementation, many advantages such as centralized database, decrease process redundancy, decreased personnel man hour and costs, would be realized.

CHAPTER V

SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

The findings from reviewing both quantitative data and qualitative data reveal the same story that manual processes with regard to input of data into a system, whichever it may be, result in erroneous transactions. These also lead to severe shortcomings such as wrong inventory data, which bring about/ cause to discrepancies in purchase order documents.

In 2012, there were a total of 225 erroneous purchase orders due to the disorganized database for purchasing, inventory and planning department as the personnel in each department followed their own inventory database. Out of the 225, 87 erroneous purchase orders came from checking raw material inventory made and 95 cases came from raw material calculation for purchasing after checking availability. Centralizing the database and increased intensity of automatic process in checking purchase orders would effectively decrease 100% of errors.

The long purchase order process is the result of manual processes. While the manual processes would work for a small and medium size enterprises and not many transactions are conducted each day, ABC Company issues more than 1,500 purchase order per day with sales of over 1 billion baht. This makes automation for these processes an essential task.

With the purchase order taking more than 3.0 minutes per document and passing through various inventory checks, the order timing is inefficient and often times many purchase orders could not be issued on time, resulting in delivery delays.

Additionally, without the automated purchase order system, the inventory could either be lacking, or overrun in some production batches.

Another finding of disorganized data shows that 3 inventory databases in total results in erroneous data derived from each operator in each department could contain wrong data. Additionally, planning or execution of a purchase order or material delivery planning with suppliers is not easy as each inventory database could be different. Ultimately, production and delivery will also be affected.

5.2 Conclusions

The objective of this research is to identify the inefficiencies of current working process flow in the purchasing department which was identified through two major causes of human errors of manual input processes. The purchase order process is the major task in the department and the disorganized database has caused a plethora of issues widely ranging from inventory planning to delivery planning.

The new design of the purchase order work process effectively follows Figure 4.3 showing unnecessary processes – rechecking manufacturing formula and rechecking stock through many complicated procedures for used and unused raw materials and finished goods. These will be totally eliminated to both decrease operation time and also possible errors along the way. Additionally, each purchase order would also not be limited to 5 purchase requisitions.

The last objective is to explore the advantages and disadvantages of the Enproduction project. While the positives outweigh the negatives in increased efficiency through reduced operation time for purchase orders, there are many implications of cost overrun, change management and commitment of management and personnel to the success of this project.

5.3 Theoretical Implications

There are a number of theoretical implications in the implementation of the Enproduction System. First of all, this implementation will follow a step-by-step strategy as stipulated (Sankar & Rau, 2006). While this strategy, known as modular conversion, at a time would work best in this case that we want to get the purchase analysis module up and run first, integration within other systems other than MACS could be a problem. This is because other system modules such as Customer Relationship Management (CRM) or sales management could be on a different software platform which makes integration more complicated.

Sharma (2004) suggested that the key attributes of ERP solutions are flexibility, and modular and open. The Enproduction MRP system is based on Microsoft.net development software, which is not as widely used as more widely available ERP systems such as SAP, Siebel and Oracle. This could, therefore, create complications in the integration with other systems. In terms of modular and open, Enproduction is a commercial ERP system, which does not use an open system software language, and third party add-ons are not easy to integrate.

5.4 Managerial Implications

The advantages of implementing the Enproduction system is clear with explored potential advantages, namely, reduced manpower costs, reduced inventory and carrying costs due to centralized database, improved process lead times. All these factors lead to better financial management.

Implications and possible shortcomings for the implementation of Enproduction are also present with the expected positive results. First of all, the implementation of Enproduction means that the working processes in the purchasing department will be totally different. While this should come with a positive response, it is possible for personnel to resist change as job functions and work instructions would be different. The total gains from implementing Enproduction could result in some redundancy.

Another risk factor that is omnipresent in an implementation project is the fact that the implementation timeline needs to stay on track to ensure that man-hour and consultant fees remain unchanged to minimize cost overrun and also the 'Go-live' timeline should be achieved. Cost overrun and longer implementation time would result in longer pay back periods.

The success of the Enproduction system implementation depends on people, process and technology and these are all risk factors. The implication of this system includes change management of the work process that would ultimately change personnel job functions and could result in redundancy. The implementation team members made up of consultants and also purchasing personnel assigned to give work process requirements to the consultants are essential for this success. Top management support and conviction of all involved in the purchasing department, starting from management, is needed to make this implementation a success. Lastly, discipline for both management and employees with conviction to learn and practice the use of this system is the most essential.

5.5 Limitations and Recommendations for Future Research

In this study, the author focuses on only one major part of the ERP system – purchase analysis. Due to the scope of the research on this module to specifically pinpoint advantages and risks involved in implementation of the system, the whole picture of the project is not presented. Additionally, due to ABC Company's early stage in information technology investing, the ERP system implemented here is more focused towards MRP. Therefore, does not cover the full scope of ERP.

Secondary information regarding implementation of ERP solutions in Asia and particularly in Thailand is limited due to the nature of the industry which would usually keep customers' names, projects and cases confidential rather than being exposed to public. Additionally, government agencies have little information regarding ERP software and their implementation on private and public companies. Considering the primary information, the research is limited to the purchasing

department manager. If he did not fully understand the scope and the implementation plan itself, the qualitative data obtained could be erroneous.

For future studies, the author would recommend other implementations of various companies in different industries to understand the real advantages and tangible gains of implementing an ERP system as well as disadvantages, challenges, and risks involved and the final outcome of each company in each industry.



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APPENDIX

Interview Questions with Purchasing Manager

Interview Questions with Purchasing Manager

1. How many individuals do you have in your department?
2. What are their roles and responsibilities?
3. Please describe the current work flow process of purchase requisition and purchase order for
 - a. Raw materials
 - b. Spare parts for machinery
 - c. Miscellaneous items
4. In your view, what are the pitfalls of the current work flow process for purchase requisition and purchase order?
5. How many individual raw material types are purchased each year?
6. In your view, what are the pitfalls of the current raw material delivery planning?
7. Please describe the flow of purchasing data between purchasing department and warehouse department.
8. In your view, what are the pitfalls of the current process?
9. What is the operations time for each purchase requisition/ purchase order?
10. In your view, what are the current inefficiencies in the purchase order process?
11. How many errors did you have in issuing purchase orders and what were their causes?