# IMPLEMENTING ENTERPRISE RESOURCE PLANNING

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## Abstract

*ABC Company Limited is a tube manufacturer wanting to modernize further after successfully deploying a Finance and Accounting software module called MAC5. This research explores the merits and shortcomings of implementing an Enterprise Resource Planning (ERP) software system in the purchasing department. The inefficiencies of the current working process flow in the purchasing department were identified: human error in the manual input processes, and a disorganized database which has wide ranging effects from inventory planning to delivery planning. The new ERP design would reduce the work processes from nine to five processes. The old purchase order processing time of thirty minutes could be reduced to fifteen minutes. The operation cost would be reduced, and the new system would integrate the database into a centralized database.*

## บทคัดย่อ

บริษัท ABC เป็นบริษัทผู้ผลิตท่อ ที่ต้องการปรับปรุงระบบให้ทันสมัยยิ่งขึ้น หลังจากที่ประสบความสำเร็จจากการใช้ซอฟแวร์ทางการเงินและบัญชี ที่เรียกว่า MAC5 งานวิจัยนี้สำรวจข้อเด่นและข้อด้อยของการใช้ระบบซอฟแวร์ ERP ในแผนกจัดซื้อ ทั้งนี้จะชี้ให้เห็นถึงความไม่มีประสิทธิภาพของกระบวนการทำงานของแผนกจัดซื้อในปัจจุบัน ซึ่งเกิดจากข้อผิดพลาดของคนทำงานในขั้นตอนการกรอกข้อมูลด้วยมือ และความไม่เป็นระบบของฐานข้อมูลที่ส่งผลกระทบในวงกว้างตั้งแต่การวางแผนสินค้าคงคลัง จนถึงการวางแผนการจัดส่ง การออกแบบ ERP ใหม่จะช่วยลดกระบวนการทำงานจาก 9 ขั้นตอนเหลือ 5 ขั้นตอน กระบวนการจัดซื้อแบบเก่าซึ่งใช้เวลาถึง 30 นาที จะลดลงเหลือเพียง 15 นาที ต้นทุนการดำเนินงานจะลดลง และระบบใหม่จะรวมฐานข้อมูลไว้ที่ส่วนกลาง

## INTRODUCTION

ABC Company Limited is a Thailand-based manufacturer of squeezable tubes mainly used in the Fast Moving Consumer Products (FMCG) industry in Thailand and in Asia Pacific. Sales have grown dramatically resulting in a 10% increase of personnel. Although the company has increased its manufacturing capability and technology through new machinery, its administrative processes and procedures have not changed. Delay problems occurred due to inefficient document flow, and there were inadequate raw

materials. This led to inefficient product delivery which caused higher logistics costs and declining customer satisfaction. The Company plans to use ERP software, called 'Enproduction', as its modules could solve the problems:

1. Material Requirements Planning (MRP) Module - generates 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 with sales analysis and MRP modules which support purchasing and approval processes and 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 the production line with many features such as bill of materials, and routing can be varied according to production schedule.
5. Job Costing Module - focuses on cost calculation (production and direct labor costs) and allocates overheads such as depreciation and electricity.
6. Inventory Management Module - used to control store movement transactions such as transfer, adjust, issue and receive. It supports first in first out (FIFO) and 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, keeps track of maintenance and repair history, and can be used to create machine maintenance plans.

The company's 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 had implemented the MAC5 accounting system which is an 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, its potential seems to be limited for the Purchasing Department, which employs 12 people 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. It processes purchase requisitions after approval of sales orders from customers, purchase order, material budgeting, and material delivery planning.

This department has inefficiencies and delays in supply due to:

1. Purchase orders not integrated with current accounting system (MAC5) and also

not linked to MRP system, therefore there is a need to check inventory on a daily basis.
2. Outstanding budgets for each particular raw material were not clearly set up in the system and therefore are hard to manage.
3. The purchase requisition process to purchase order needs to be manually done to issue a PO and therefore takes up a lot of time for the numerous variations of raw materials to be purchased.
4. Material delivery planning currently cannot be done which makes the planning of production difficult.

Enproduction is MRP II software developed in 2003 for organizations that need software solutions for manufacturing functions, including Sales Order, Bill of materials, Auto purchase order, Capacity and scheduling, and Stock Management. Enproduction software is designed to integrate with MAC5. This study aims to identify the pros and cons of the Purchase Analysis module of Enproduction, and its tangible operational improvements such as decreased work processes, decreased manpower, penalty cost savings and overtime costs. The research question to be answered is: Should Enproduction ERP software be applied to improve the working processes of the company's Purchasing Department?

## REVIEW OF RELATED LITERATURE

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.

### ERP Definition and Characteristics

O'Leary (2000) defined 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 and finance and sales and has effectively blurred the lines between IT and users.

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

ing capability (Garg & Venkitakrishnan, 2003). Escalle, Cotteleer, and Austin (1999) mentioned that ERP expenses could be as high as 2-3% of sales.

Monk and Wagner (2009) state that today, business is 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. The main objective of the 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. They are semi-finished in that companies usually do not 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 ranging from: Manufacturing systems; Supply chain management systems; Financial systems; Human resources system; and Customer relationship management. 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 of ERP solutions are:

1. Flexibility to changing needs and across various databases.
2. Modular & Open: modules can be integrated or removed without affecting other modules, and systems should support different types of hardware platforms and support third party add-ons.
3. Comprehensive - the system should support various business functions for different types of organizations.
4. Beyond the company - The ERP system should be compatible with other business entities.
5. Best business practices - these should be incorporated to enable their use by clients.
6. Simulation of Reality of business processes, and include accountability of users controlling the system.

Nowadays, functional specialists are the ERP users. ERP has blurred the line between departments (O'Leary, 2000). The integration via ERP reduces costs, improves relationships and efficiencies and increases the number of cross-function users that could improve the overall use of ERP.

**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).

Tangible benefits of ERP that can be counted and measured are made up of: Reduced inventory and inventory carrying costs; Reduced manpower costs, typical labor savings approximately a 10% reduction (Leon, 2008); Reduced raw materials, resulting in an approximate cost reduction of 5% (Leon, 2008); Improved sales and service; and Efficient financial management.

The intangible benefits of ERP are: Accounting and administration; Product and Process Design; Production and Materials Management; Sales; and MIS function.

Other factors in implementing ERP systems to be considered include implementation costs, production and business transaction costs, reporting costs, personnel costs, business process change and enhancement costs, and customer and partner support (Leon. 2008). However, there are also disadvantages: ERP implementation can be time consuming, expensive, ERP vendor dependence, too many features and complexities, and future compatibilities (Noah, 2002).

Sankar and Rau (2006) state 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) categorizes the risks in using ERP as Challenges during ERP Implementation: Challenges for ongoing maintenance and operation of ERP systems, and Challenges of managing people.

People issues are the most important, as ERP implementation always involves change and human nature resists change, so cooperation from every stakeholder is most essential (O'Leary, 2000). The main people issues are: Change management; Internal staff adequacy; Project team; Training; Employee re-location and re-training; Staffing/ turnover; Top management support; Consultants; Discipline; and Resistance to change.

ERP implementation introduces various business processes and makes redundant a number of existing work flows. Managing the implementation of these processes will decide the success of the implementation. The key areas of concern are:

1. Program management - The management of one database for all transactions between functions and operations is important to success.
2. Business process reengineering (BPR) - Many issues such as structural change, management systems, performance measurement, training, and IT usage, must be addressed.
3. Stage transition - Transition of responsibilities after the system 'goes-live' needs to considered.
4. Benefit realization - Operations 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: Software functionality; Technological obsolescence; Application portfolio management; and Enhancement / upgrades.

**ERP Implementation Strategies**

Implementation strategies play an integral part in defining how implementation should be conducted. According to Sankar and Rau (2006), three possible implementation strategies are step-by-step, big-bang, and roll-out. Sankar and Rau (2006) suggest that step-by-step implementation strategy allows the organization to implement the ERP system in steps. The project team gains implementation skills and knowledge that is transferrable for future projects. Disadvantages of step-by-step implementation include longer total implementation and deployment time and increased costs. Bagranoff et al. (2005) describe the big-bang implementation strategy as a direct conversion strategy through a single operation. 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. For ABC, the step-by-step strategy is chosen due to complexities involved in each department as well as the implementation team's inexperience in implementing large scale software for use in manufacturing and sales.

**Definition and Scope**

Enproduction is MRPII software developed in 2003 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. The Enproduction software is also designed to integrate with MAC5 for reporting and analysis purposes. There are seven modules within Enproduction. The scope of initial implementation at ABC will be the Purchase Analysis Module for the purchasing department.

**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.

The advantages of Enproduction over other vendors include: Price, Familiarity of ERP consultants with ABC's proceses, Easy Easy integration of Enproduction with MAC5, Ability to customize business processes of ABC, Familiarity of IT administrators with the system, and Minimal system training for the core implementation team.

## RESEARCH METHODOLOGY

Research is conducted to find the current working process of the purchasing department through the use of data collection, data analysis, identify the inefficiencies of working process flow in the department, 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.

**Data Collection: Documentary Reviews**

The documents reviewed and assessed are:

1. Sales order in 2012 - transactions and volumes.
2. Purchase requisitions in 2012 - number each year and how grouped together.
3. Purchase orders in 2012 - number in 2012 and how many requisitions are grouped into a purchase order.
4. Operations time for purchasing processes - to find any bottlenecks.
5. Operations time for checking inventory before placing purchase order - to find any redundant checking time.

**Data Collection: Interviews**

Primary data is collected via interviews with purchasing department management to obtain qualitative data through specific questions to gain insights into work flow and processes as well as any pitfalls that lead to redundant processes, ineffective inventory stocking, and delayed delivery of products. The scope of the interview will cover the working processes within the purchasing department and its workflow across to sales department, accounting department and warehouse department.

**Data Analysis Plan**

Data analysis maps the current work process in the purchasing department as well as any bottleneck and the shortcomings, so as to propose a new process. Operation time, process flow, and process sequence is gauged and mapped to check the possibility for process improvement through the implementation of the Enproduction ERP Software. Each bottleneck and shortcoming in the purchase order process is analyzed to find the key improvement points, and reengineering of the work processes is reviewed.

**Design of the ERP Implementation Plan**

The Enproduction System follows the planning and phases mentioned by Leon (2008). The implementation process is expected to last six months from launch.

1. Project planning phase -The project team is set up and a detailed scope of the project is created.
2. Gap analysis - gap identification and analysis between current business processes and best practices available in the Enproduction system.
3. Reengineering - changing the way some business processes need to be conducted to develop and find the right business requirements.
4. Customization - configuration of the Enproduction system to balance between best practices and the business processes specific to ABC Company.
5. Implementation team training - essential, as the team has to configure the system to meet the organization's needs.
6. Testing - of business rules in the Enproduction software system for any bug fixes, process realignment and other configuration issues.
7. Going Live - putting the Enproduction software online for use.
8. End-user training - for those operating and feeding data into the system.
9. Post-implementation - support team, maintenance and updating ERP and planning further phases, plus measuring performance improvements.

## PRESENTATION AND CRITICAL DISCUSSION OF RESULTS

**The Flow and Current Problems of the Purchasing Process**

The purchasing department is currently divided into three main sections: Raw Material Purchasing, General Purchasing, and Maintenance Parts Purchasing. 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 procures parts and consumable materials such as lubricants.

The work process flow with regards 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 availability of raw material inventory. A sales order is issued when raw material is needed. Purchase requisition is calculated and subsequently purchase requisitions are grouped into purchase orders.

The problems in the department stems from three main issues:

1. There are three inventory databases - for planning, purchasing and warehouse departments, increasing the risk of erroneous data and inventory discrepancies.
2. Long processing time of 30 minutes for purchase order issuance, through a complicated process with risk factors including erroneous data entry and many manual and automatic processes.
3. Purchase order is not integrated with the current accounting system (MAC5) resulting in many manual processes.

Of the nine major processes, seven are manual, and only two are automatic (Record Purchase Requisition, and Record Purchase Order).

Due to the many manual processes that need to be input into Excel and verified within MAC5, and due to many databases, the purchase order process produced many errors. Out of a total of 1,545 purchase orders issued in 2012, there were a total of 225 orders (14.6%) that needed revision due to human error. Out of these 225 purchase orders, revisions from error in checking raw material inventory made up 87 cases, error in manufacturing formula made up 43 cases, raw material calculation for purchasing after checking availability made up the remaining 95 cases. An ERP system connected to MAC5 would help solve these issues and also decrease the use of manpower by 1 or 2 persons.

Reviewing purchase order process documents and historical operation times, it is revealed that to produce each purchase order takes approximately 30 minutes. The purchase order process begins after the sales order is approved from the customer service department, as shown in Table 1:

**Table 1: 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 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 MAC5 and into excel file | 1 | Manual | Currently MAC5 allows a maximum of 5 purchase requisitions per each purchase order |
| 9 | Input Purchase order into MAC5 | 1 | Manual | |
| | **TOTAL PROCESS TIME** | **30** | | |

**Source:** Purchasing Department of ABC Company

From interviews and document reviews, inefficiencies and erroneous transactions of working process in the purchasing department come mainly from two causes:

1. *Processing time for purchase order is unacceptable at 30 minutes per document.* Considering the number of purchase orders of 1,545 orders per annum in 2012, on average 30 minutes elapsed time per purchase order. Thus a total of 46,350 minutes or 773 hours per year is used to process these orders. This equals 3.9 hours per available working 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 a man-day. The purchase officer processing a purchase order uses 18 minutes manually. However, a closer look into the automatic processes in the MAC5 system reveal that there are still checks of raw material from a new batch and a used batch and also of finished goods, so the processing time of 12 minutes could possibly be reduced.

2. *Many databases for inventory management result in errors and miscalculations* The disorganized database for purchasing, inventory and planning departments results in erroneous transactions due to personnel in each department following their own inventory database. Out of a total of 225 erroneous purchase orders, 87 came from checking raw material inventory, and 95 cases came from raw material calculation for purchasing after checking availability. These two cases make up approximately 81% of all these errors. This disorganized database also results in the need for the purchasing department to check for raw materials from each new and used batches and also finished goods inventory. With a centralized database, the need to check raw material and finished goods will be minimized and process time will be lessened.

**Enproduction Implementation Plan**

The timing for the project should take approximately six months. The implementation of Enproduction is 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. Some details are below.

In Gap Analysis, from Table 1 it is obvious that raw material is checked in four processes. These can be automated in ERP into a single process. A number of business processes need to be reengineered. Currently two purchasing officers are in charge of purchase requisition and purchase order processes. With ERP, one officer's work will be moved from issuing purchase orders to final checking for approval. This change could substantially lower erroneous purchase orders. Due to the centralized inventory database, the planning and warehouse departments will also be able take out the cross checking of

inventory with the other departments. The processes that will be reengineered and implemented into ERP include:

1. Manufacturing formula check automation - this process will be automated instead of manually checking to minimize any formula errors from the start.
2. Raw material checks automation - both unused and used raw materials will be automatically checked in one process rather than as two separate processes.
3. Finished goods check automation - finished goods will be checked in one centralized inventory database.
4. Raw material calculation automation - the calculation of raw materials to be ordered is to be automated to increase efficiency and minimize human error of data entry.
5. Purchase requisition input increase - MAC5 only allows a maximum of 5 purchase requisitions per purchase order. ERP would allow an increase to 10 purchase requisitions per order.
6. Purchase order printing automation - each purchase order needs to be chosen and printed out; the ERP would allow automatic printing of purchase orders.
7. Centralize inventory database in ERP - this process would create less errors in inventory checking through disorderly inventory database, which resulted in 182 errors.

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

1. Reports of purchasing department customization
   Currently, four reports are manually calculated in Microsoft Excel:
   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 would be customized in the ERP system so that they can be viewed and retrieved on demand rather than having the need to calculate every report.
2. Product units customization
   Eight main raw materials need to be ordered. The ordering unit for each raw material is not available in ERP and needs to be customized to be able to input each unit into the system.
3. Purchase requisition maximum amount customization
   Currently, the maximum number of purchase requisitions for each purchase order is five. ERP can customize this to a maximum of ten requisitions for each purchase order.

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

***Decrease Redundant Work Processes***

The proposed purchase order process would decrease operations time from 30 minutes to 15 minutes, reducing redundant work processes. 9 processes would be replaced with 5 processes. The redundant processes of checking raw materials and finished goods in many different processes would be eliminated. Purchase requisition and purchase order printing would be automated.

***Decrease Costs***

The ERP implementation cost is 200,000 baht. The use of Enproduction can theoretically reduce the operations time by half, which would reduce the cost of personnel, paper and printer, through paperless processes. Daily man-hours would reduce from 4 hours per day to 2 hours per day.

To save 2 hours of work in processing purchase orders per day would equal 75,000 baht for a working year. To break even with the cost of software implementation would take 2.56 years, for personnel cost alone. If erroneous data resulting from manual operations are considered, the merits of Enproduction software would be even greater.

***Decrease Erroneous Transaction***s

The disorganized database for purchasing and manual processes resulted in 225 erroneous purchase orders (14.6%). 87 were due to checking raw material inventory and 95 cases due to raw material calculation for purchasing after checking. With a centralized database, it is likely the 87 errors would be eliminated. The allocation of personnel checking raw material calculation should substantially reduce the 95 erroneous cases. The result of having automatic process and centralized database can eliminate 100% of erroneous transactions.

***Decrease Duplication of Data Entry***

Through ERP, manual processes to input into Excel would be changed to input only into ERP. Processes that are currently in Excel would now only be input and processed in Enproduction. This would reduce duplication of data entry, and decrease errors due to less input into different databases and programs.

***Integrate Faster Operations***

Implementing Enproduction on a step-by-step basis would ultimately integrate sales, purchasing, warehouse and accounting departments, through database centralization. This would be achieved initially through centralizing the inventory database which would

aid the the purchasing department and inventory and planning departments, as centralizing the inventory database for raw materials and finished goods would eradicate manual checking in Excel for the purchasing department and manual checking for the other departments.

***Augment ABC's Workforce to Meet International Standards***

The use of an ERP system would naturally increase ABC workforce's professionalism in working to best multinational practices. ERP would make the purchasing officers realize the value of efficiency and time management to increase productivity.

***Decrease Training Time***

Tasks needed would decrease from 9 processes to 5, which would decrease the purchase order issuance tasks of the purchasing officer, leaving more time for checking the correctness of orders. This decreases the time needed to train new personnel.

***Decrease Inefficiency in Raw Material Inventory***

A centralized database means less errors in auditing and counting raw material inventory. The task of the warehouse department to be in charge of raw material inventory would place responsibility on one party.

***Decrease Lead Time of Production***

With better management of raw materials through a centralized database, lead times of production would decrease due to better raw material planning and faster execution of purchase orders to suppliers. A summary of all the expected results is listed in the Table 2 below:

**Table 2: Summary of Expected Results**

| No. | Subject | Expected Results |
|---|---|---|
| 1 | Redundant work processes | Decreased from 9 processes to 5, Decrease 50% of operation 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 process of duplicate data entry |
| 5 | Integrate faster operations | Integrate 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 | Expected to decrease significantly due to process decrease from 9 to 5 |

| No. | Subject | Expected Results |
|---|---|---|
| 8 | Decrease inefficiency in raw material inventory | Ownership of inventory tracking transferred to warehouse department from three departments |
| 9 | Decrease lead time of production | Faster execution of purchase order to suppliers and better inventory planning leads to faster lead times |

## CONCLUSIONS AND RECOMMENDATIONS

In the new design of the purchase order work process unnecessary processes through many complicated procedures will be totally eliminated, reducing operation time and possible errors along the way. Each purchase order would not be limited to five purchase requisitions.

An important objective of this study 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.

There are a number of theoretical implications in the implementation of the Enproduction System. First, this implementation will follow a step-by-step strategy as stipulated (Sankar & Rau, 2006). While this strategy where modules are implemented one at a time would work best in this case where we want to get the purchase analysis module up and running first, integration within other systems other than MAC5 could be a problem. This is because other system modules such as Customer Relationship Management 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/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 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.

The advantages of implementing the Enproduction system are clear: reduced manpower costs, reduced inventory and carrying costs due to centralized database, and improved

process lead times. All these lead to better financial management.

Implications and possible shortcomings for the implementation of Enproduction are also present alongside the expected positive results. First, the implementation of Enproduction means that the working processes in the purchasing department will be totally different. While this should generate 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 such as this is the fact that the implementation timeline needs to stay on track to ensure man-hours and consultant fees remain unchanged to minimize cost overrun and also achieve the 'Go-live' timeline. 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 also risk factors. The implications of this system include change management of the work process that would ultimately also change personnel job functions and could result in redundancy. The implementation team members made up of consultants and purchasing personnel are essential for success. Top management support and conviction of all involved in the purchasing department, is needed to make implementation a success. Lastly, discipline for both management and employee with conviction to learn and practice the use of this system is most essential.

A limitation of this study is that secondary information regarding implementation of ERP solutions in Asia and particularly in Thailand was limited, due to the nature of the industry which usually keeps customer names, projects and cases confidential. Additionally, government agencies have little information regarding ERP software and their implementation in private and public companies.

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