Inventory Management System of Perfect Packaging Company

by

Ms. Phloenphit Puengprarattanatrai

A Final Report of the Three-Credit Course
CS 6998 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
Assumption University

November, 2001

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Project Title	Inventory Management System of Perfect Packaging Company
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Academic Year	November 18, 2001

The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

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ABSTRACT

This project presents the understanding of the Inventory Management System of Perfect Packaging Co., Ltd. providing an overview of the company structure, processed, workflow and data transactions. From the preliminary analysis and investigation of the problems from the existing system of the company, the writer found that the process is slow and there are many errors inside the system, which come from manually handling the transactions. Although there are working papers to control the process in each step, the transactions are not accurate. The quantity of the physical inventory is not equal with the report number; it is difficult and time consuming to search the information such as level of the remaining inventory in the stock or keep tracking sales transactions during month or even the inventory usage under each production order. The finished goods are kept for long time before the shipment date while there are some material shortages during the months. The inventory forecasts system cannot be made. The existing system is a manual system, although some reports are printed using computer but manually tracking in paper work needs to be done and do just only the final report. The cost of the system seems to be increasing every year and due to the company expansion of the new plant, a faster and accurate system is required.

To reengineer the inventory management system from the existing system which is a manual system to be made computerized system, is the main objective of this project. The proposed system concentrates on the inventory transactions for both materials and finished goods, starting from the marketing department until distributing to the customers, through the computerized system is the scope of this project. This project will exclude the accounting and costing for the inventory transactions. The

company needs to invest in both hardware and software which costly for the first year of the investment. But the payback period will be covered in a few years. To fulfill the users' requirements, the writer used to interviewing, observation and questioning methodology as a tool, so it does not have any other alternative since all tasks in this project is done under the users' needs.

Project manager of the system and staff of Perfect Packaging Co., Ltd. do the evaluation of the project using white box testing methodology as a tool to test the system. The staff uses back box testing methodology as a tool. To make the program user friendly, the screen design and output design concentrate more on users' requirements.

As this project is completed, the management of the Perfect Packaging Co., Ltd. has a plan to reengineer the other parts such as accounting and costing system which is related to the Inventory Management System in order to increase the company's performance. This proposed system will be fully utilized in the new plant, to be ready within December 2001.

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She also would like to thank all Professionals of the MS(CIS) program from whom she has gained knowledge. Her sincere thanks also goes to the Project Committee members of the Graduate School of Computer Information Systems of Assumption University.

She express her thankfulness to the Management and all staff of Perfect Packaging Co., Ltd., for providing her useful information, guidance and opportunity to develop this project.

Moreover, she also would like to thank her colleagues, especially Miss Vilawan Withoonsomboon and Mr. Nadt Samattiya for all kind motivation they provided her during this project.

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I. INTRODUCTION

1.1 Background of the Project

The Inventory Management System is a project development for Perfect Packaging Co., Ltd. All the services concerning gathering and generating information, transferring of the inventory transaction starting from marketing department until the finished goods are distributed to the customers. To provide more efficient service within the organization and preparing of the new control system for the new plant, the management decided to improve the inventory management system. The existing system has to analyze the problems and the alternative of the new system before a better new system can be designed and developed as an alternative. Computer Information System is a certain tool to help the writer to define the appropriate ways, to improve the Inventory Management System.

1.2 Objectives of the Project

The objectives of the Inventory Management System are as follows:

(1) To study the current existing system

(2) To evaluate the current existing system, identify the problems and find out the possible solutions to solve those problems.

(3) To perform the user requirement analysis and identify the specifications for new proposed system.

(4) To analyze and design the system development for the Inventory Management.

(5) To design the controlling process for the inventory information and generate the user friendly report support top management decision making

(6) To implement the Inventory Management System to be ready for use within the real business world.

(7) To suggest the procedures and methodologies for the storeroom department after the Inventory Management System is implemented.

(8) To reduce the paper work and non-value added activities in the organizations

(9) To provide the real time accurate information for the inventory level in the storeroom

(10) To improve working capital and reduce the loss that may occur due to weak management system

(11) To reengineering inventory system by using computerized system

(12) To standardize work process and be proactive for the inventory control system.

1.3 Scope of the Project

This project emphasizes on the inventory management system in the storeroom department. The responsibility area of this department is the materials and finished goods management. It does not include the software program development but providing the information about the logical and technical design including design of system output and input. The inventory management system comprises of the majority activities as follows:

(1) Collecting information and requirements by interviewing with employees in the storeroom department, other related department and managing director for better understanding the operation.

(2) Studying the forms, reports and any existing documents required by Finance & Accounting Department, managing director and Revenue Department.

(3) The Inventory Management System will provide the graphic user interface screen to enter or query the data.

(4) The Inventory Management System will provide the reports, which serves the needs and requirements from Managing Director, Finance & Accounting Department and Revenue Department.

(5) Install the Inventory Management System.

(6) Training class and user manual for the users.

(7) Emergency Action Plan (EAP) and practice.

(8) Implement

(9) Post implementation and follow up.

1.4 Deliverables

The deliverables for the inventory management system are as follows:

(1) Relational Database, which is developed using Microsoft Access. The Database comprises 9 tables. These tables are as follows:

(a) Customer Database Table

(b) Employee Database Table

(c) Finished Goods Database Table

(d) Formula Card Database Table

(e) Inventory Transaction Database Table

(f) Job Order Database Table

(g) Material Database Table

(h) Purchase Order Database Table

(i) Supplier Database Table

(2) Input User Interface, which is developed using Microsoft Access.

(3) Report Design, which is developed using Microsoft Access. List of reports are summarized as follows:

(a) Customer List Report

(b) Daily Inventory Report

(c) Job Order Report

(d) Monthly Inventory Report

(e) Monthly Summary Shipment Report

(f) Purchase Order Report

(g) Production Order Report

(h) Stock Card Report

(i) Summary Finished Goods Report

1.5 Project Plan

The schedule of the whole project is about 6 months. The project is divided into 3 phases: analysis of the existing system, analysis and design of the proposed system and implementation of the proposed system. The estimated time used in the analysis of the existing system phase is about 2 months. Then the system analyst can start the system design of the proposed system, which will take about one and a half months to finish system design.

Finally, the system implementation phase will take about two and a half months to complete. Please see Figure 1.1 for the project planning of the system.

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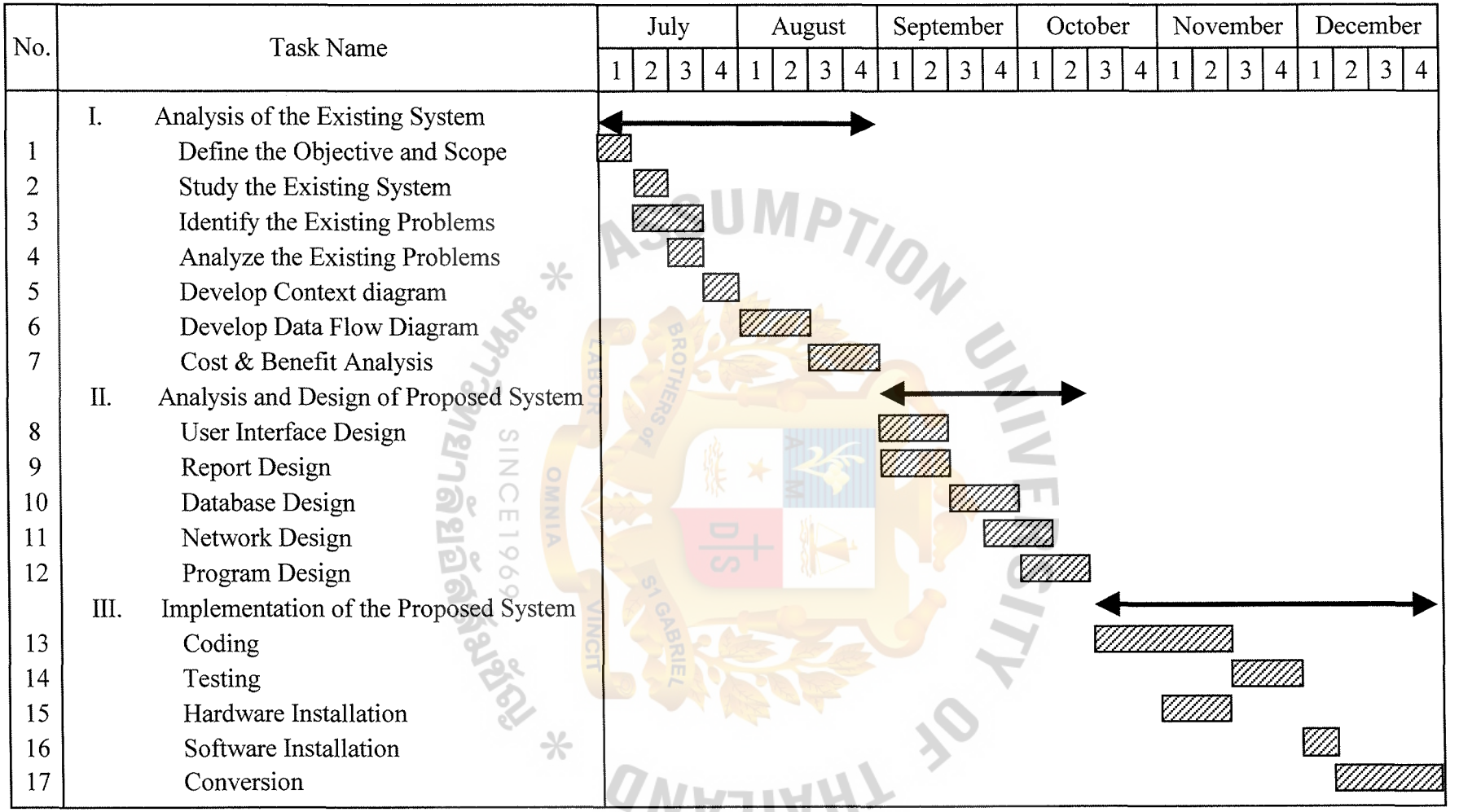

Figure 1.1. Project Planning of Inventory Managment System of Perfect Packaging Company.

II. THE EXISTING SYSTEM

2.1 Background of the Organization

Perfect Packaging Company was established in 1995 by a group of people who have experiences in plastic packaging and plastic film. This company is located on Ekkachai road, Samutsakorn province.

Perfect Packaging Company is a medium sized plastic manufacturing company. The main product is plastic wrapping package for food and candy. As the company is located in Samutsakorn Province, the seafood packaging is also another main product. Considering to the rapid changes in packaging technology, the company must develop their products to match with the new technology and to maximize their customers' satisfaction through shorter lead time for ordering products and developing new packaging formula, so good inventory control system will help the company to deliver their mission.

There are many kinds of materials in this company that are difficult to control such as plastic film, where the price changes due to the oil price and exchange rates. So, the company needs to have an automated system to control the quantity of material and providing accurate information support top management decision for purchasing the material.

The Figure 2.1 will illustrate the organization chart of Perfect Packaging Company. The organization chart shows that the Managing Director is at the top level of the company. The Managing Director has an Assistant Managing Director. Production Manager and Purchasing Manager will report to Assistant Managing Director. Finance & Accounting Manager, Marketing, Human Resource Manager, Store Room and Distributing will report directly to the Managing Director. Each member directly report to their managers.

Organization Chart

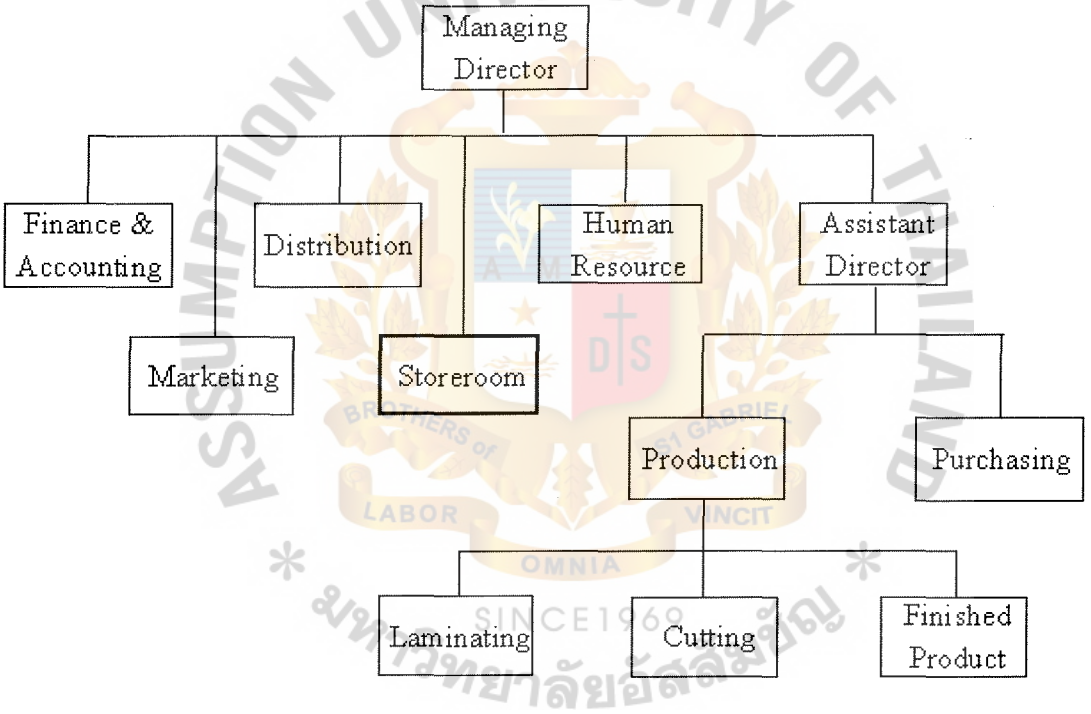

Figure 2.1. Organization Chart.

2.2 Evaluation of Problems

The system analysis is conducted through the systematic collection of facts and opinions relating to how current systems work. The data collection is based on the primary sources of data, which constitutes the users of the system while the secondary sources which are the documents of information and reports. The methods of gathering data are: conducting personal interviews, providing questionnaires, observation of the work process from the company management and staff.

The problems of the existing system and improvement area are:

(1) Accuracy of the inventory balance.

Normally, the daily inventory report is printed every morning and it was difficult to identify the inventory level during the day since the inventory transactions did not recorded immediately. In order to get the remaining balance of the inventory in the Store Room, manual tracking needs to be done. Sometimes, the inventory balance in the report is not equal to the physical balance. Material shortage is the majority issue during the operations.

(2) Conflict of role and responsibility of the staff.

There are many staff who are involved in the inventory movements therefore, the production planner can be able to deduct the inventory instead of that being done by the Store Room Officers. The Store Room Officers cannot find the actual balance of the inventory in the stock while the production planners will be able to know.

(3) Over stocking of slow moving inventory and Shortage of fast moving inventory

Since it is difficult to find the actual balance of the inventory in the system, sometimes Purchase Officers purchase too much of the slow moving items while they stop ordering the fast movement items. Note that the useful life of each material is not the same, this increases the level of obsolete stock in the Storeroom and sometimes is the root course of the production shut down due to material shortage.

(4) Weak internal control of the Inventory System.

The other officers or workers should not have the permission to enter the Store Room Area. This will cover for the materials and spares.

(5) Time Consume to generating the useful report.

Since all process is done manually, it is time consuming which is one issue. In order to get the monthly inventory ending balance, the Store Room Officers need to spend more than five working days to generate the inventory report.

(6) Too much paper work

Documentation needs to be prepared in order to control the process. Sometimes, the Store Room Officers need to find out the source of materials or finished goods (note that there are some customers, order the finished goods but still not allow to ship to their factory. Some finished goods do not belong to the company itself and the Store Room Officers need to identify the ownership of the products.) This data can be tracked from the document, which keeps all in another filing system.

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2.3 Analysis and Selection of Alternative

From the evaluation of the current existing problems, we can see that the manual system is the major cause of the problems. It creates a lot of human errors and delay in the work process. In this case, the use of computer-based system seems to be the best solution to solve these problems. Before selection of any new design system, the following factors will be considered:

2.3.1 Computer-Based Versus Manual System

There are several reasons for building a computer-based system. The advantages of computer-based system over the manual system are summarized as follows:

(1) Improve the inventory movement among departments.

(2) Improve accuracy and consistency of data in the store room.

(3) Reduce the redundancy in paper work.

(4) Improve the speed of preparing inventory report.

(5) Support the increase in number of transactions in the future with minimum cost and space utilization.

Although there are many advantages of the computer-based system, it also has some constraints as follows:

(1) High investment cost at an early stage and usually involves lump-sum payment.

(2) High training cost during the transitional period.

(3) High maintenance cost.

After comparing both advantages and constraints, we can see that the computer-based system has many advantages over the manual system. The only major constraint is the capital investment, which is not the problem of the system itself. So the

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computer-based system is recommended in this project. The next step is to define whether to build or buy a new system.

2.3.2 Build versus Buy

Should the company build a new system or buy software packages and implement it directly? There are many factors to be considered. The most important factors are functionality, availability, ease of understanding, performance, and initial and recurring costs.

Currently, there are a large number of software products available for sale in the market. The company can buy the general purposes software such as word processing, electronic spreadlets and other office packages from the market. This can reduce the cost of developing the new system.

Although the company can buy some application software from the vendors, there are still some systems such as job order systems and formula card processing systems that have to be developed specially for the company. There are many specific conditions for the purchasing and production order creation processes, which are totally different from any other businesses.

To avoid a lot of modification costs, which will be incurred in order to modify the software packages to fit the company's requirement, I choose to develop the inventory management system. However, for other general purposed systems, it is cheaper for the company to buy from the vendors instead of developing them by itself.

Note that the existing of an Inventory Management Information System for Perfect Packaging Co., Ltd. is base on manual to perform work.

(1) Production Planner takes inventory transactions from the Inventory reports and prepares the production order. Manual calculations need to be done per production order note

(2) If the inventory stock is not available to produce the finished goods, the out of stock report needs to be prepared and sent to Purchasing Department in order to contact the suppliers.

(3) After the supplier sends the materials to the Storeroom Department, the staff will check the product and manually update into the receiving book. If the suppliers send the wrong quantity, the Purchasing officer will change the quantity in purchase order in order to make it equal with the suppliers' invoices. There is no control system between Purchasing Department and Storeroom.

(4) The copy of purchase order and Tax invoices will be sent to F&A for payment process.

(5) Production issue Stock Issue Note in order to indicate the materials and quantity to be moved in each production order. Then using, the Stock Issue Note as the reference to update into the control book.

(6) Summary inventory balance will be prepared as a report to the Production Department everyday. If the materials are issued within the day, production planner will manually adjust it in the Summary Inventory Report.

(7) After the finished goods are produced, the physical inventory will be kept in the storeroom and waiting for sending to the customers.

(8) The inventory balance will be update after the finished goods sent to the customers.

(9) The Storeroom officer will prepare the monthly summary inventory balance during month-end to the F&A and Management.

The above functions of the existing system are shown in the context and data flow diagram as follows:

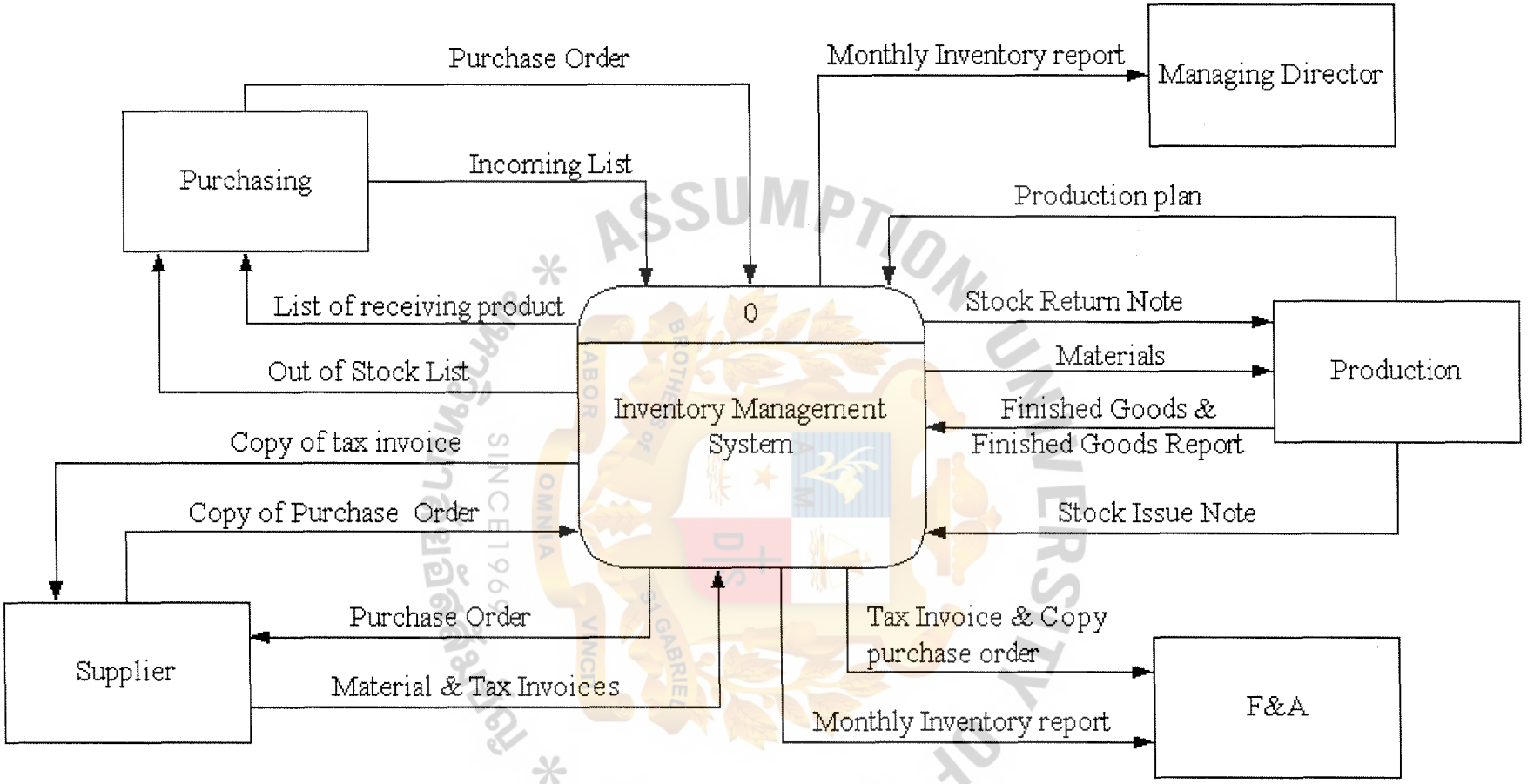

Figure 2.2. Context Diagram of the Existing System.

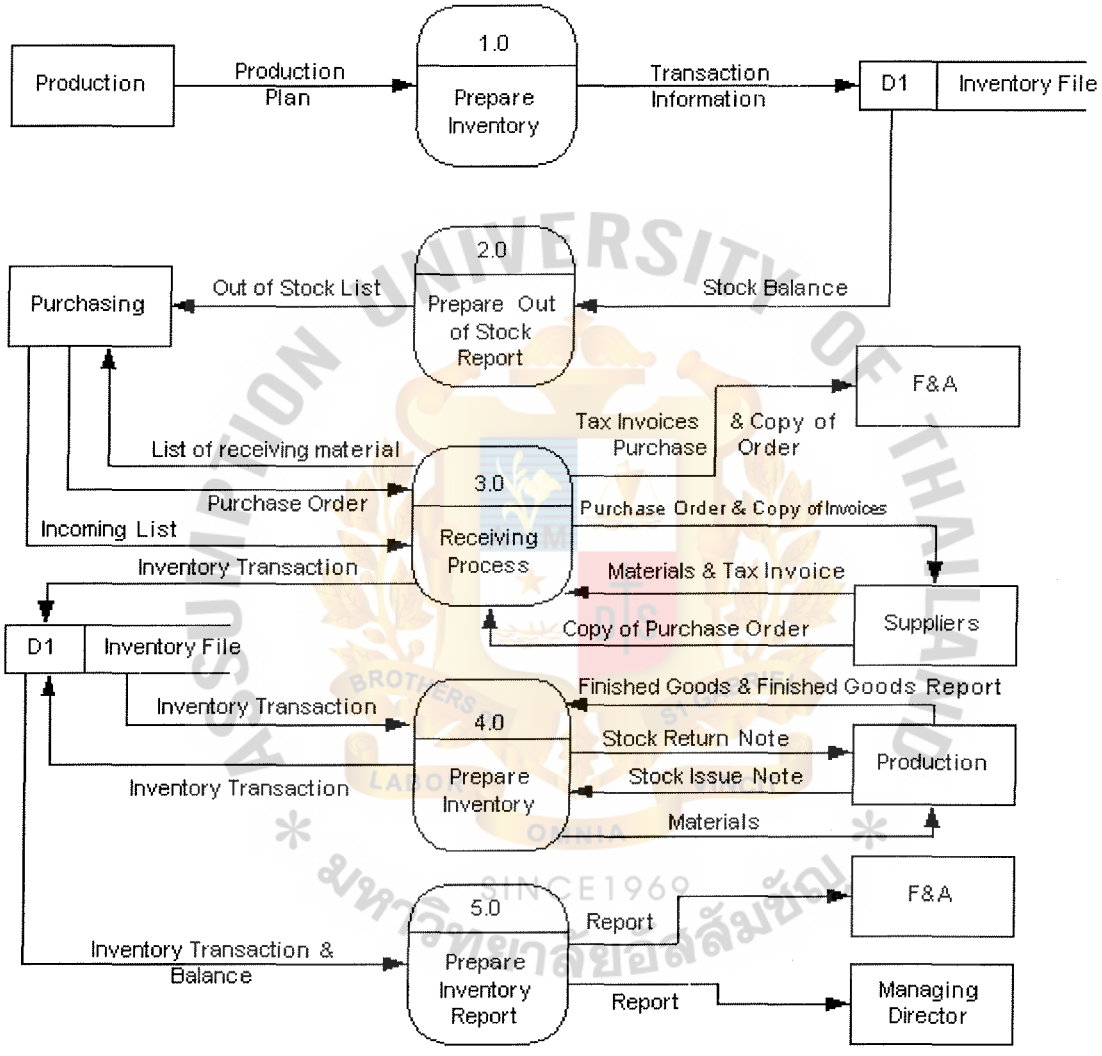

Figure 2.3. Data Flow Diagram (Level 0) - Existing System.

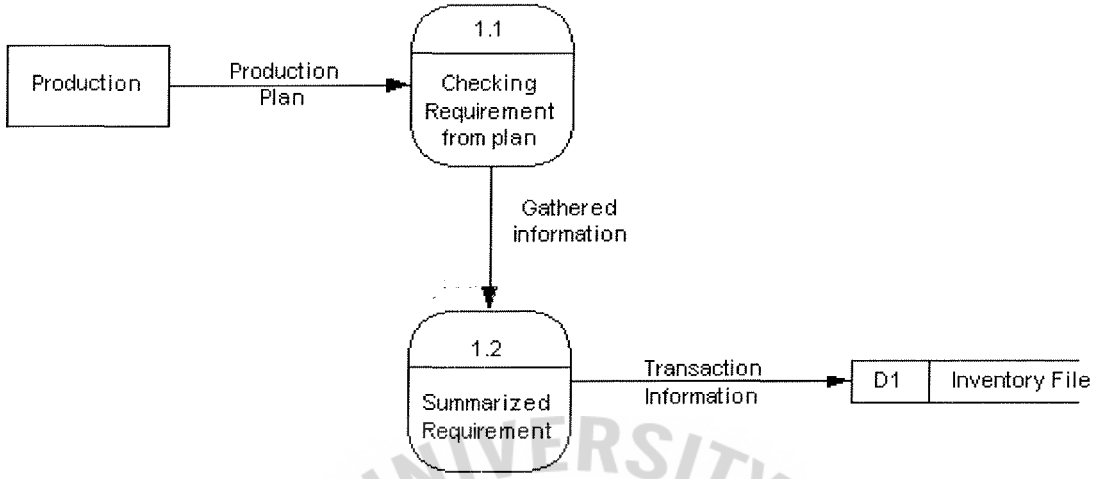

Figure 2.4. Data Flow Diagram (Level 1 Process 1) – Existing System.

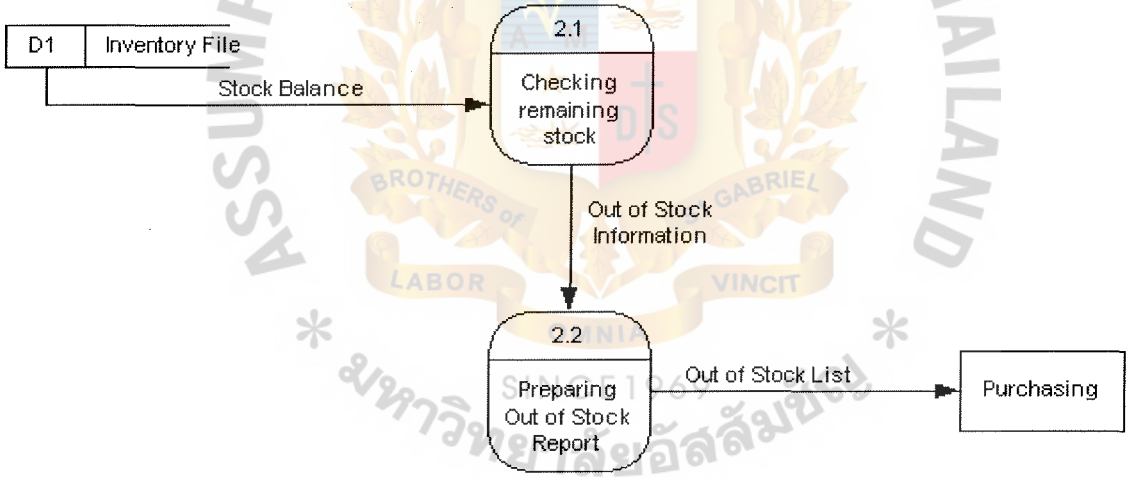

Figure 2.5. Data Flow Diagram (Level 1 Process 2) – Existing System.

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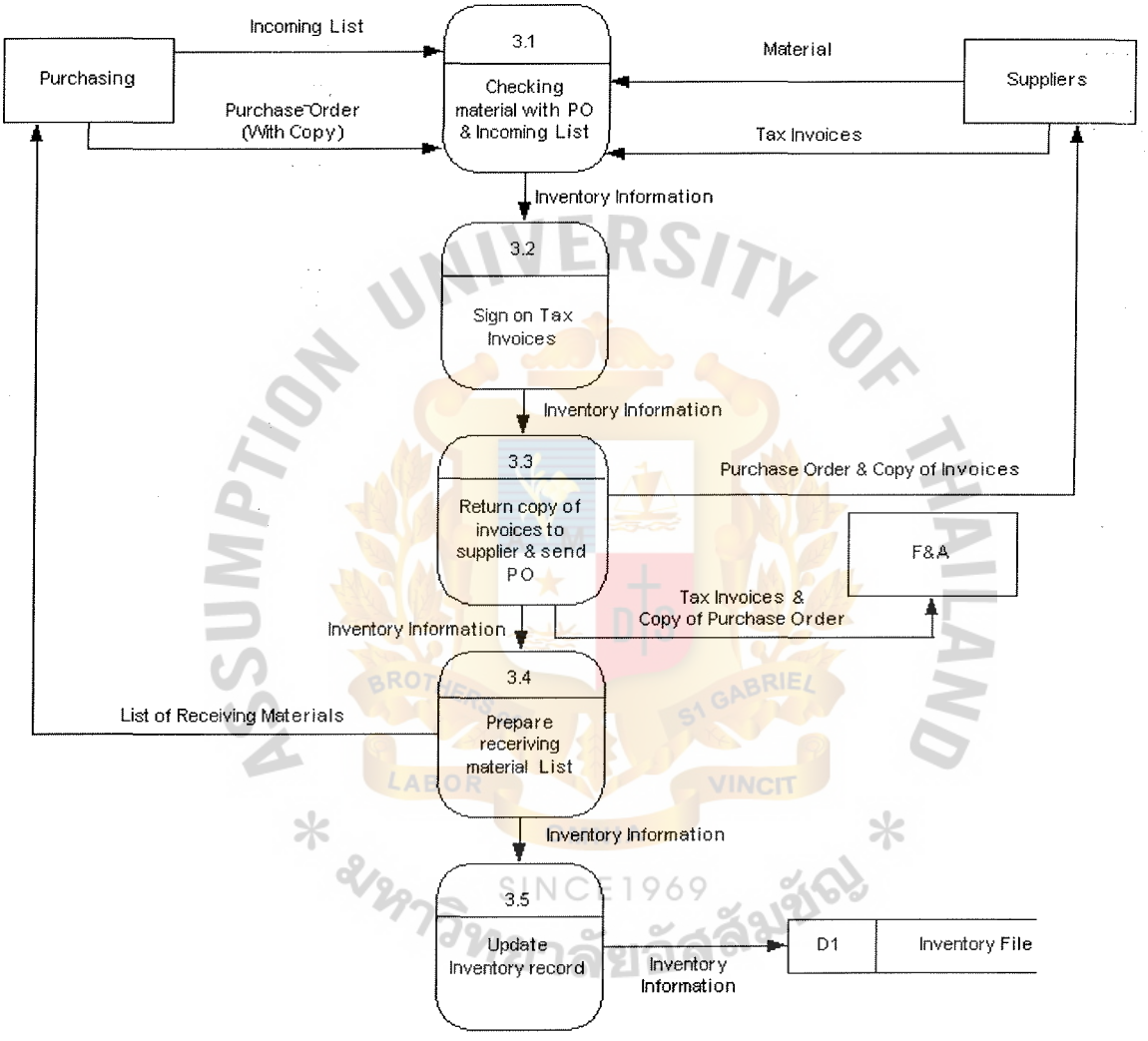

Figure 2.6. Data Flow Diagram (Level 1 Process 3) – Existing System.

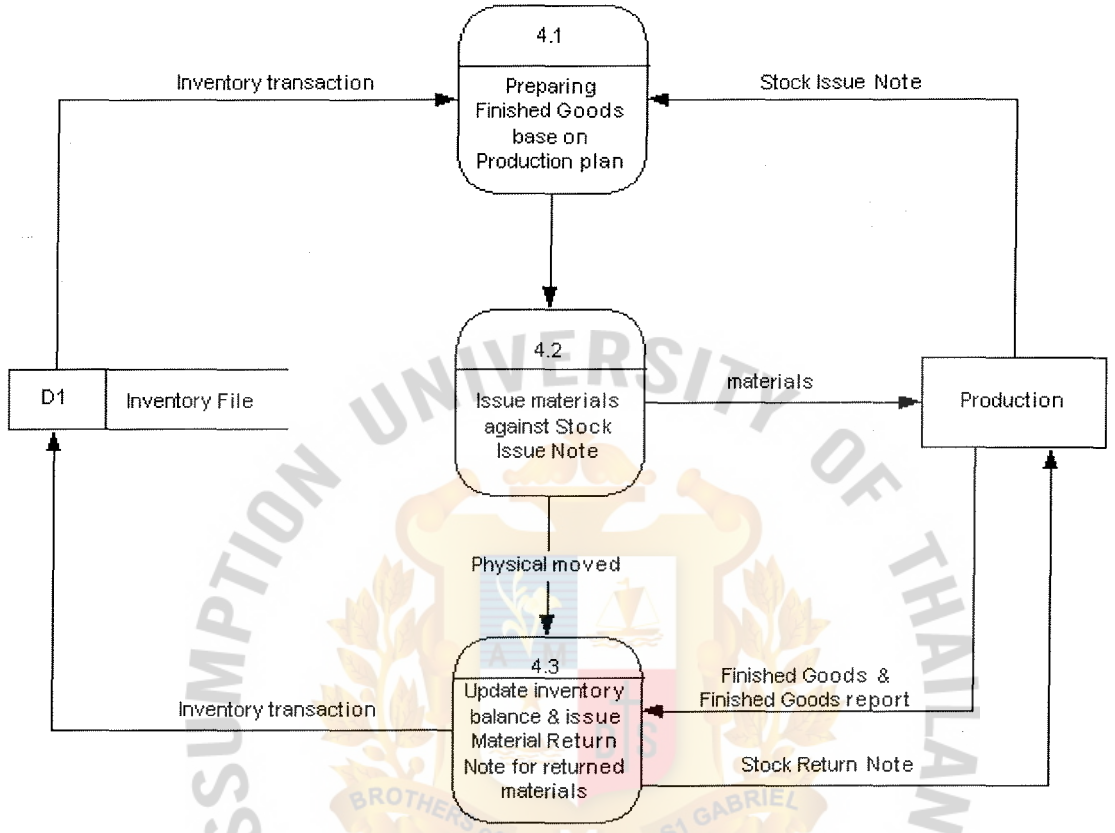

Figure 2.7. Data Flow Diagram (Level 1 Process 4) – Existing System.

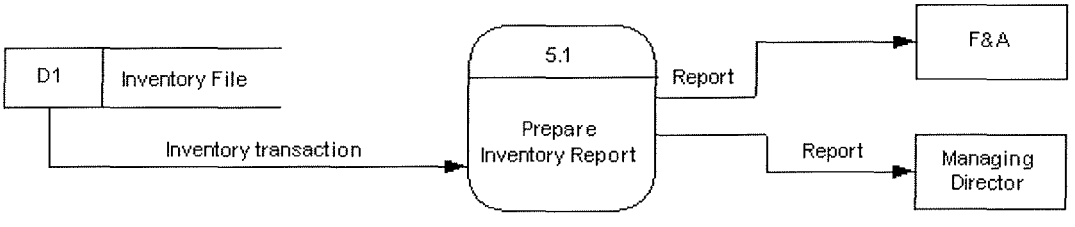

Figure 2.8. Data Flow Diagram (Level 1 Process 5) – Existing System.

III. THE PROPOSED SYSTEM

3.1 System Specification

According to the previous chapter, the Inventory System of Perfect Packaging Co., Ltd. now requires an effective computer system with an sufficient control which can facilitate the work processes, minimize the current issues, improve the accuracy of data in the system, using computerized system to the inventory control.

There are various techniques which are used in the analysis of user requirements Firstly, the formal interview with the management team, was conducted to gather the information about the improvement areas, attitudes and expectations of the management team. As a result, the writer of the project notices that the management team has a positive attitude towards the system changes and is willing to invest in the development cost. Moreover, they expect that this new system will be able to improve the efficiency of the system.

Secondly, the store room officers and production managers were interviewed in order to gather more detail about the system flow. The proposed system expectations and the additional requirements were kept during the sessions.

As a result of the above stage, the following requirements are reported.

(1) System Output Requirement

There are several reports required by both management teams and operations staff. Some are legal requirements and the operations staff use some internally. The important requirements are the accuracy of data, timeliness, friendly use and provide good internal control. The required reports are as follows;

(a) Customer List Report

(b) Daily Inventory Report

(c) Job Order Report

(d) Monthly Inventory Report

(e) Monthly Summary Shipment Report

(f) Purchase Order Report

(g) Production Order Report

(h) Stock Card Report

(i) Summary Finished Goods Report

(2) System Input Requirement

Apart from the output requirements, the following users' requirements need to be fulfilled.

(a) The user friendly input screen and menu.

(b) The system should cover all required information

(c) The system should be adequate and has security control

The context diagram and data flow diagram decomposition is shown in the attached figures.

3.2 System Design

After completing the users' requirement process, the next step is to design the system according to those requirements. The system flexibility is one of the major concerns during this phase to support the change in users' requirement and expansion of the business in the future.

There will be many changes need to be made under the Inventory System. To be changed from the manual process to computerized process, the company has to install new computer hardware and software. The working environment may be changed from the existing system.

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The data flow diagram of the new proposed system is designed to support this change. The workflow of some processes may be changed a little bit to reflect the use of computerized system.

The input and output are designed to respond to the management and users' requirements. Various reports are created automatically by the system with only one time input. This will reduce the chance of human errors and mistakes in preparing the reports for the management. The input screens are designed to be most user-friendly and various controls are put into the system to protect any human errors that may occurr during the input process.

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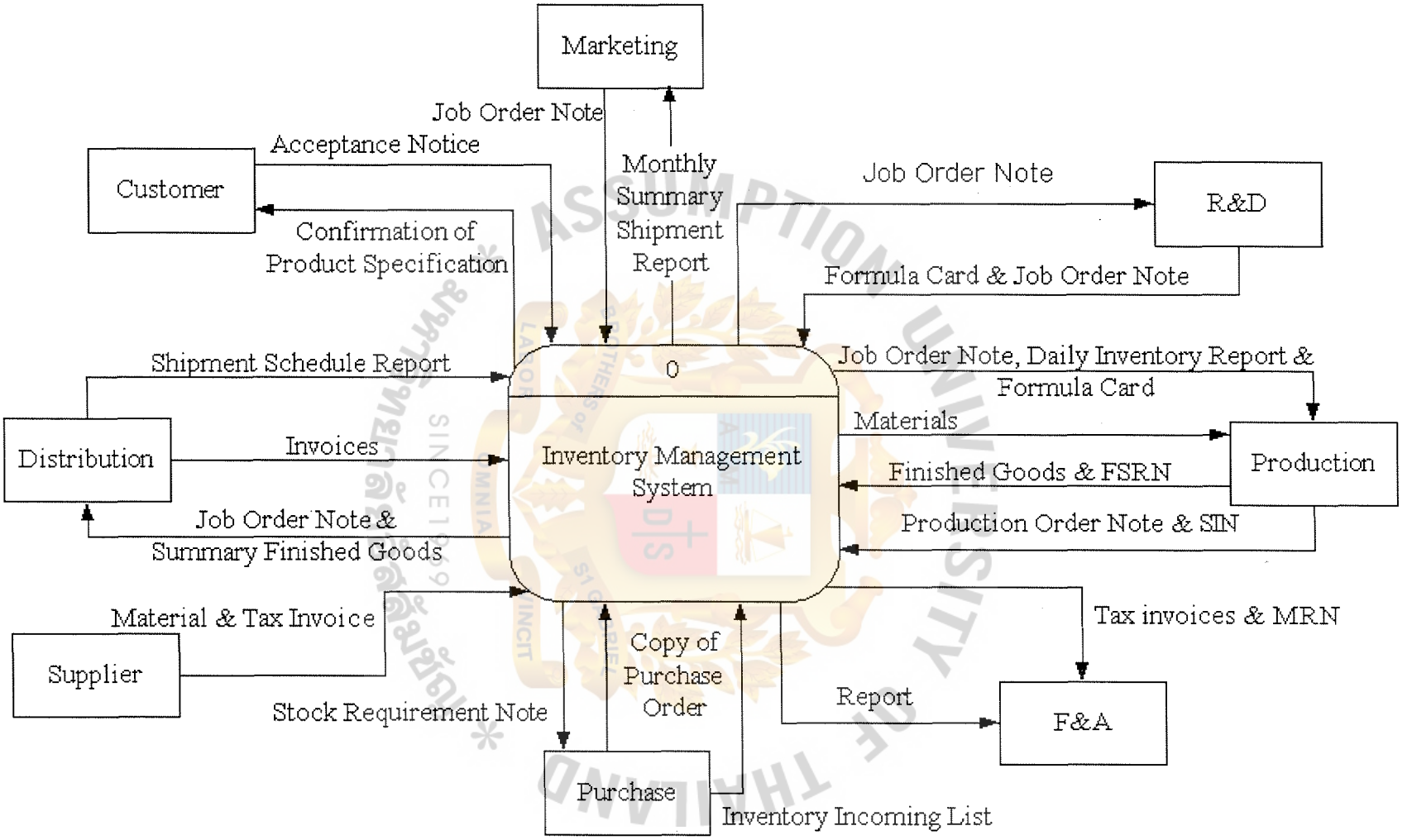

Figure 3.1. Context Diagram of the Proposed System.

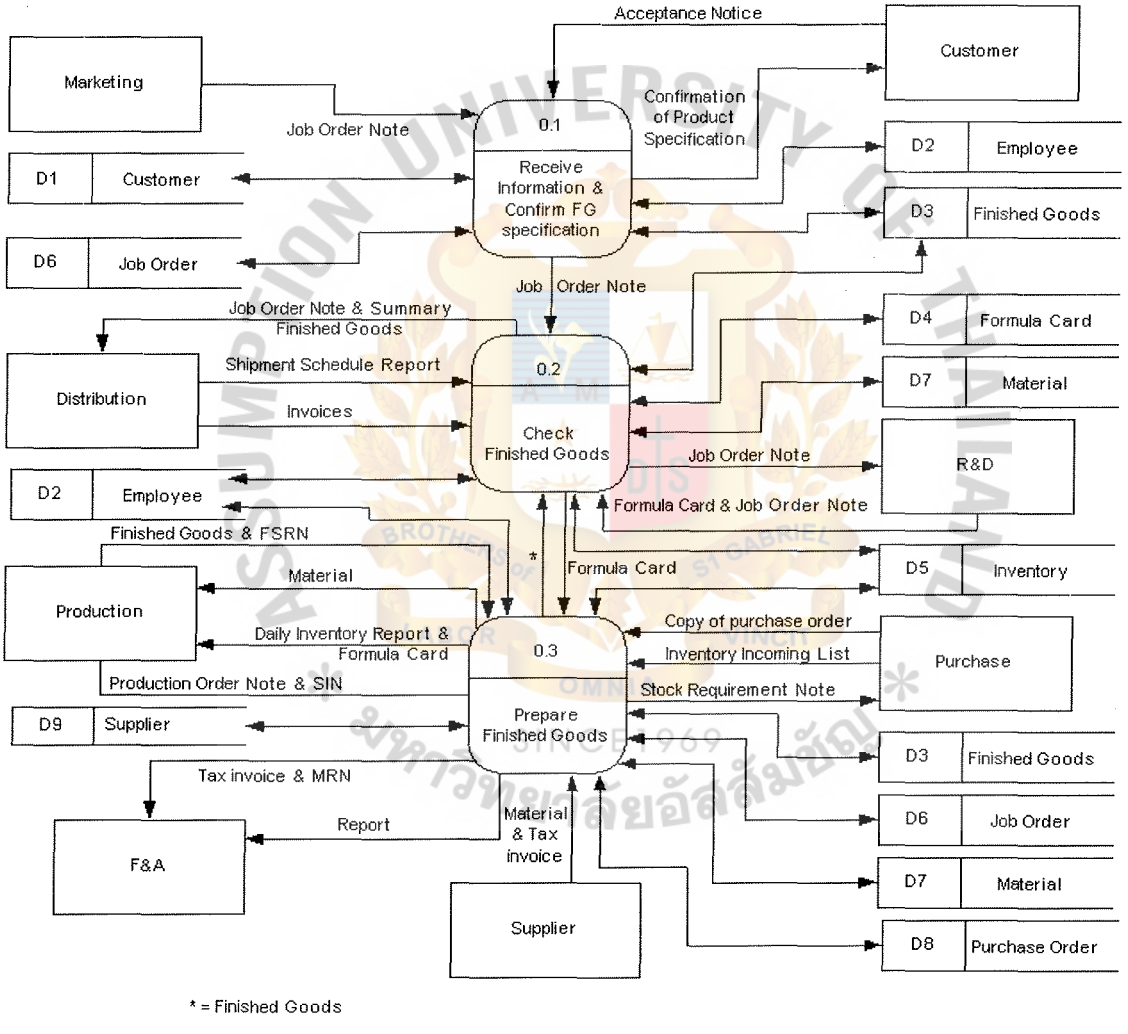

Figure 3.2. Data Flow Diagram (Level 0) - Proposed System.

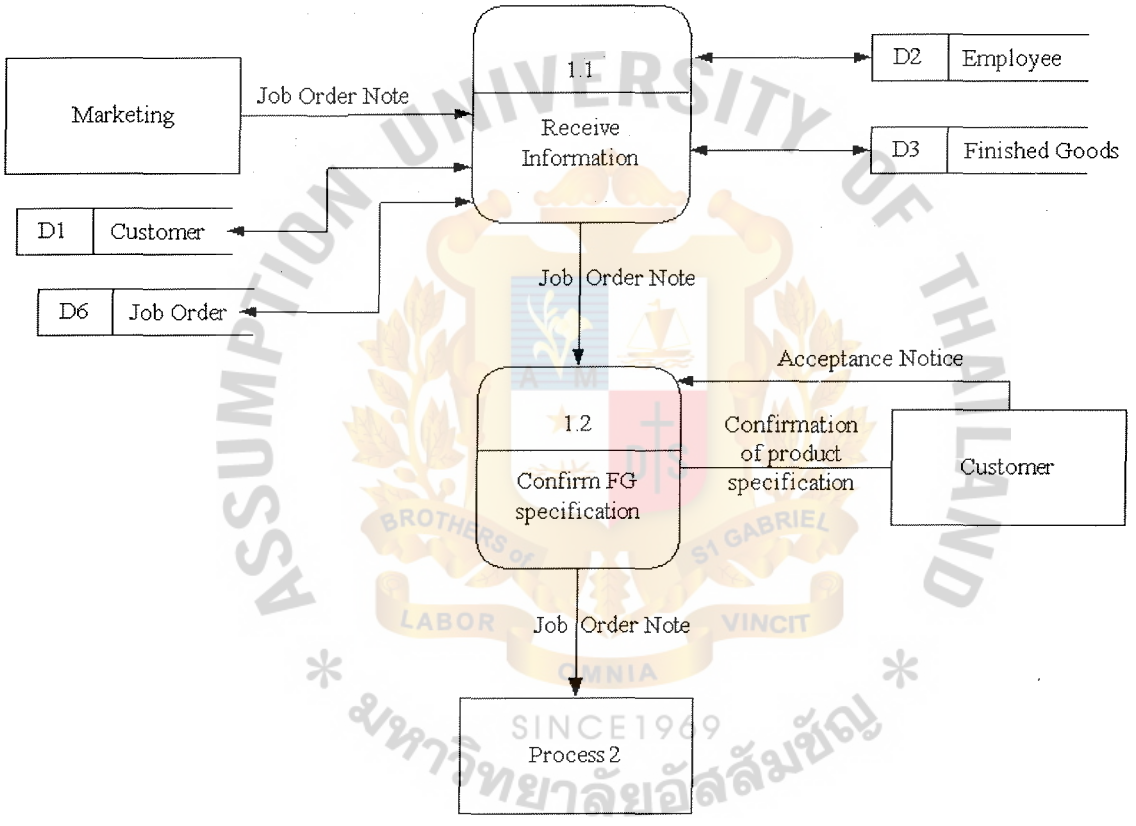

Figure 3.3. Data Flow Diagram (Level 1 Process 1) – Proposed System.

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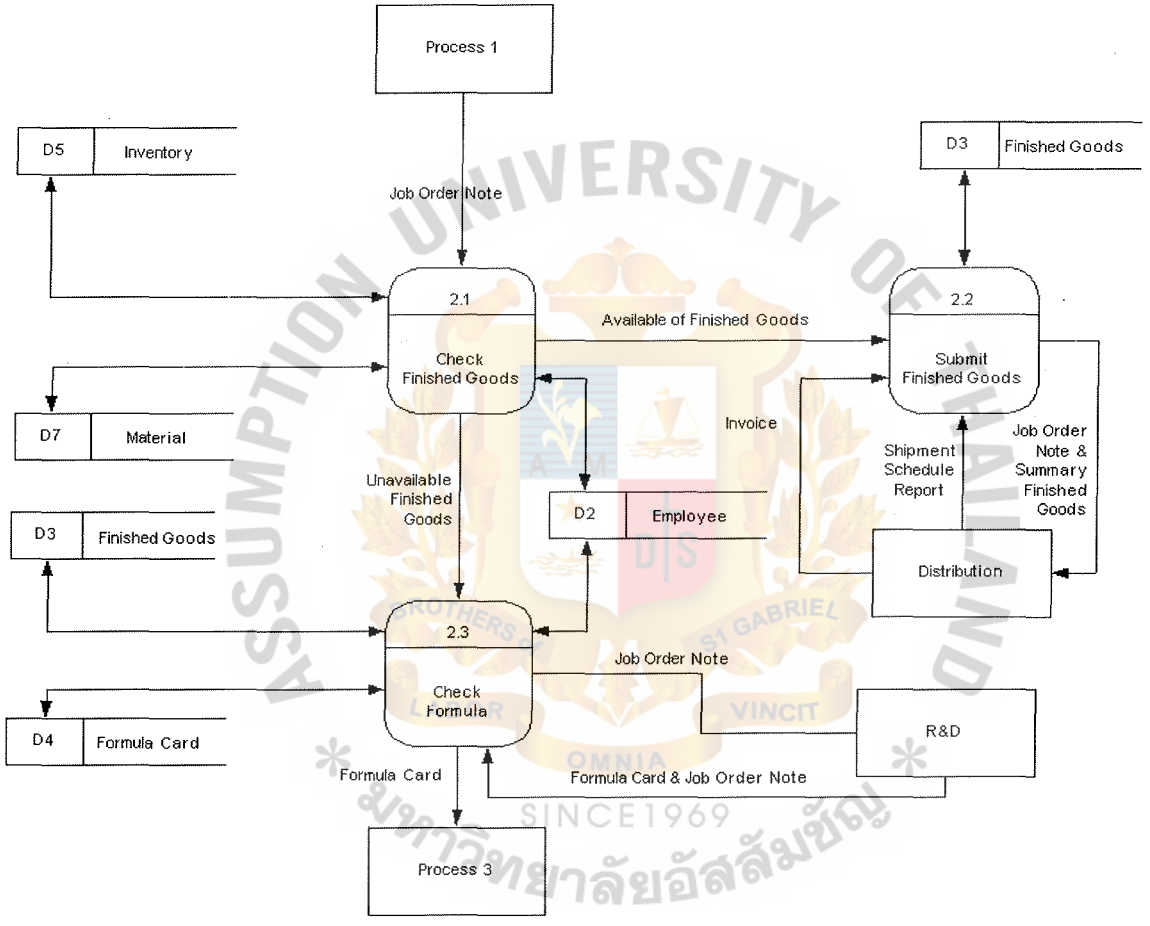

Figure 3.4. Data Flow Diagram (Level 1 Process 2) – Proposed System.

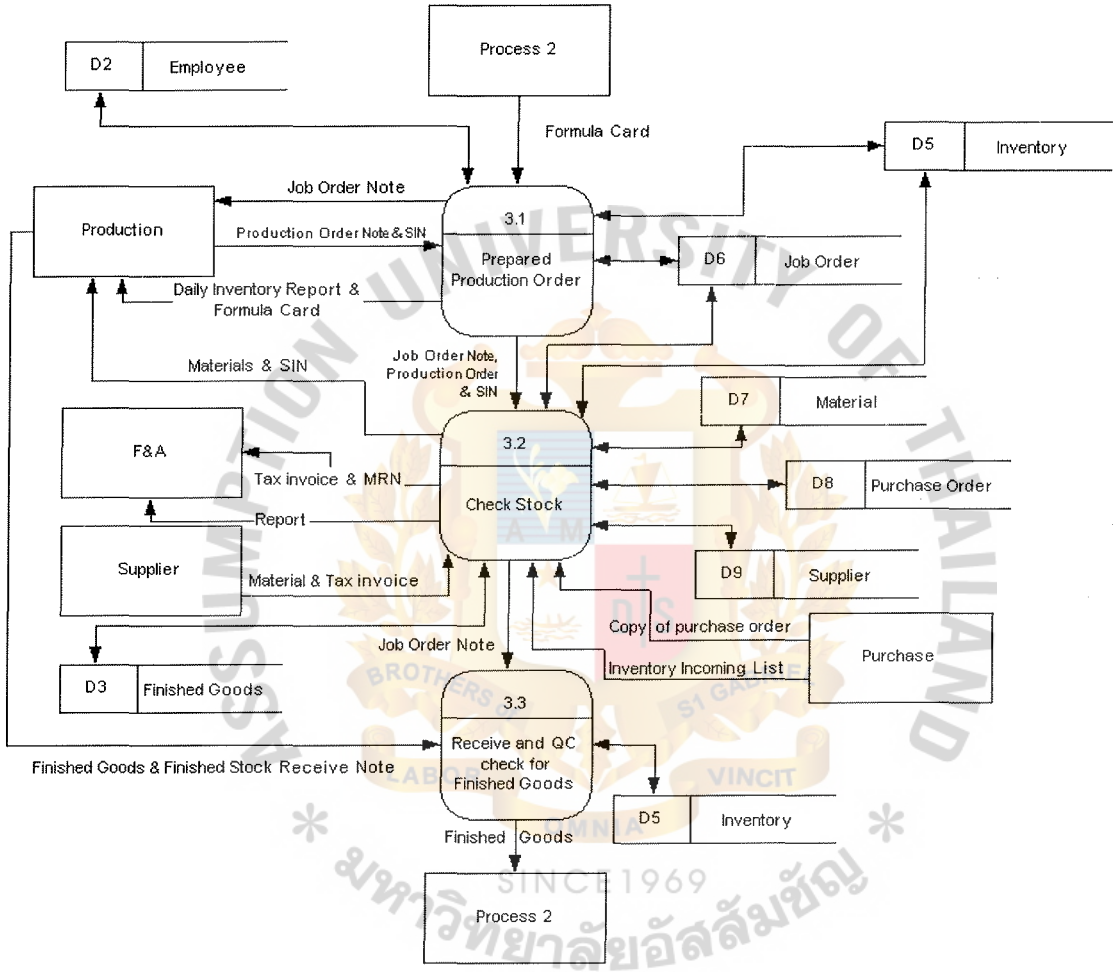

Figure 3.5. Data Flow Diagram (Level 1 Process 3) – Proposed System.

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3.3 Hardware and Software Requirement

The proposed new system is a computer-based system. So there is the need to purchase and develop new hardware and software. Set out below is the hardware and software specification required for the new system.

(1) Hardware Requirements

(a) 1 set of database server

(b) 6 sets of personal computer (clients)

(c) 2 sets of printers

(d) 1 set of UPS

(e) Network Accessories

The detail specification of each type of hardware is defined as follows:

(a) Database Server

Microprocessor Intel Pentium III 866 MHz Coppermine Technology

INTEL STL2 (Dual Processor Upgradeable) Server Mainboard

Kingtons KVR133X 7RC3 ECC SDRAM 256 MB 168 Pins Bus 133 MHz

20GB Wide Ultra SCSI3 10K Hard Disk Drive

SCSI Adaptec Controller Built-in on board

Integrated VGA Display Adapter with VRAM 4 MB

15" Digital Control SVGA Color Monitor

1.44 MB Floppy Disk Drive

Server ATX Case with sx300 Watts Power Supply

Integrated Ethernet Network Card 10/100 Mbps

Keyboard

Mouse

(b) Personal Computer (clients)

Microprocessor Intel Celeron 700 MHz Coppermine Technology

M758LMR / M754LMR SiS630 Chipset Mainboard

SDRAM 128 MB 168 Pins Bus 133 MHz

10 GB 7200 rpm Ultra ATA 100 Hard Disk Drive

CD ROM 40 X

VGA 3D Display Adapter with VRAM Share Memory up to 32 MB

15" Digital Control SVGA Color Monitor

ATX Case with 300 Watts Power Supply

Integrated Ethernet Network Card 10/100 Mbps

Keyboard

Mouse

(c) Printer

Dot matrix printer (EPSON LQ 1170 ESC/P 2)

(d) UPS

UPS (Uninterrupted Power Supply) 1 KVA for server

(f) Network Accessories

8 Port 10/100 Ethernet Switching HUB

10/100 Base-TX Ethernet Lan Card

(2) Software Requirements

The software requirements for the server and client machines are identified as follows:

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Operating system

Microsoft Windows 98 (Thai Edition)

Application software

Microsoft Visual Studio 98

Microsoft Office 2000 Professional Edition (comprises the Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Access, Microsoft Photo Editor, and other accessory programs)

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Table 3.1. The Hardware Specification for Server Machine.

Hardware	Specification
CPU	Intel Pentium III 866
Cache	512 MB
Memory	128 MB
Hard Disk	20 GB
CD-Rom Drive	50X
Floppy Drive	1.44 MB
Display	15" Super VGA
Printer	Dot matrix (EPSON LQ 1170 ESC/P 2)
UPS	1 KVA

Table 3.2. The Software Specification for Server Machine.

Software	Specification
Operating System	Microsoft Windows 98 (Thai Edition)
Application Software	1) Microsoft Visual Studio 98
	2) Microsoft Office 2000 Professional Edition

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Table 3.3. The Hardware Specification for Client Machine.

Hardware	Specification
CPU	Intel Celeron 700
Cache	64 MB
Memory	64 MB
Hard Disk	10 GB
CD-Rom Drive	40X
Floppy Drive	1.44 MB
Display	15" Super VGA
Printer	Dot matrix (EPSON LQ 1170 ESC/P 2)

Table 3.4. The Software Specification for Client Machine.

Software	Specification
Operating System	Microsoft Windows 98 (Thai Edition)
Application Software	1) Microsoft Visual Studio 98
	2) Microsoft Office 2000 Professional Edition

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3.4 Security and Control

There are four types of processing controls: source-document controls, input transmission controls, output controls, and computer program controls. The new proposed system is designed to have all of these controls within the system. The details of each control are listed below:

(1) Source-Document Controls

The source-document control procedures are designed to verify that all data have been entered into processing and that the source documents can be recovered should the content of data transmission have some errors.

Each source-document e.g. the Job Order Note, Stock Issue Note, Material Receive Note and Production Order at source has its own format and color. So the users can easily identify the form to be used by its color. The risk of misunderstanding or mix-ups is low in this case.

Each form provides space at the bottom of the form for the approval signature of the manager. The staff has to observe the approval signature before inputting the information into the system. This will prevent unwriterized documents from being processed into the system. Moreover, the form also provides space for the staff to sign after processing that form. This signature is the evidence that the form is already processed and it can protect the duplicate processing.

Each source-document has its own sequential number on the top right of the form. So after the processing the staff have to file all of the forms in separate file running by the sequential number. Performing this, the staff can ensure the completeness of the documents being processed into the system and can detect the missed documents on a timely manner. All of the

forms are kept at the company's warehouse for at least 5 years as required by the Revenue Department.

(2) Input-Transmission Controls

Input-transmission controls are designed to verify that the computer receives data keyed to processing. The input-transmission controls designed in the proposed new system can be summarized as follows:

(a) Flashback (echo) checks

The staff has to enter a customer number or Job Order Note number into the input screen and then the computer will respond by returning the customer's name or the Job Order Note number. This control is designed to help staff check the accuracy of the input information.

At the same time, using the customer number or Job Order Note number is separated by character in front of the number, which can reduce the time to key in all the information by the operation staff. In addition, this control can also reduce the number of human errors from the typing process.

(b) Filing balancing control

This control is designed to permit the recovery of data should the data transmission be faulty. As stated in the file-balance control, there is the transmission of information between the sub-system. So every time the transmission of data will be generated and will be kept in the spool file for a period of time until it receives the signal that the data is transmitted completely without any error, then that temporary spool file will be deleted.

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(3) Output Controls

Output controls are designed to verify that all data have been sent from processing and unwriterized personnel cannot obtain output materials. The new system controls the output from the system by printing out the register. This control is considered to be the most traditional type of output control.

The system can provide many reports and registers. The daily inventory report and stock card will be printed out and reviewed by the Store room manager together with the inventory physical count before making any adjustment to the system balance. In this report, it shows the total number of transactions and the summary ending balance. The store room manager can cross check the total number of transaction with the total inventory balance to ensure the completeness of the transactions.

In order to have the restricted access to the system, the new system has the security control to block the intruders from gaining access to sensitive materials. Each staff has specific user name and password. The system requires multiple passwords to gain access to particular work area. The password has to be changed every 3 months.

The user is given three chances to enter a correct user name and password. After three incorrect tries, the computer is locked and forbids any future attempts. Once locked, the manager of each department is the one that can unlock the computer.

(4) Computer Program Controls

The computer program controls are designed to validate the accuracy of the programmed procedures. The proposed new system has various data validation procedures as follows:

(a) Field-tests

This control is designed to test the accuracy of input information. For example the field to input customer code and material number will accepts only one character and follow with the numeric data. If the staff key in more than one alphabetic data, the program will alert the warning statement to tell the user that input data is wrong.

(b) Range tests

This is to test whether a value assigned to a variable falls within an acceptable range. The quantity of material issue should not be over the available inventory balance. If there is an error, then the message telling that the quantity exceeds the available stock will be pop up.

(c) Combination tests

This control is to combine the values of several fields to determine whether their combined value is valid. The receiving quantity will not exceed the order quantity. The warning message will be shown in the case that the receiving quantity is exceeding the receiving tolerant.

3.5 Cost and Benefit Analysis

The analysis of the cost of the existing system is shown in Table 3.5. The analysis of the cost of the new proposed system is shown in Table 3.6. The comparison of the

The analysis of the cost of the existing system is shown in Table 3.5. The analysis of the cost of the new proposed system is shown in Table 3.6. The comparison of the cost and the benefit of the new proposed system to the existing system is also prepared and presented in Table 3.9 and Table 3.10.

The cost of the new system comprises the cost of hardware, software, maintenance, system development, and system implementation. The benefit from the implementation of the new system mainly comes from the decrease in staff cost and to fasten the operation. There is no need to pay the overtime cost during the month-end and eliminate the loss of money to buy slow moving inventory.

(1) Benefits from the Proposed System

The company will have both financial and non-financial benefits from the new proposed system. The benefits derived from the new system can be classified into cost-saving benefits, cost-avoidance benefits and improved-service-level benefits.

(a) Cost-saving benefits

The company will save some administrative and operating expenses from the used of the new system. From the analysis in Table 3.9, the company can be able to save the people cost for 2.3 million Baht within 5 years. The net present value of the total benefits over the whole project life will be 1.8 million Baht.

However, the company has to pay for the system development cost for the total amount of 774,500 Baht during the first year of the project. It also has to pay for the operating and maintenance cost throughout the project. The net present value of the cumulative costs over the lifetime is 1.3 million Baht.

As conclusion, the cost and benefit analysis of the new project gives the followings outcomes:

(1) Payback Period

The payback period is 3 years and 2 months as shown in the Table 3.10. At the end of the 4th year, the cumulative time adjusted of the new benefit has the positive value. Therefore, the payback period is between the 3rd and 4th year. The following formula is computed to show the exact number of payback period.

Year 3 + 19,510 / (19,510 + 215,670) *12

Therefore, the payback period will be 3 years and 2 months.

(2) The break-even point is 1 Year and 11 months.

(3) Return on investment is about 22 % (given the discount rate of 10%).

(4) Net present value of the net benefits of the project is 433,151 Baht.

(b) Cost-avoidance benefits

The company can eliminate the future administrative and operational expenses. The new computerized system can support the increase in business transactions and the expansion of the business. So the company can expand its business and perform all of the workflow using the same level of staff. However, this benefit is not included in the analysis table because it is difficult to estimate the amount of future cost avoidance.

(c) Improved of time consuming and employee's satisfactions benefits

During the problem identification stage, various problems occurred from the existing systems such as errors in quantity recording into the system, lack of employee computer skill, etc. These problems cause increasing in time consuming to finish the inventory transaction through the new system and also the level of employees' satisfaction.

With this new system, the company can prepare the inventory report accurately and in a timely manner. The Finance & Accounting Department and the Managing Director can be able to get the inventory report faster than before. The report is more accurate and consistent with other information generated from the same system. So the new system will improve the service level of the company, both its productivity as well as employees.

This financial figure is hardly derived from the level of satisfaction because this type of benefit is intangible rather than tangible. It is difficult to estimate the amount of intangible benefits, so the cost and benefit analysis is not included this type of benefits in the calculation table.

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Table 3.5. Existing System Cost Analysis, Baht.

Cost Items		Years				
		1	2	3	4	5
Office Equipment Cost:						
Calculator	5 units @ 2,500	12,500	-	-	13,750	-
Total Office Equipment Cost		12,500	-	-	13,750	-
Operating Expenses:						
Staff Cost:						
Operation Head	2 persons @ 15,000	360,000	378,000	396,900	416,745	437,582
Clerk	4 persons @ 9,000	432,000	453,600	476,280	500,094	525,099
Operation Staffs	8 persons @ 8,500	816,000	856,800	899,640	944,622	991,853
Storeroom Manager	1 person @ 20,000	240,000	252,000	264,600	277,830	291,722
Total Staff Cost		1,848,000	1,940,400	2,037,420	2,139,291	2,246,256
Office Supplies & Utility Expenses:						
Stationery		6,000	6,300	6,615	6,946	7,293
Printing materials		30,000	31,500	33,075	34,729	36,465
Miscellaneous expenses		10,000	10,500	11,025	11,576	12,155
Utility expenses		36,000	37,800	39,690	41,675	43,758
Total Office Supplies & Utility Expenses		82,000	86,100	90,405	94,925	99,672
Total Operating Expenses		1,930,000	2,026,500	2,127,825	2,234,216	2,345,927
Total Existing System Cost		1,942,500	2,026,500	2,127,825	2,247,966	2,345,927

Table 3.6. Computerized System Cost Analysis, Baht.

Cost Items	Years				
	1	2	3	4	5
Office Equipment Cost:					
Hardware Cost:					
1 set of Computer Server	90,500	4,525	4,751	4,989	5,238
6 sets of Client Computers	210,000	10,500	11,025	11,576	12,155
2 sets of Printers	50,000	2,500	2,625	2,756	2,894
Other Hardware Cost	100,000	5,000	5,250	5,513	5,788
Total Hardware Cost	450,500	22,525	23,651	24,834	26,076
Maintenance Cost:					
Maintenance Cost	-	20,000	21,000	22,050	23,153
Total Maintenance Cost	-	20,000	21,000	22,050	23,153
Software License Cost:					
Software License Cost	100,000	5,000	5,000	5,000	5,000
Total Software Cost	100,000	5,000	5,000	5,000	5,000
System Development Cost:					
System Development Cost	150,000	-	-	-	-
Total System Development Cost	150,000	-	-	-	-
System Implementation Cost:					
Training Cost	30,000	5,000	5,250	5,513	5,788
Set up Cost	40,000	-	-	-	-
Total Implementation Cost	70,000	5,000	5,250	5,513	5,788
Other Office Equipment Cost:					
Calculator 2 units @ 2,000	4,000	-	-	3,000	-
Total Other Office Equipment Cost	4,000	-	-	3,000	-
Total Office Equipment Cost	774,500	52,525	54,901	60,396	60,016

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Table 3.6. Computerized System Cost Analysis, Baht (Continued).

Cost Items		Years				
		1	2	3	4	5
Operating Expenses:						
Staff Cost:						
Operation Head	2 persons @ 15,000	360,000	378,000	396,900	416,745	437,582
Clerk	2 persons @ 9,000	216,000	226,800	238,140	250,047	262,549
Operation Staffs	6 persons @ 8,500	612,000	642,600	674,730	708,467	743,890
Storeroom Manager	1 person @ 20,000	240,000	252,000	264,600	277,830	291,722
Total Staff Cost		1,428,000	1,499,400	1,574,370	1,653,089	1,735,743
Office Supplies & Utility Expenses:						
Stationery		6,000	6,300	6,615	6,946	7,293
Printing materials		12,000	12,600	13,230	13,892	14,586
Miscellaneous expenses		13,000	13,650	14,333	15,049	15,802
Utility expenses		50,000	52,500	55,125	57,881	60,775
Total Office Supplies & Utility Expenses		81,000	85,050	89,303	93,768	98,456
Total Operating Expenses		1,509,000	1,584,450	1,663,673	1,746,856	1,834,199
Total Computerized System Cost		2,283,500	1,636,975	1,718,574	1,807,252	1,894,215

Table 3.7. Five Years Accumulated Existing System Cost, Baht.

Year	Total Manual Cost	Accumulated Cost
1	1,942,500	1,942,500
2	2,026,500	3,969,000
3	2,127,825	6,096,825
4	2,247,966	8,344,791
5	2,345,927	10,690,718
Total	10,690,718	-

Table 3.8. Five Years Accumulated New Proposed System Cost, Baht.

Year	Total Computerized Cost	Accumulated Cost
1	2,283,500	2,283,500
2	1,636,975	3,920,475
3	1,718,574	5,639,049
4	1,807,252	7,446,301
5	1,894,215	9,340,516
Total	9,340,516	-

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Table 3.9. Cost Comparison between the Existing System and New Proposed System, Baht.

Cost Items	Years				
	1	2	3	4	5
Existing System:					
Staff (15 Staffs) increase 5% per year	1,848,000	1,940,400	2,037,420	2,139,291	2,246,256
Office Supplies & Utility Expenses	82,000	86,100	90,405	94,925	99,672
Office Equipment Cost	12,500	-	-	13,750	-
Total Annual Cost	1,942,500	2,026,500	2,127,825	2,247,966	2,345,927
Cumulative Cost	1,942,500	3,969,000	6,096,825	8,344,791	10,690,718
Proposed System:					
Hardware Cost	450,500	22,525	23,651	24,834	26,076
Software License Cost	100,000	5,000	5,000	5,000	5,000
System Development Cost	150,000	-	-	-	-
System Implementation Cost	70,000	5,000	5,250	5,513	5,788
Maintainance Cost increase 5% per year	-	20,000	21,000	22,050	23,153
Staff (11 staffs) increase 5% per year	1,428,000	1,499,400	1,574,370	1,653,089	1,735,743
Office Equipment Cost	4,000	-	-	3,000	-
Office Supplies & Utility Expenses	81,000	85,050	89,303	93,768	98,456
Total Annual Cost	2,283,500	1,636,975	1,718,574	1,807,252	1,894,215
Cumulative Cost	2,283,500	3,920,475	5,639,049	7,446,301	9,340,516

Table 3.10. Cost and Benefit Analysis, Baht.

Cost Items	Years					
	0	1	2	3	4	5
Benefits						
Staff Cost Saving		420,000	441,000	463,050	486,203	510,513
Other Operating Cost Saving		9,500	1,050	1,103	11,908	1,216
Total Benefits from New System	-	429,500	442,050	464,153	498,110	511,728
Discount factors for 10%:	-	0.91	0.83	0.75	0.68	0.62
Time-adjusted benefits (NPV)	-	390,455	365,331	348,725	340,216	317,743
Cumulative time-adjusted benefits over lifetime	-	390,455	755,785	1,104,510	1,444,726	1,762,469
Costs						
System Development cost	-774,500					
Operation & maintenance cost (5% increase annually)	0	-133,525	-139,951	-149,699	-153,784	-161,473
Discount factors for 10%:	1	1	1	1	1	1
Time-adjusted costs (NPV)	-774,500	-121,386	-115,662	-112,471	-105,036	-100,262
Cumulative time-adjusted costs over lifetime	-774,500	-895,886	-1,011,549	-1,124,019	-1,229,056	-1,329,318
Cumulative time-adjusted net amount	-774,500	-505,432	-255,763	-19,510	215,670	433,151
Return on Investment						433,151

Return on Investment: 22 %
Payback period : 3 Years and 2 Months

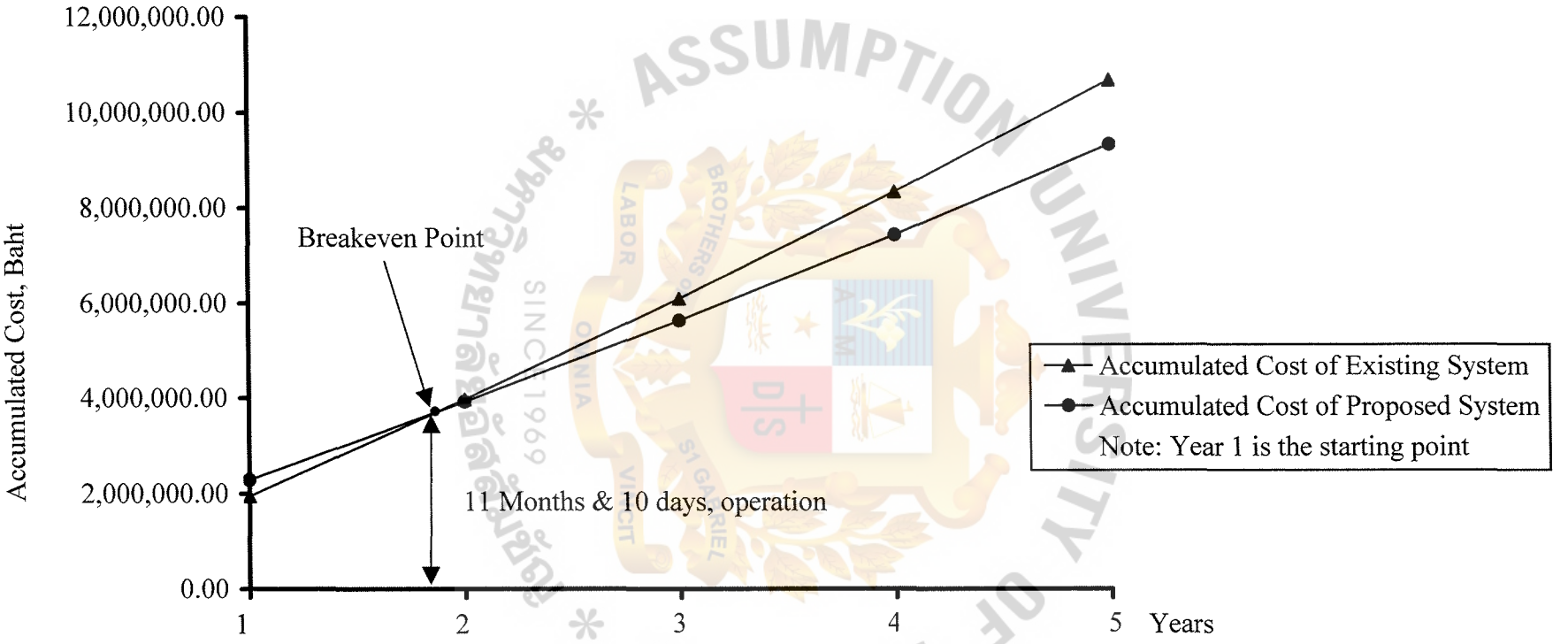

Figure 3.6. Cost Comparison between the Existing System and the Proposed System.

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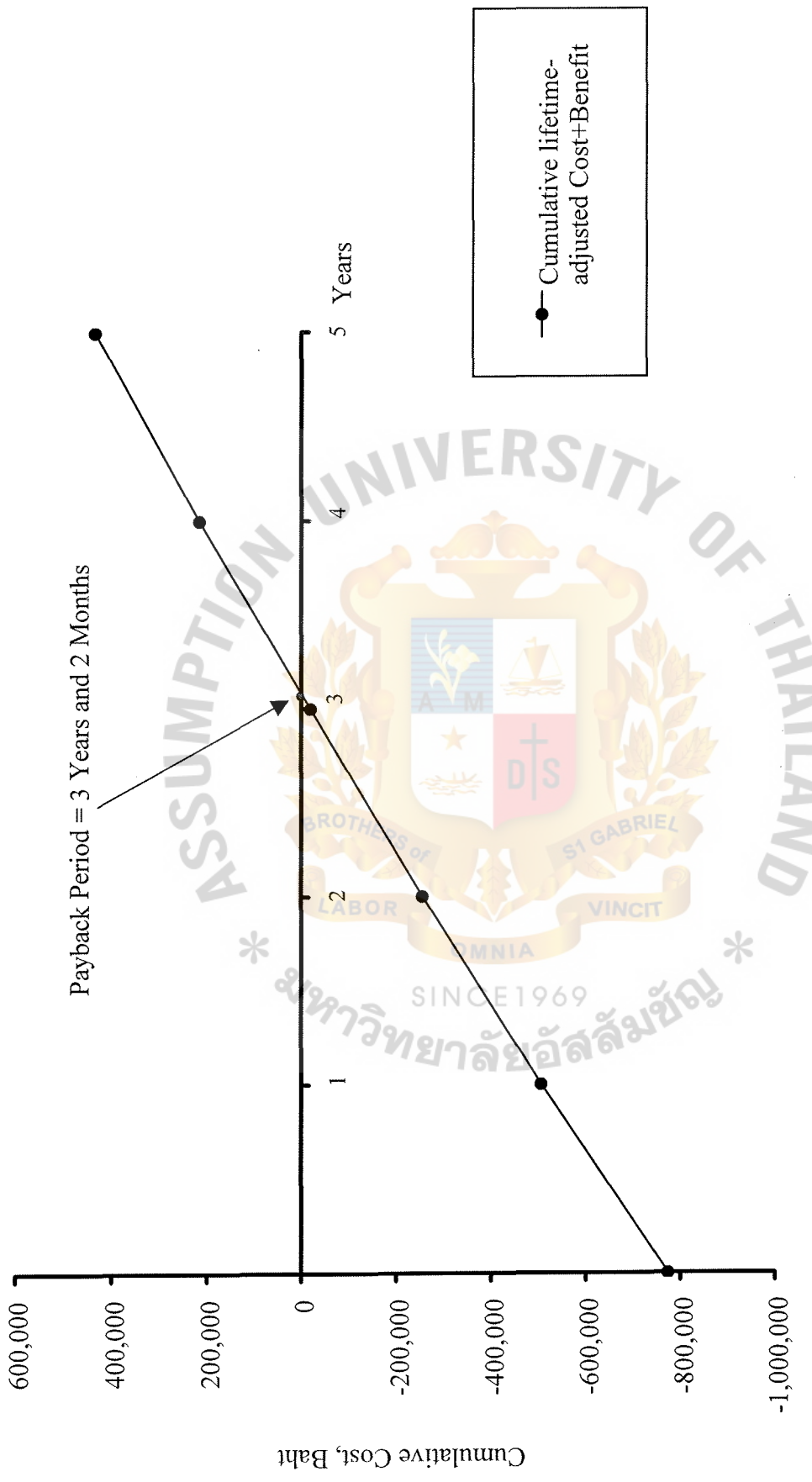

Figure 3.7. Payback Period of the Proposed System.

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3.6 Budget for the Proposed System

The budget for this new computerized system is about 770,500 Baht. The budget is classified into 4 main categories, which comprise cost of hardware, software, system development and system implementation. Although it involves quite high investment in the initial stage, it is a one-time cost. For the following year, the company may have to only pay for little maintenance cost. Please see the details of the computerized system in Table 3.7.

The major cost of this project is the hardware cost because the company has to invest for the new computer equipment amounting to 450,500 Baht. The hardware specification is identified in section 3.2 already mentioned above. The new system requires 1 server, 6 client personal computers, 2 printers, and 1 UPS.

Moreover, the company has to spend on the software license and on the system development cost at about 250,000 Baht. The software license cost is for the general application software such as Microsoft office software. The system development cost is for the system analyst and programmer to design and write the computer program for the new system.

Finally, the company has to pay another 70,000 Baht for the implementation cost. This cost includes the set up cost for the new computerized system and the training course to be provided to the company's staff.

Table 3.11. Budget Cost for the Computerized System, Baht.

Cost Items	Amount
Hardware Cost:	
1 set of Computer Server	90,500
6 sets of Client Computers	210,000
2 sets of Printers	50,000
Other Hardware Cost	100,000
Total Hardware Cost	450,500
Software License Cost	100,000
System Development Cost	150,000
System Implementation Cost:	
Training Cost	30,000
Set up Cost	40,000
Total Budget Cost for the Computerized System	770,500

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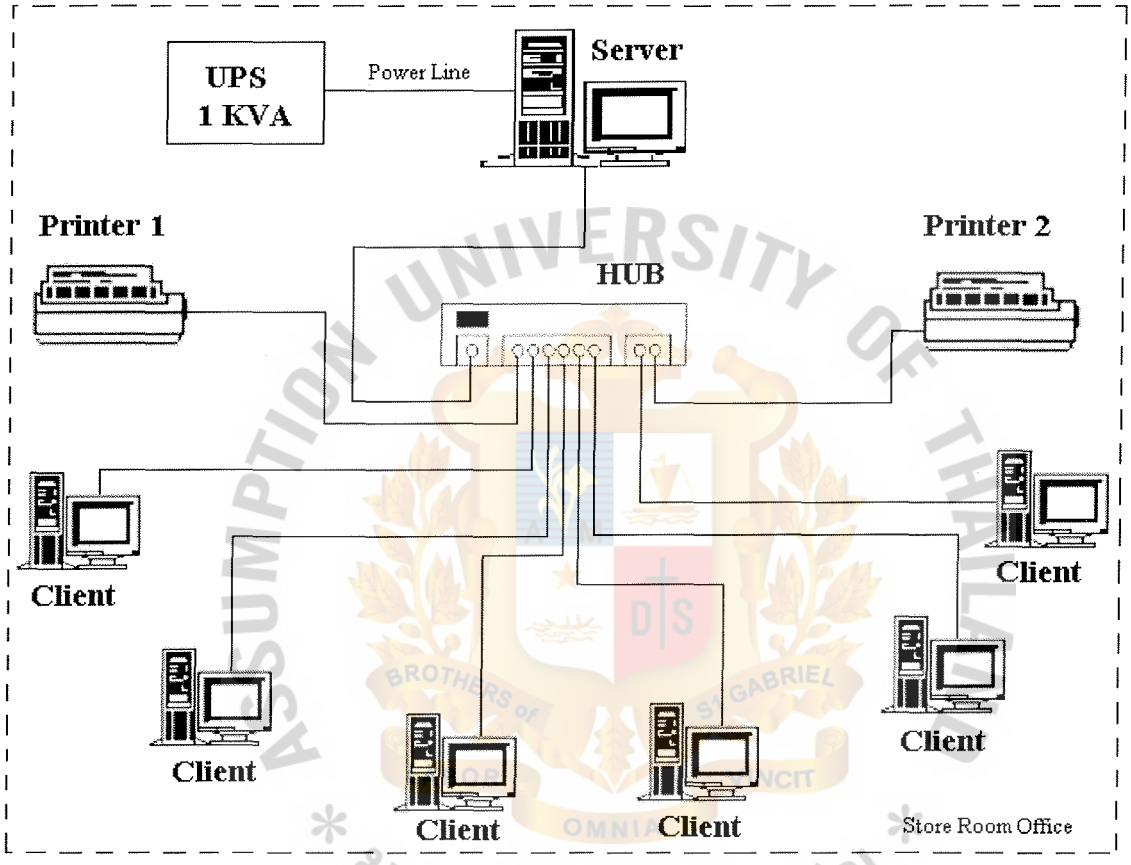

Figure 3.8. Configuration of the Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

System implementation is the plan to convert the manual system to computerized system. The plan for the implementation of new computerized system comprises coding, testing, hardware and software installation and system conversion.

It takes quite long period of time to complete the coding process. Then the system testing has to be performed to ensure the correctness and investigate for any errors or wrong function of the system. During the system testing process, the program may be modified to remove all of the errors.

After system testing and modification of the program, the system analyst will install the hardware and software program. Before conversion to computerized system, the users have to attend the training course in order to be familiar with the new system. The new computerized system has to be parallel run with manual system for a period of time before fully conversion to new system.

4.2 Source Code

This project uses software, Microsoft Access 97, as the application for the database and user interface design. The database and user interface designs are preformed simultaneously. The manual and user guides are provided to the users after the system is ready to be used.

4.3 Test Plan

Before conversion to the new system, the system testing has to be performed for at least 1 month. This is to test the logic of the system and to ensure that the output of the system is accurate and coincide with the users' needs. From the testing, the users can identify the errors or any wrong function of the system. Then the system analyst can modify and remove all of the errors from the system.

During the testing phase, the users have to test the computerized system parallel with the manual work so that they can compare the results of the two systems and check for any errors that may occur from the new system.

The system testing is to be performed by the Store Room Officers, who are directly responsible for the work process, and the manager in charge of each process. The test data has to be carefully prepared in order to cover all conditions and alternatives provided in the system. The number of unit testing data has to be identified appropriately before the testing.

The time to start testing the program is after the completion of system installation. After testing it, the testing team has to give the response to the system analyst. The system failures are to be documented along with the success; any errors or requirements for modification of the program also have to be carefully documented.

Then it will take a couple of days to correct the errors. Once again any modification made to the program has to be recorded by the programmer in order to provide the audit trails for future modification. The parallel run is being used. The existing system process is done to ensure that the result from new system is accurate enough. The documentation is prepared in order to help the Store Room Manager modify the results of new system.

After final testing, the results of the system has to be carefully checked and compared with the manual work to ensure system correctness and avoid any system resistance by the users.

4.4 Conversion

System conversion consists of installing the system software and making it fully operational. There are 2 activities occurring simultaneously during the conversion: making new software operational, to replace the existing system, and helping users understand and operate the new software. There are 5 steps in making the transition from the old manual system to the new computerized system.

(1) Install the New System

During this phase, the parallel method is recommended. It involves the concurrent operation of both the old and the new systems until the new system is judged to be effective. This method permits system results to be compared and corrective action to be taken if results show any deviation.

Although it is costly and may place some pressures on the company's staff by asking them to work two jobs at the same time, it has considerable advantages for the company to use this method. The greatest advantage of the parallel method is that it preserves the audit trail. The result of the new and the old systems can be compared to verify that the new system leads to correct results.

The daily report will be printed at the end of each day. This report will be kept for one month before destruction. This process will be done as the emergency plan if the system is down or the data is destroyed.

(2) Create the New Database

Since the existing system is performed manually, there is not any database in the computerized system. The Store Room officer and other related functions, Marketing for the Supplier Master Data, R&D Officer for the formula card and the Purchasing Department for the supplier database, have to key in the data to many master databases after the new system is installed. This step can take considerable time according to the new database in each certain period.

(3) User Training

User training is one of the most important parts of conversion. This stage is to provide users with experience with the new system. The Store Room Officers and the Store Room Manager are the ones who must attend the training courses. The steps in arranging the training session are as follows:

(1) Identify the staffs who have to attend the training for each function.

(2) Design the training materials and the topics to be presented.

(3) Select the most appropriate method to be used in training courses.

(4) Determine the time and place to conduct training.

(5) Distribute the training materials to all attendants in advance.

(6) Evaluate the staffs to assess their knowledge after the training.

(7) Retraining for the staffs who fail in the evaluating step until they pass.

(8) Provide the users with the full set of users' manual of each process.

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V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

After the system analysis and design, the computerized system is the best solution to solve the current problems existing in the company. Currently, the company faces many problems about the inaccurate and inconsistent data and timeliness of producing various reports.

The company has to pay the overtime cost for the people during month-end the company has to hire temporary staff to prepare various reports. The quantity of the physical inventory is not equal to the number shown in the report. The staff has to work harder during the month-end in order to collect and consolidate the data from many sources to produce the reports. The management of the company does not have the required report on time and cannot plan to purchase the valuable materials.

During the analysis phase, I conducted interview sessions with the company's management and staff. Various users' requirements are derived from those interviews. The requirement analysis is performed together with the system analysis phase. The result of analysis shows that the major cause of the current problems is from the manual system. So the computerized system is recommended for this company.

The new system can reduce the redundancy of the work and can accelerate many processes. The conversion from the manual to the computerized system involves quite high initial investment. The company has to purchase new computer equipment and software. It has to pay for the system development and system conversion cost. To analyze the project feasibility, the cost and benefit analysis is performed during the analysis phase.

The cost and benefit analysis show return on investment for the new system of about 22%. The breakeven point is about 1 year and 11 months. The cumulative cost of the existing system was about 10,690,718 Baht comparing with the cumulative cost of new system of 9,340,516 Baht. So by implementing this project, the company will gain about 1,350,202 Baht or the net present value of 433,151 Baht.

The inventory report and preparation of the production order will take less time. The information produced from the system will be more accurate and consistent with the data produced from other process. The level of time consumption and employees' satisfaction will be improved. Please see the table below for the degree of achievement of the proposed system.

Table 5.1. The Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
Generate Formula Card Process	4 hrs.	45 mins.
Production Order Process	3 hrs.	20 mins.
Preparation of report Process	5 hrs.	15 mins.
Total Overall Process	11 hrs.	1 hr. 20 mins

(1) Accuracy of Inventory Balance

In the Existing System, the inventory balance is performed manually tracking through the report. The report is printed out and distributed to the other related functions. It is difficult to find out the updated inventory level in the Store Room at the certain period. The Proposed System is computerized system, so it reduces the processing time to update the inventory transaction. The user has to input the required information into the inventory

system and the system will show the actual inventory balance immediately.

(2) Conflict of role and responsibility of the staff

There are many staff who are involved in the inventory movement. The control of the inventory is weak. The Store Room officers face the difficulty in order to identify the location of the inventory in Store Room and also cannot control the movement of the inventory level under the Existing System

With the Proposed System, the inventory system will be locked for the other users to input in the system. Each user will have the limitation of authority to access the system. Moreover, the company decide to implement ISO 9000 by next year, each officer is identified the clear role and responsibility. So, there is no conflict in each person after implement the proposed system.

(3) Over Stock for slow movement inventory and Shortage in fast movement items.

The current existing system is done manually. It is difficult to find the actual inventory level and some data is not accurate. This causes the weak in material planning. The slow movement inventory item is kept in the Store Room, which make the weak space utilization and also increasing in number of obsolete materials.

The Proposed System is computerized and it hastens the preparation of the inventory report with the accurate amount. So, the material planner can be able to know the inventory level and improve the forecasting

performance. This will help in terms of working capital improvement as well.

Table 5.1 shows the time used in each process comparing between the Existing System and the Proposed System. The new system uses less time in each process. After considering the advantages and disadvantages of the project the new proposed system is recommended to increase the system efficiency of the company. Finally the new computerized system can support the change in the business activities and the expansion of the business in the future.

5.2 Recommendations

Though the new inventory system can help the company to have systematic transactions and improving the accuracy of data, the analysis team recommends that there are some more improving areas, which will help the system, be more applicable.

(1) Bar Code Reader and Scanner

The bar code reader and scanner is another additional tool to stimulate and accelerate the work process. There is no need for the users to input the information manually. But the company need to concentrate on the investment cost since the cost of this tool seem to be very high and it need to have specific software to control.

(2) Costing System and Financial System

In order to get the full benefit of the computerize system; the costing system and financial system need to be develop. This will help the company have the automate data from the inventory transaction. Moreover, this will help the company to get more accurate data in term of inventory quantity and the accounting records.

(3) Purchasing System

The proposed system focus only the supplier master data and generating the purchasing order. There is no system support in term of ordering or bargaining process. So, the purchasing system is another improvement area under computerize system that should be implement. The EDI system will be another tool to escalate and fasten the work process. The good security control and Internet tools need to be invested in order to get the highest benefit from the new system and protect from the intruders.

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APPENDIX A

USER INTERFACE DESIGN

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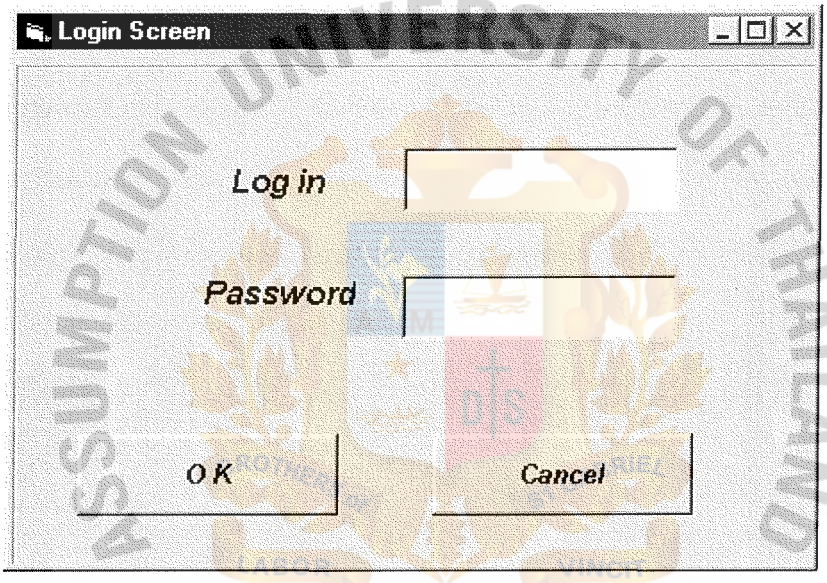

Figure A.1. Login Form.

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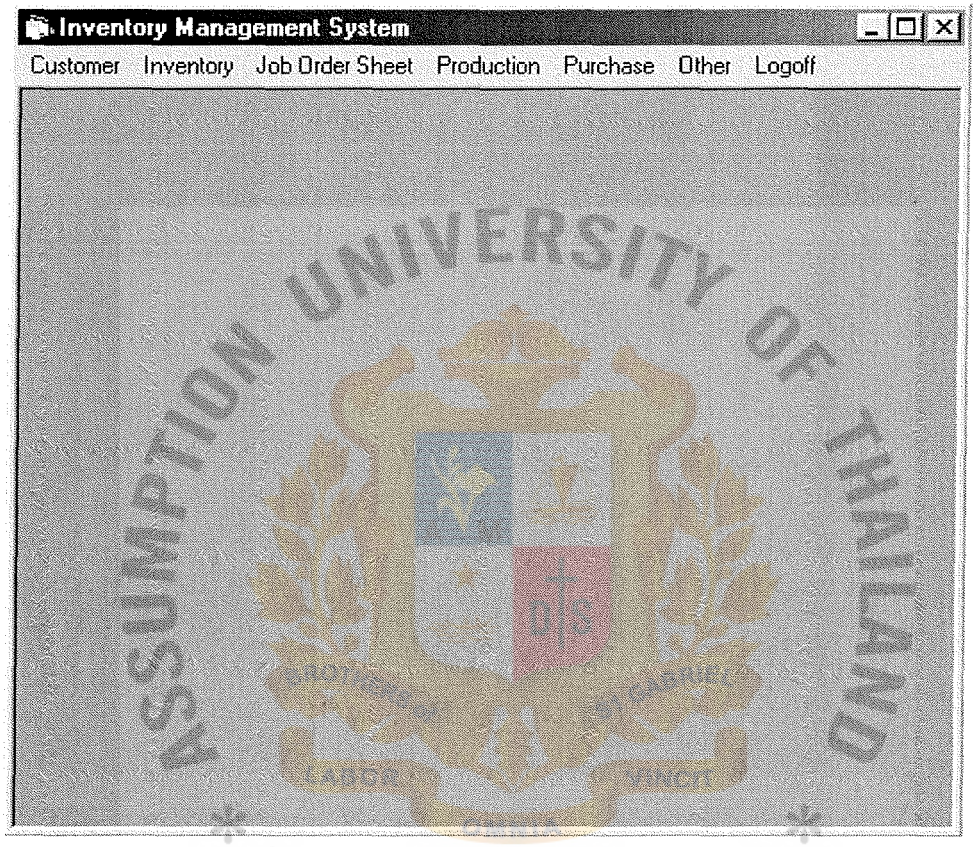

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Figure A.2. Inventory Management System – Main Menu.

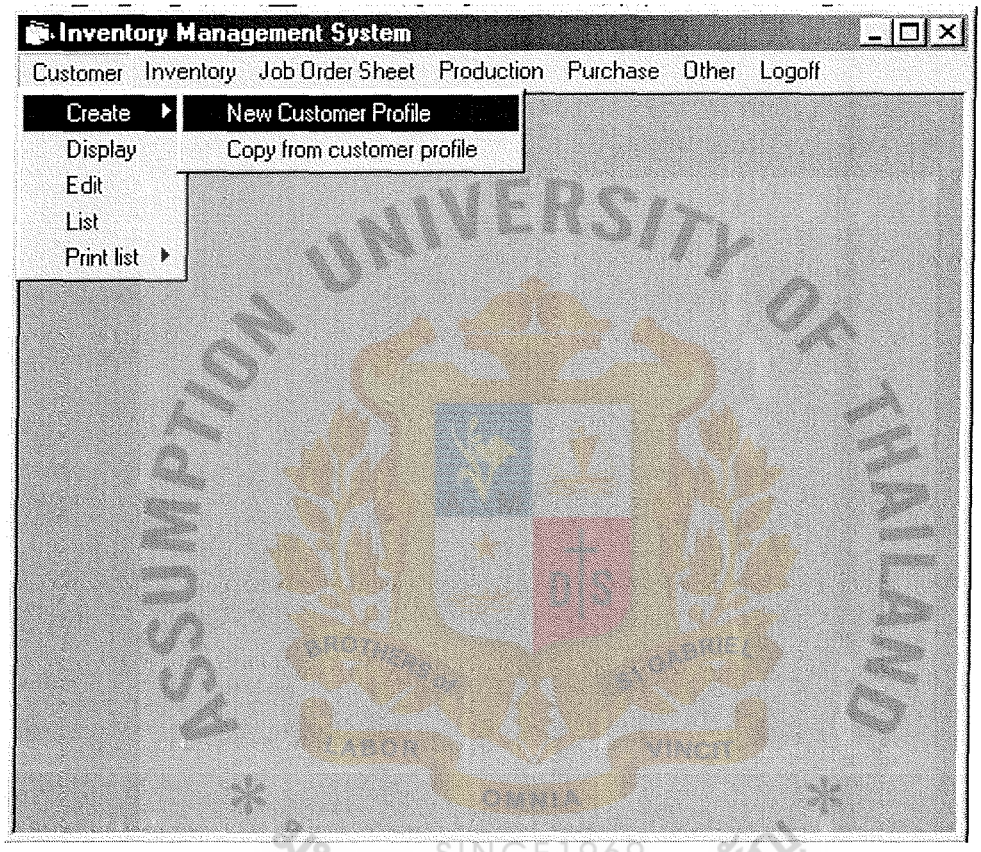

Figure A.3. Inventory Management System – Create Customer Master Menu.

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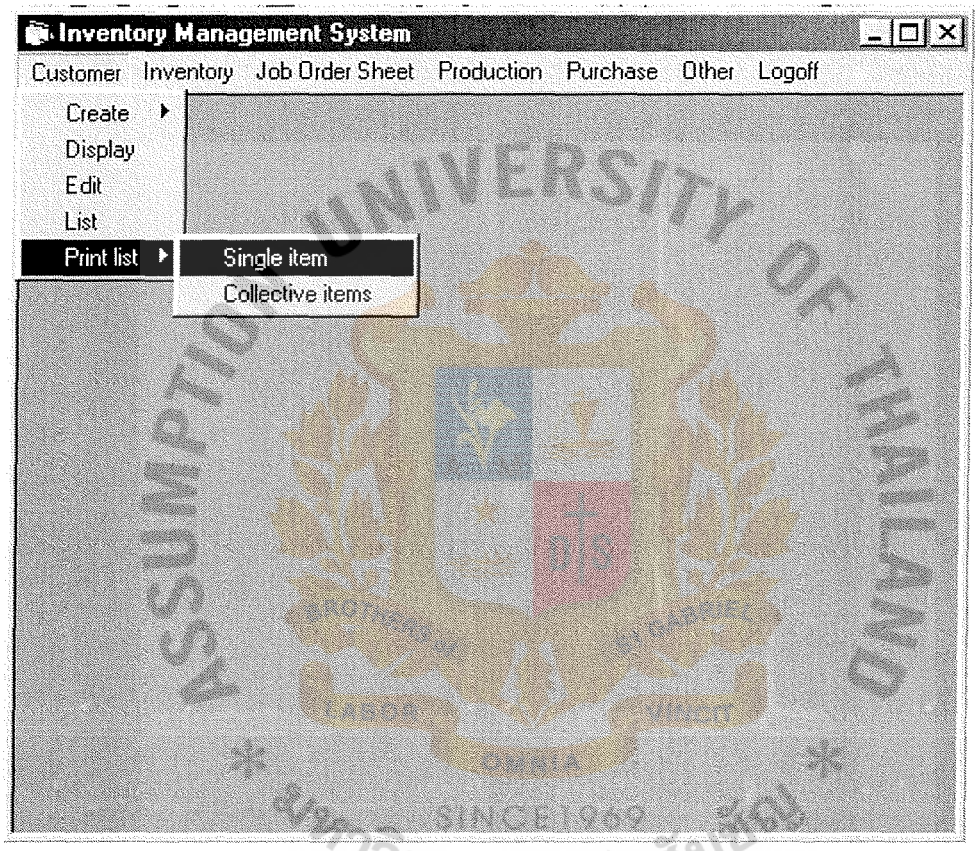

Figure A.4. Inventory Management System – Print Customer Master Menu.

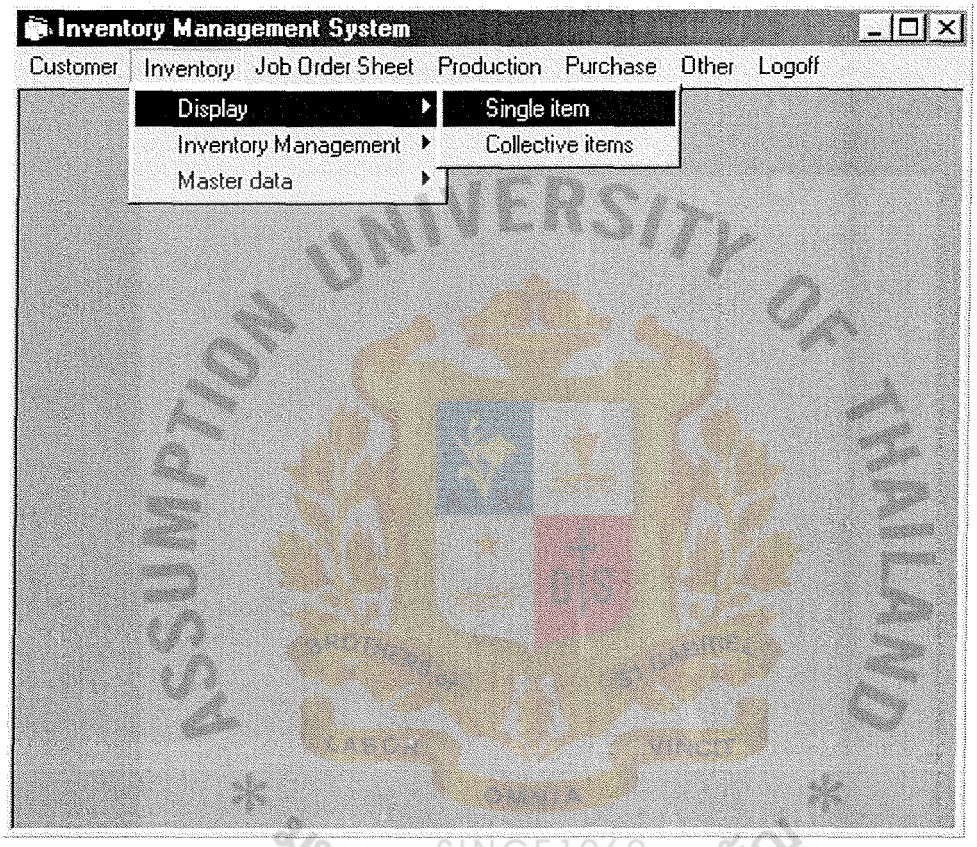

Figure A.5. Inventory Management System – Display Inventory Menu.

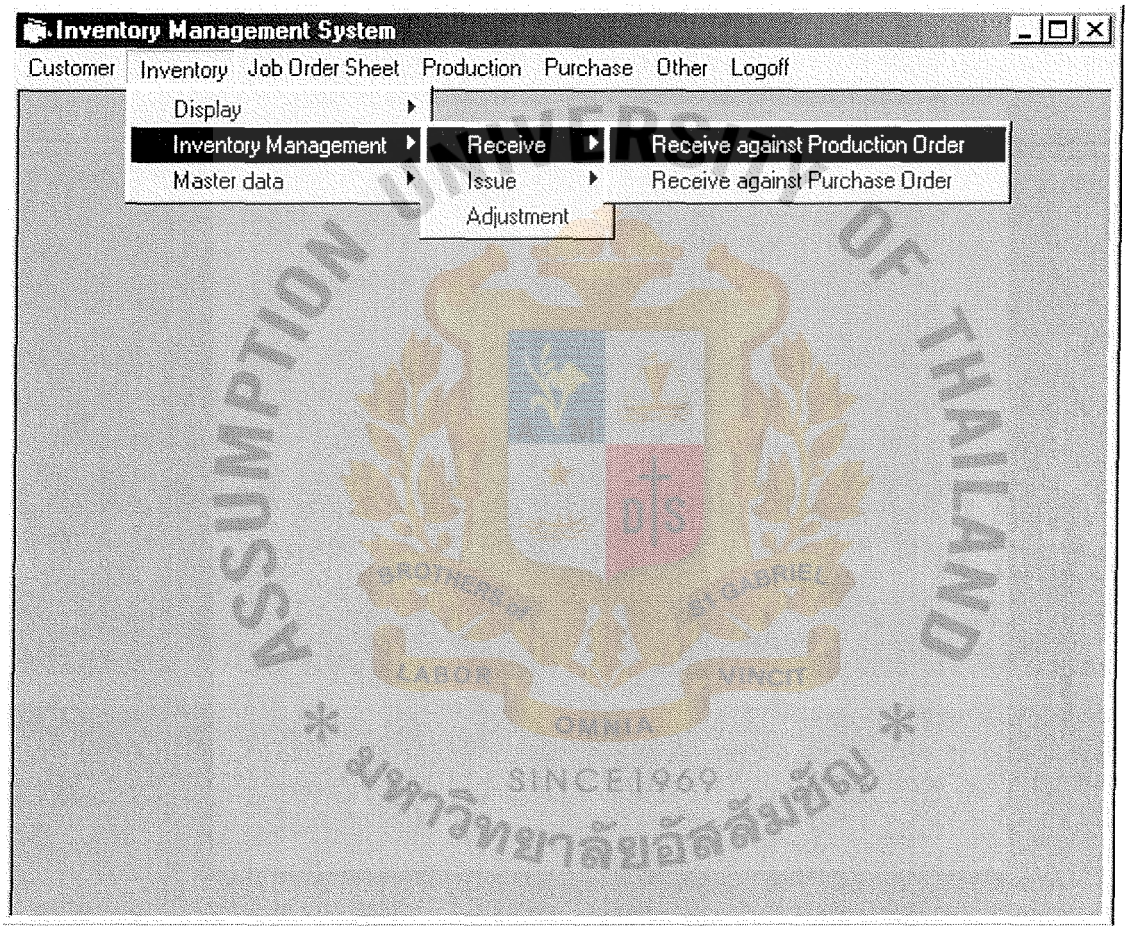

Figure A.6. Inventory Management System – Inventory Management Menu.

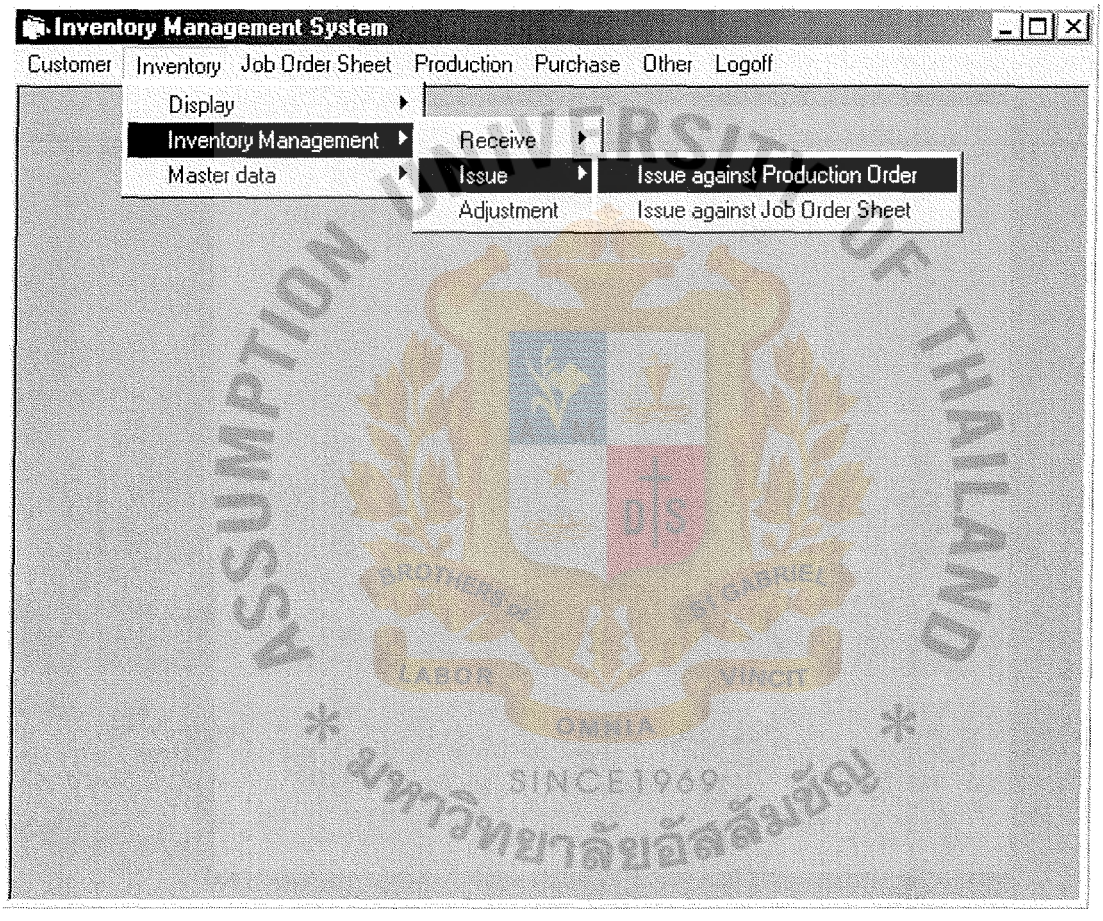

Figure A.7. Inventory Management System – Inventory Management Issue Menu.

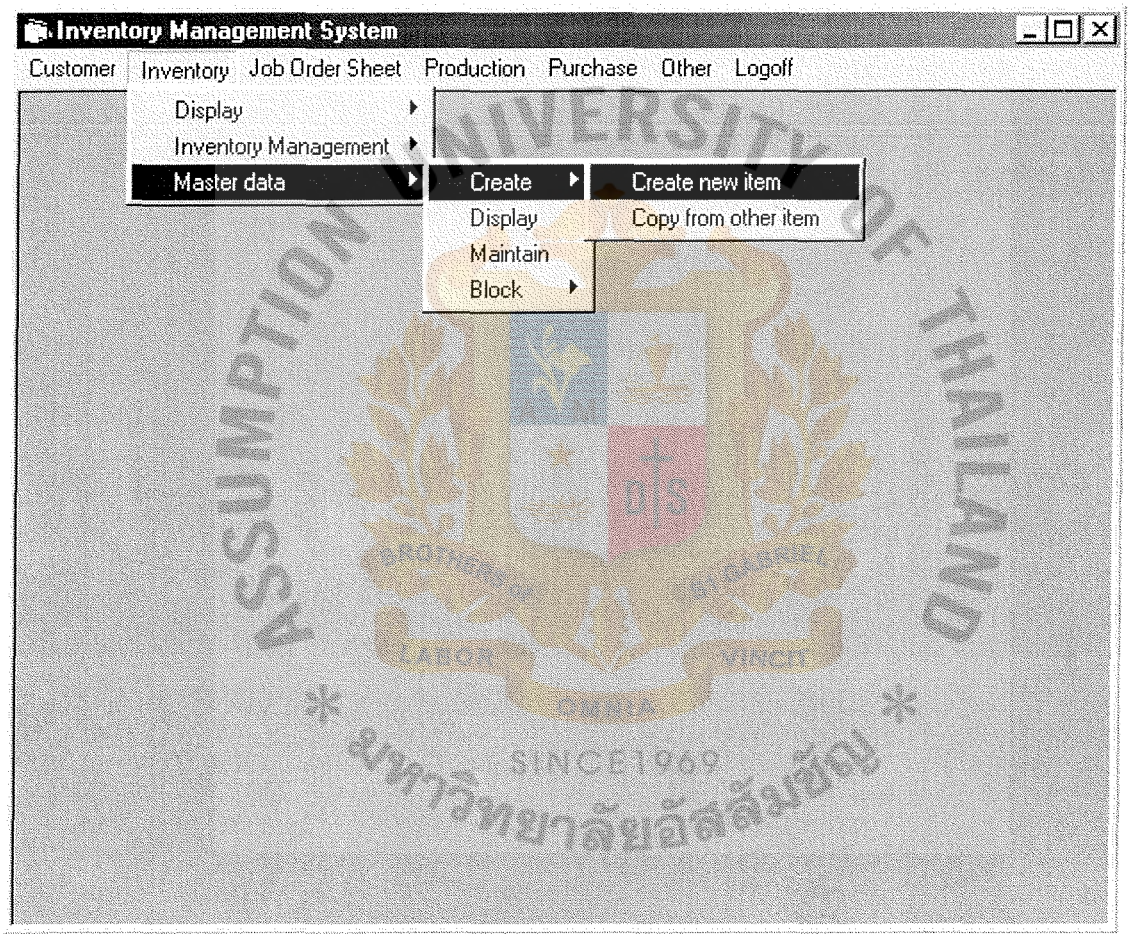

Figure A.8. Inventory Management System – Inventory Master Data Menu.

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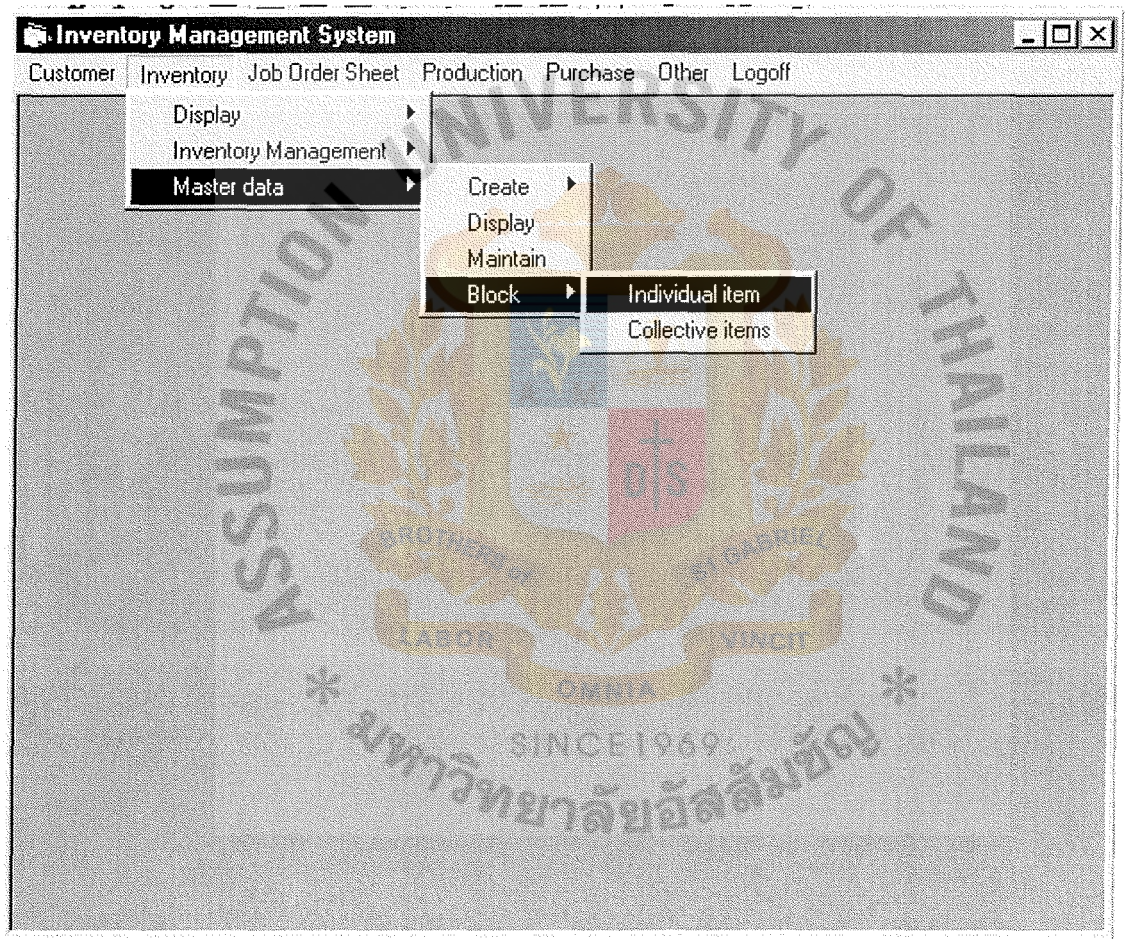

Figure A.9. Inventory Management System – Inventory Master Data Block Menu.

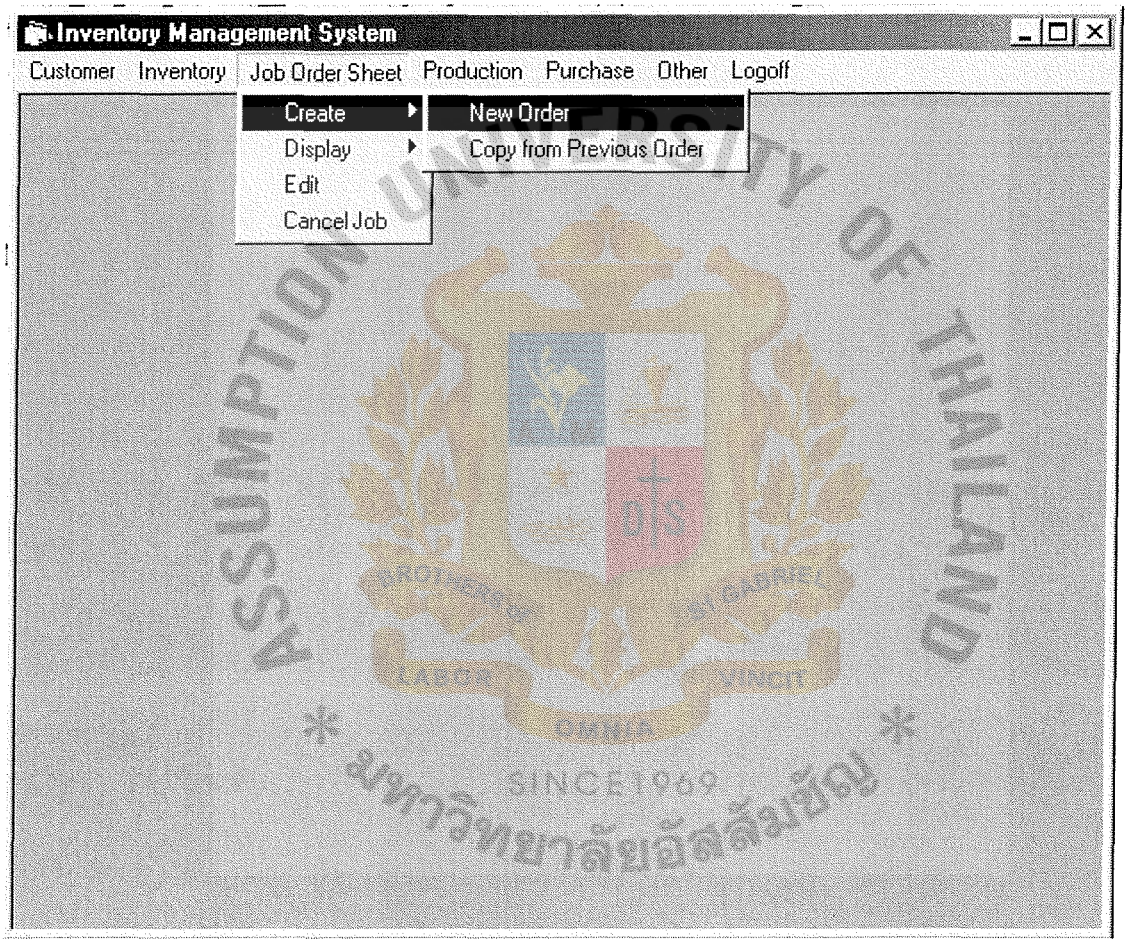

Figure A.10. Inventory Management System – Job Order Sheet Create Menu.

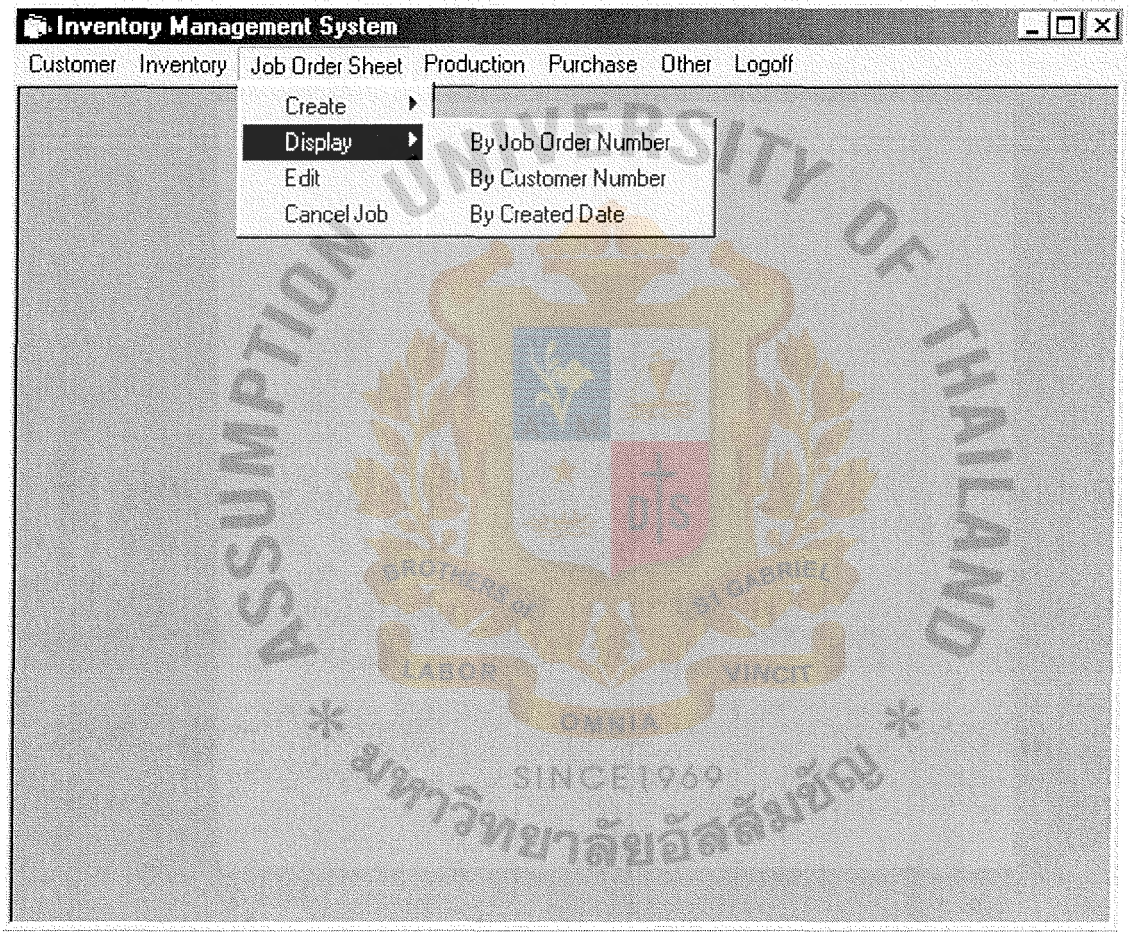

Figure A.11. Inventory Management System – Job Order Sheet Display Menu.

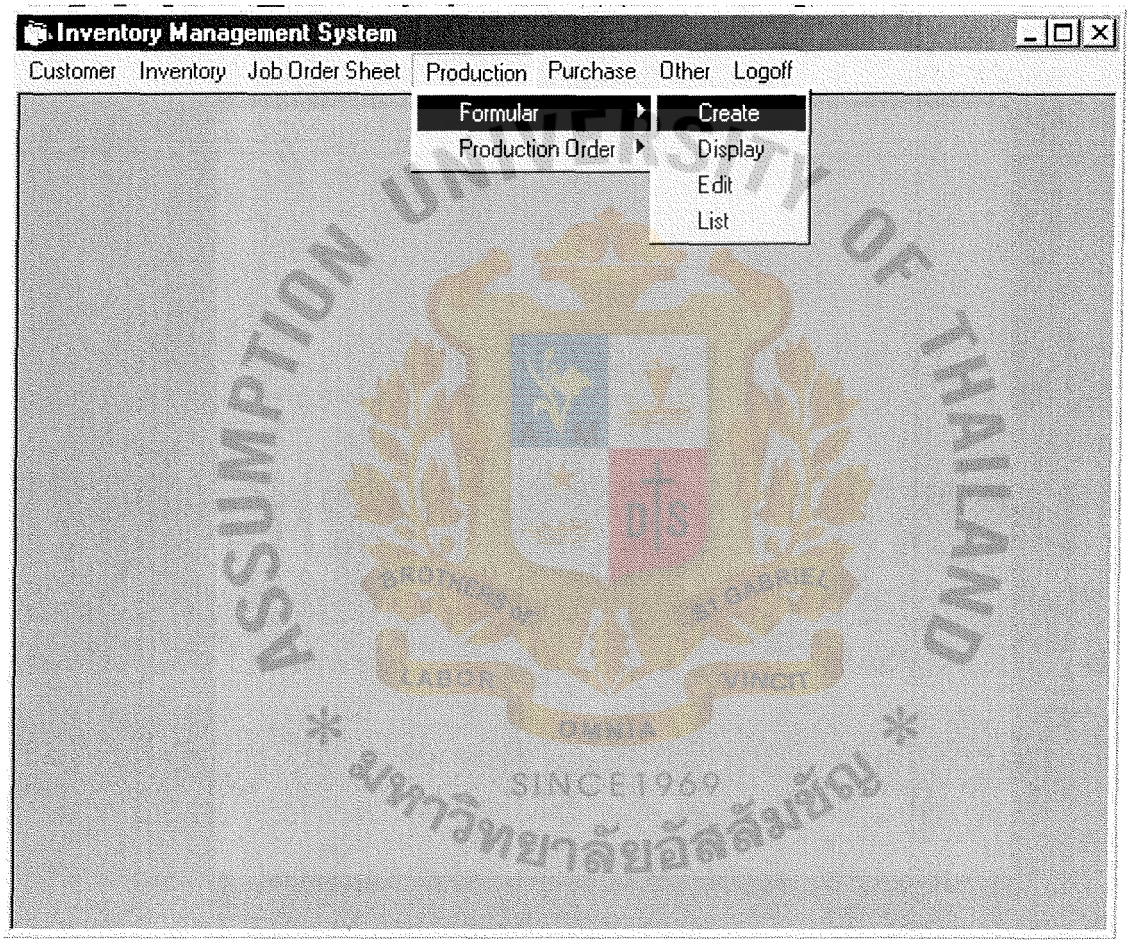

Figure A.12. Inventory Management System – Production Menu.

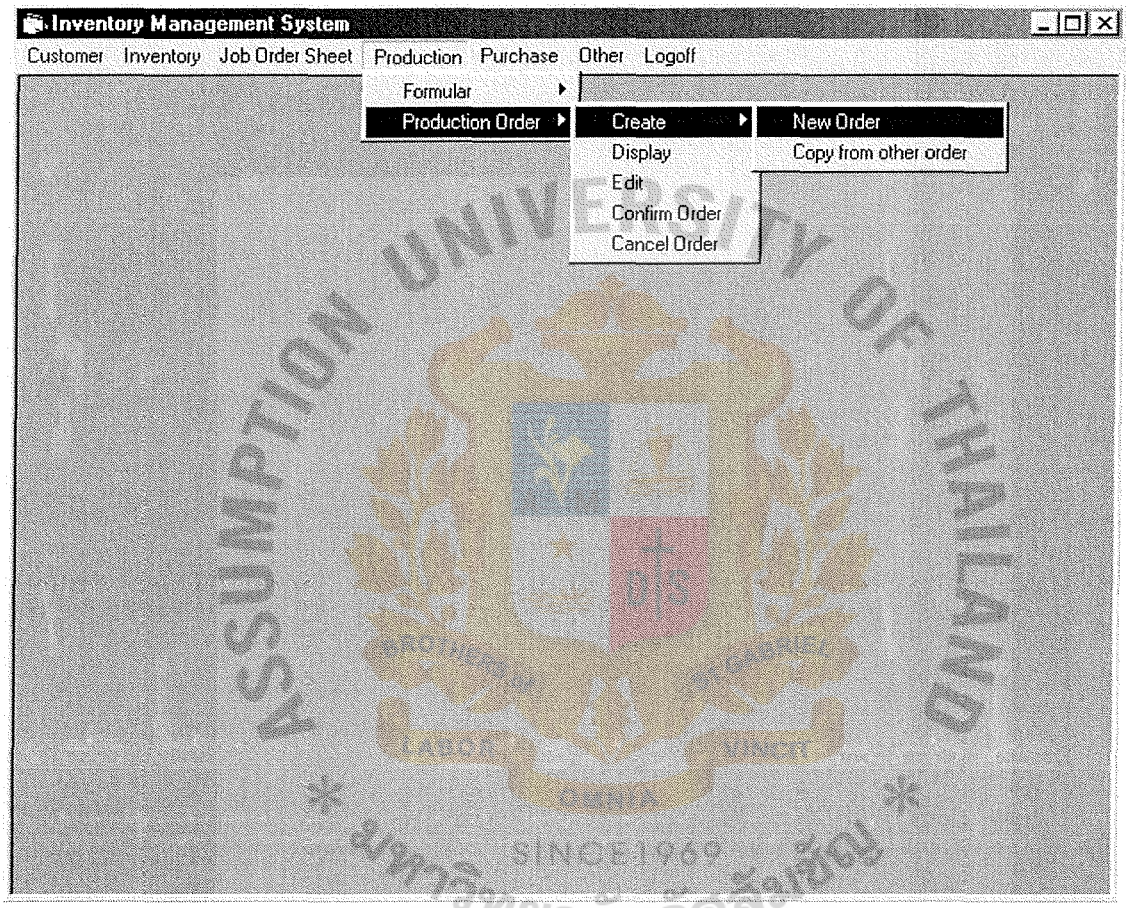

Figure A.13. Inventory Management System – Production Order Menu.

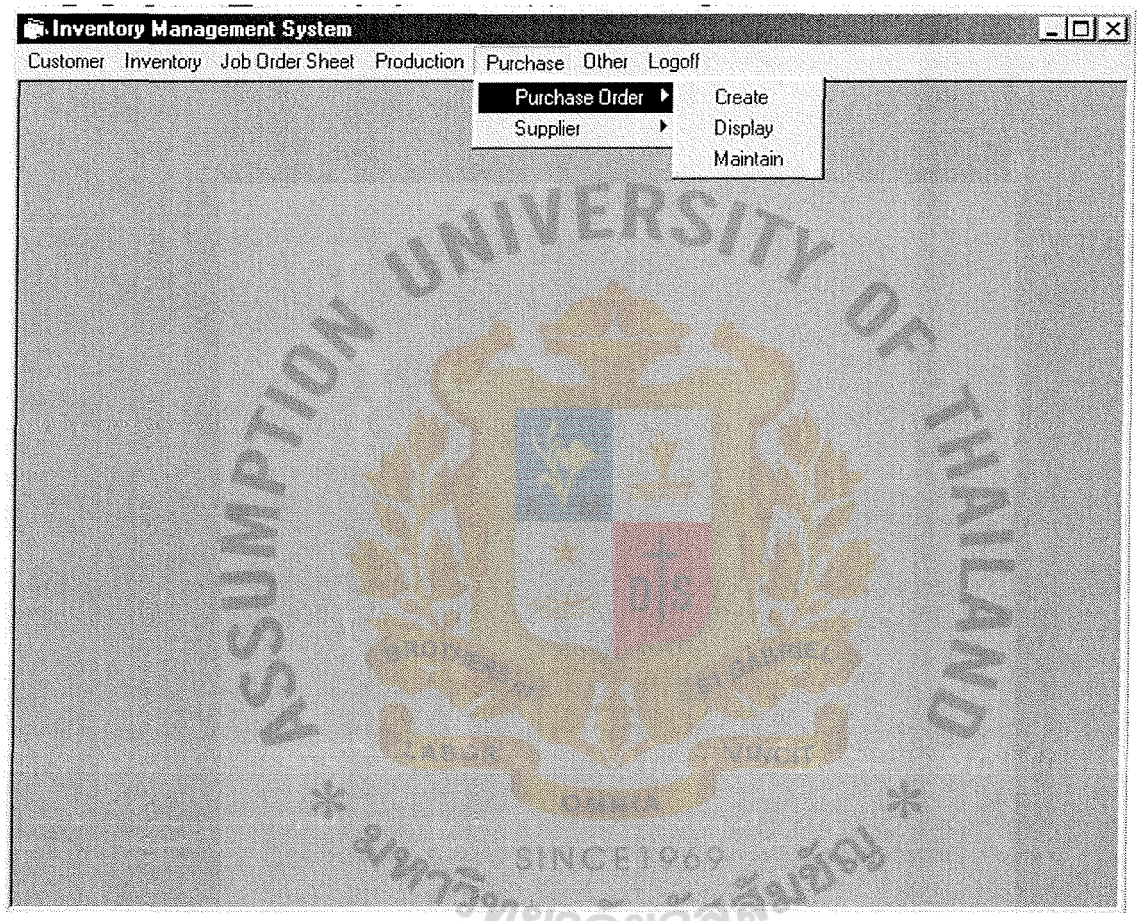

Figure A.14. Inventory Management System – Purchase Order Menu.

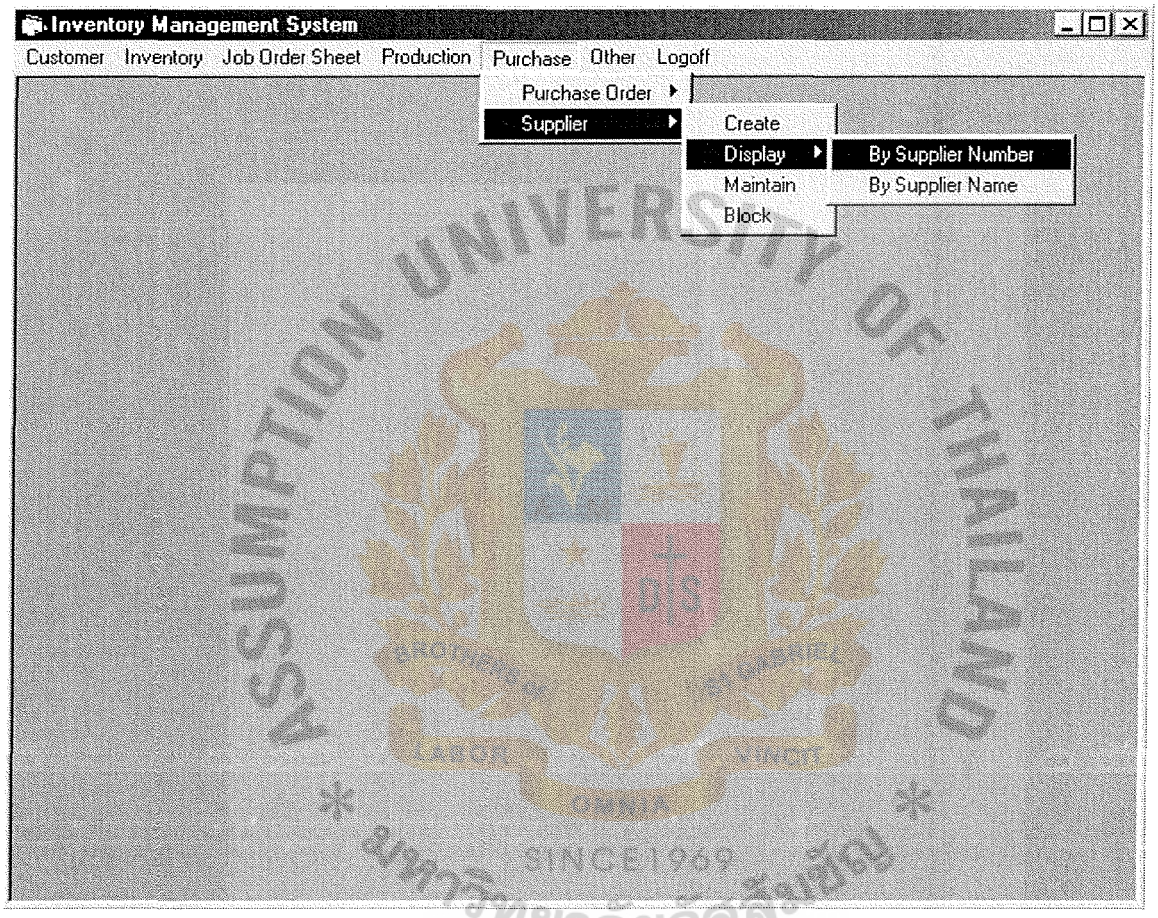

Figure A.15. Inventory Management System – Supplier Master Menu.

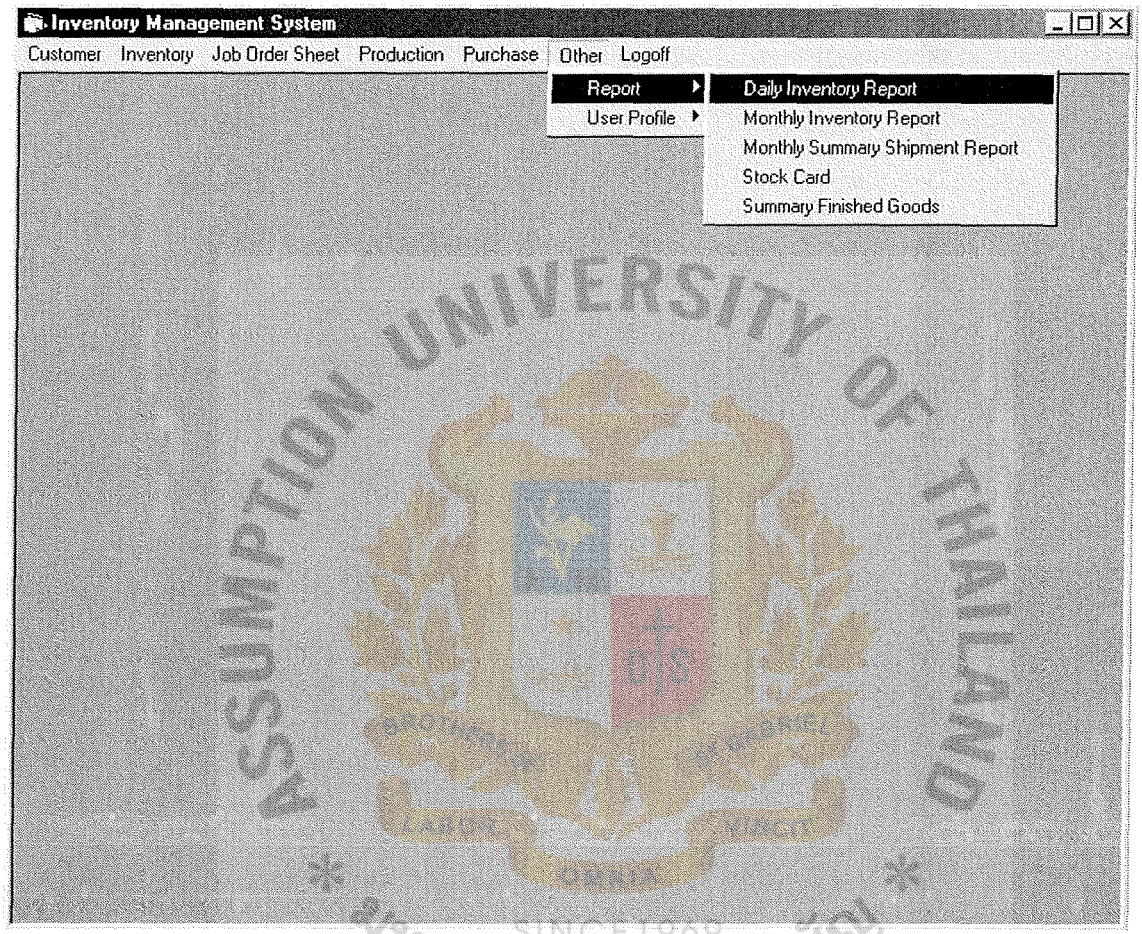

Figure A.16. Inventory Management System – Report Menu.

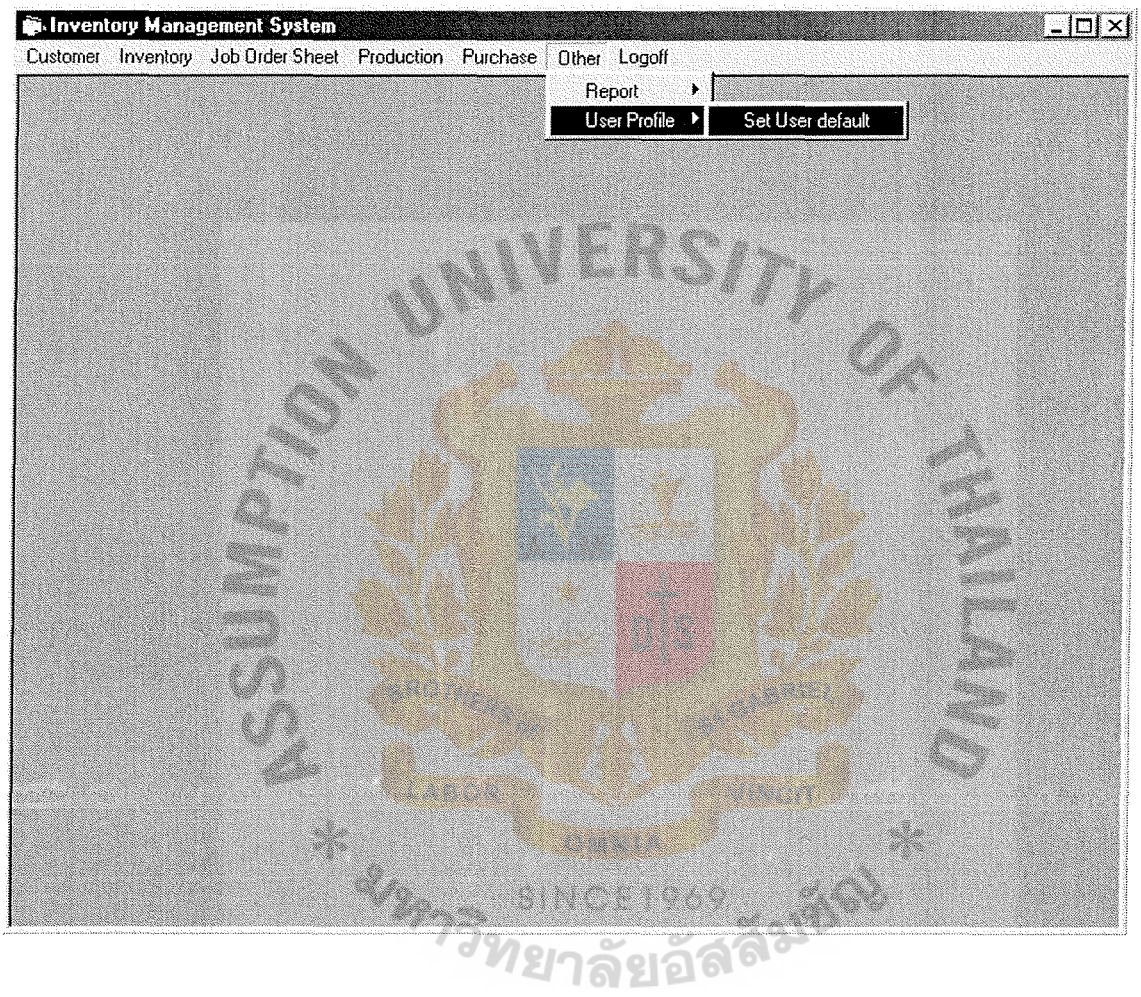

Figure A.17. Inventory Management System – User Profile Menu.

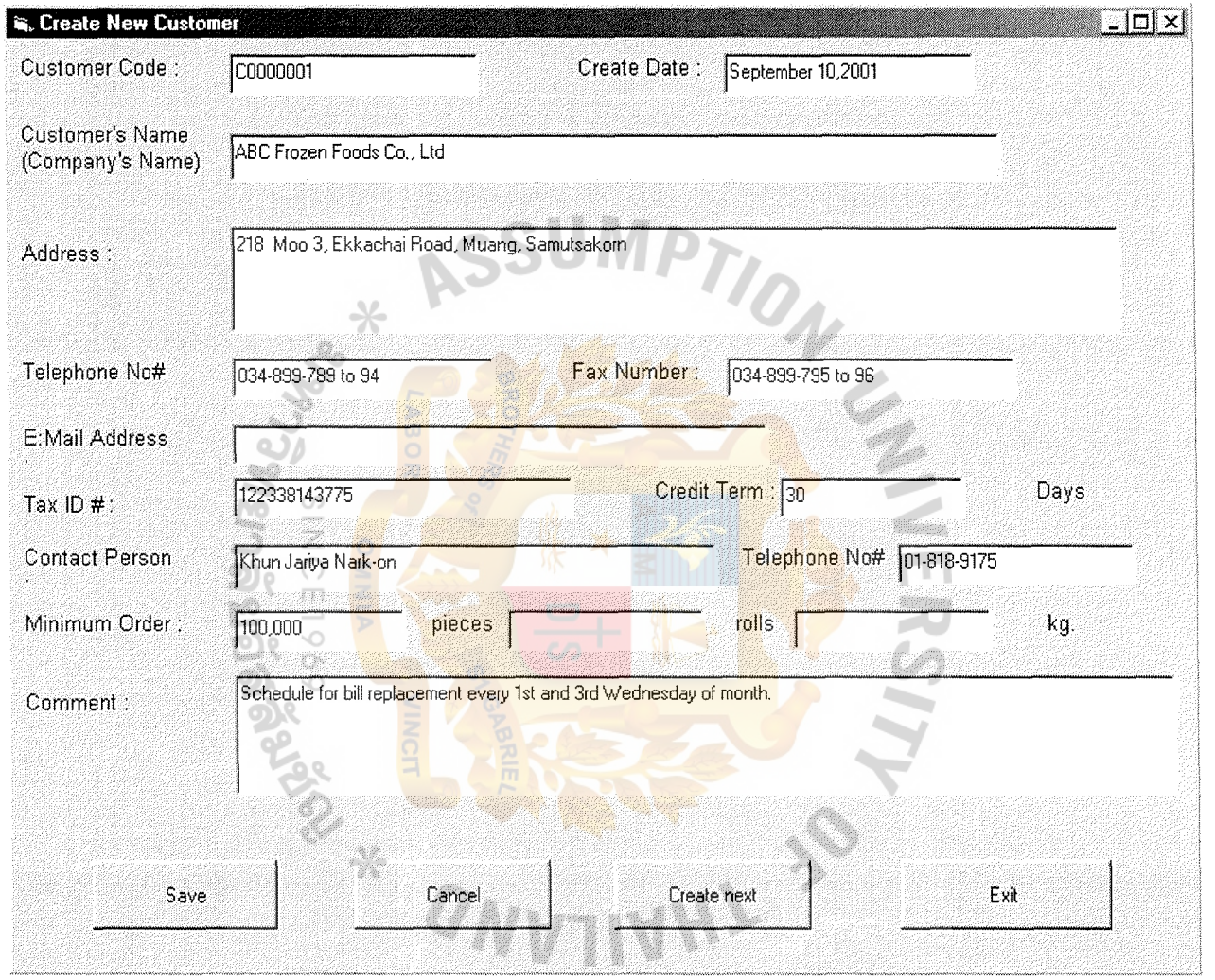

Figure A.18. Customer Master Screen.

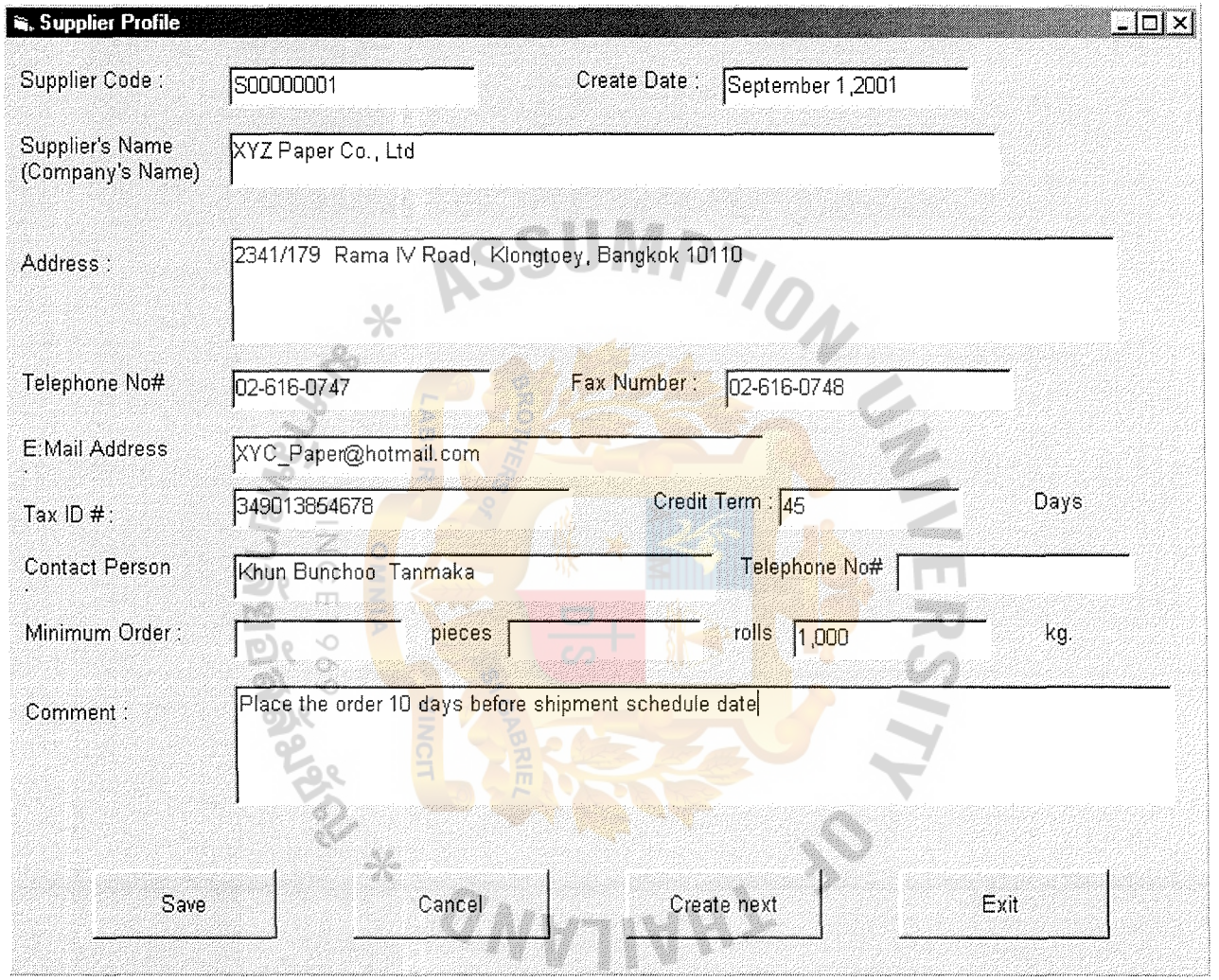

Figure A.19. Supplier Master Screen.

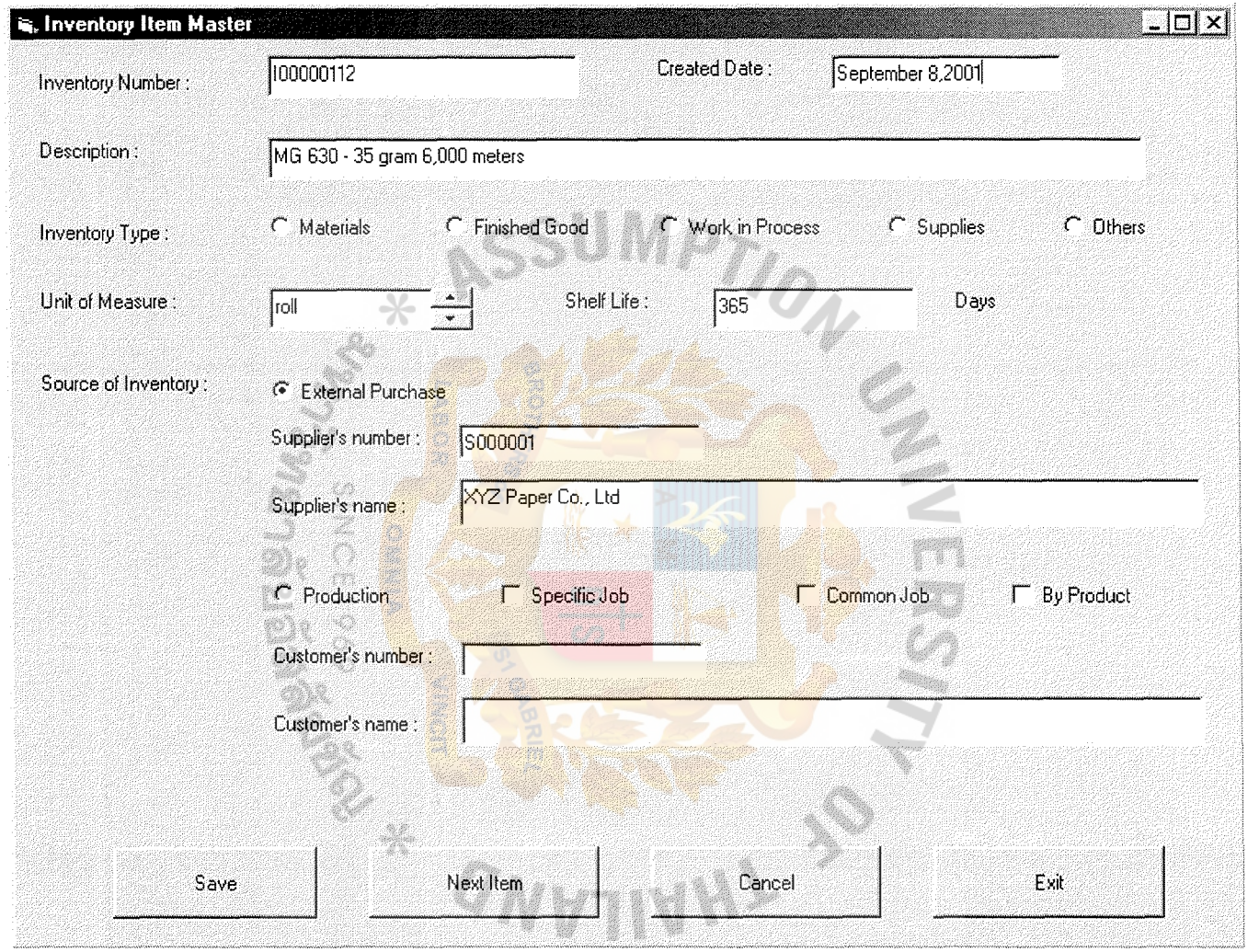

Figure A.20. Inventory Master Screen.

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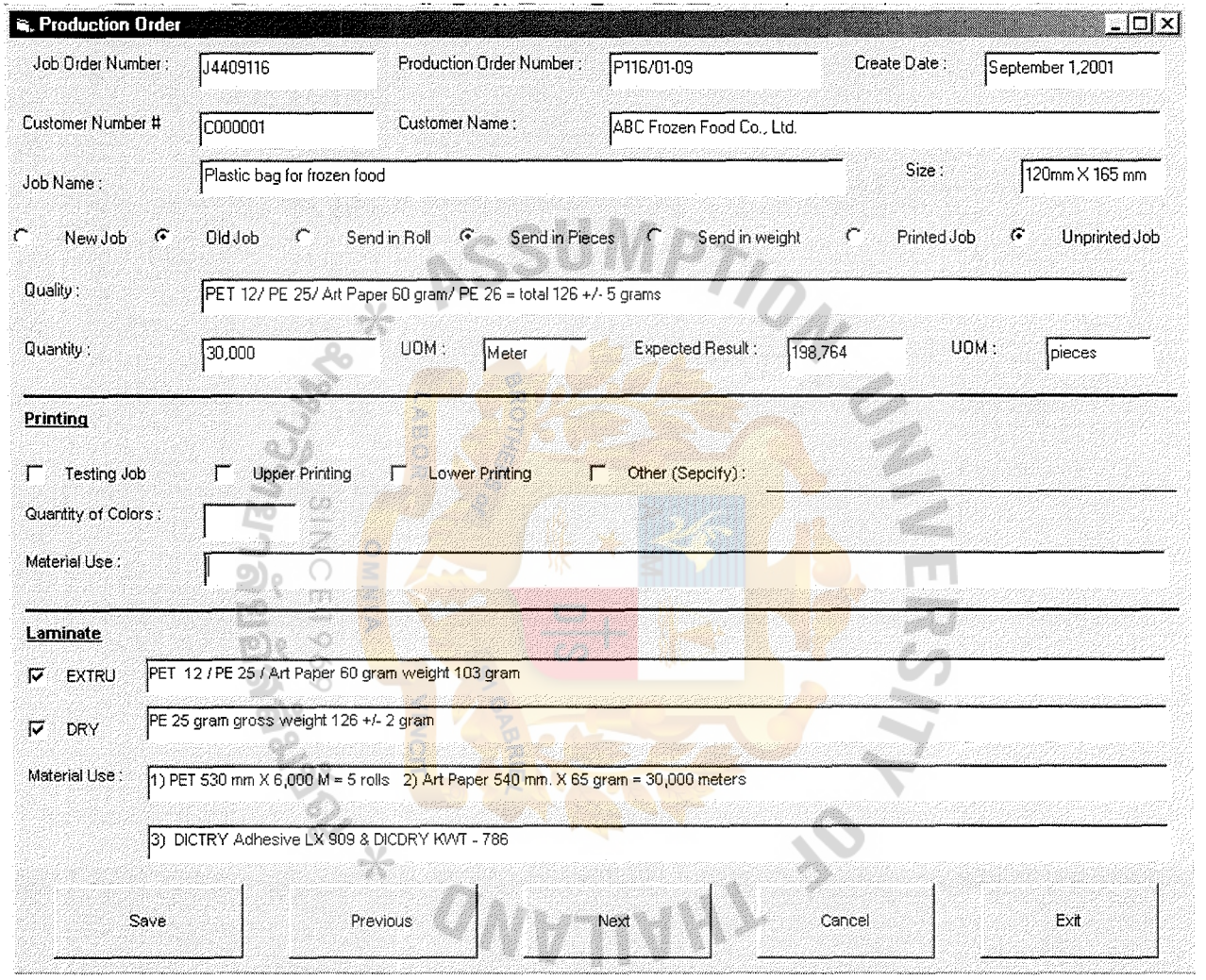

Figure A.21. Production Order Screen.

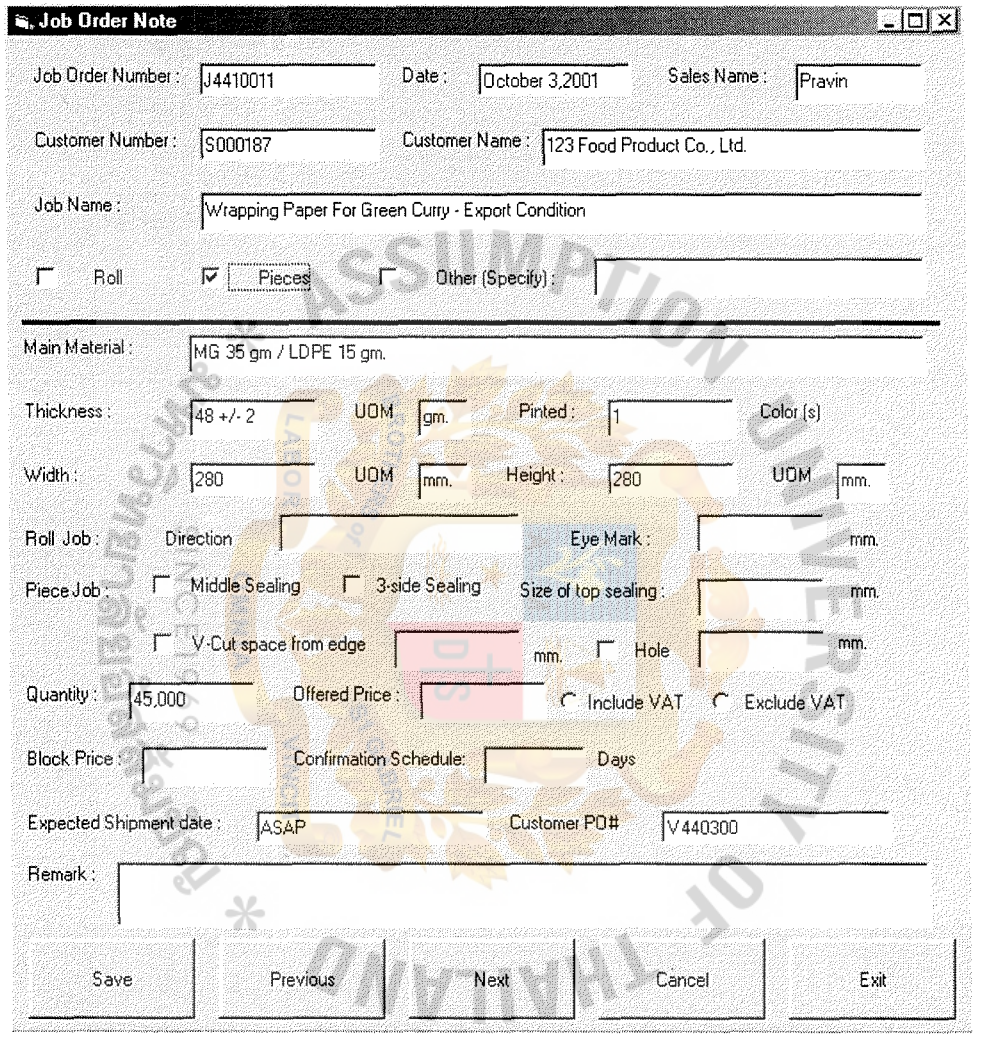

Figure A.22. Job Order Note Screen.

APPENDIX B

REPORT DESIGN

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Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Customer List Report

Customer #	Customer Name	Address	Contact Person	Credit term
C000001	ABC Frozen Foods Co., Ltd	218 Moo 3, Ekkachai Rd., Muang, Samutsakorn	Khun Jariya Nark0on	30
C000002	Star Candy	12/2 Petchakasem Rd, Pasricharoen, Bangkok	Khun Niyom Deewong	45
C000003	Adams (Thailand)Ltd.	415 Sukhumvit 74 Road, Samrong Nua, Samutprakarn 10270	Khun Somboon Tongma	45
C000004	Alphatec Semiconductor Pac	17/2 Moo 18, Suwintawong Road, Saladaeng, Bang-Num-Priow, Chachoengsa	Somchai Khamenkij	15
C000005	Application Hosting Service	23/3 Moo 9 Sukhumvit 103 Road, Nhongbon, Prawet, Bangkok 10260	Somchai Boonma	30
C000006	Asian Online Plaster (Thaila	360/7 Suppasarnrangsun Road, Hatyai, Songkhla	Chaiyapong Nasawat	15
C000007	Bando Manufacturing (Thail	47/7 Moo 4 Soi Wad bangpla, T. Bank, A.Muang, Samutprakarn 74000	Chaiyasit Suwanchawee	7
C000008	Bayer Polymers Co.,Ltd.	4, 1 - 8 Road, Map Ta Phut Industrial Estate, Amphur Muang, Rayong 21150	Duangpen Fukada	0
C000009	Bio Consumer Co., Ltd.	55 Biohouse Bldg., 6th Floor, Sukhumvit 39 Rd., North Klongton, Wattana, Ba	Dusit Suwannakul	15
C000010	C.P. Pet Food	47/45-46 Soi Chan 24, Chan Road, Sathorn, Bangkok 10120	Jiraphat Tansandose	45
C000011	DOMARO INDUSTRIALS	299/38-41 Moo 2, Tambon Bangbuathong Amphor Bangbuathong Nonthaburi	Jirapong Jaroensri	30
C000012	Great Food Group of Comap	1168/64 Lumpini Tower, 22thFl., RamaIV Road, Sathorn, Bangkok 10120	Kasem Khunphet	15

Total 12 items

------- end of report ----------

Figure B.1. Customer List Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Daily Inventory Report

As of September 19,2001

Inventory #	Description	Remaining Balance	UOM
M0010001	Ethyl Acetate	200	kg
M0010002	Toluene	250	kg
M0010003	Wax Properseal	50	box
M0010004	Copper Powder	24	kg
M0020005	CPP Film	18000	M
M0030001	Nylon 620 x 3,000	23	roli
M0040032	Methalyte 530 x 25 x 6,000	1718.5	m
M0050013	K-Coated Oriented Nylon 500 x 15 x 2,000	915	roll
M0060009	OPP film 480 x 20 x 6,000	324	roll
M0070003	MG Paper Kraft 540 x 28 x 7,000	1000	roll

------- end of report ----------

Figure B.2. Daily Inventory Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Job Order Report

For the month of September 2001

Job#	Customer #	Customer Name	Qty	UOM	Status
J4409116	C000001	ABC Frozen Foods Co., Ltd	198,500	pcs	Closed
J4409117	C000002	Star Candy	1,500	kg	Closed
J4409118	C000003	Adams (Thailand)Ltd.	2,500	kg	Closed
J4409119	C000004	Alphatec Semiconductor Packaging Co.,Ltd.	200,000	pcs	Closed
J4409120	C000007	Bando Manufacturing (Thailand) Ltd.	30,500	M	Closed
J4409121	C000008	Bayer Polymers Co.,Ltd.	20,000	pcs	Closed
J4409122	C000009	Bio Consumer Co., Ltd.	15,000	pcs	Closed
J4409123	C000010	C.P. Pet Food	5,000	pcs	Closed
J4409124	C000011	DOMARO INDUSTRIALS CO.,LTD.	7,800	M	Closed
J4409125	C000012	Great Food Group of Comapanies	100,000	pcs	Closed

------- end of report ----------

Figure B.3. Job Order Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Monthly Inventory Report
For the month of September 2001

Inventory #	Description	Beginning	In	Out	Ending	UOM
M0010001	Ethyl Acetate	200.00	46.98	153.00	93.98	kg
M0010002	Toluene	250.00	58.73	191.25	117.48	kg
M0010003	Wax Properseal	50.00	11.75	38.25	23.50	box
M0010004	Copper Powder	24.00	5.64	18.36	11.28	kg
M0020005	CPP Film	18,000.00	4,228.20	13,770.00	8,458.20	M
M0030001	Nylon 620 x 3,000	23.00	5.40	17.60	10.81	roll
M0040032	Methalyte 530 x 25 x 6,000	1,718.50	403.68	1,314.65	807.52	m
M0050013	K-Coated Oriented Nylon 500 x 15 x 2,000	915.00	214.93	699.98	429.96	roll
M0060009	OPP film 480 x 20 x 6,000	324.00	76.11	247.86	152.25	roll
M0070003	MG Paper Kraft 540 x 28 x 7,000	1,000.00	234.90	765.00	469.90	roll

------- end of report ----------

Figure B.4. Monthly Inventory Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Monthly Summary Shipment Report

As of September 2001

FG #	FG Description	Qty	UOM
F00001567	Plastic bag for candy - Blue Print	1,250,560	pcs
F00007631	Laminated film size 12X45	138,000	pcs
F00000917	Green Curry Fishing Food	86,000	pcs
F00001288	Gelatin bag - Nangfah brand	25,400	pcs
F00003642	Plastic wrapper candy for export - Chew Chew	118,500	M
F00007211	Plastic bag for Frozen Food - ABC	15,600	pcs
F00003455	Nilon bag size 12X15 cm	30,000	pcs
F00002341	Laminated paper for Chicken Niece	3,000	kg

------- end of report ----------

Figure B.5. Monthly Summary Shipment Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Purchase Order Report

As of September 1 - 15,2001

PO#	Supplier #	Supplier Name	Material #	Material Description	Qty	UOM
POS09-0001	S0000002	Hercules Chemicals (Thailand) Co,. Ltd.	M0010001	Ethyl Acetate	46.98	kg
POS09-0002	S0000007	Kurita- GK Chemical Co Ltd.	M0010002	Toluene	58.73	kg
POS09-0003	S0000048	National Starch & Chemical (Thailand)	M0010003	Wax Properseal	11.75	box
POS09-0004	S0000051	Namrung Industry Co., Ltd.	M0010004	Copper Powder	5.64	kg
POS09-0005	S0000090	NIPPON PAINT (THAILAND) CO.,LTD.	M0020005	CPP Film	4,228.20	M
POS09-0006	S0000076	Oji Paper (Thailand) Ltd.	M0030001	Nylon 620 x 3,000	5.40	roll
POS09-0007	S0000001	XYC Paper Co., Ltd.	M0040032	Methalyte 530 x 25 x 6,000	403.68	m
POS09-0008	S0000009	PRC PLAST (THAILAND) CO.,LTD.	M0050013	K-Coated Oriented Nylon 500 x 15 x 2,000	214.93	roll
POS09-0009	S0000008	Rhodia (Thailand) Limited	M0060009	OPP film 480 x 20 x 6,000	76.11	roll

Total 9 items

------- end of report ----------

Figure B.6. Purchase Order Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Production Order Report

As of September 01,2001

Prod#	FG #	FG Description	Qty	UOM	Qty Receive
P111/01-09	F00001567	Plastic bag for candy - Blue Print	250,000	pcs	250,560
P112/01-09	F00007631	Laminated film size 12X45	100,000	pcs	98,000
P113/01-09	F00000917	Green Curry Fishing Food	65,000	pcs	66,000
P114/01-09	F00001288	Gelatin bag - Nangfah brand	25,000	pcs	25,400
P115/01-09	F00003642	Plastic wrapper candy for export - Chew Chew	120,000	M	118,500
P116/01-09	F00007211	Plastic bag for Frozen Food - ABC	15,000	pcs	15,600
P117/01-09	F00003455	Nilon bag size 12X15 cm	25,000	pcs	30,000
P118/01-09	F00002341	Laminated paper for Chicken Niece	1,000	kg	1,000

------- end of report ----------

Figure B.7. Production Order Report.

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Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.
Tax ID# 1234567890

Stock Card Report

Material # : I00000112 **Description : MG 630 - 35 gram** **UOM : Meters**

Date	Ref#	In	Out	Balance
Sep 1,01	Balance Forward			98,767
Sep 1,01	SIN#09010001		6,578	92,189
Sep 6,01	SIN#09060006		12,000	80,189
Sep 7,01	SIN#09070001		13,452	66,737
Sep 10,01	SIN#09100011		24,000	42,737
Sep 14,01	SIN#09140009		30,000	12,737
Sep 15,01	MRN#0915001	15,000		27,737
Sep 19,01	MRN#0919004	45,000		72,737
Sep 19,01	SIN#09190007		60,000	12,737
Sep 24,01	SIN#09240006		10,000	2,737
Sep 25,01	MRN#0927008	10,000		12,737
Total		70,000	156,030	12,737

------- end of report ----------

Figure B.8. Stock Card Report.

Perfect Packaging Co.,Ltd.
48/52-3 Moo 1, Ekkachai Road, Muang, Samutsakorn 74000.

Summary Finished Goods Report
For the month of September 2001

FG#	Description	Qty	UOM
F00001567	Plastic bag for candy - Blue Print	198,500	pcs
F00007631	Laminated film size 12X45	1,500	kg
F00000917	Green Curry Fishing Food	2,500	kg
F00001288	Gelatin bag - Nangfah brand	200,000	pcs
F00003642	Plastic wrapper candy for export - Chew Chew	30,500	M
F00007211	Plastic bag for Frozen Food - ABC	20,000	pcs
F00003455	Nilon bag size 12X15 cm	15,000	pcs
F00002341	Laminated paper for Chicken Niece	5,000	pcs

------- end of report ----------

Figure B.9. Summary Finished Goods Report.

APPENDIX C

DATABASE DESIGN

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DATABASE DESIGN

Table C.1. Customer Database Table.

Field Name	Type	Length	Description
C_no	A	7	Customer number
C_create_date	D	10	Customer Master Create Date
C_Name	A	50	Customer name
C_address	A	250	Customer address
C_tel	A	15	Telephone number
C_fax	A	15	Fax number
C_email	A	15	E-mail Address
C_tax	A	15	Customer Tax number
C_credit	N	3	Customer credit term
C_contact	A	50	Customer Contact person name
C_contact_tel	A	15	Contact person telephone number
C_min_piece	N	20	Minimum order by pieces
C_min_roll	N	20	Minimum order by rolls
C_min_kg	N	20	Minimum order by kilogram
C_comment	A	300	Special comment

Table C.2. Employee Database Table.

Field Name	Type	Length	Description
E_no	A	7	Employee number
E_name	A	15	Employee name
E_surname	A	15	Employee surname
E_position	A	15	Employee position
E_department	A	15	Employee department
E_password	A	15	Employee password

Table C.3. Finished Goods Database Table.

Field Name	Type	Length	Description
Fg_no	A	7	Finished Goods number
Fg_Desc	A	45	Finished Goods description
Fg_Qty	N	15	Finished Goods quantity
Fg_UOM	A	10	Unit of measure
Use_Life	N	15	Finished Goods useful life
Fg_source	A	15	Source of finished goods

Table C.4. Formula Card Database Table.

Field Name	Type	Length	Description
For_no	A	7	Formula card number
Fg_no	A	7	Finished Goods number
Fg_Qty	N	15	Finished Goods quantity
Fg_UOM	A	10	Unit of measure of finished goods
Mat_no	A	7	Material number
Mat_UOM	A	15	Unit of measure of material
Waste	A	3	Waste percentage
Mach_no	A	10	Machine number

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Table C.5. Inventory Transaction Database Table.

Field Name	Type	Length	Description
For_no	A	7	Formula card number
Fg_no	A	7	Finished Goods number
Fg_Qty	N	15	Finished Goods quantity
Fg_UOM	A	10	Unit of measure of finished goods
Mat_no	A	7	Material number
Mat_UOM	A	15	Unit of measure of material
Waste	A	3	Waste percentage
Mach_no	A	10	Machine number

Table C.6. Job Order Note Database Table.

Field Name	Type	Length	Description
Job_no	A	7	Job Order number
Fg_no	A	7	Finished Goods number
C_no	A	7	Customer number
Qty	A	10	Job Order quantity
UOM	A	15	Unit of measure of order
Ship_date	D	15	Shipment date
POC_no	A	15	Customer purchase order
Credit_spe	A	10	Special credit term for this job order note

Table C.7. Material Database Table.

Field Name	Type	Length	Description
Mat_no	A	7	Material number
Mat_Desc	A	45	Material description
Mat_Qty	N	15	Material quantity
Mat_UOM	A	10	Unit of measure
Use_Life	N	15	Material useful life
Mat_source	A	15	Source of Material

Table C.8. Purchase Order Database Table.

Employee field	Type	Length	Description
PO_no	A	7	Purchase order number
PO_date	D	15	Purchase order date
Sy_no	A	7	Supplier number
PO_qty	N	15	Purchase order quantity
UOM	A	10	Unit of measures
Mat_no	A	7	Material number

Table C.9. Supplier Database Table.

Field Name	Type	Length	Description
S_no	A	7	Supplier number
S_create_date	D	10	Supplier Master Create Date
S_Name	A	50	Supplier name
S_address	A	250	Supplier address
S_tel	A	15	Telephone number
S_fax	A	15	Fax number
S_email	A	15	E-mail Address
S_tax	A	15	Supplier Tax number
S_credit	N	3	Supplier credit term
S_contact	A	50	Supplier Contact person name
S_contact_tel	A	15	Contact person telephone number
S_min_piece	N	20	Minimum order by pieces
S_min_roll	N	20	Minimum order by rolls
S_min_kg	N	20	Minimum order by kilogram
S_comment	A	300	Special comment

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APPENDIX D

PROCESS SPECIFICATION

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PROCESS SPECIFICATION

Table D.1. Process Specification of Process 1.

Item	Description
Process Name:	Receive Information and Confirm Finished Goods Specification
Input:	Job Order Note Acceptance Notice from Customer
Output:	Confirmation of Product Specifications
Process:	(1) Marketing requests customers and product information from customers. (2) Get customer and product information from customers (3) Prepares the Job Order Note and forwards to the Storeroom. (4) Keep product and customer records in the database if it is new record. (5) Update products and customer records in the database if there are any changes. (6) Storeroom officers confirm product specification with the customers. (7) Receiving acceptance notice from customer in order to do the further process.
Attachment:	(1) Data Store D1 – Customer (2) Data Store D2 – Employee (3) Data Store D3 – Finished Goods (4) Data Store D6 – Job Order

Table D.2. Process Specification of Process 2.

Item	Description
Process Name:	Check Finished Goods
Input:	Job Order Note Shipment Schedule List Invoices Material file Finished Goods data
Output:	Formula card
Process:	(1) Storeroom officer get the required product information. (2) Retrieving summary finished goods data from database and check the finished goods stock. If available, then forward the Job Order Note and summary finished goods report to the Distribution Department. (3) The Distribution clerks confirm shipment date with the customer and prepared the shipment schedule list return to the Storeroom. The invoice will be printed on the shipment date and send to the Storeroom Department in order to pick up the finished goods. (4) The Storeroom officers update the finished goods stock in the system and move the physical finished goods to the Distribution. (5) If the finished goods are not available, the storeroom officers check the formula card database. If it is already prepared, the formula card number will be indicated on the Job Order Note and forward to the Production Department.

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Table D.3. Process Specification of Process 2 (Continued).

Item	Description
Process Name:	Check Finished Goods
Attachment:	(1) Data Store D2 – Employee (2) Data Store D3 – Finished Goods (3) Data Store D4 – Formula Card (4) Data Store D5 – Inventory (5) Data Store D7 – Material

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Table D.4. Process Specification of Process 3.

Item	Description
Process Name:	Prepared Finished Goods
Input:	Inventory data Job Order Note Formula card Material data Finished goods data
Output:	Production Order Note Inventory Requirement list Material Receipt Note Suppliers' invoices Finished Goods Finished Goods Receive Note Daily inventory report Inventory Requirement List Stock Issue Note
Process:	(1) Storeroom officer forwards the Job Order Note, Daily Inventory List and Formula card to the Production Department. (2) Production Planner generates the Production Order Note and fill in the Stock Issue Note then forwards to the Storeroom Department. (3) The Storeroom officer communicates with Purchasing to prepare the purchase order to the supplier. (4) The Storeroom officers receive materials against the purchase order and update into the system. The Material Receipt Note will be prepared and send to F&A together with the Tax Invoices, for the payment process.

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Table D.5. Process Specification of Process 3 (Continued).

Item	Description
Process Name:	Prepared Finished Goods
Input:	Inventory data Job Order Note Formula card Material data Finished goods data
Output:	Production Order Note Inventory Requirement list Material Receipt Note Suppliers' invoices Finished Goods Finished Goods Receive Note Daily inventory report Inventory Requirement List Stock Issue Note
Process:	(5) The materials will be transferred to the production to produce the finished goods. (6) Production staff prepared the FSRN and send together with the finished goods to Storeroom in order to ship to the customers.

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Table D.6. Process Specification of Process 1.1.

Item	Description
Process Name:	Receive information
Input:	Job Order Data Customer data Finished goods data
Output:	Job Order Note
Process:	(1) Contact with customers to get information. (2) Check with customer database. (3) Update in the system and prepared Job Order Note.
Attachment:	(1) Data Store D1 – Customer (2) Data Store D2 – Employee (3) Data Store D3 – Finished Goods (4) Data Store D6 – Job Order

Table D.7. Process Specification of Process 1.2.

Item	Description
Process Name:	Confirm Finished Goods Specification
Input:	Job Order Data Acceptance Notice from Customer
Output:	Confirmation of Product Specification
Process:	(1) Getting job order information (2) Contact with customer to confirm the product specification (3) Receive Acceptance Notice from customers.
Attachment:	-

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Table D.8. Process Specification of Process 2.1.

Item	Description
Process Name:	Check Finished Goods
Input:	Finished goods data Job Order data Material data
Output:	Formula card
Process:	Check finished goods from database
Attachment:	(1) Data Store D2 – Employee (2) Data Store D5 – Inventory (3) Data Store D7 – Material

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Table D.9. Process Specification of Process 2.2.

Item	Description
Process Name:	Submit Finished Goods
Input:	Finished goods data Job Order data Shipment Schedule List
Output:	Summary Finished Goods Invoices
Process:	(1) Found finished goods available to ship. Prepare summary Finished Goods. (2) Contact Distribution to confirm the shipment date with customers. (3) Receiving shipment schedule list from Distribution. (4) Update inventory stock in the system using information on Invoices.
Attachment:	(1) Data Store D3 – Finished Goods

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Table D.10. Process Specification of Process 2.3.

Item	Description
Process Name:	Check Formula
Input:	Formula data Finished Goods data Job Order data Material data,
Output:	Formula card no #
Process:	(1) If finished goods are not available to ship. (2) Check formula card no# from the database. (3) Contact with R&D for new formula. (4) Update formula card into the system and indicate formula no# on the Job Order Note
Attachment:	(1) Data Store D2 – Employee (2) Data Store D3 – Finished Goods (3) Data Store D4 – Formula Card

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Table D.11. Process Specification of Process 3.1.

Item	Description
Process Name:	Prepare Production Order
Input:	Daily Inventory Report Formula data Finished Goods data Job Order data Material data
Output:	Production Order Stock Issue Note (SIN)
Process:	(1) Getting Formula Card data, Material data and Job Order data from the database. (2) Prepare Production Order (3) Issue SIN against Production Order and Formula Card
Attachment:	(1) Data Store D2 – Employee (2) Data Store D5 – Inventory (3) Data Store D6 – Job Order

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Table D.12. Process Specification of Process 3.2.

Item	Description
Process Name:	Check Stock
Input:	Inventory Incoming List Material data Stock Issue Note (SIN)
Output:	Inventory Incoming List Materials data Material Receipt Note (MRN) Tax invoices
Process:	(1) Check Materials stock from the database. (2) Contact Purchasing Department if materials are not available (3) Getting materials and prepared Material Receipt Note. (4) Forward MRN and Tax invoices to F&A for payment process. (5) Send materials and copy of SIN to Production.
Attachment:	(1) Data Store D3 – Finished Goods (2) Data Store D5 – Inventory (3) Data Store D6 – Job Order (4) Data Store D7 – Material (5) Data Store D8 – Purchase Order (6) Data Store D9 - Supplier

Table D.13 Process Specification of Process 3.3.

Item	Description
Process Name:	Receive and QC checked for Finished Goods
Input:	Finished Goods data Inventory data Job Order Note
Output:	Finished Goods Finished Goods Receive Note (FSRN)
Process:	(1) Receive Finished Goods from Production Line (2) Issue FSRN (3) QC approve and update into the database (4) Send physical Finished Goods to the keeping
Attachment:	(1) Data Store D5 – Inventory

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APPENDIX E

DATA DICTIONARY

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DATA DICTIONARY

Table E.1. Data Dictionary of Confirmation of product specification in Data Flow Diagram.

Object Name	Object Type	Long Description
Confirmation of product specification	Data Flow	*Date + Customer PO Number + Sample of Product + Order Quantity + Unit Of Measure * Customer PO Number = * Digit Number + Character * Order Quantity = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Date = * DD+MM+YY* Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.2. Data Dictionary of Customer Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Customer Information	Data Flow	* Customer Number + Customer Name + Customer Address +Customer telephone number + Customer fax number + E-mail + Customer contact person + Contact person telephone number + Credit Term + Minimum order + Unit of Measure * Customer number = * Digit number + Character * Customer name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Customer Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number *

Table E.2. Data Dictionary of Customer Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Customer Information	Data Flow	District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Customer telephone number = * Digit number * Customer fax number = * Digit number * E-mail = * Character + Digit number * Customer Contact person = * Name of person * Contact telephone number = * Digit number * Credit term = * Digit number * Minimum order = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

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Table E.3. Data Dictionary of Customer Purchase Order in Data Flow Diagram.

Object Name	Object Type	Long Description
Customer Purchase Order	Data Flow	* Purchase order number + Date + Customer Name + Customer Address + Customer telephone number + Customer Fax number Purchase order number = * Customer's purchase order number * Customer's purchase order number = * Digit Number * Date = * DD + MM + YY * Customer Name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Customer Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character *

Table E.3. Data Dictionary of Customer Purchase Order in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Customer Purchase Order	Data Flow	Province = * Character * City = * Character * Zip code = * Digit number * Customer telephone number = * Digit number * Customer fax number = * Digit number * Finished goods description = * Character * Qty = * Digit Number * Price = * Digit Number * Amount = * Digit Number * Total amount = * Digit Number * VAT = * Digit Number * Payment term = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %]

Table E.3. Data Dictionary of Customer Purchase Order in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Customer Purchase Order	Data Flow	Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.4. Data Dictionary of Customer's PO Number in Data Flow Diagram.

Object Name	Object Type	Long Description
Customer's PO number	Data Flow	Customer's PO number = * Digit Number * Digit Number = 0 {number} 9

Table E.5. Data Dictionary of Finished Goods Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Finished Goods Information	Data Flow	* FG number + Finished Goods Description + Qty + UOM* FG number = * Digit Number * Finished goods description = * Character * Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9

Table E.6. Data Dictionary of Finished Goods Receive Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Finished Stock Receive Note	Data Flow	* Date + Production order number + FG number + Finished Goods Description + Qty + UOM * Date = * DD + MM + YY * FG number = * Digit Number * Finished goods description = * Character * Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.7. Data Dictionary of Formula Card in Data Flow Diagram.

Object Name	Object Type	Long Description
Formula Card	Data Flow	* FOC number + FG number + Finished Goods Description + UOM + material number + material description + Qty + waste %+ Machine number * FOC number = * Character + Digit number * FG number = * Digit Number * Finished goods description = * Character * Unit Of Measure = [piece | roll | kilogram | meter] Material number = * Character + Digit number * Material Description = * Character * Qty = * Digit Number * Waste % = * Digit Number * Machine number = * Digit Number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9

Table E.8. Data Dictionary of Job Order Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Job Order Note	Data Flow	* Job number + Date + Customer number + Customer Name +Customer PO number + Finished Goods number + Finished Goods Description + Qty + UOM + shipment Date + Comment * Job number = * Character + Digit number * Date = * DD + MM + YY * Customer number = * Digit number + Character * Customer Name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Customer PO number = * Digit number * FG number = * Digit Number * Finished goods description = * Character * Qty = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter]

Table E.8. Data Dictionary of Job Order Note in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Job Order Note	Data Flow	Shipment Date = * MM + DD + YY * Comment = * Character * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.9. Data Dictionary of Job Order Number in Data Flow Diagram.

Object Name	Object Type	Long Description
Job Order Number	Data Flow	Job Order Number = * Digit Number * Digit Number = 0 {number} 9

Table E.10. Data Dictionary of Material Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Material Information	Data Flow	* Material number + Material Description + UOM + Useful life * Material number = * Character + Digit Number * Material description = * Character * Unit Of Measure = [piece | roll | kilogram | meter] Useful Life = * Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9

Table E.11. Data Dictionary of Material Receive Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Material Receive Note	Data Flow	* MRN number + Date + Material number + Material Description+ Supplier's number + Supplier Name + Invoices number + Qty +UOM + Quality of product * MRN number = * Character + Digit number * Date = * MM + DD + YY * Material Number = * Character + Digit number * Material Description = * Character * Supplier's number = * Character + Digit number * Supplier name = * [Supplier Company name | Name of person] * Supplier Company name = * Character * Name of person = * Character * Invoices number = * Digit number + Character * Qty = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter]

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Table E.11. Data Dictionary of Material Receive Note in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Material Receive Note	Data Flow	Quality of product = * [Good condition | Rejected]* Good condition = condition of product is good Rejected = damaged product Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.12. Data Dictionary of Production Order Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Production Order Information	Data Flow	* Production Order number + Date + Finished goods number + Finished Goods description + Qty + UOM + Material number + Material Description + M_Qty + Waste Qty + Machine number + Expected Qty produced * Production Order number = * Character + Digit number * Date = * MM + DD + YY * Finished goods number = * Character + Digit number * Finished goods Description = * Character* Qty = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter] Material Number = * Character + Digit number * Material Description = * Character * M_Qty = * Digit number * Waste_Qty = * Digit number * Machine number = * Character + Digit number *

Table E.12. Data Dictionary of Production Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Production Order Information	Data Flow	Expected Qty produced = * Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

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Table E.13. Data Dictionary of Purchase Order Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	* Purchase order number + Date + Supplier Name + Supplier Address + Supplier telephone number + Supplier fax number+ E-mail + Contact name + Material number + Material Description + Qty + UOM + Price + Amount + Total Amount + VAT + Shipment Address + Shipment date + Authorized person + Payment term * Purchase Order number = * Digit number * Date = * MM + DD + YY * Supplier name = * [Supplier Company name | Name of person] * Supplier Company name = * Character * Name of person = * Character * Supplier address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number *

Table E.13. Data Dictionary of Purchase Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Supplier telephone number = * Digit number * Supplier fax number = * Digit number * E-mail = * Character + Digit number * Material number = * Digit number * Material description = * Character * Qty = * Digit Number * Price = * Digit Number * Amount = * Digit Number * Total amount = * Digit Number * VAT = * Digit Number *

Table E.13. Data Dictionary of Purchase Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	Shipment address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Shipment date = * MM + DD + YY * Authorized person = * Character * Payment term = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.13. Data Dictionary of Purchase Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.14. Data Dictionary of Purchase Order Number in Data Flow Diagram.

Object Name	Object Type	Long Description
Purchase Order Number	Data Flow	Purchase Order number = * Character + Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.15. Data Dictionary of Reports in Data Flow Diagram.

Object Name	Object Type	Long Description
Reports	Data Flow	* Customer Information + Supplier information + Finished Goods Information + Material Information + Customer Purchase Order + Purchase Order Information + Job Order Note + Material Receive Note + Finished Goods Receive Note + Production Order Information + Stock Issue Note + Daily Inventory Report + Customer List Report + Stock card report + Summary finished goods report * Customer List Report = * Customer number + Customer Name + Customer Address + Contact Person + Credit term * Customer number = * Character + Digit number * Customer name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Customer Address = * Address number + [Road | Street] + District + Province + City + Zip code *

Table E.15. Data Dictionary of Reports in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Reports	Data Flow	Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Customer Contact person = * Name of person * Credit term = * Digit number * Daily inventory report = * Material number + Material description + Finished goods number + Finished goods description + Qty + UOM * Material number = * Character + Digit number * Material description = * Character * Finished goods number = * Character + Digit number *

Table E.15. Data Dictionary of Reports in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Reports	Data Flow	Finished goods Description = * Character* Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 Stock Card Report = * Material number + Material Description + Finished Goods number + Finished Goods Description + Qty + UOM + SIN number + MRN number + FSRN number * Material number = * Character + Digit number * Material description = * Character * Finished goods number = * Character + Digit number * Finished goods Description = * Character* Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] MRN number = * Character + Digit number *

Table E.15. Data Dictionary of Reports in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Reports	Data Flow	SIN number = * Character + Digit number * FSRN number = * Character + Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 Summary finished goods report = * Finished Goods number + Finished Goods Description + Qty + UOM * Finished goods number = * Character + Digit number * Finished goods Description = * Character* Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.16. Data Dictionary of Shipment Schedule Reports in Data Flow Diagram.

Object Name	Object Type	Long Description
Shipment schedule report	Data Flow	* Job Order number + Customer Number + Customer name + Customer PO number + Finished goods number + Finished Goods description + Qty + UOM + Shipment Date + Shipment address * Job order number = * Character + Digit number * Customer number = * Character + Digit number * Customer name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Customer PO number = * Digit number + Character * Finished goods number = * Character + Digit number * Finished goods description = * Character * Qty = * Digit number * UOM = * Unit of Measure* Unit of measure = [piece | roll | kilogram | meter] Shipment Date = * MM + DD + YY *

Table E.16. Data Dictionary of Shipment Schedule Reports in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Shipment schedule report	Data Flow	Shipment address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.17. Data Dictionary of Stock Requirement Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Stock Requirement Note	Data Flow	* Requirement number + Date + Material number + Material description + Qty + UOM + Expected shipment date * Requirement number = * Character + Digit number * Date = * MM + DD + YY * Material number = * Character + Digit number * Material description = * Character * Qty = * Digit number * UOM = * Unit of Measure* Unit of measure = [piece | roll | kilogram | meter] Expected Shipment Date = * MM + DD + YY * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.18. Data Dictionary of Supplier Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Supplier Information	Data Flow	* Supplier Number + Supplier Name + Supplier Address + Supplier telephone number + Supplier fax number + E-mail + Supplier contact person + Contact person telephone number + Credit Term + Minimum order + Unit of Measure * Supplier number = * Digit number + Character * Supplier name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Supplier Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character *

Table E.18. Data Dictionary of Supplier Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier Information	Data Flow	City = * Character * Zip code = * Digit number * Supplier telephone number = * Digit number * Supplier fax number = * Digit number * E-mail = * Character + Digit number * Supplier Contact person = * Name of person * Contact telephone number = * Digit number * Credit term = * Digit number * Minimum order = * Digit number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.19. Data Dictionary of Supplier's Invoice in Data Flow Diagram.

Object Name	Object Type	Long Description
Supplier's invoice	Data Flow	* Supplier invoice number + Invoice Date + Supplier name + Supplier Address + Supplier telephone number + Supplier fax number + material number + material description + Qty + UOM + Price + Amount + Total amount + VAT + Authorized person + Payment term * Supplier invoice number = * Character + Digit number * Invoice Date = * MM + DD + YY * Supplier name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Supplier Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number *

Table E.19. Data Dictionary of Supplier's Invoice in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier's invoice	Data Flow	Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number * Supplier telephone number = * Digit number * Supplier fax number = * Digit number * Material number = * Character + Digit number * Material description = * Character * Qty = * Digit Number * Price = * Digit Number * Amount = * Digit Number * Total amount = * Digit Number * VAT = * Digit Number * Payment term = * Digit number *

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Table E.19. Data Dictionary of Supplier's Invoice in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier's invoice	Data Flow	Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.20. Data Dictionary of Data Store 1 : Customer.

Object Name	Object Type	Long Description
D1 Customer	Data Store	*Customer number + Customer name + Customer Address + Telephone Number + Fax Number + E-mail + Contact person + Tax ID Number + Credit Term + Create Date * Customer number = * Digit number + Character * Customer name = * [Company's name | Name of person]* Company name = * Character + Digit number * Name of person = * Character * Customer Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number *

Table E.20. Data Dictionary of Data Store 1: Customer (Continued).

Object Name	Object Type	Long Description
D1 Customer	Data Store	Telephone number = * Digit number * Fax number = * Digit number * E-mail = * Character + Digit number * Customer Contact person = * Name of person * Credit term = * Digit number * Create Date = * MM + DD + YY * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.21. Data Dictionary of Data Store 2: Employee.

Object Name	Object Type	Long Description
D2 Employee	Data Store	* Employee number + Name + Surname + Position +Department + Password * Employee number = * Digit number * Name = * Character * Surname = * Character * Position = * Character * Department = * Character * Password = * Character + Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.22. Data Dictionary of Data Store 3: Finished Goods.

Object Name	Object Type	Long Description
D3 Finished Goods	Data Store	* FG number + Finished Goods Description + Qty + UOM* FG number = * Digit Number * Finished goods description = * Character * Qty = * Digit Number * Unit Of Measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9

Table E.23. Data Dictionary of Data Store 4: Formula Card.

Object Name	Object Type	Long Description
D4 Formula Card	Data Store	* FOC number + FG number + Finished Goods Description + UOM + material number + material description + Qty + waste % + Machine number * FOC number = * Character + Digit number * FG number = * Digit Number * Finished goods description = * Character * Unit Of Measure = [piece | roll | kilogram | meter] Material number = * Character + Digit number * Material Description = * Character * Qty = * Digit Number * Waste % = * Digit Number * Machine number = * Digit Number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0 {number} 9

Table E.24. Data Dictionary of Data Store 5: Inventory Transaction.

Object Name	Object Type	Long Description
D5 Inventory Transaction	Data Store	* Transaction number + Transaction Date + Employee number+ Qty + UOM + Finished goods number + Material number +Reference number + Job Order number * Transaction number = * Character + Digit number * Transaction Date = * MM + DD + YY * Employee number = * Digit number * Qty = * Digit Number * UOM = * Unit of Measure* Unit of measure = [piece | roll | kilogram | meter] Finished Goods number = * Character + Digit number * Material number = * Character + Digit number * Reference number = * Character + Digit number * Job Order number = * Character + Digit number * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.24. Data Dictionary of Data Store 5: Inventory Transaction (Continued).

Object Name	Object Type	Long Description
D5 Inventory Transaction	Data Store	MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.25. Data Dictionary of Data Store 6: Job Order Note.

Object Name	Object Type	Long Description
D6 Job Order Note	Data Store	* Job Order number + Finished goods number + Customer Number + Qty + Unit of Measure + Shipment Date + Customer PO number + Credit Term * Job Order number = * Character + Digit number * Finished Goods number = * Character + Digit number * Customer number = * Character + Digit number * Qty = * Digit number * Unit of measure = [piece | roll | kilogram | meter] Shipment Date = * MM + DD + YY * Customer PO number = * Character + Digit number * Credit Term = * Digit Number* Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.26. Data Dictionary of Data Store 7: Material.

Object Name	Object Type	Long Description
D7 Material	Data Store	* Material number + Material description + Useful life + UOM + Source * Material number = * Character + Digit number * Material description = * Character * Useful life = * Digit number * UOM = * Unit of Measure* Unit of measure = [piece | roll | kilogram | meter] Source = * Character * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9

Table E.27. Data Dictionary of Data Store 8: Purchase Order.

Object Name	Object Type	Long Description
D8 Purchase Order	Data Store	* PO number + PO Date + Supplier number + Material number + Qty + UOM * PO number = * Character + Digit number * PO Date = * MM + DD + YY * Supplier number = * Character + Digit number * Material number = * Character + Digit number * Qty = * Digit number * UOM = * Unit of Measure* Unit of measure = [piece | roll | kilogram | meter] Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

Table E.28. Data Dictionary of Data Store 9: Supplier.

Object Name	Object Type	Long Description
D9 Supplier	Data Store	*Supplier number + Supplier name + Supplier Address + Telephone Number + Fax Number + E-mail + Contact person + Tax ID Number + Credit Term + Create Date * Supplier number = * Digit number + Character * Supplier name = * [Company's name | Name of person] * Company name = * Character + Digit number * Name of person = * Character * Supplier Address = * Address number + [Road | Street] + District + Province + City + Zip code * Address number = * Digit number + Character * Road = * Character + Digit number * Street = * Character + Digit number * District = * Character * Province = * Character * City = * Character * Zip code = * Digit number *

Table E.28. Data Dictionary of Data Store 9: Supplier (Continued).

Object Name	Object Type	Long Description
D9 Supplier	Data Store	Telephone number = * Digit number * Fax number = * Digit number * E-mail = * Character + Digit number * Supplier Contact person = * Name of person * Credit term = * Digit number * Create Date = * MM + DD + YY * Character = [A-Z | 0-9 | / | & | %] Digit Number = 0{number}9 MM = 1 { number } 12 DD = 1 { number } 7 YY = 00 { number } 99

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APPENDIX F

STRUCTURE CHART

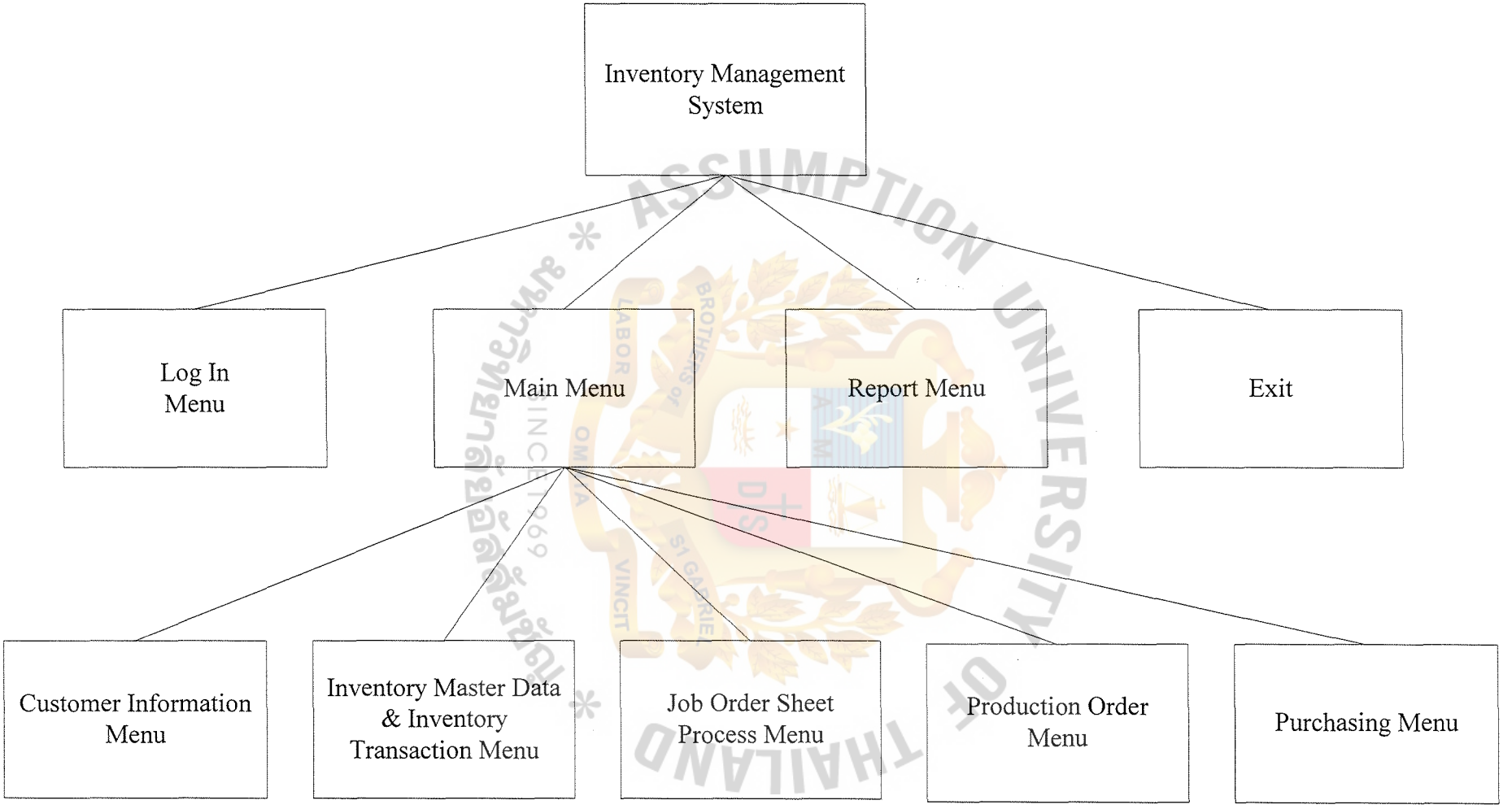

Figure F.1. Structure Chart of Main Menu.

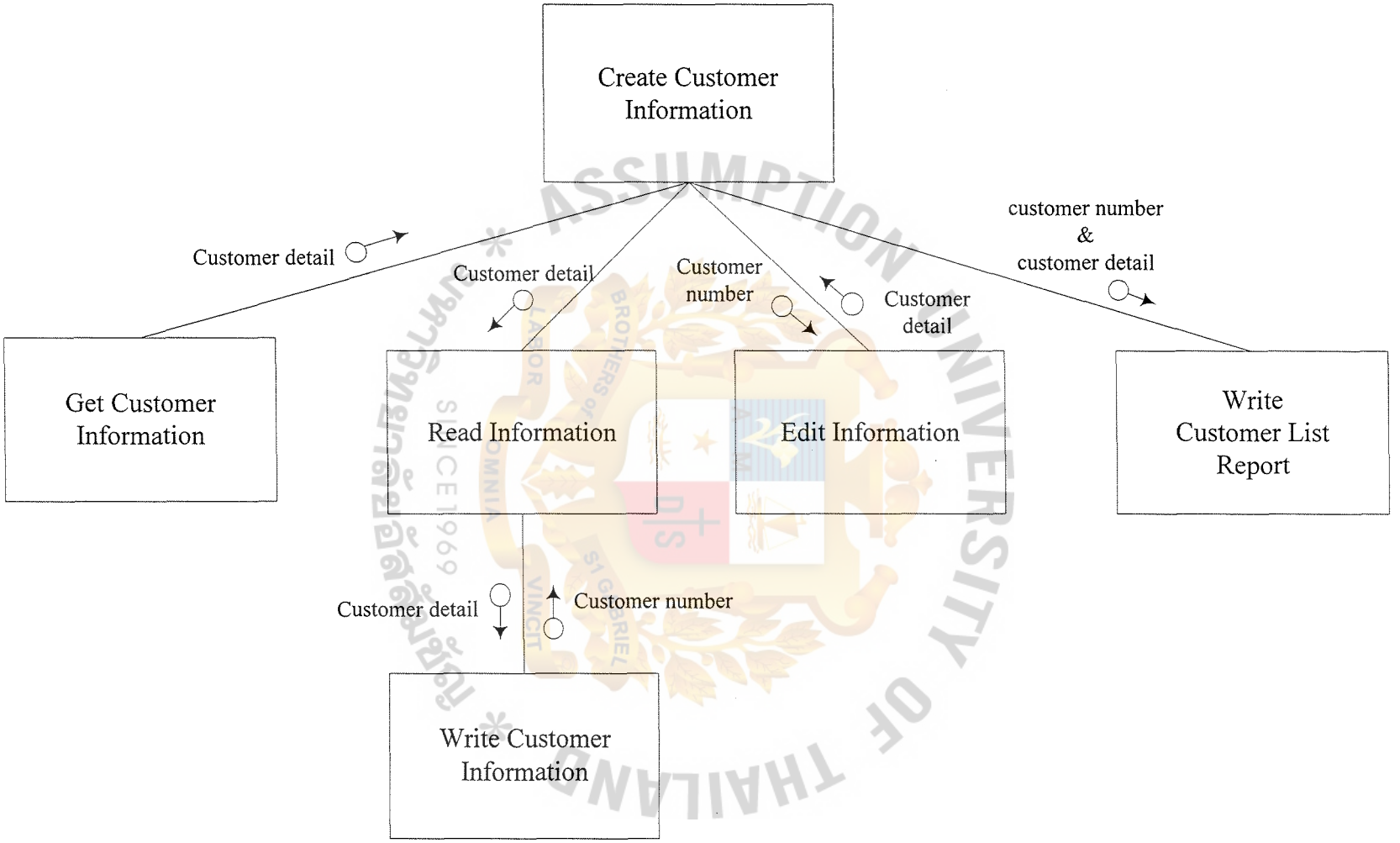

Figure F.2. Structure Chart of Customer Menu.

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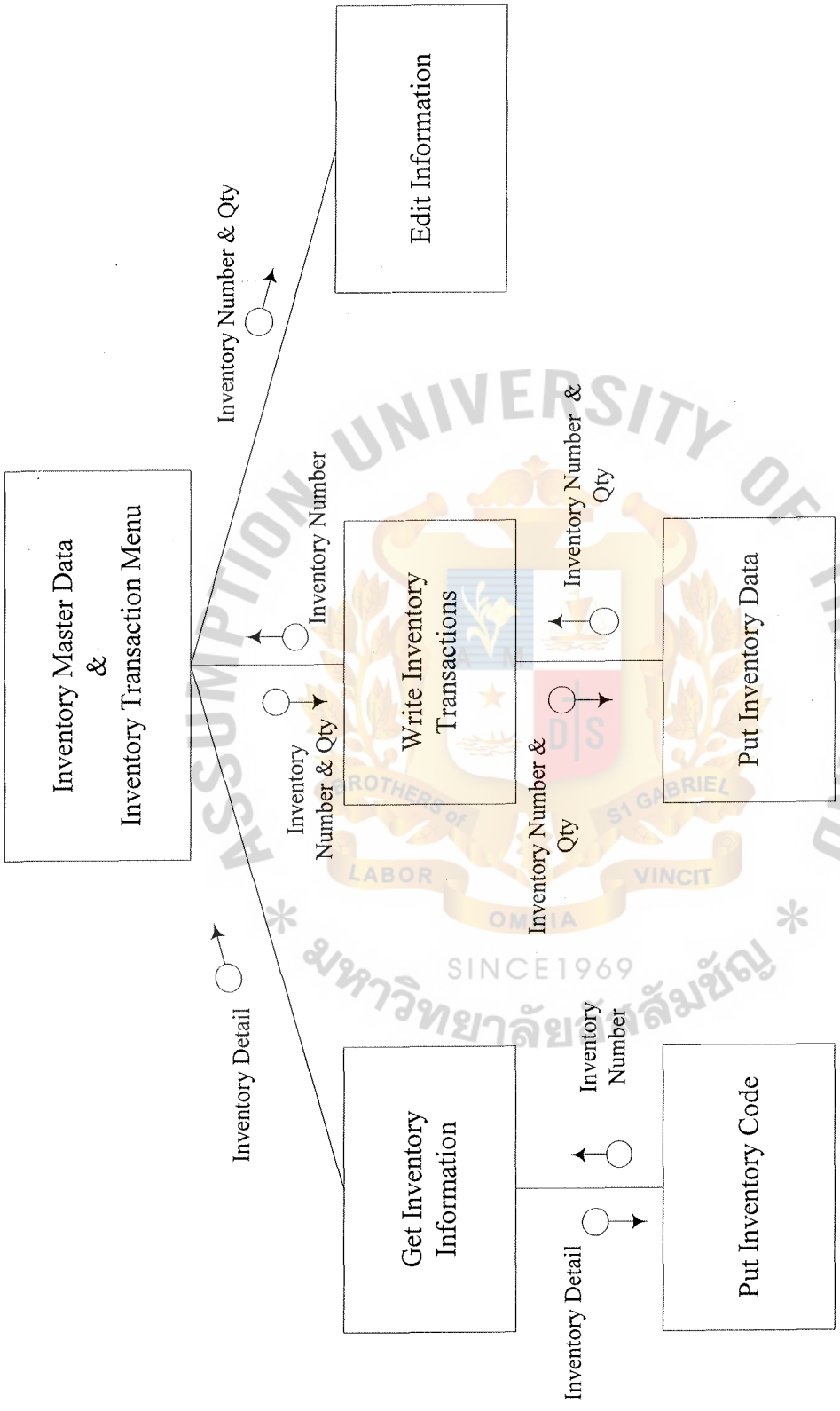

Figure F.3 Structure Chart of Inventory Menu.

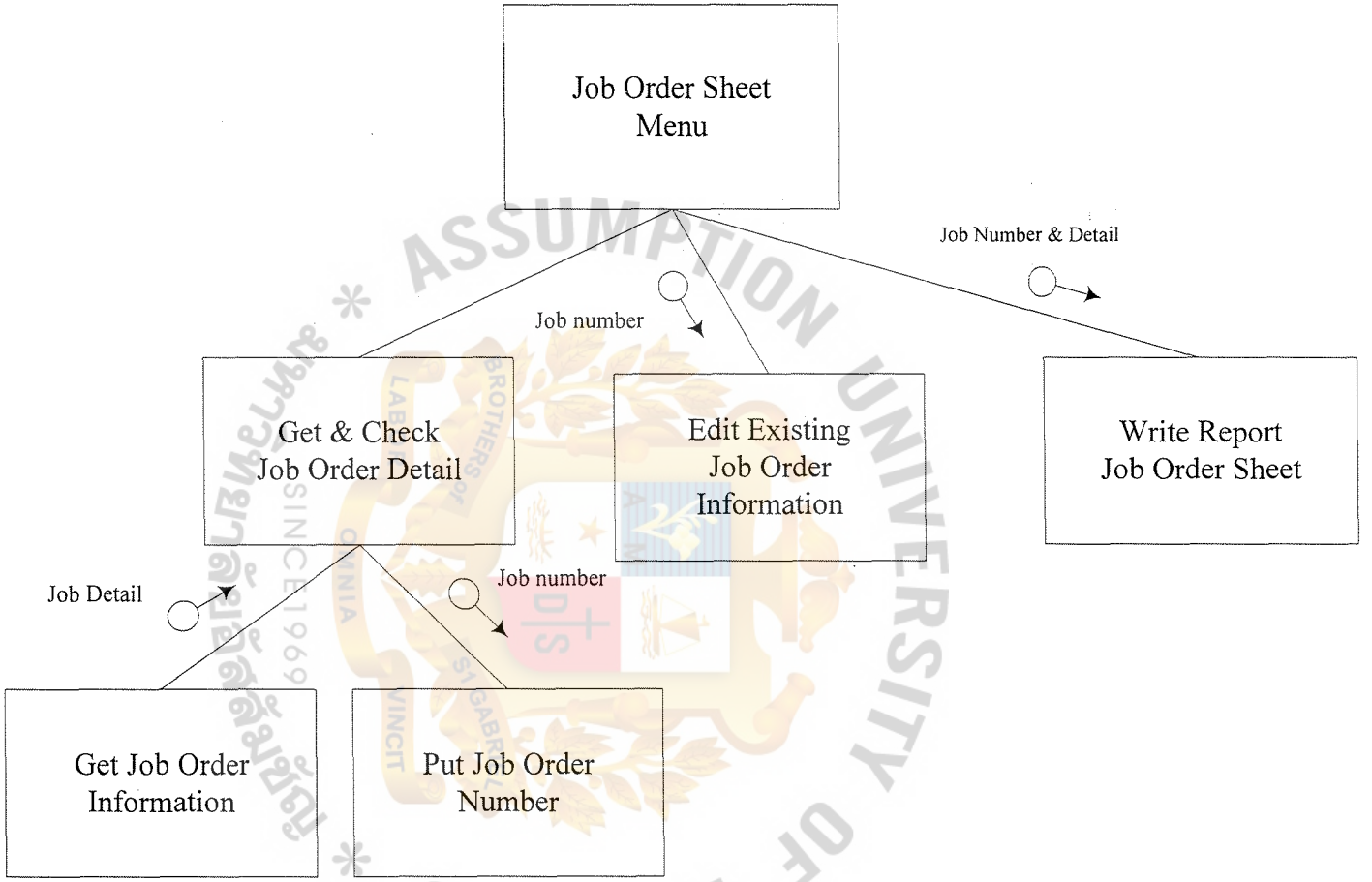

Figure F.4. Structure Chart of Job Order Sheet Menu.

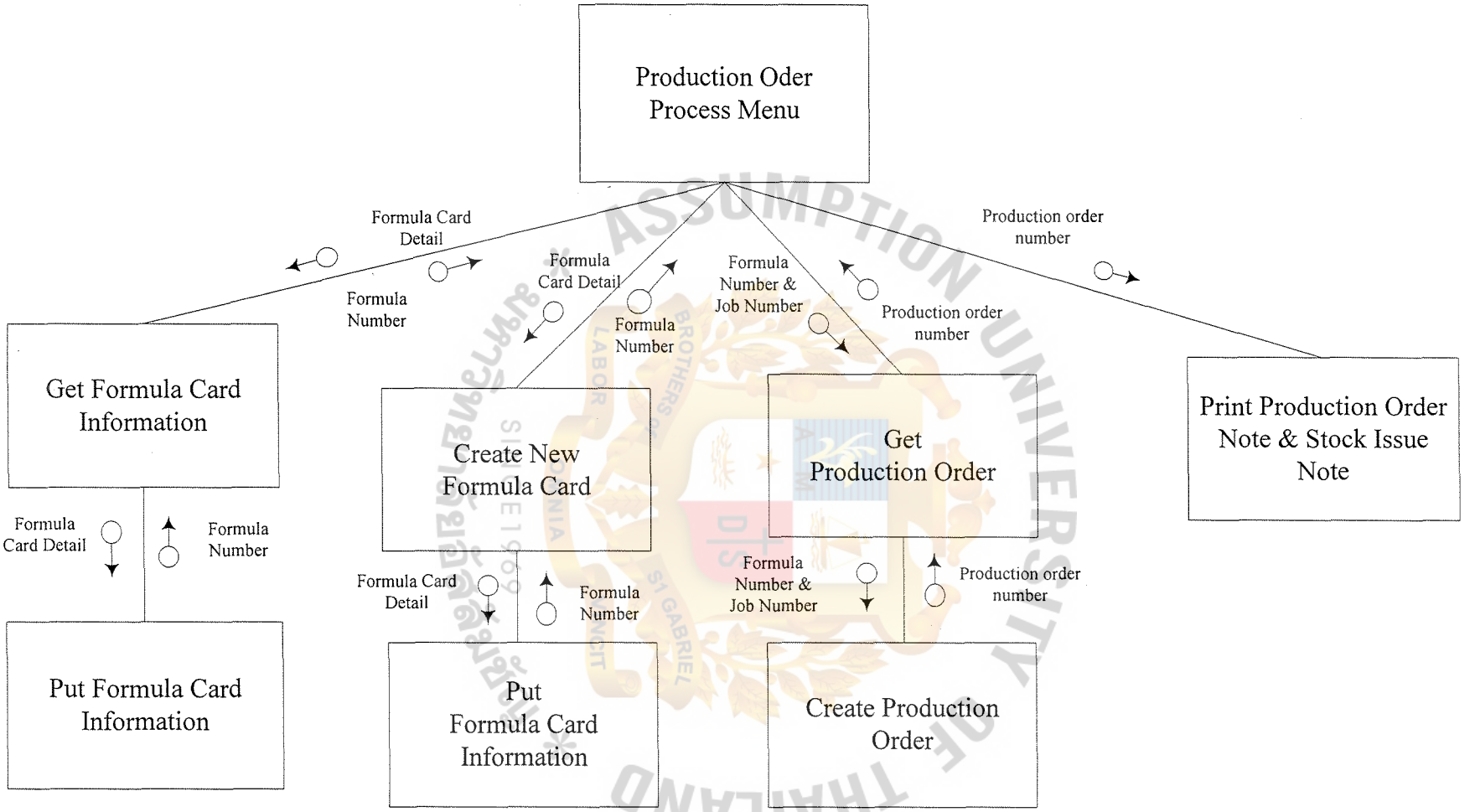

Figure F.5. Structure Chart of Production Order Process Menu.

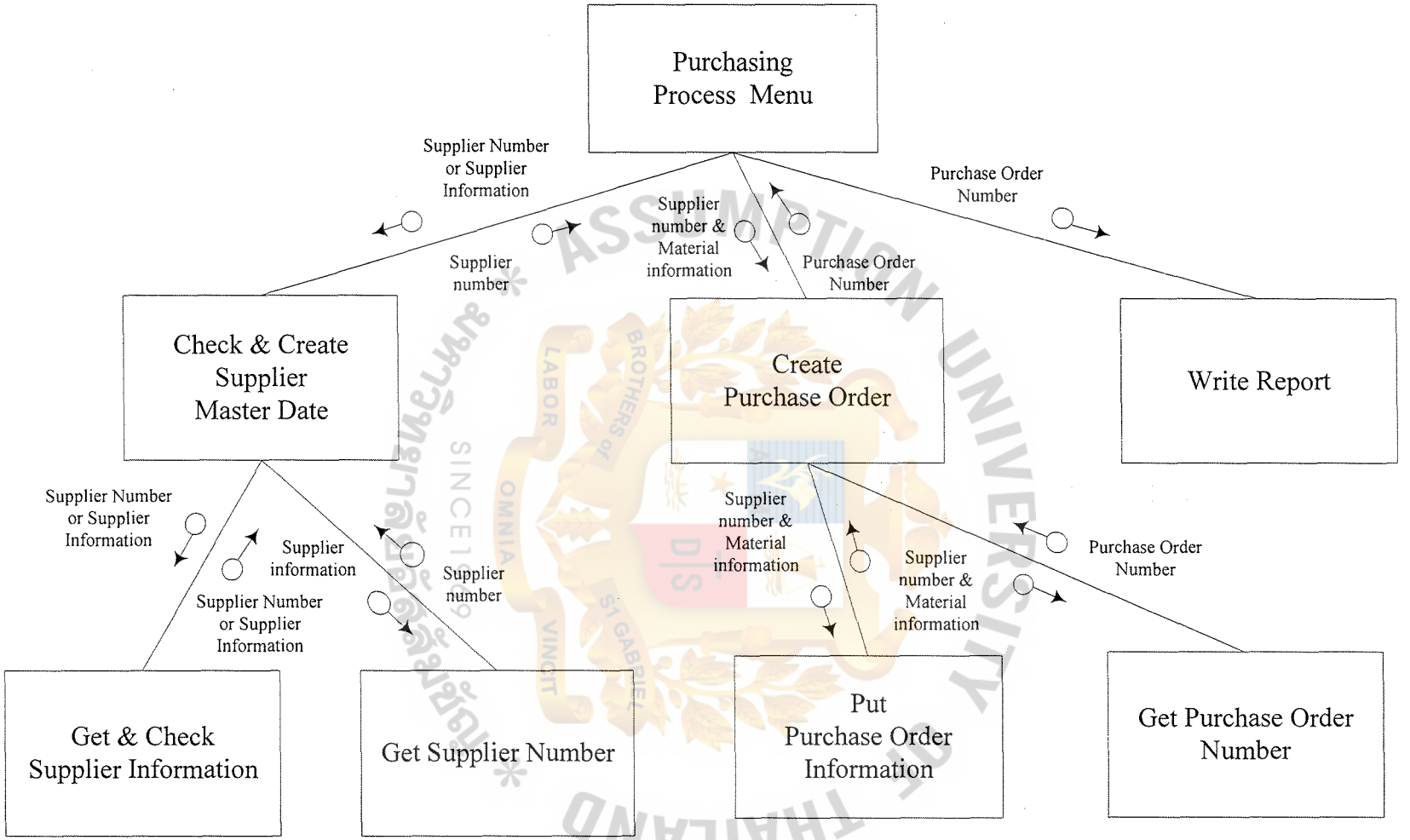

Figure F.6 Structure Chart of Purchasing Process Menu.

APPENDIX G

ENTITY RELATIONSHIP DIAGRAM

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Figure G.1. ER Diagram of the Proposed System: Session 1.

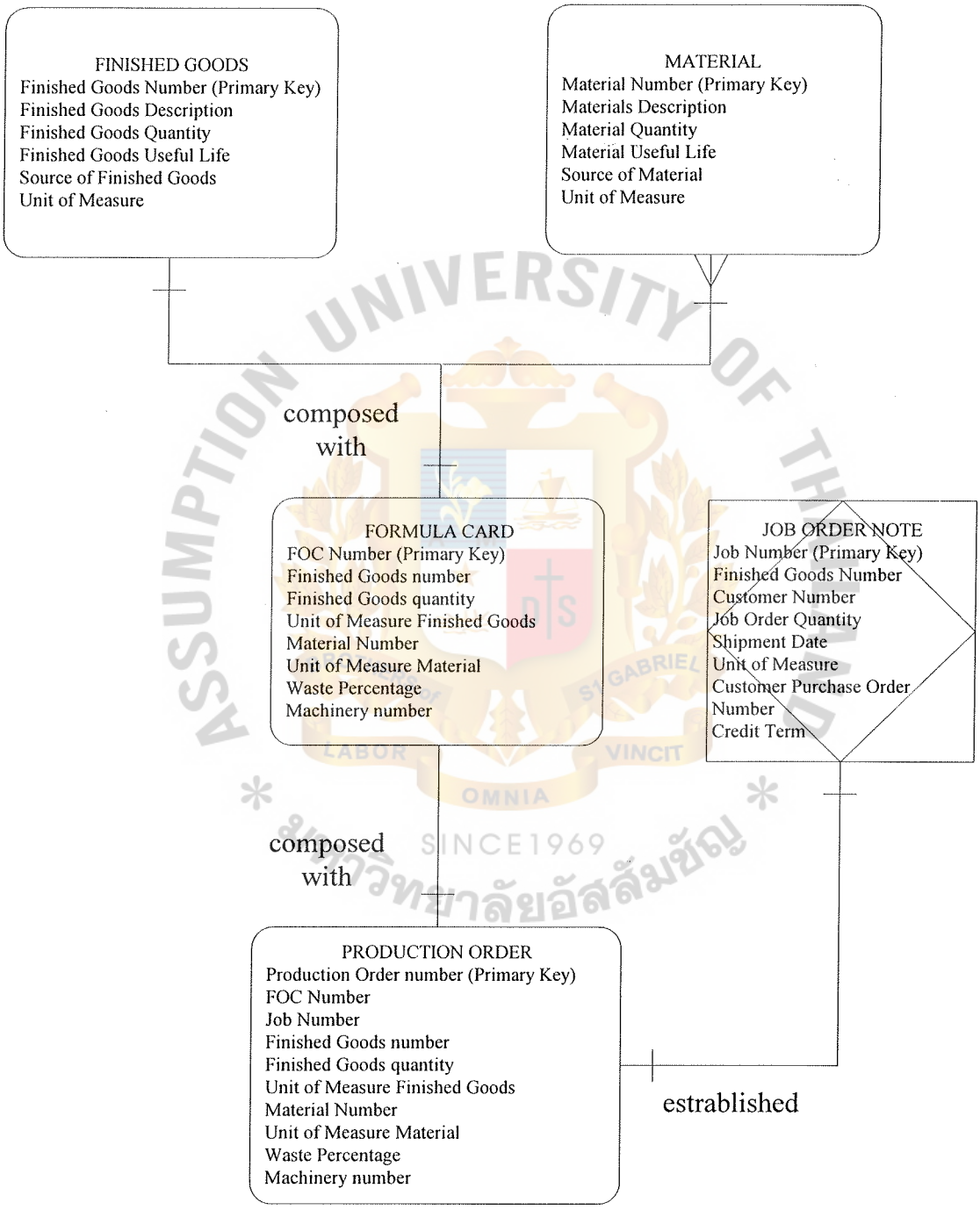

Figure G.2. ER Diagram of the Proposed System: Session 2.

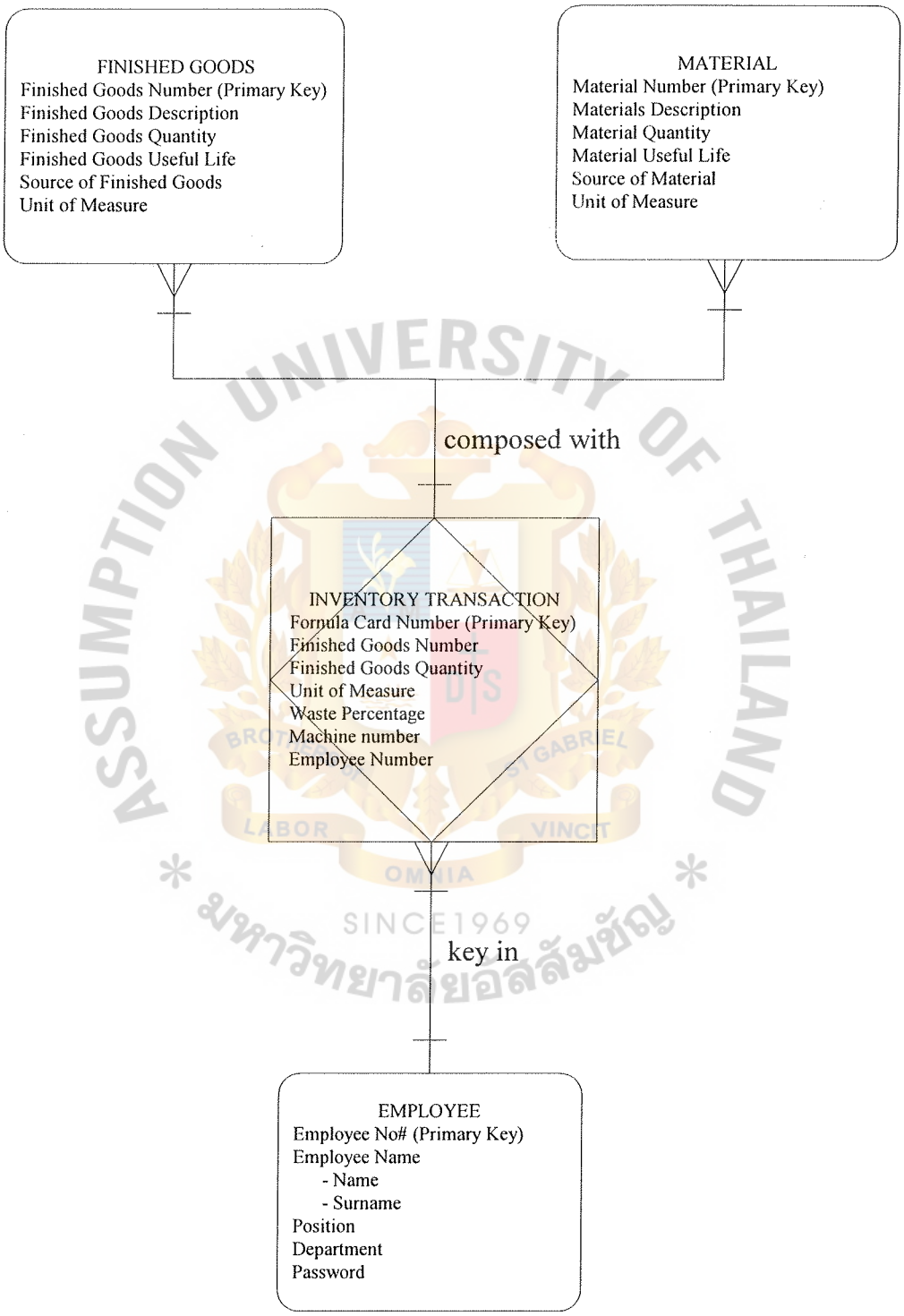

Figure G.3. ER Diagram of the Proposed System: Session 3.

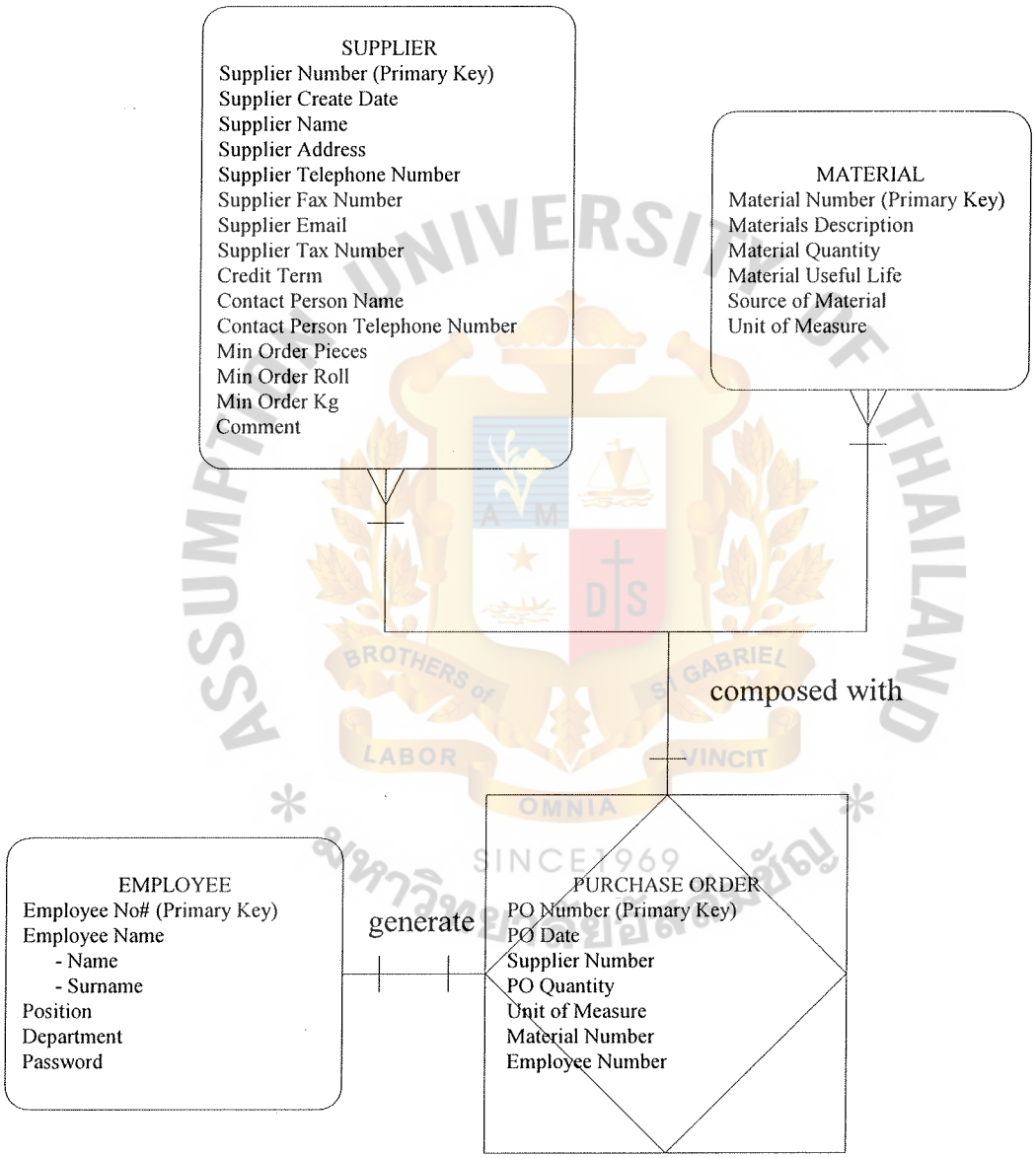

Figure G.4. ER Diagram of the Proposed System: Session 4.

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