



Spare Part Inventory System of  
GAP Manufacturing Company

by

Mr. Amnaj Phandhufung

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

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Project Title                      Spare Part Inventory of GAP Manufacturing Company

Name                                Mr. Amnaj Phandhufung

Project Advisor                   Air Marshal Dr. Chulit Meesajjee

Academic Year                    March 17, 2002

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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.

Approval Committee:



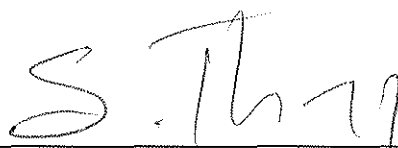
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## ABSTRACT

This project presents the understanding of the Spare parts Inventory Management System of GAP Manufacturing Co., Ltd. providing an overview of the company structure, processes, workflow and data transactions. From the study of the existing system, the major problem of the existing system is use of the manual system. Although there are working papers to control each steps of processes, the transactions are not accurate. The quality of physical spare parts in storeroom is not equal with report number via manual system. And it is very difficult and taking more time to search the information such as level of the outstanding balance in stock. This inconsistency is major cause of shortage spare parts in storeroom when needs from production line. And cost from not running production line is seriously problems which company needs to eliminate it as first priority too. The existing system is a manual system, although some reports are printed out by using computer but still have manually tracked in paper work needs to be done. As cost of the system are increasing every year due to company expansion in new production line based on business opportunity. So the accuracy and efficiency system is required to achieve the company goal.

To develop the spare parts management system from the existing system, which is a manual system, to computerized system is the main objective of this project. The proposed system concentrate on spare parts inventory transactions from starting point till ended consumptions in each production line. This project will exclude the accounting and costing for the inventory transactions. The project does not require huge initial investment and the payback period of the project is not very long. The company needs to invest in both hardware and software which costly first year of the investment, which will be recovered in a few years. So it will be very useful for the company to

change its system to be a computerized system.

To fulfill and satisfy users' requirements, the writer had used many methodologies such as interviewing, observation and various types of questionnaire. Project manager and staffs of company do evaluation of the project using white box testing methodology as a tool to test the system. And making program is more user friendly, the screen design and output design concentrate more on users' requirements.

As project completion, the management of the GAP manufacturing Co., Ltd. has a plan to develop other work processes apart from this project scope. For example, developing work processes for maintenance tracking tools and maintenance processing system for all production lines in company and costing system, which is related to maintenance processing system. The maintenance processing system can use the success of this project as fundamental information during analysis and design phase too. This next phases plan to ready for starting around next couple months later.

## ACKNOWLEDGEMENTS

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He expresses his thankfulness to the management and staffs of GAP manufacturing Co., Ltd., for their cooperation and kindness. They give a lot of valuable information and comments during the preparation of this project.

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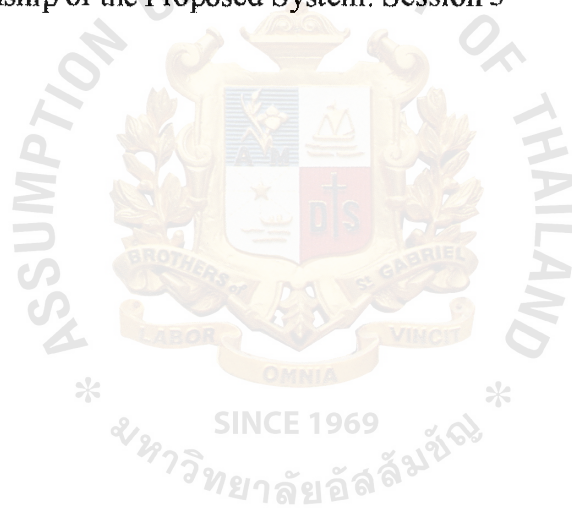


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## **I. INTRODUCTION**

### **1.1 Background of the Project**

Nowadays, consumer product business performs and grows at very high growth rates in Thailand. The total market share are many billions Thai baht value for Thailand market. Especially for GAP manufacturing company, the business growth rate has grown very sharply from the past until now even though our country had faced the tragedy of economic crisis the last couple of years ago.

The business environment and technology have changed rapidly. And also a number of competitors in this business are also increasing everyday. In order to maintain business growth rate, company could not only use pricing strategies but also system analysis and design.

Work redundancy is one major problem which makes inefficiency in company's operation. Some work processes may be too complicated to be performed by company's staffs. And some processes overlapped the others. To solve this problems, company needs to study current workflow, identify and analyze the problems in each particular process, design processes that match company's environment.

Many manual processes caused human errors and inaccurate data input. Sometimes company also spends more time in producing various reports and paper work manually. This also increases more human efforts and operating cost of company. Using information technology is considered to be one best solution for a company that would like to maintain current business among competitors.

Spare parts inventory management system is one pilot of many projects in developing company's information system for GAP manufacturing company. This information system will accelerate company's work processes with highest efficiency,

reduce any redundancy and increase company's profit at final day. Company will study about work processes in order to identify specific problems within the whole process. Then analysis and design of new proposed system will be conducted in order to match the most suitable computer system which is best suited for business conditions.

## **1.2 Objectives of the Project**

The objectives of "Spare parts Inventory Management System" are as follows:

- (1) To study and analyze current existing system.
- (2) To evaluate key problems of current system
- (3) To analyze and design the system development for Spare parts Inventory Management.
- (4) To design controlling process for the spare parts inventory information.
- (5) To generate the user-friendly report to support decision making of management.
- (6) To reduce the paper work and non-value added activities in organization.
- (7) To provide both real time and accurate information for spare parts inventory level in the storeroom.
- (8) To reengineer storeroom inventory system by using computerized system.
- (9) To standardize work process for spare parts inventory control system.
- (10) To support spare parts supplies to production line at on time basis.
- (11) To manage minimize spare parts stock keeping unit in storeroom which provides high efficiency support to production line.

### **1.3 Scope of the Project**

This project will focus to develop only the new system for spare parts inventory in storeroom department. The responsible area of storeroom department is only one central storeroom for spare parts inventory management of GAP manufacturing plant. This does not include only software development but also provides information about logical and technical design including system input and output design. The spare parts inventory management system comprises of majority activities as follows:

- (1) Collecting information and requirements by interviewing employees in the storeroom department, other related department and managing director for better understanding the operation and recognize any problems of the existing system.
- (2) Studying forms, reports and any existing documents required by Finance & Accounting Department, managing director and other external parties such as Revenue Department.
- (3) The Spare parts Inventory Management System will provide the graphic user interface screen to enter or query the data.
- (4) The Spare parts Inventory Management System will provide the reports, which serve the needs and requirements from Managing Director, Finance & Accounting Department and other external parties such as Revenue Department.
- (5) To install Spare parts Inventory Management System.
- (6) To provide training class and user manual to related users.
- (7) Post implementation and follow up.



## 1.4 Deliverables

The deliverables for spare parts inventory management system are as follows:

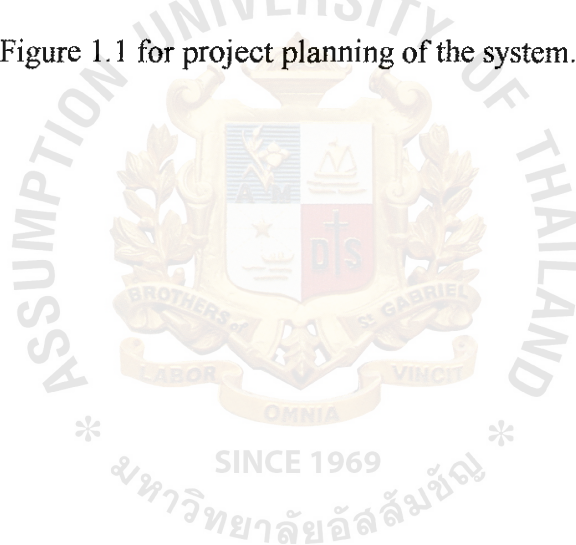
- (1) Relational Database, which is developed using Microsoft Access. The Database comprises 8 tables. These tables are as follows:
  - (a) Employee Database Table
  - (b) Spare parts Inventory Master Data Database Table
  - (c) Spare parts Inventory Transaction Database Table
  - (d) Supplier Database Table
  - (e) Purchase Order Database Table
  - (f) Production Line Database Table
  - (g) Storeroom Storage Location Database Table
  - (h) Maintenance Order 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) Daily Spare Parts Inventory Report
  - (b) Monthly Spare Parts Inventory Report
  - (c) Purchase Order Report
  - (d) Stock Card Report
  - (e) Daily Spare Parts Inventory Receipt Report
  - (f) Monthly Spare Parts Inventory Consumption Report
  - (g) Spare Parts Inventory Report by Location
  - (h) Spare Parts Discrepancy Report
  - (i) Spare Parts Out of Stock Report

(j) Spare Parts Incoming List Report

### 1.5 Project Plan

The schedule of the whole project is about 6 months. The project is divided into 3 major phases: studying and analysis of 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 system analyst can start the system design of the proposed system, which will take about one and a half months to finish the system design.

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



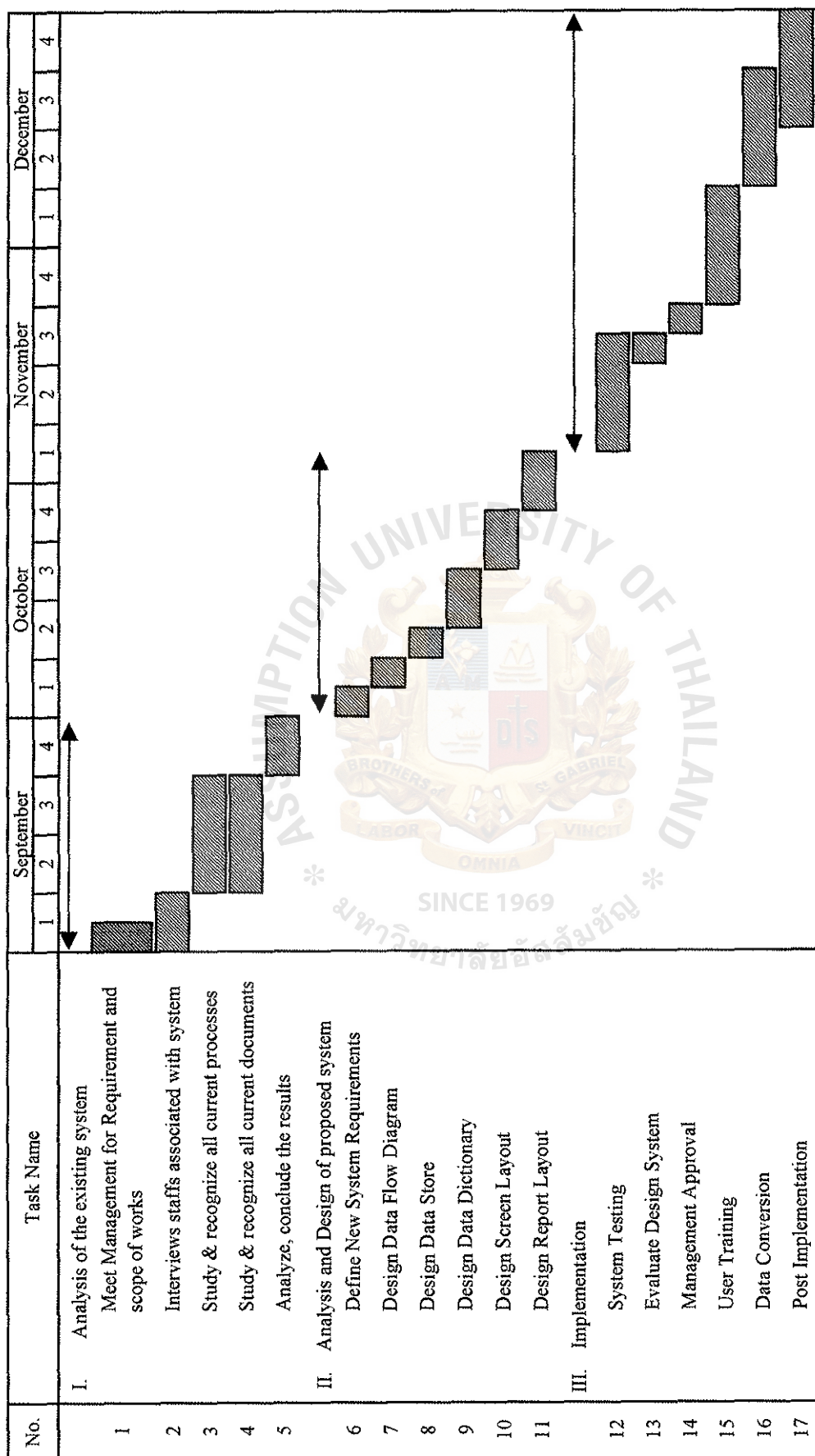


Figure 1.1. Project planning of Spare Parts Inventory Management System of GAP Manufacturing Company.

## **II. THE EXISTING SYSTEM**

### **2.1 Background of the Organization**

GAP Manufacturing Company was established in 1990 by a group of people who has experience in consumer products. Location of this company is on Bang na Trad Km 18, Samutprakarn province.

GAP Manufacturing company is a medium size company. The main products of GAP manufacturing company are in hair care business such as shampoo and conditioner. As the consumer product market is a huge market in Thailand, which had a total share value of more than five billion bath last year. So GAP company has planned to expand its production capacity for supplying growth of customer needs in the next couple years.

For reaching production high volume level, company needs to have effective controlling maintenance plan for each operation line. The main major problems of every production line is having more shut down time than expected. And each time of shut down operation line caused more high cost which is composed of people cost, electricity cost, product damage during shut down time of operation and so on. And spare parts material availability is the main problem for shut down time of operation. So company needs to have plans to have spare parts availability enough for every production line to prevent shutting down time of each production line.

There are many kinds of spare parts materials that are difficult to control by a manual system such as gearboxes and motors. So company needs to have automated system to control material availability and provide accurate information system to support management decisions for spare parts material acquisition.

The Figure 2.1 will illustrate the organization chart of GAP manufacturing system. The organization chart shows the Managing Director is at top level of the company. The Managing Director has many Assistant Managing Directors for each departments such as Production department, Quality Assurance department, Purchasing department, Human Resource department, Finance and Accounting department, Logistic and planning department, Warehouse and Store Room department. All these departments will report directly to the Managing Director. Each staff directly reports to their managers. Especially for assistant managing director for warehouse and storeroom department, who will have responsibility for two managers. One responsible for storeroom, which keeps only spare parts inventory, and the other responsible for warehouse, which keeps other inventories such as raw materials and finished goods products.

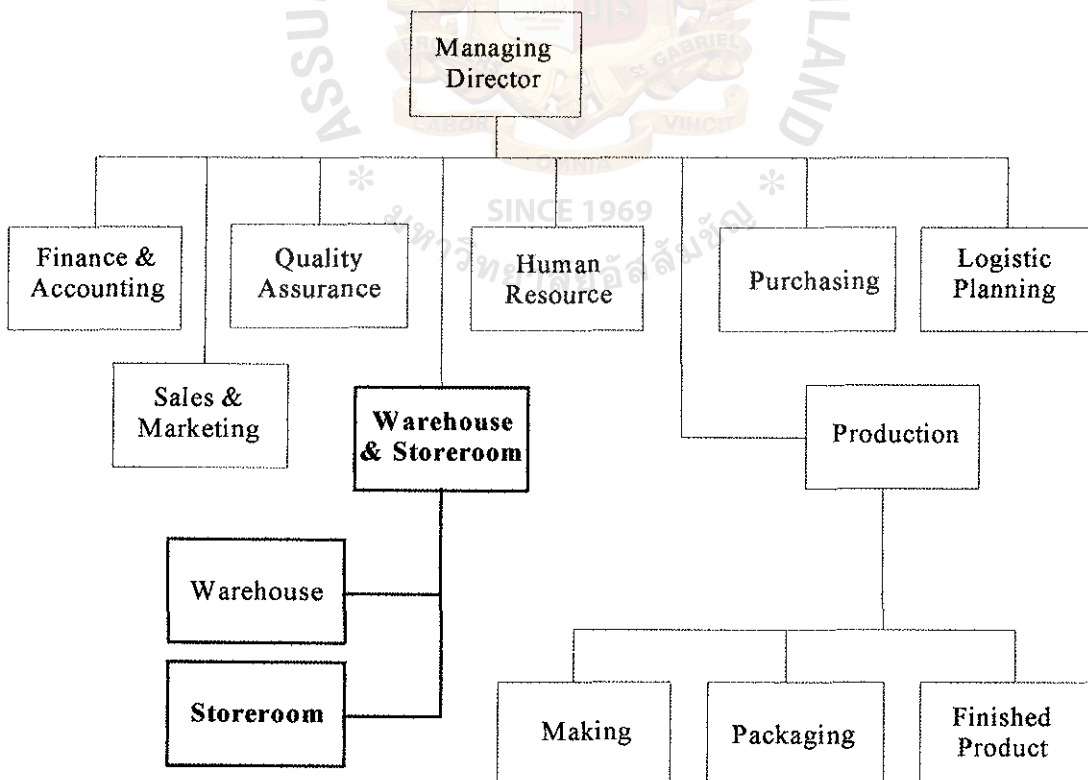


Figure 2.1. Organization Chart.



## 2.2 Evaluation of Problems

The system analysis is conducted through information collection on how current systems work. Information collection is based on two sources of data. First is primary sources of data have been collected from ended users and key users of system while secondary sources of data have been collected from all documentations and reports. The methods of gathering information are: personal interviews, providing questionnaires, observation of work process from company staffs.

The problems of the existing system and improvement areas are:

(1) Data Accuracy problems.

Normally, daily spare parts inventory report is prepared every morning. The report was provided via manual system. And it is difficult to guarantee data accuracy since the inventory transactions did not record immediately. And in order to get inventory balance at storeroom, manual-tracking system need to be done for reconciliation. Sometime, spare parts inventory balance report has discrepancy against physical balance.

(2) Over stocking of slow moving spare parts inventory and Shortage of fast moving spare parts inventory

Since the correct spare parts inventory balance is difficult to define, sometimes it is very difficult for Purchasing Officers in planning to place purchase order. And also it is difficult to plan delivery date too. Based on the cause of this problem, spare parts planner may have difficulty to forecast spare parts inventory level in storeroom too. Sometime purchase officers acquire too much slow moving items while they stop ordering fast moving items. And this will cause spare parts shortage in storeroom that may affect

operation line to shut down when operation line need spare parts replacement.

(3) Weak internal control of Spare parts inventory system

Some officers who do not have any authorization can enter storeroom area. And this will cause spare parts inventory moving or missing without any record.

(4) Time consuming to generate useful report

Since all processes are done with a manual system and do not have any proper information collection system, it consumes more time in prepare one report. For example, in order to prepare monthly spare parts inventory report, storeroom officers need to spend more than five working days to generate and reconcile spare parts inventory report.

(5) Too much paper work

Many documents need to be prepared in order to have enough satisfying results of data accuracy. For example, when storeroom officers find any spare parts inventory stock discrepancy, they need to reconcile and track from many documents. Because of manual system, documentations are kept in many places and many departments, so storeroom officers need some time in asking required documentation from other departments and getting response back from that department.

### **2.3 Analysis and Selection of Alternative**

From the evaluation of the current existing system problems, we can see that the manual system is the major cause of the problems. It creates many human errors in data input process and some delay in work processes. 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 spare parts inventory movement on production department.
- (2) Improve accuracy and consistency of data in storeroom.
- (3) Reduce the redundancy of paper work.
- (4) Support number of transactions increasing in the future with less cost and space utilization.
- (5) Reduce time in preparing spare parts inventory report.

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 transitional period.
- (3) High maintenance cost.

After comparing both advantages and disadvantages, 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 system itself. So the computer-based system is recommended in this project. Then 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, 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 spreadsheets and other office packages from the market. This can reduce cost of developing the new system.

Although the company can buy some application software from any vendor, there are still some systems such as maintenance order system that have to be developed specially for the company. There are many specific conditions for the purchasing and maintenance processes that are totally different from any other businesses.

To avoid many modification costs, which will be incurred in order to modify the software packages to fit the company's requirement, the author of this project choose to develop the spare parts inventory management system. However, for other general purpose system, it is cheaper for the company to buy from the vendors than developing them itself.

Note that the existing system of spare parts inventory management information system for GAP manufacturing Co., Ltd. is based on manual in performing work

- (1) Storeroom planner checks spare parts inventory stock level via Daily Spare parts report.

- (2) If spare parts inventory stock level is lower than safety stock level, the out of stock report needs to be prepared and submitted to Purchasing Department in order to place purchase order to suppliers.
- (3) After suppliers sent spare parts to storeroom department, storeroom staffs will check quality of spare parts randomly and check quantity based on purchase order. For any quantity discrepancy, purchasing staffs need to update purchase order in order to equal quantity. There is no enough control system between Purchasing Department and storeroom.
- (4) Copy of purchase order and Tax invoices will be sent to Finance and Accounting department for payment process.
- (5) Production issue Spare parts issue note in order to request spare parts in replacement in production line.
- (6) Monthly Spare Parts Inventory Consumption will be prepared to production Department manager every month for tracking their expense.
- (7) Storeroom staff will prepare monthly summary spare parts inventory balance during month-end to Finance and Accounting department and Management.

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



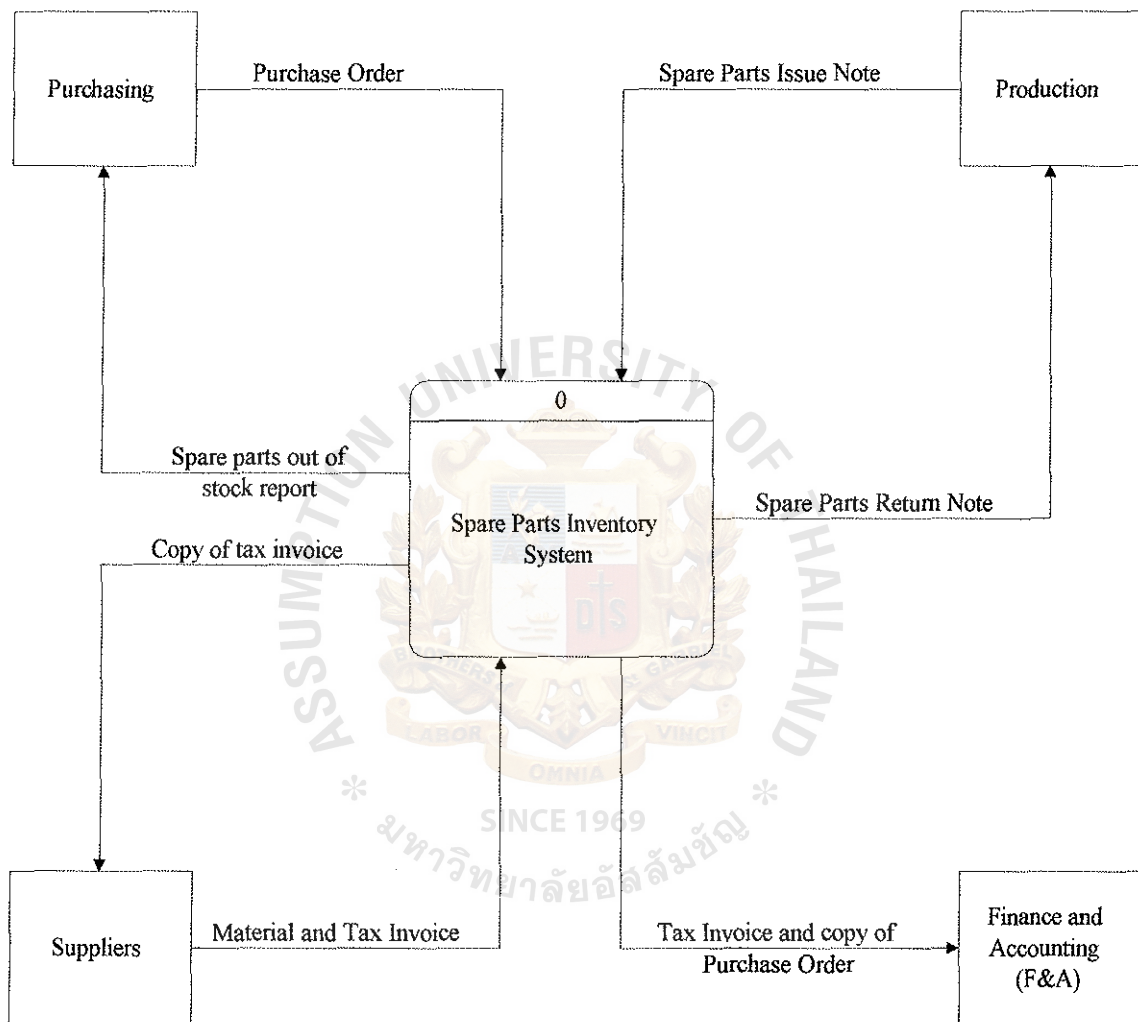


Figure 2.2. Context Diagram of the Existing System.

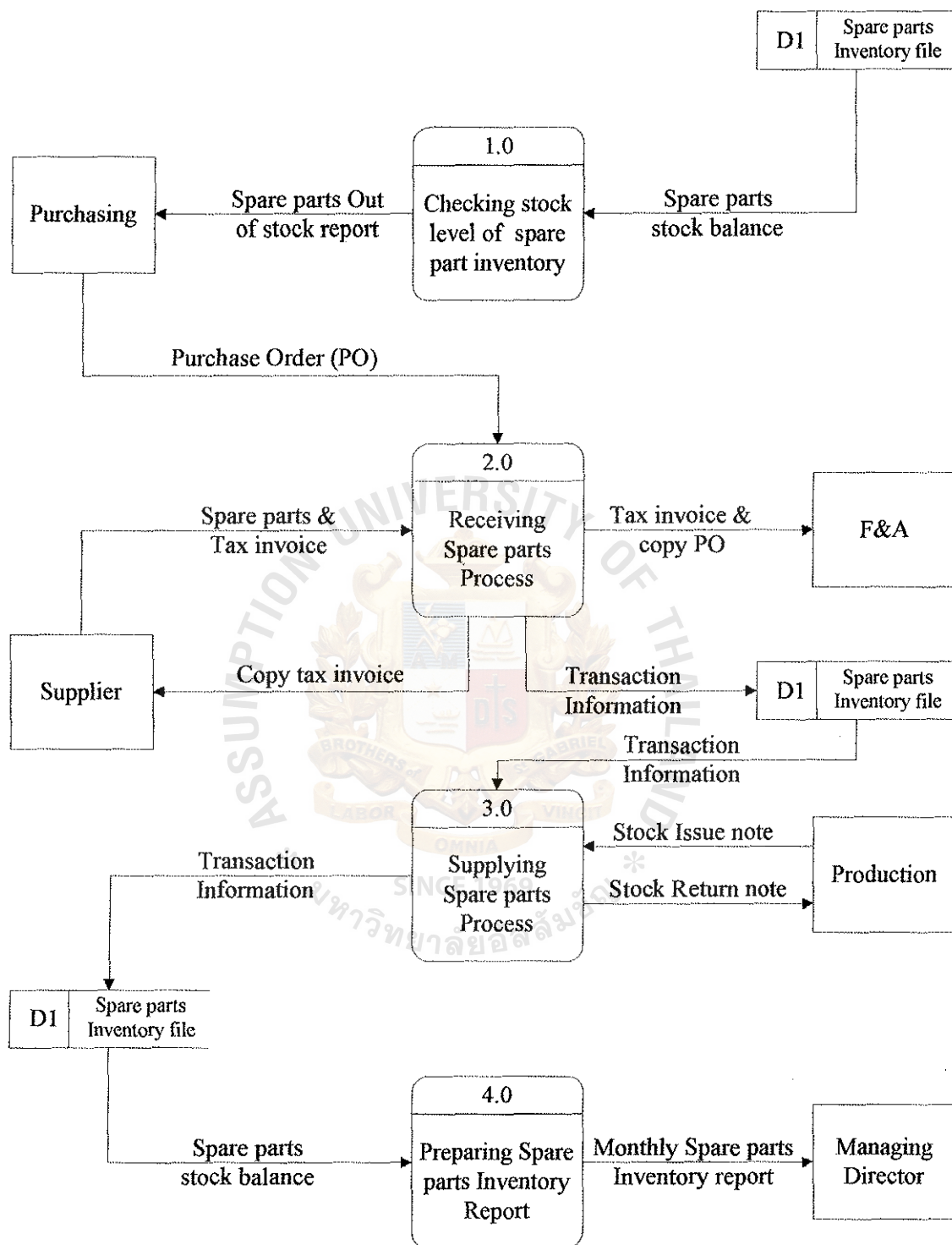


Figure 2.3. Data Flow Diagram (Level 0) – Existing System.

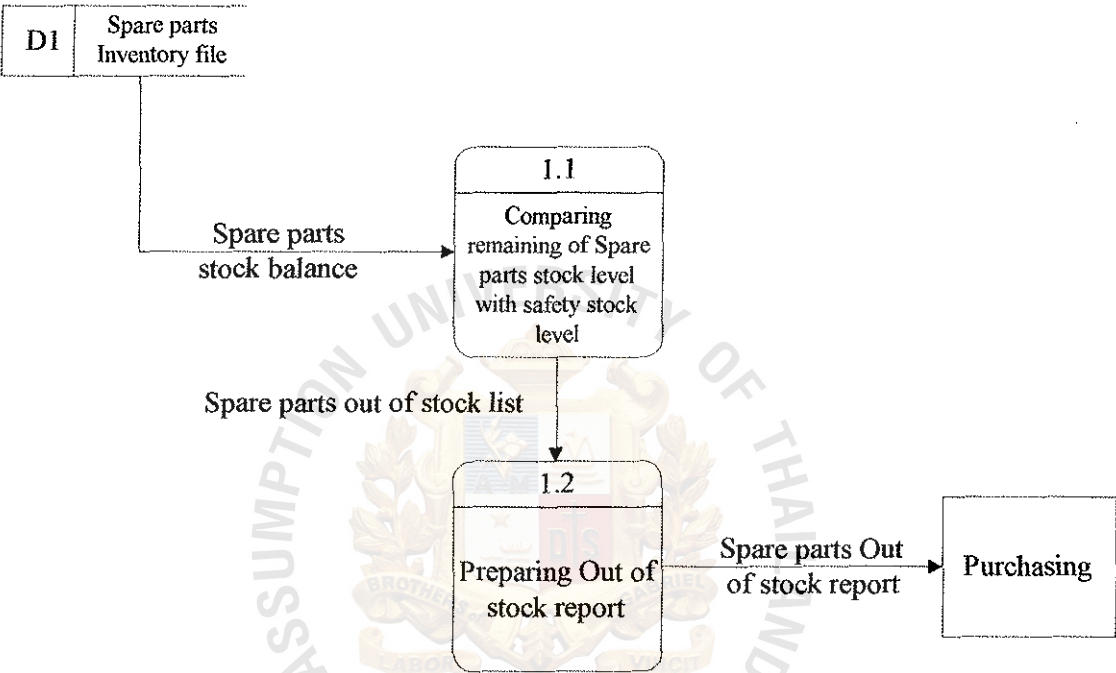


Figure 2.4. Data Flow Diagram (Level 1 Process 1) – Existing System.

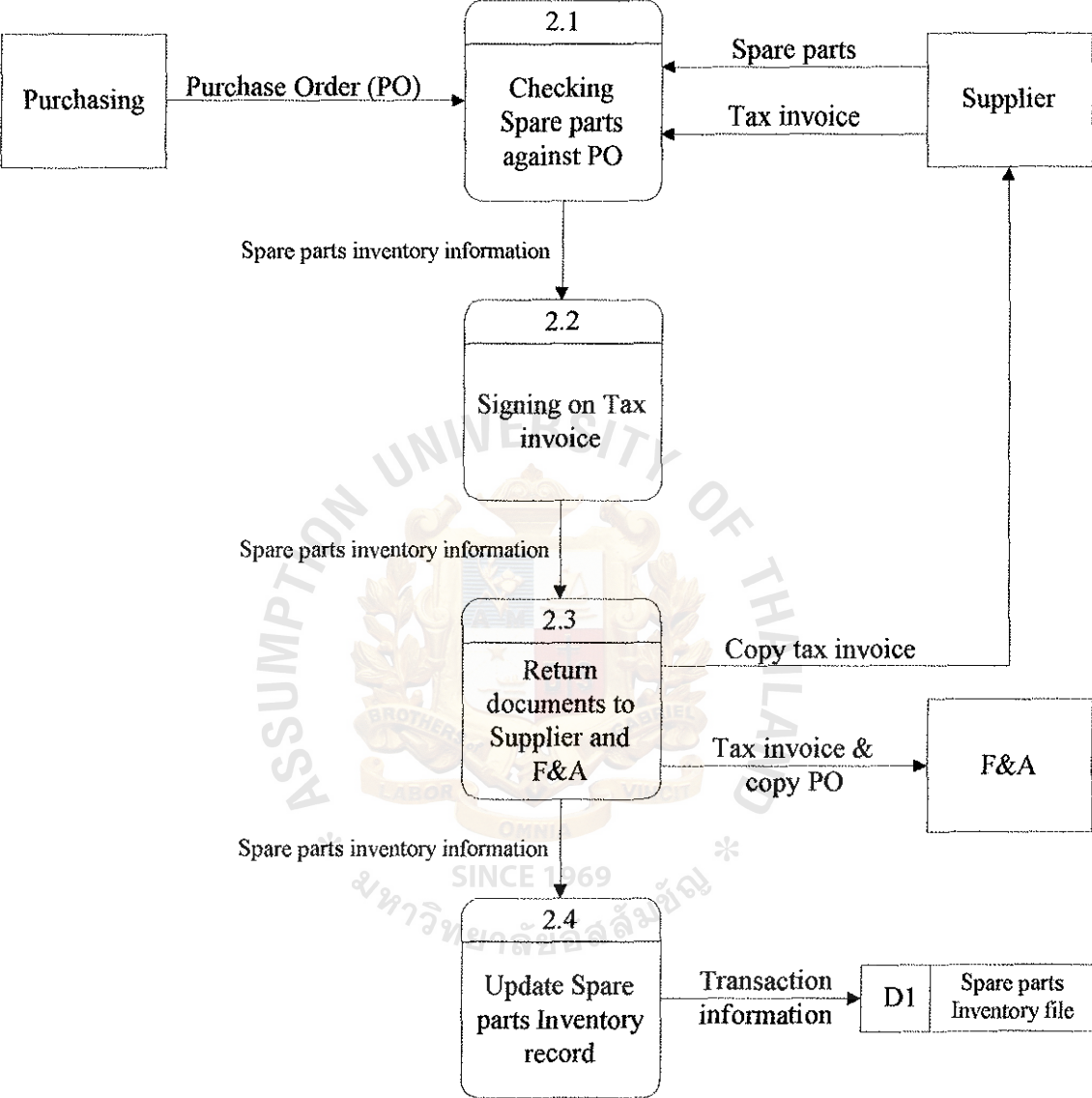


Figure 2.5. Data Flow Diagram (Level 1 Process 2) – Existing System.

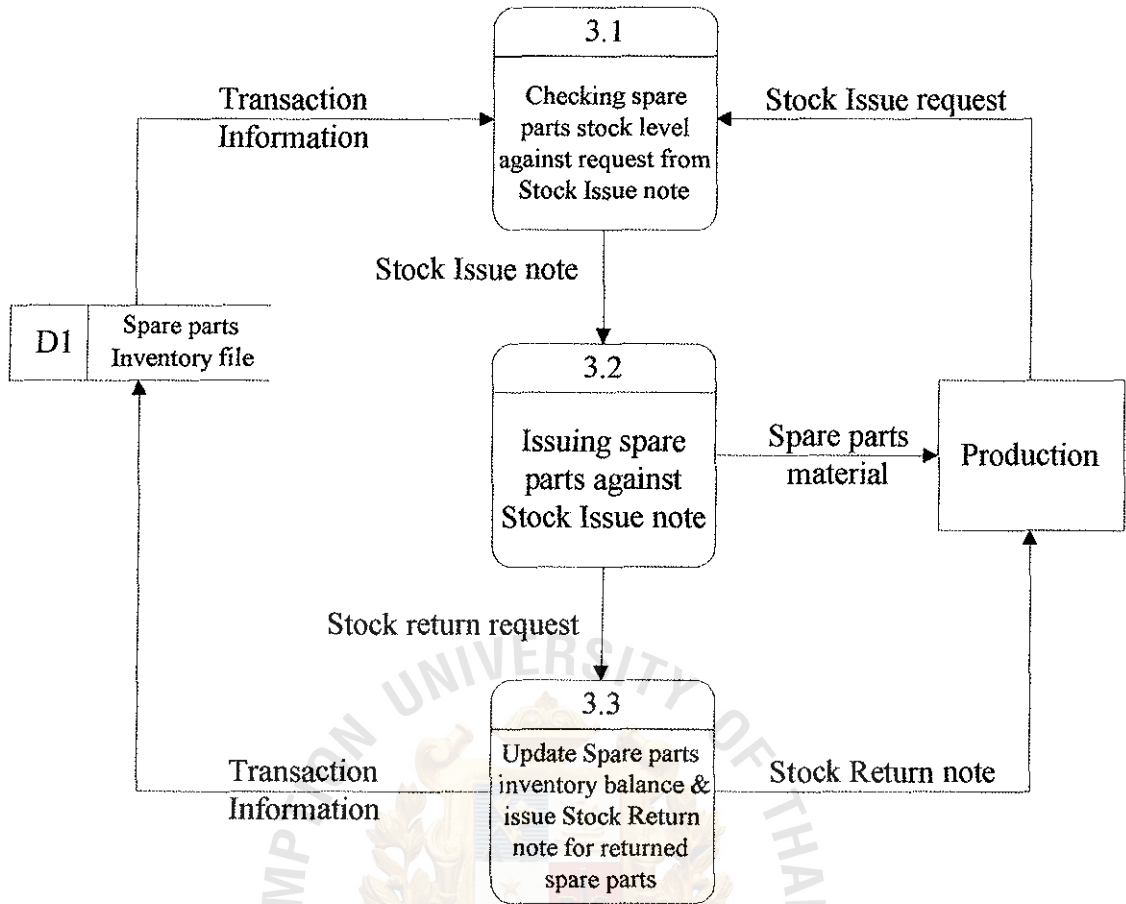


Figure 2.6. Data Flow Diagram (Level 1 Process 3) – Existing System.

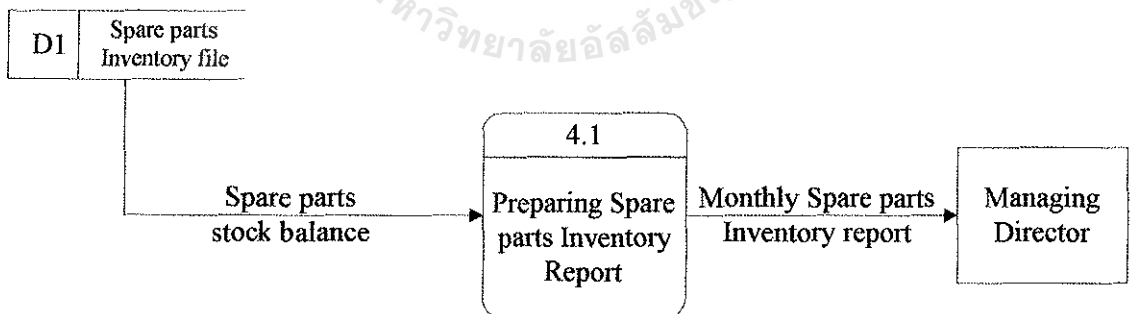


Figure 2.7. Data Flow Diagram (Level 1 Process 4) – Existing System.

### **III. THE PROPOSED SYSTEM**

#### **3.1 System Specification**

From the previous chapter, the author has learned that spare parts inventory system of GAP manufacturing company now requires an effective computer system with sufficient control process that can improve data accuracy in the system, minimize the current problems and have good spare parts inventory control by using a computerized system.

In order to achieve this satisfaction, there are various techniques, which can be used to analyze user requirements. Firstly, the formal interview with company's management team is conducted to gather the information about the needs of improving areas, attitudes and expectations from management team. From the interviews, the author knows that the management team has a positive attitude towards the system changes and is willing to invest in development cost for improving efficiency of system.

Secondly, the storeroom staffs and production manager were interviewed in order to gather detailed information about the system flow. The requirement of the staffs and their expectations from the new proposed system are also derived from that interview sessions.

From the interview and discussion with company's management and its staffs, the requirements to be system output and input requirement are summarized.

##### **(1) System Output Requirement**

There are several reports required by both management and operation staffs. Some reports are required by government and some are used internally by management for monitoring the business. The important requirements from report are the accuracy of data, appropriate format to be



used with minimum modification and up to date. The required reports are as follows:

- (a) Daily Spare Parts Inventory Report
  - (b) Monthly Spare Parts Inventory Report
  - (c) Purchase Order Report
  - (d) Stock Card Report
  - (e) Daily Spare Parts Inventory Receipt Report
  - (f) Monthly Spare Parts Inventory Consumption Report
  - (g) Spare Parts Inventory Report by Location
  - (h) Spare Parts Discrepancy Report
  - (i) Spare Parts Out of Stock Report
  - (j) Spare Parts Incoming List Report
- (2) System Input Requirement

Apart from the output requirements, the users also need to have the following input requirements:

- (a) The user friendly input screen and easy to use
- (b) The system should require minimum manual key in to prevent human errors.
- (c) The system should have adequate security control.

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

### **3.2 System Design**

After completion in users' requirement process, the next step is designing the system aligned with those requirements. The flexibility in system is one major concern

during this phase in supporting the change in users' requirement and expansion of the business in the future.

There will be many changes under spare parts inventory system. To be moved from the manual process to computerized process, the company needs to install new computer hardware and software. The working environments may be changed from the existing system.

The input and output are designed to respond to the management and users' requirements. Some business processes may be changed to reflect the use of computerized system. Various reports are created automatically by the system with only one time input. This will reduce the opportunity of human errors and mistakes in gathering data to prepare reports to the management. The input screens are designed to be most user-friendly and various controls are put into the system to prevent any human errors, which may occur along the input process.

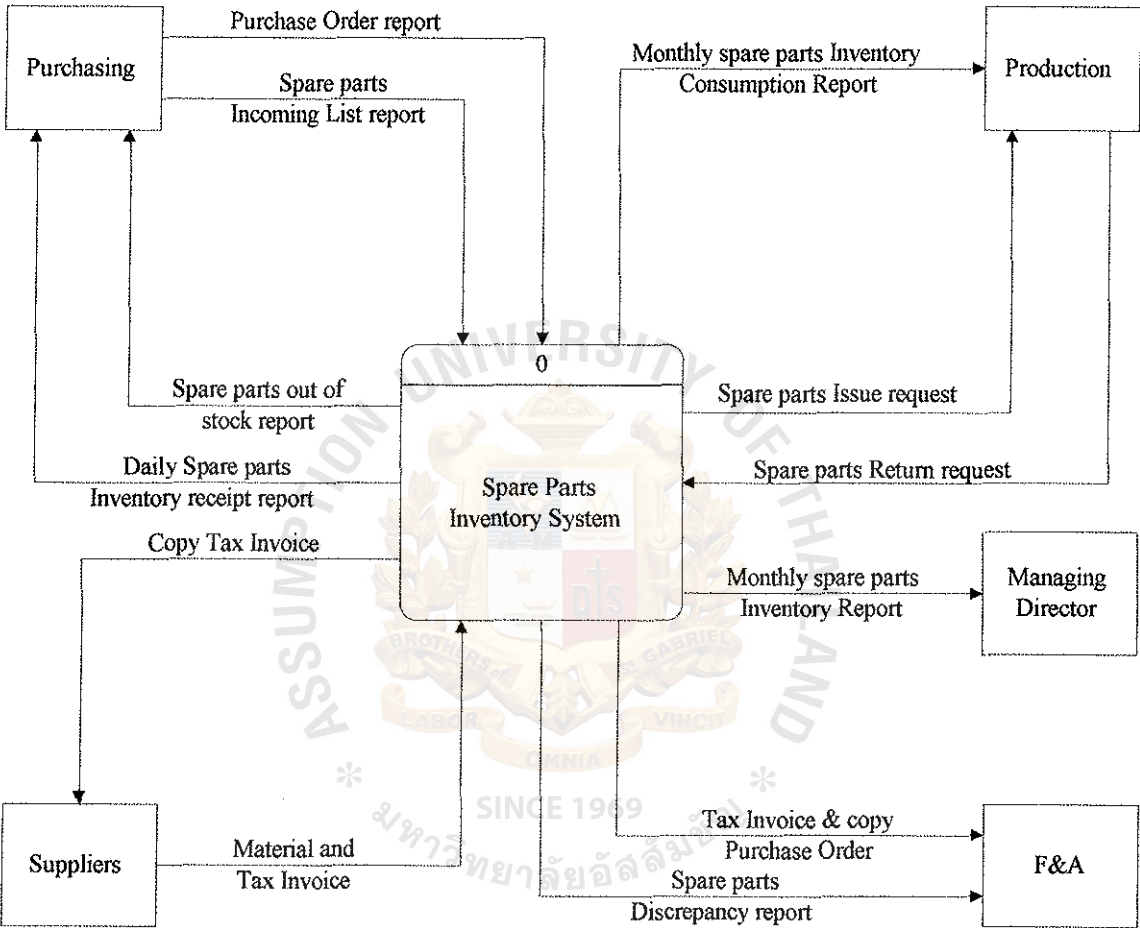


Figure 3.1. Context Diagram of the Proposed System.

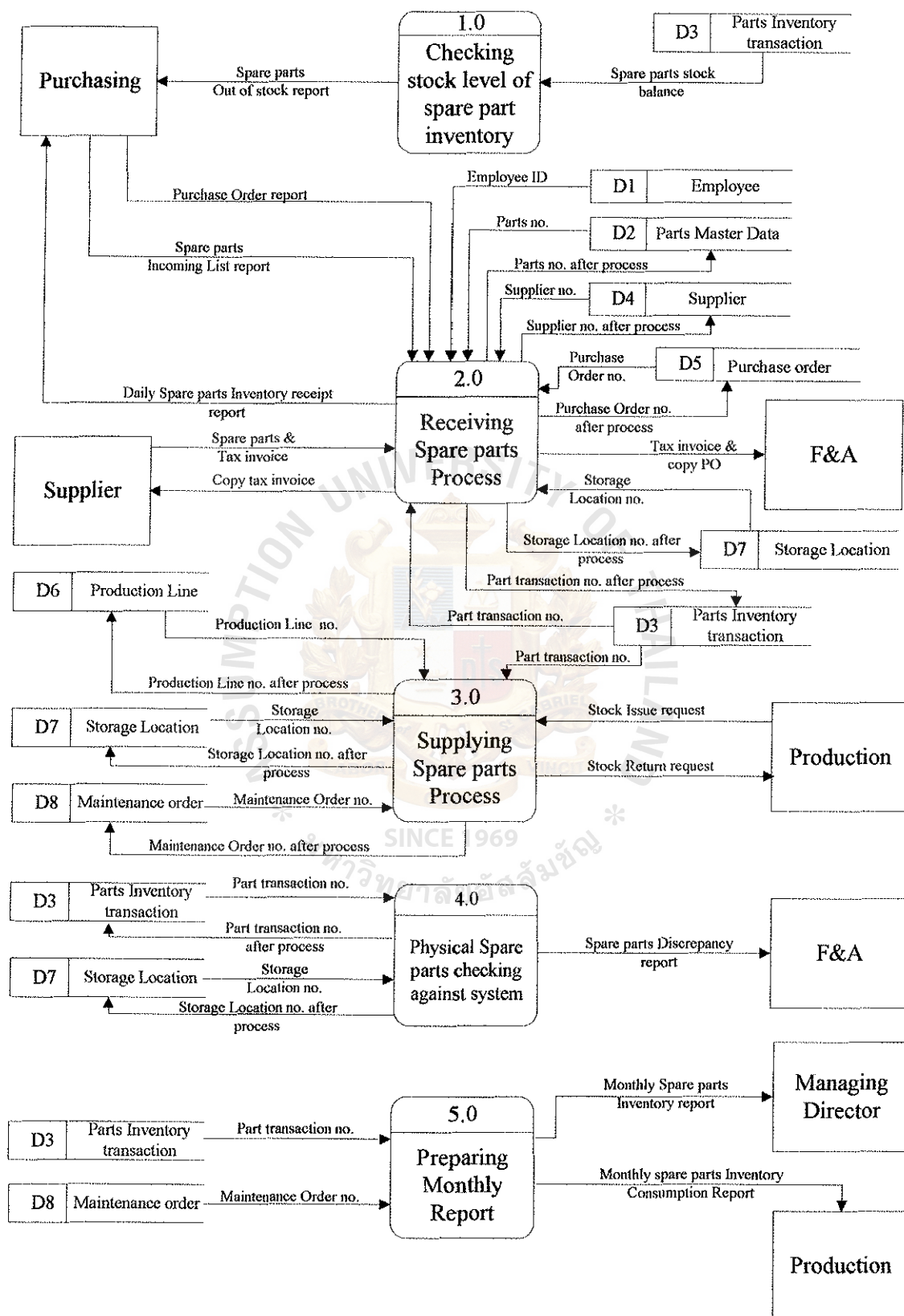


Figure 3.2. Data Flow Diagram (Level 0) – Proposed System.

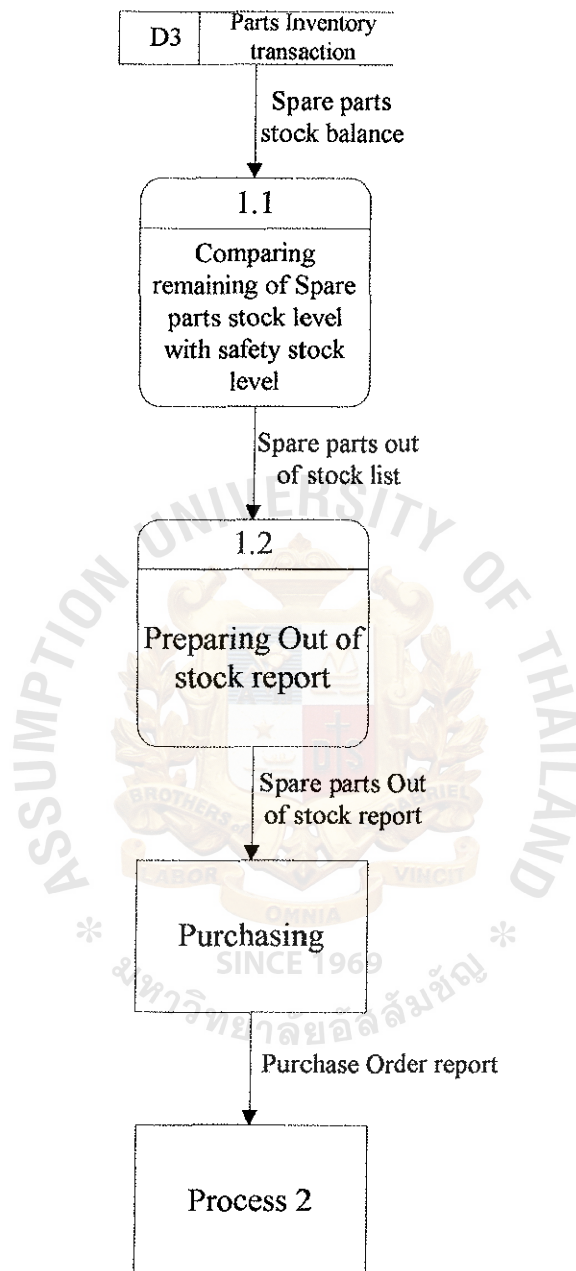


Figure 3.3. Data Flow Diagram (Level 1 Process 1) – Proposed System.

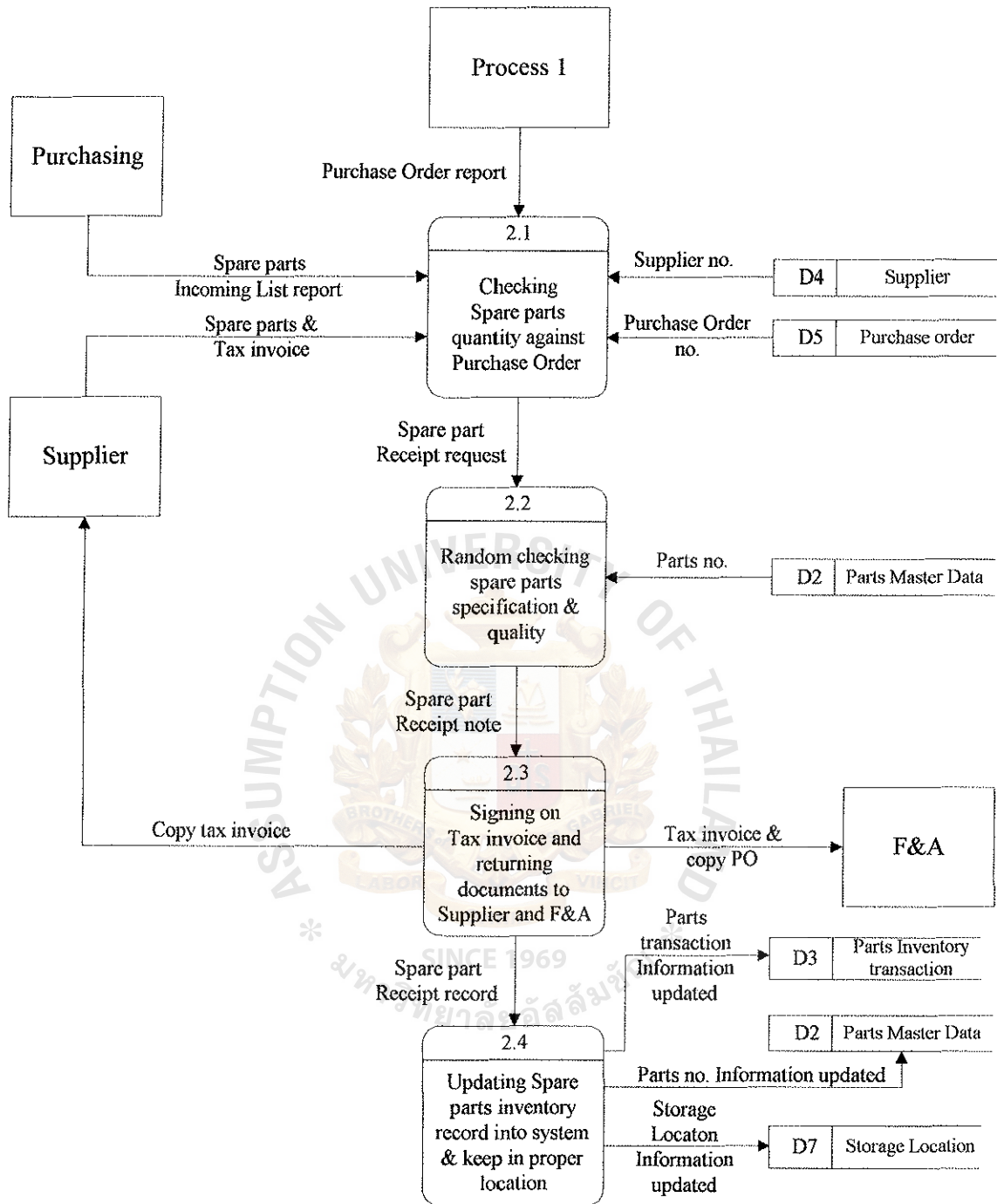


Figure 3.4. Data Flow Diagram (Level 1 Process 2) – Proposed System.



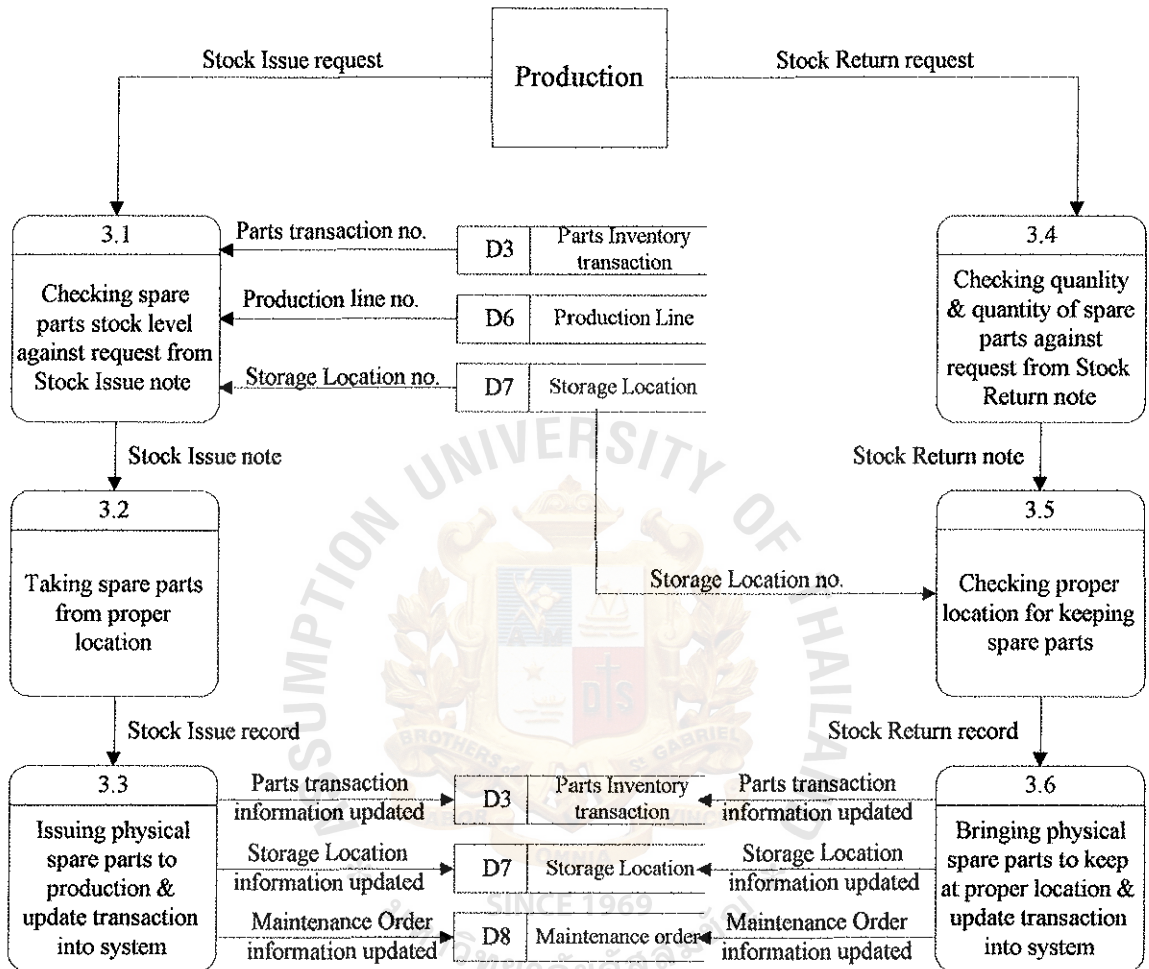


Figure 3.5. Data Flow Diagram (Level 1 Process 3) – Proposed System.

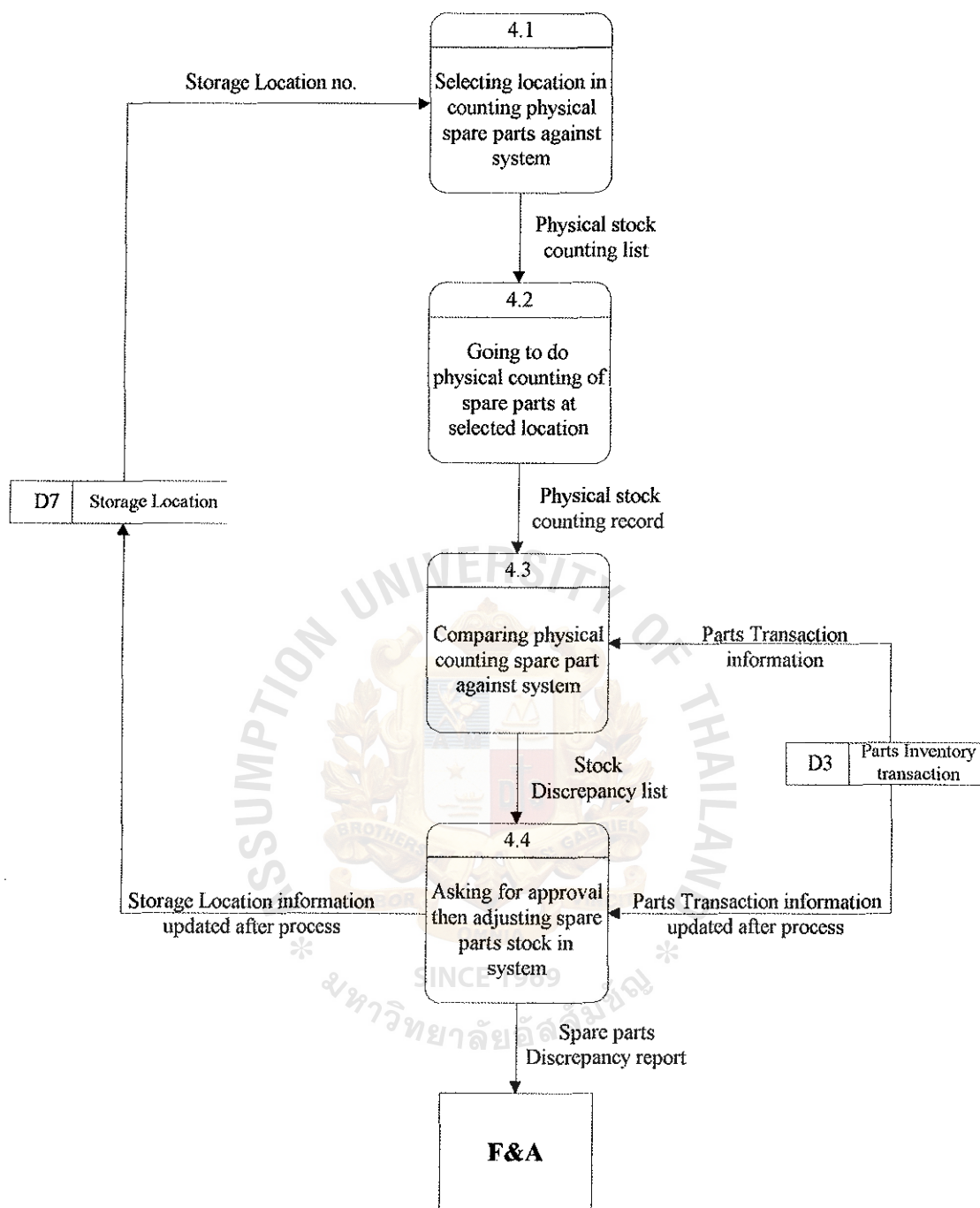


Figure 3.6. Data Flow Diagram (Level 1 Process 4) – Proposed System.

### 3.3 Hardware and Software Requirement

The proposed new system is a computer-based system. So company needs 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 850 MHz Coppermine Technology

INTEL STL2 (Dual Processor Upgradeable) Server Mainboard

Kingtons KVR 133X 7RC3 ECC SD RAM 256 MB 168 Pins Bus 133 MHz

20 GB Wide Ultra SCSI3 10K Hard Disk Drive

SCSI Adaptec Controller Built-in on board

Monitor 15" Super VGA Color-digital

1.44 MB Floppy Disk Drive

Server ATX Case with 300 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 Pinis 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

(e) 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:

Operating system

Microsoft Window 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)



Table 3.1. The Hardware Specification for Server Machine.

Hardware	Specification
CPU	Intel Pentium III 850
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



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

### 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 as mentioned 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 recover the content of data transmission that have some errors.

Each source-document e.g. the Purchase Order, Spare Parts Issue Note and Spare parts Return Note at source has its own format and color, which users can easily identify. So the risk of misunderstanding or mix-ups is low in this case.

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

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

easily detect the missed documents in a timely manner. All of the forms are kept at company's storeroom 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 supplier number or Purchase Order number into the input screen and then the computer will respond by returning the supplier's name or spare parts number in that Purchase Order number. This control is designed to help staff check the accuracy of the input information.

At the same time, using the supplier number or Purchase Order number is short can reduce the time to key in all the information by operation staffs him/ herself. In addition, this control can also reduce the number of human errors from the typing process.

(b) File-balance control

There is the transmission of receipt information from receiving module to the spare parts inventory transaction module. The system has to check the total number of records being sent from the receiving module and compare with the number of spare parts inventory transaction module. If there is any difference, the system will prompt

warning message to remind the users so that the data can be retransmitted again.

(c) Journaling

This control is designed to permit the recovery of data that was transmitted erroneously. As stated in the file-balance control, there is the transmission of information between sub-systems. So every time there is the transmission of data, that file will be kept in the spool file for a certain period of time. Until it receives the signal that the data is transmitted completely without any errors, that temporary spool file will be deleted.

(3) Output Controls

Output controls are designed to verify that all data have been sent from processing and unauthorized personnel cannot obtain any 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 spare parts inventory report and stock card report will be printed out and reviewed by Storeroom manager with spare part discrepancy report before making any adjustment on the system balance. In this report, it shows the total number of transactions and the summary of ending balance. The storeroom manager can also do some cross check total number of transaction randomly with spare parts inventory report to ensure the completeness of 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 2 months.

The user is given three chances to enter a correct user name and password. After three incorrect tries, the computer will be 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

The control is designed to test the accuracy of input information. For example, the field to input supplier code and spare part material number will accept only numeric data. If the staff key in alphabetic data, the program will alert the warning message to tell the user that inputs incorrect data.

(b) Range tests

This is to test whether a value assigned to a variable falls within an acceptable range. The number of spare parts issue quantity should not be over the available spare parts stock balance. If there is an error,

then the error message telling that the quantity issued exceeds the available stock need to 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 spare parts receiving quantity shall not exceed the order quantity plus some certain tolerance percentage in Purchase Order. The error message will be shown in case that the receiving quantity is more than order quantity.

### **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 cost and 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 comprised 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 make the operation faster. There is no need to pay overtime cost during the month-end and eliminate the loss of money to buy slow moving spare parts 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 use of the new system. From the analysis in Table 3.9, the company can be able to save the people cost for 2,055,535 Baht within 5 years. The net present value of the total benefits over the whole project life will be 1,576,600 Baht.

However, the company has to pay for the system development cost for the total amount 739,700 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 1,287,503 Baht.

Finally, the cost and benefit analysis of the new project gives the following outcomes:

(1) Payback Period

The payback period is 3 years and 5 months as shown in the Table 3.10. At the end of the 4<sup>th</sup> year, the cumulative time adjusted of the new benefit has the positive value. Therefore, the payback period is between the 3<sup>rd</sup> and 4<sup>th</sup> year. The following formula is computed to show the exact number of payback period.

$$\text{Year 3} + 95,966 / (95,966 + 102,794) * 12$$

Therefore, the payback period will be 3 years and 5 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 289,097 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-service-level benefits

During the problem identification stage, various problems occurred from the existing system. For example, errors that come from quantity recording into the system or lack of computer skills in company employees and etc. These problems cause increase in time consuming in finishing the spare parts inventory transaction through the new system and also level of employees' satisfaction.

With this new system, the company can prepare the spare parts inventory report accurately and in a proper timely manner. The Finance and Accounting Department and the Managing Director can be able to get the spare parts inventory report more quickly compared with the existing system. 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 in employees.

This financial portion is derived with difficulty from the level of satisfaction because this type of benefit is intangible rather than tangible. It is hard to estimate or measure the amount of intangible benefits, so the cost and benefit analysis does not include this type of benefits in the calculation table.



Table 3.5. Existing System Cost Analysis, Baht.

Cost Items	Years				
	1	2	3	4	5
Office Equipment Cost:					
Calculator           5 units @ 1,500	7,500	-	-	8,250	-
Total Office Equipment Cost	7,500	-	-	8,250	-
Operating Expenses:					
Staff Cost:					
Operation Head    3 persons @ 14,000	336,000	352,800	370,440	388,962	408,410
Clerk               4 persons @ 9,500	456,000	478,800	502,740	527,877	554,271
Operation Staffs   10 persons @ 9,000	1,080,000	1,134,000	1,190,700	1,250,235	1,312,747
Storeroom Manager 1 person @ 22,000	264,000	277,200	291,060	305,613	320,894
Total Staff Cost	2,136,000	2,242,800	2,354,940	2,472,687	2,596,321
Office Supplies & Utility Expenses:					
Stationery	6,000	6,300	6,615	6,946	7,293
Printing materials	35,000	36,750	38,588	40,517	42,543
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	87,000	91,350	95,918	100,713	105,749
Total Operating Expenses	2,223,000	2,334,150	2,450,858	2,573,400	2,702,070
Total Existing System Cost	2,230,500	2,334,150	2,450,858	2,581,650	2,702,070

Table 3.6. Computerized System Cost Analysis, Baht.

Cost Items	Years				
	1	2	3	4	5
<u>Office Equipment Cost:</u>					
Hardware Cost:					
1 set of Computer Server	90,700	4,535	4,762	5,000	5,250
6 sets of Client Computers	180,000	9,000	9,450	9,923	10,419
2 sets of Printers	46,000	2,300	2,415	2,536	2,663
Other Hardware Cost	100,000	5,000	5,250	5,513	5,788
Total Hardware Cost	416,700	20,835	21,877	22,971	24,119
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 @ 1,500	3,000	-	-	3,000	-
Total Other Office Equipment Cost	3,000	-	-	3,000	-
Total Office Equipment Cost	739,700	50,835	53,127	58,533	58,060

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

Cost Items	Years				
	1	2	3	4	5
Operating Expenses:					
Staff Cost:					
Operation Head	504,000	529,200	555,660	583,443	612,615
Clerk	456,000	478,800	502,740	527,877	554,271
Operation Staffs	540,000	567,000	595,350	625,118	656,373
Storeroom Manager	264,000	277,200	291,060	305,613	320,894
Total Staff Cost	1,764,000	1,852,200	1,944,810	2,042,051	2,144,153
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	1,845,000	1,937,250	2,034,113	2,135,818	2,242,609
Total Computerized System Cost	2,584,700	1,988,085	2,087,239	2,194,351	2,300,669

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

Year	Total Manual Cost	Accumulated Cost
1	2,230,500	2,230,500
2	2,334,150	4,564,650
3	2,450,858	7,015,508
4	2,581,650	9,597,158
5	2,702,070	12,299,228
Total	12,299,228	-

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

Year	Total Computerized Cost	Accumulated Cost
1	2,584,700	2,584,700
2	1,988,085	4,572,785
3	2,087,239	6,660,024
4	2,194,351	8,854,375
5	2,300,669	11,155,044
Total	11,155,044	-



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 (18 Staffs) increase 5% per year	2,136,000	2,242,800	2,354,940	2,472,687	2,596,321
Office Supplies & Utility Expenses	87,000	91,350	95,918	100,713	105,749
Office Equipment Cost	7,500	-	-	8,250	-
Total Annual Cost	2,230,500	2,334,150	2,450,858	2,581,650	2,702,070
Cumulative Cost	2,230,500	4,564,650	7,015,508	9,597,158	12,299,228
Proposed System:					
Hardware Cost	416,700	20,835	21,877	22,971	24,119
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	1,764,000	1,852,200	1,944,810	2,042,051	2,144,153
Office Equipment Cost	3,000	-	-	3,000	-
Office Supplies & Utility Expenses	81,000	85,050	89,303	93,768	98,456
Total Annual Cost	2,584,700	1,988,085	2,087,239	2,194,351	2,300,669
Cumulative Cost	2,584,700	4,572,785	6,660,024	8,854,375	11,155,044

Table 3.10. Cost and Benefit Analysis, Baht.

Cost Items	Years					
	0	1	2	3	4	5
<b>Benefits</b>						
Staff Cost Saving		372,000	390,600	410,130	430,637	452,168
Other Operating Cost Saving		10,500	6,300	6,615	12,196	7,293
Total Benefits from New System	-	382,500	396,900	416,745	442,832	459,461
Discount factors for 10%:	-	0.91	0.83	0.75	0.68	0.62
Time-adjusted benefits (NPV)	-	347,727	328,017	313,107	302,460	285,289
Cumulative time-adjusted benefits over lifetime	-	347,727	675,744	988,850	1,291,311	1,576,600
<b>Costs</b>						
System Development cost	-739,700					
Operation & maintenance cost (5% increase annually)	0	-131,835	-138,177	-147,836	-151,827	-159,419
Discount factors for 10%:	1	1	1	1	1	1
Time-adjusted costs (NPV)	-739,700	-119,850	-114,196	-111,071	-103,700	-98,986
Cumulative time-adjusted costs over lifetime	-739,700	-859,550	-973,746	-1,084,817	-1,188,517	-1,287,503
Cumulative time-adjusted net amount	-739,700	-511,823	-298,002	-95,966	102,794	289,097
Return on Investment						289,097

Return on Investment: 22 %  
Payback period : 3 Years and 5 Months

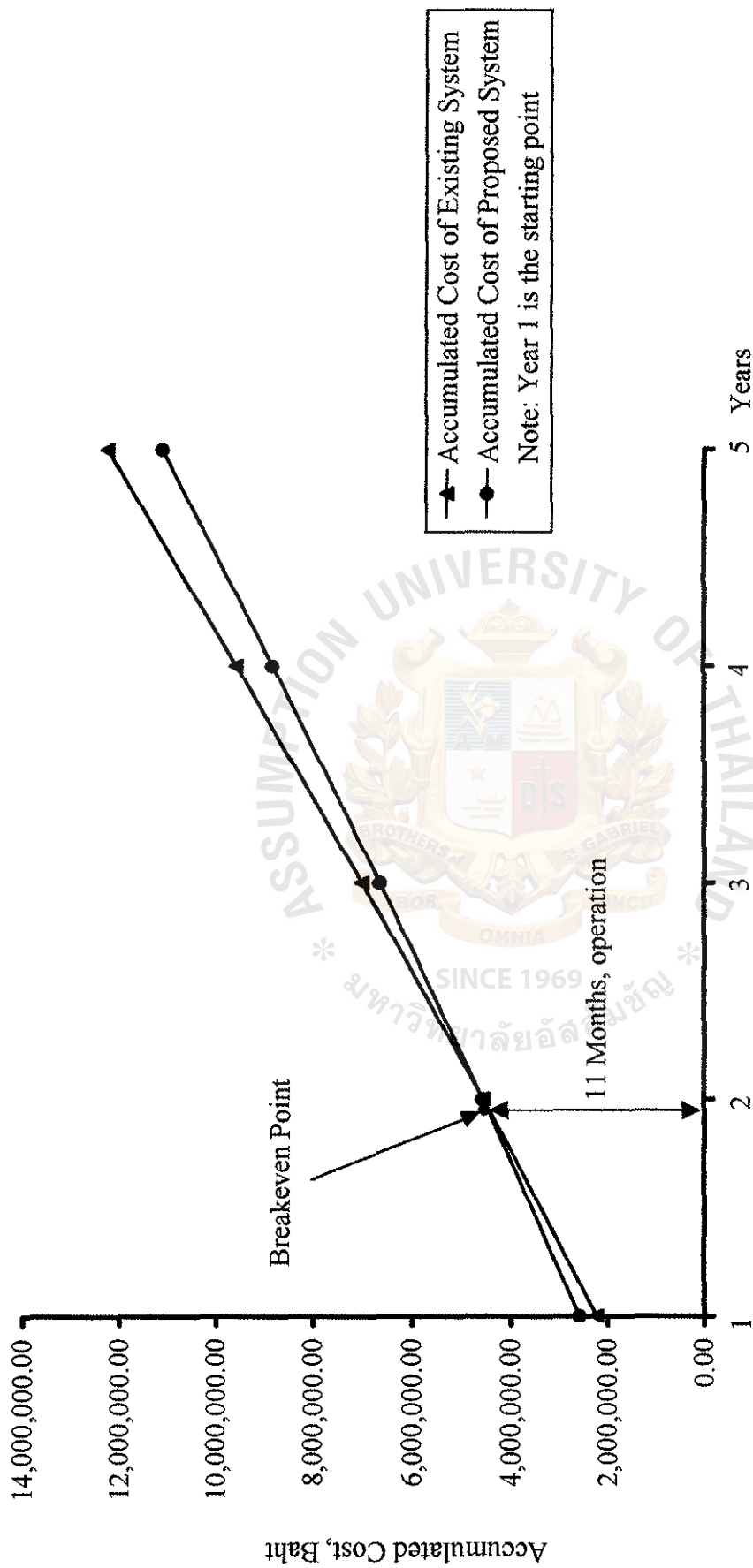


Figure 3.7. Cost Comparison between the Existing System and the Proposed System.

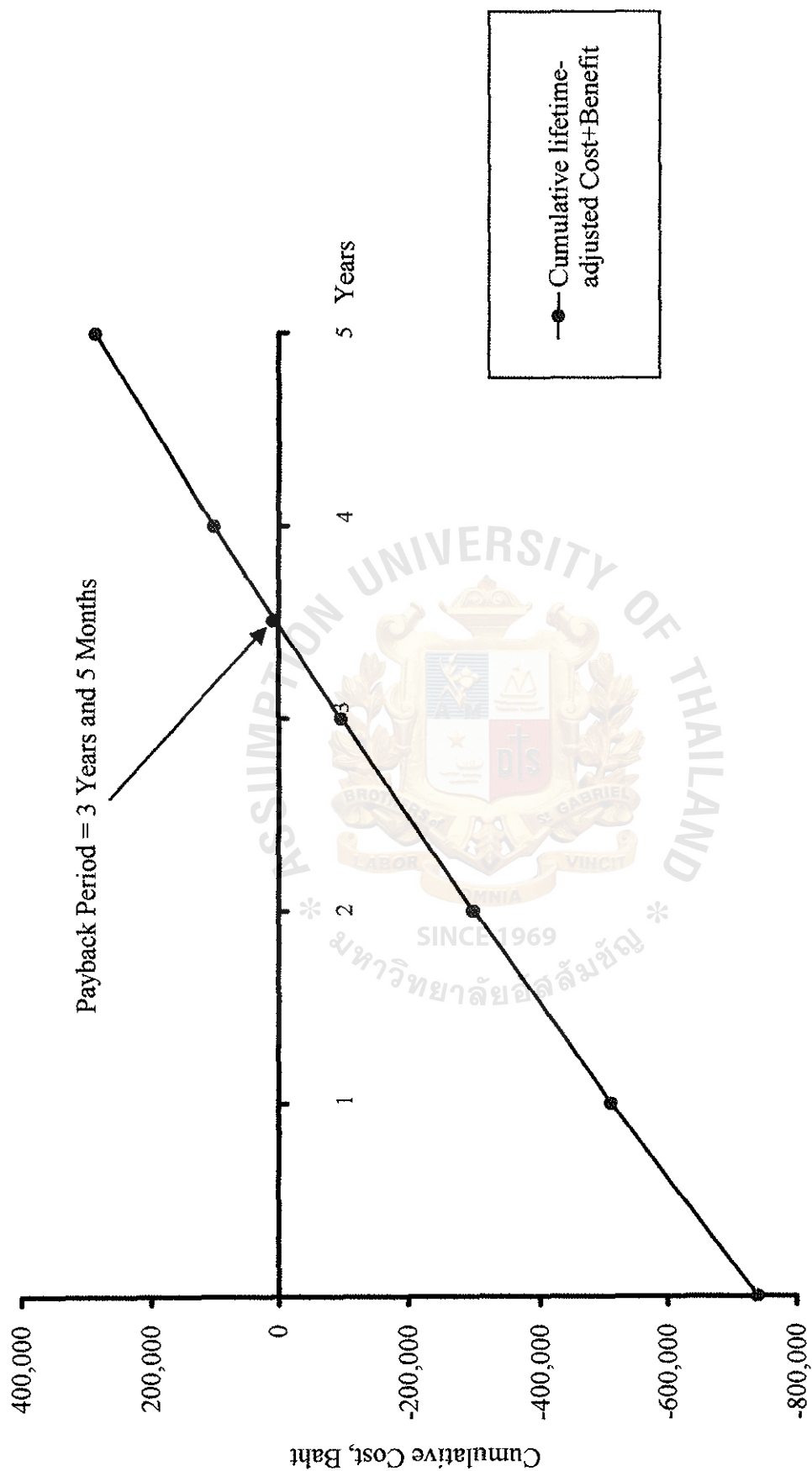


Figure 3.8. Payback Period of the Proposed System.

### **3.6 Budget for the Proposed System**

The budget for this new computerized system is about 739,700 Baht. The budget is classified into 4 main categories, which comprise cost of hardware, software, system development and system implementation. Although it involves quite a high investment in the initial stage, it is a one-time investment cost. For the following year, the company will pay only a small amount in maintenance cost. Please see the details of the computerized system in Table 3.6.

The major cost of this project is the hardware cost because the company has to invest in the new computer equipment amounting to 416,700 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 for 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	90,700
6 sets of Client Computers	180,000
2 sets of Printers	46,000
Other Hardware Cost	100,000
Total Hardware Cost	416,700
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	736,700

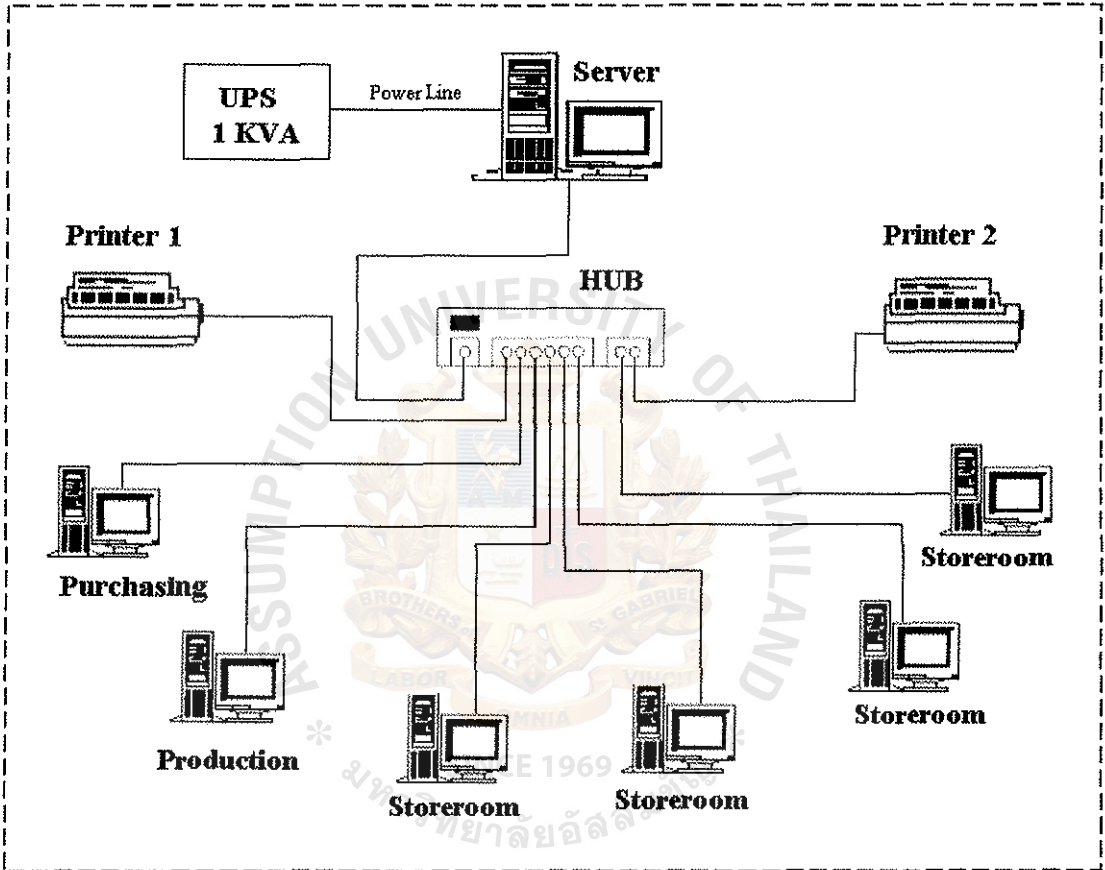


Figure 3.8. Configuration of the Proposed System.



## **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 of coding, testing hardware and software installation and system conversion.

It takes a long period of time to complete the coding process. Then the system testing has to be performed in ensuring the correctness and investigate for any errors or unexpected function of the system. During the system testing process, the program may be modified to ensure that all errors have been removed.

After the system testing and modification of the program stage, 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 the manual system for a period of time before full 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 performed 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 unexpected function of the system. Then the system

analyst can modify and solve all 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 Storeroom Staffs, who are directly responsible for the work processes, 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 with actual transactions before the testing.

The time to start testing the program is after the completion of system installation. After testing, the testing team has to give the response to the system analyst. Any system failures are to be documented along with the success; any errors, unexpected results or additional requirements for further 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 is made to the program has to be recorded by the programmer in order to provide the audit trails of the future modification. And some testing need to be provided after modification is made in order to meet users' requirements. The parallel run is also being used. The existing system process is done to ensure that the result from new system is accurate and satisfactory. The documentation is prepared in order to help the Storeroom manager modify the results of the 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 two 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 five 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 evaluated 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 staffs by asking them to work two jobs at the same time, it has considerably more advantages for the company to use this method. The greatest advantage of the parallel method is that it preserves the audit trail. And this also gives company's staffs advantages in comparing current manual process with the new system for more practical perspective in each one. 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 for any emergency plan in case 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 Storeroom staff and other related

functions, Purchasing Department for supplier database and Production Department for production line 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 company.

### (3) User Training

User training is one of the most important steps of conversion. This stage is to provide users with experience with the new system. The Storeroom staffs and the Storeroom manager are the ones who must attend this training course. The steps in arranging the training session are as follows:

- (1) Identify the staffs that 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 the training.
- (5) Distribute the training materials to all attendants in advance.
- (6) Evaluate the staffs to assess their knowledge after training both theory and practice in system.
- (7) Retraining for the staffs that got under estimated score in the evaluating step until qualified.
- (8) Provide the users with the full set of users' manual of each process.
- (9) Provide some tips/ short cut menu to users for major transactions for example Good Receipt access screen.

## **V. CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Conclusions**

After the system analysis and design, the computerized system is the best solution to solve the current existing problems of the company. Currently, the company faces many problems about the inaccurate and inconsistent data. And also company spends more time for producing various effective reports.

The company needs to pay the overtime cost for staffs during month-end closing of accounting department. And company has to hire temporary staffs to prepare various reports too. The quantity of the physical spare parts inventory is also not equally tied with the number that is shown in the report. The staffs has to work more harder during that period in order to investigate the root cause of differences, collecting correct data and consolidate the data from many various sources to produce one useful report. The management of the company does not have the required report that met management's need on time. And also Purchasing department cannot plan any spare parts acquisition time due to unequal numbers between storeroom spare parts report and their physical spare parts inventory.

During the analysis phase, the author conducted interview sessions with the company's management and staffs. Various users' requirements are derived from these 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 caused from the manual system. So the computerized system is recommended for the company.

The new system can reduce the redundancy of the work and can accelerate most processes. The conversion from the manual system to the computerized system involves

quite a 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 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 12,299,228 Baht comparing with the cumulative cost of new system of 11,155,044 Baht. So by implementing of this project, the company will gain about 1,144,184 Baht or the net present value of 289,097 Baht.

The spare parts inventory report and preparation 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 increased. The table below has shown the degree of achievement of the proposed system.

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

Process	Existing System	Proposed System
Receiving Spare Parts Process	45 mins.	10 mins.
Supplying Spare Parts Process	30 mins.	10 mins.
Physical Spare Parts Checking Process	2 hrs.	20 mins.
Total Overall Process	3.15 hrs.	40 mins.



(1) Spare Parts Receiving Process

In the Existing System, the storeroom staffs have to perform Spare Parts Receiving Process manually. The storeroom staffs have to first compare more document papers and copies for example Purchase Order, Supplier Tax Invoice, and Delivery Note. After number equalization among those papers, storeroom will write stock receipt note. Then returning to other related departments and suppliers. The Proposed System is a computerized system, so it reduces many processing time of comparing more document papers. The user can see and compare the Purchase Order in the system. And the user has to input the required information into the system.

(2) Spare Parts Supplying Process

The Existing System is a manual process. Storeroom staffs need to first compare spare parts issue note from production line with daily spare parts inventory manual report. In this comparing step, storeroom staffs need to find the spare parts inventory balance manually too..

With the Proposed System, the spare parts inventory balance can be checked automatically via system database. So this saves time for storeroom staffs in searching spare parts inventory manually.

(3) Physical Spare Parts Checking Process

The Spare parts checking process of existing system is done manually too. Storeroom staffs need to go to count physical spare parts in storeroom first. Then staffs will go back and compare quantity with spare parts inventory balance report. Because these steps are done manually so there



may be any spare parts movement during physical counting which caused some unequal quantity comparison.

For the proposed system, system can update spare parts inventory stock by real time basis. And also while doing physical counting, system can also provide function of temporary blocking for any system posting to each particular spare part. So this will save company in case of less timeliness and also data accuracy in each transaction.

Table 5.1 shows the time used in each process compared 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 for 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**

The new spare parts inventory system can help the company in having spare parts transaction to be systematic. There is a major improving on data accuracy in spare parts inventory system. The analysis team recommends some further steps improvement areas, which will help company in gaining more benefits from system for future business expansion.

### **(1) Bar Code Reader and Scanner**

The bar code reader and scanner system is another tool to accelerate work process. There will be no need to input any information into system by users. Users just only scan the code into system. But the company needs to concentrate more on the investment cost of this tool because the application

fees is still very high even if there are many software suppliers in market.

(2) Plant Maintenance System

This plant maintenance system will provide more help for company in tracking and analyzing deep detail root causes of each production line, as this system will break down production line into the most detail units level. And operation staffs need to fill all information related with each detail unit of production line in order to have causes and solutions for each maintenance tasks. And this information will be kept in system as historical reference data. So this information will help operation manager in attacking each problem in each production line with correct direction and in a timely manner.

(3) Finance and Costing System

In order to gain the full benefit of computerized system, the financial and costing system is recommended in developing the company too. This function will help the company in having automate data in the whole process from receiving spare parts till preparing payment to suppliers. Moreover, this function will help the company in gaining various financial analysis reports. And this will help company's management in providing appropriate forecast for future business based on both accurate information and a user friendly report style.

(4) Purchasing System

The proposed system focuses only on basic functionality in purchasing system such as the supplier master data, purchase order generating. There is no supporting in terms of ordering process that is very

helpful for purchasing staffs. So further implementation in purchasing system will be recommended to company development too. For example, the purchasing system that can help purchasing staffs in matching supplier reliability with spare parts delivery time from placing purchase order till receiving spare parts into the company. Spare parts pricing history report for each supplier, will help company in having proper information for price bargaining process with other suppliers. And EDI system is another interesting and essential application tool for nowadays business to make company communication and work process faster. But the good and proper security control and Internet tool need to be concerned and invested in order to have the highest benefit from system and protection from any intruder.



A screenshot of a Windows-style dialog box titled "Welcome to GAP Log on Screen". The dialog box has a standard title bar with a close button in the top right corner. The main area of the dialog is light gray and contains two text input fields. The first field is labeled "User Name:" and the second is labeled "Password:". Below these fields are two buttons: "OK" on the left and "Cancel" on the right. A faint, large watermark is visible in the background of the dialog box, featuring a circular emblem and the text "SINCE 1969" and "มหาวิทยาลัยราชภัฏวชิรญาณอุบล".

Welcome to GAP Log on Screen

User Name:

Password:

OK Cancel

Figure A.1. Login Form.



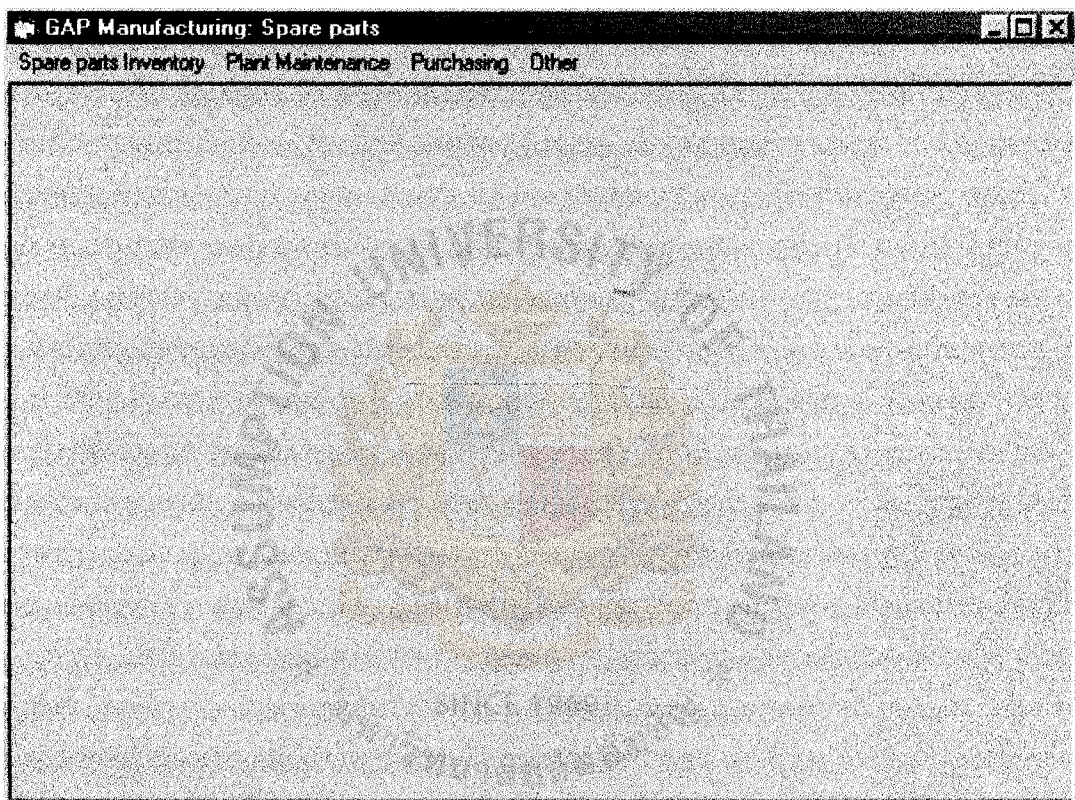


Figure A.2. Spare Parts Inventory Management System – Main Menu.

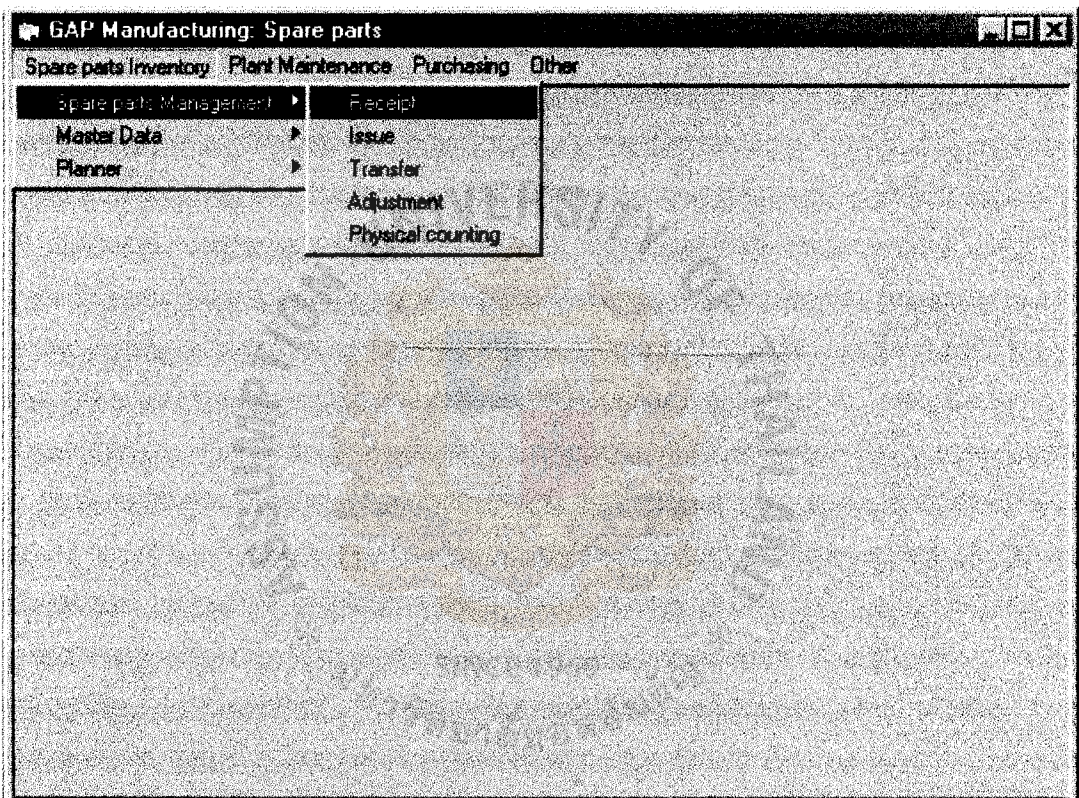


Figure A.3. Spare Parts Inventory Management System – Transaction Menu.



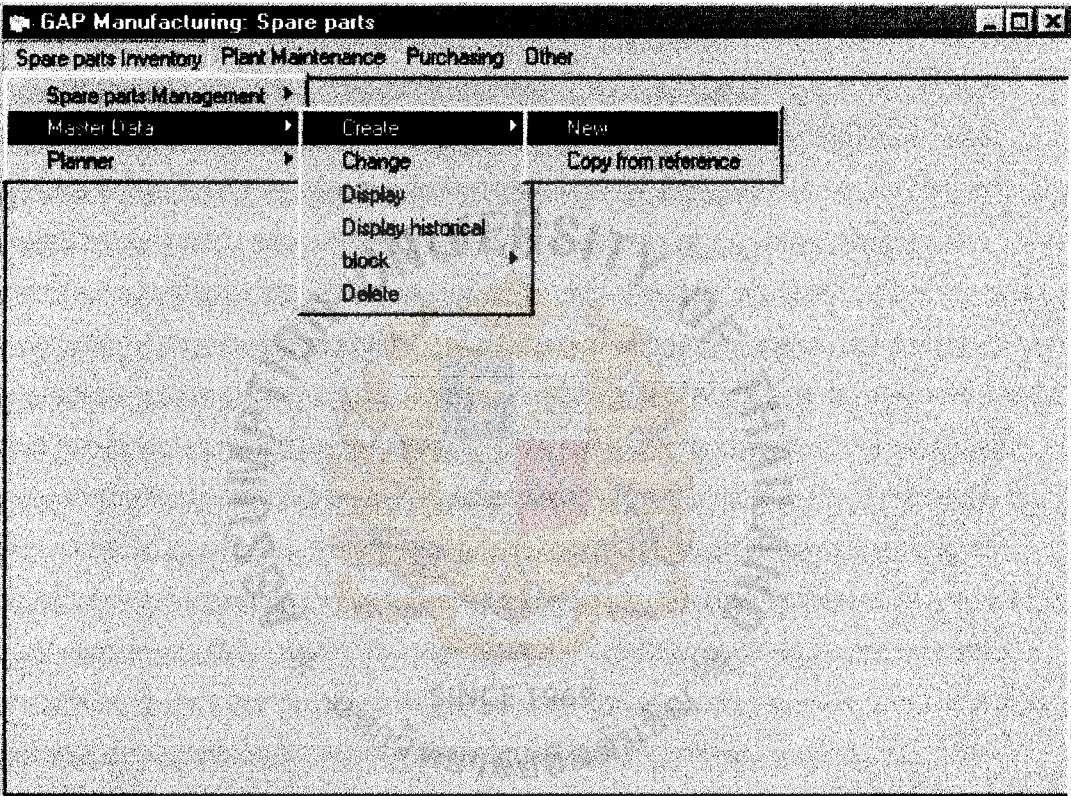


Figure A.4. Spare Parts Inventory Management System – Master Data Menu.

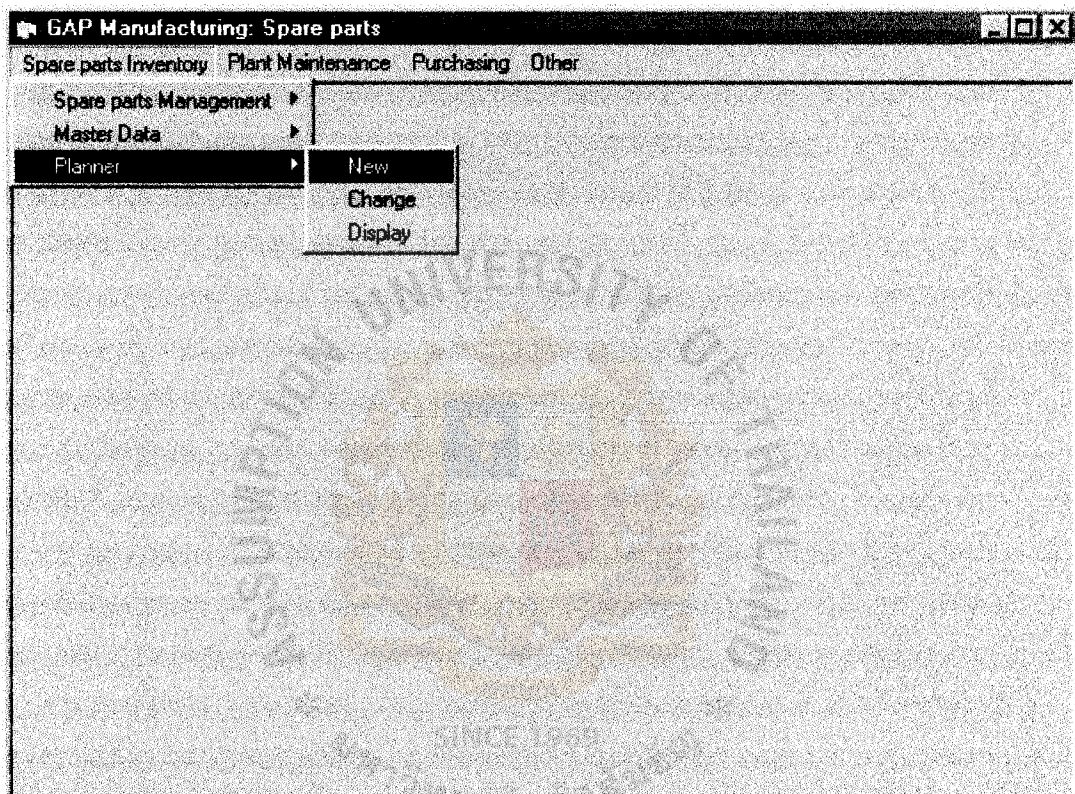


Figure A.5. Spare Parts Inventory Management System – Planner Create Menu.



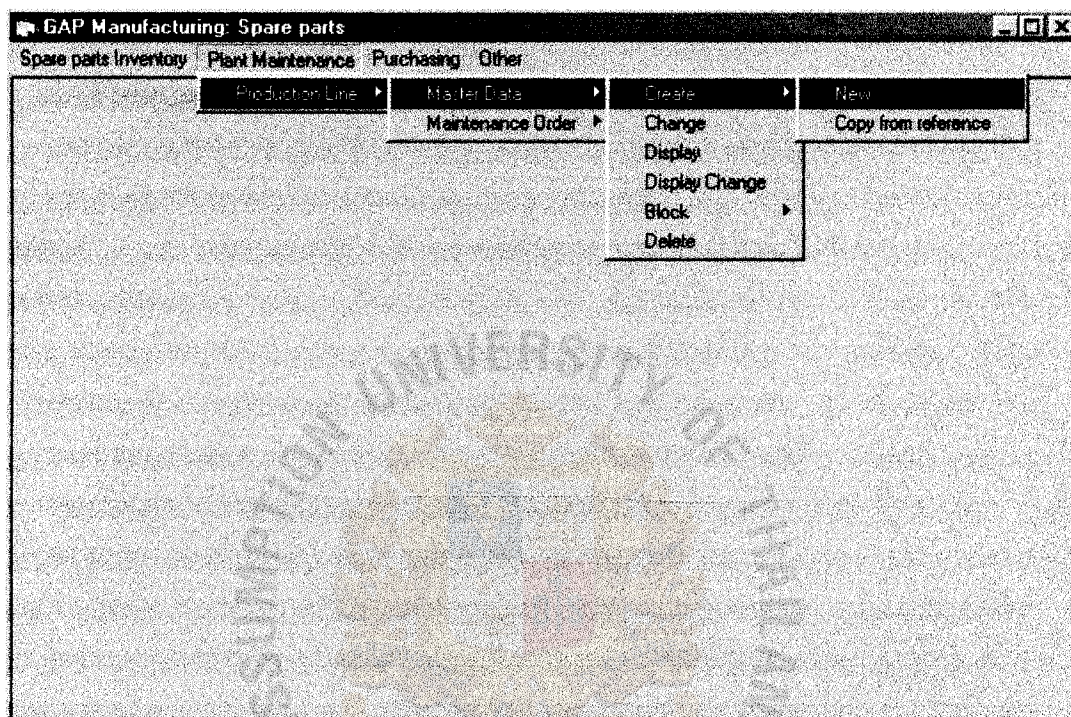


Figure A.6. Spare Parts Inventory Management System – Production Line Menu.

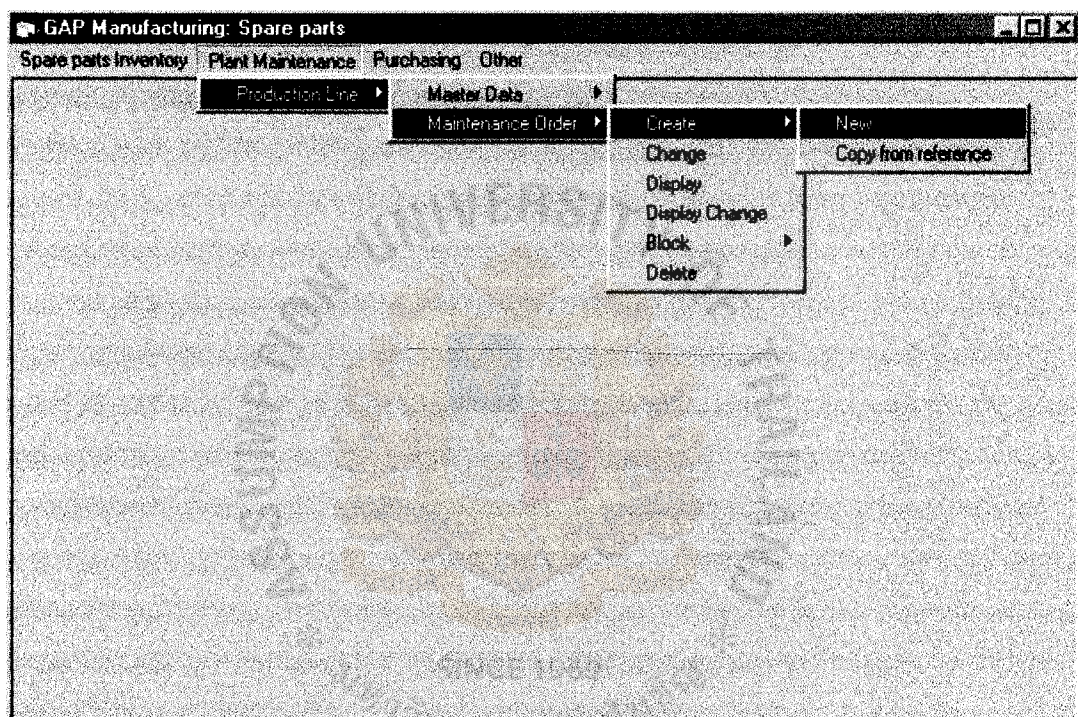


Figure A.7. Spare Parts Inventory Management System – Maintenance Menu.



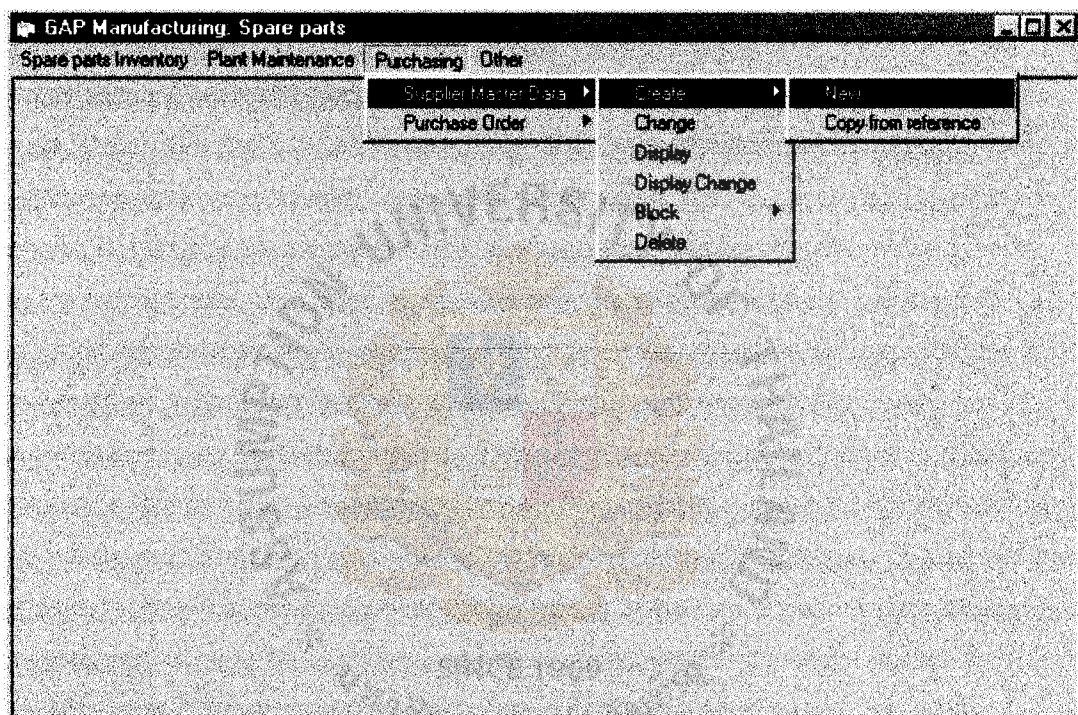


Figure A.8. Spare Parts Inventory Management System – Supplier Menu.

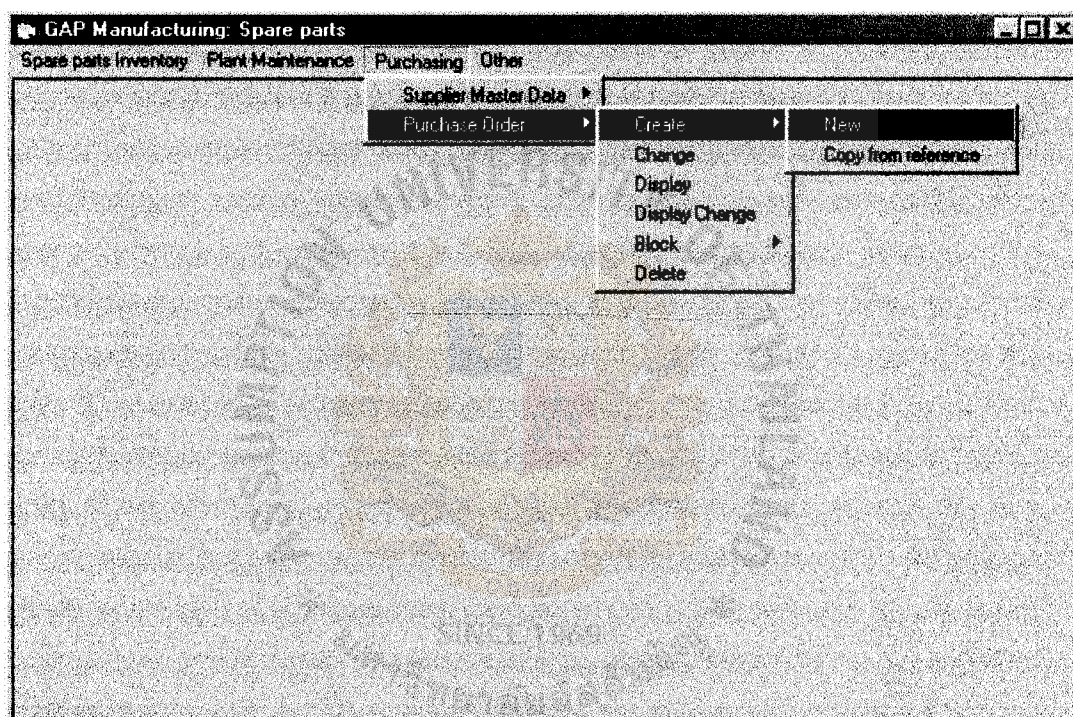


Figure A.9. Spare Parts Inventory Management System – Purchase Order Menu.



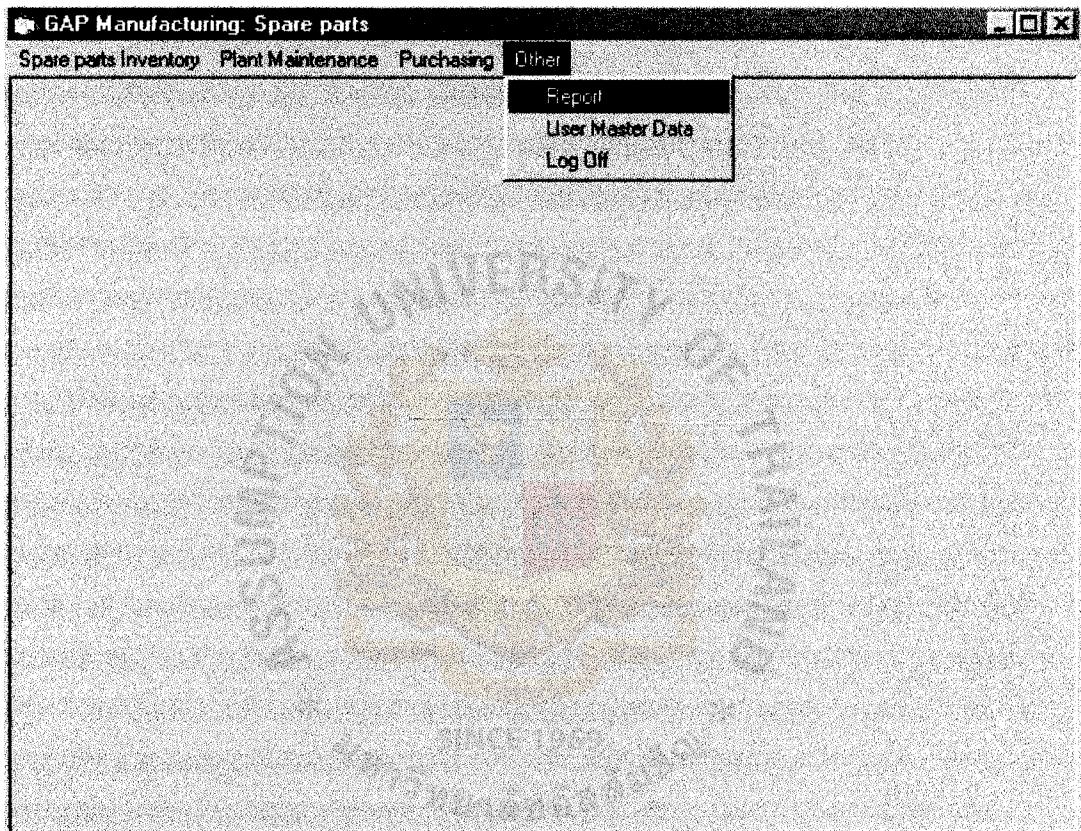


Figure A.10. Spare Parts Inventory Management System – Report Menu.



Spare Parts Receipt

Posting Date

15/01/2002

Purchase Order

PO80000021

Enter

Items

Item no.	Spare part no.	Description	Quantity	UOM	Location
001	80000122	Gasket set 1.5" full set	20	PCS	003-3-3

Save

Figure A.11. Spare Parts Inventory Management System – Receipt Screen.

Spare Parts Issue

Posting Date

15/1/2001

Maintenance Order

MO600000025

Items

Item no.	Spare part no.	Quantity	UCM	Location	Remarks
1	80000001	29	PCS	005-2-3	issue for replacement
2					
3					
4					
5					
6					
7					
8					
9					
10					

Save

Cancel

Figure A.12. Spare Parts Inventory Management System – Issuing Screen.

Spare Parts Transfer

Posting Date

14/1/2002

Items

Item no.	Spare part no.	Quantity	UOM	From Location	To Location	Remarks
1	80000080	3	PCS	001-1-1	004-1-1	Trf from rac 1 to rack 4
2						
3						
4						
5						
6						
7						
8						
9						
10						

Save

Cancel

Figure A.13. Spare Parts Inventory Management System – Stock Transfer Menu.



**Spare parts master data**

Spare part number: 800000040 Created Date: 12/1/2002

Description: O ring size 1" full set

Type of Spare Parts:

☒ Machine and Equipment ☐ Building Facilities ☐ Operating Supplies

Sourcing data:

Supplier no.: S0000009

Supplier name: Sumeth Engineering Co., Ltd.

Capacity data:

UOM: PCS Lead time delivery: 5 days

Safety stock level: 200 PCS Minimum stock for placing order: 400 PCS

Maximum stock store in storeroom: 1000 PCS

Save Cancel Exit

Figure A.14. Spare Parts Management System – Spare Parts Master Data Screen.

**Supplier Master Data**

Supplier no.	S0000001	Create Date	01/1/2002
Supplier name (Company's name)	Apichart Parts and Services Ltd., Part.		
Address	153 Soi Sawatdee 1, Sukumvit 105, Bangna subdistrict, Bangna, Bangkok 10260		
Telephone no.	0-2393-5261-5	Fax no.	0-2393-5266
E mail Address	APS_part@yahoo.com	Country	Thailand
Tax ID no.	349014598702	Credit term	30 days
		Payment currency	THB
Contact sales person name	Khun Boonchai Rungpaiboonsakdi		
Contact telephone number	0-1344-0876	Minimum Order Placement	400 PCS
Texts/Remarks Please contact Khun Boonchai for spare parts availability 2 weeks before required date.			
Save		Cancel	Exit

Figure A.15. Spare Parts Management System-Supplier Master Data Screen.



**Production Line**

Production no. IC-001-001

Production name Mixing tank number 1

Production Department Haircare department

Historical Data

Supplier no. S0000045

Maintenance Order no. MO80000001

Save Cancel Exit

Figure A.16. Spare Parts Management System – Production Line Master Data Screen.

**Maintenance Order**

Maintenance Order no.

Description

Historical information

Planned Start Date	<input type="text" value="10/1/2002"/>	Planned Finished Date	<input type="text" value="11/1/2002"/>
Actual Start Date	<input type="text" value="10/1/2002"/>	Actual Finished Date	<input type="text" value="12/1/2002"/>

Production Line Order

Text Notes/Remarks

Figure A.17. Spare Parts Management System – Maintenance Order Master Data Screen



**APPENDIX B**

**REPORT DESIGN**



**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

**Daily Spare Parts Inventory Report**  
**As of December 15, 2001**

Spare part #	Description	Balance	UOM
80000001	Adapter 3"	40	pcs
80000050	Battery 4.5V	50	pcs
80000078	Box, Control 24V	85	pcs
80000080	Valve 2" - Tiger	290	pcs
80000104	Breaker, circuit	45	pcs
80000110	Filter	58	pcs
80000122	Gasket set 1.5" full set	224	pcs
80000130	Gasket set 2" full set	115	pcs
80000132	Gasket set 3" full set	210	pcs
80000139	O-Ring 1"	185	pcs
80000140	Sensor	10	pcs
80000142	Spring 2"	120	pcs
80000145	Switch green light	10	pcs

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

Figure B.1. Daily Spare Parts Inventory Report.

**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

**Monthly Spare Parts Inventory Report**  
**For the month of December, 2001**

Spare part #	Description	Beginning	Receipt	Issue	Balance	UOM
80000001	Adapter 3"	20	50.00	20.00	50.00	pcs
80000050	Battery 4.5V	25	15.00	25.00	15.00	pcs
80000078	Box,Control 24V	80	10.00	30.00	60.00	pcs
80000080	Valve 2" - Tiger	53	5.00	45.00	13.00	pcs
80000104	Breaker, circuit	55	10.00	40.00	25.00	pcs
80000110	Filter	37	29.00	30.00	36.00	pcs
80000122	Gasket set 1.5" full set	45	100.00	89.00	56.00	pcs
80000130	Gasket set 2" full set	60	120.00	140.00	40.00	pcs
80000132	Gasket set 3" full set	36	100.00	95.00	41.00	pcs
80000139	O-Ring 1"	79	200.00	150.00	129.00	pcs
80000140	Sensor	20	10.00	15.00	15.00	pcs
80000142	Spring 2"	100	40.00	78.00	62.00	pcs
80000145	Switch green light	23	12.00	18.00	17.00	pcs

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

Figure B.2. Monthly Spare Parts Inventory Report.

**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

**Purchase Order Report**  
**As of December 1, 2001**

PO#	Supplier #	Supplier Name	Spare part #	Description	Qty	UOM
PO80000001	S0000002	Thep Enterprise Co., Ltd.	80000001	Adapter 3"	30.00	pcs
PO80000002	S0000007	TECH Co.,Ltd.	80000050	Battery 4.5V	25.00	pcs
PO80000003	S0000018	S.N.J. Multi Supply Ltd., Part.	80000110	Filter	35.00	pcs
PO80000004	S0000035	Namrung Industry Co., Ltd.	80000122	Gasket set 1.5" full set	40.00	pcs
PO80000005	S0000003	Suwan Engineering Ltd., Part.	80000139	O-Ring 1"	200.00	pcs
PO80000006	S0000076	Somboon Supplies and Tools Co., Ltd.	80000140	Sensor	55.00	pcs
PO80000007	S0000001	Apichart Parts and Services Ltd., Part.	80000142	Spring 2"	150.00	pcs
PO80000008	S0000009	Sumeth Engineering Co., Ltd.	80000080	Valve 2" - Tiger	170.00	pcs
PO80000009	S0000008	Superstar Parts and Services Co., Ltd.	80000078	Box, Control 24V	30.00	pcs

Total 9 items

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

Figure B.3. Purchase Order Report.

GAP Manufacturing Co., Ltd.  
125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.  
Tax ID# 1245879200

Spare Parts Stock Card Report				
Spare part # :	80000075	Description : Valve, 220 V AC 5	UOM : Pieces	
Date	Ref#	In	Out	Balance
Dec 1,01	Beginning Balance			21,600
Dec 2,01	SPRN#10000005	28,800		50,400
Dec 2,01	SPIN#900000003		7,200	43,200
Dec 8,01	SPIN#900000010		9,600	33,600
Dec 10,01	SPIN#900000015		8,160	25,440
Dec 12,01	SPIN#900000027		6,240	19,200
Dec 13,01	SPIN#900000032		11,520	7,680
Dec 19,01	SPRN#100000047	57,600		65,280
Dec 21,01	SPIN#900000058		12,000	53,280
Dec 24,01	SPIN#900000067		8,640	44,640
Dec 26,01	SPIN#900000069		6,720	37,920
Total		86,400	70,080	37,920

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

Figure B.4. Spare Parts Stock Card Report.

GAP Manufacturing Co., Ltd.  
125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.

Daily Spare Parts Inventory Receipt Report  
As of December 15, 2001

Spare part #	Description	Qty	UOM	Price per Unit	Total Amount	Currency	Ref. Document#	Ref. Purchase Orde	Location
80000001	Adapter 3"	40.00	pcs	350.00	14,000.00	THB	SPRN#10000015	PO80000040	001-1-3
80000050	Battery 4.5V	10.00	pcs	1,500.00	15,000.00	THB	SPRN#10000016	PO80000037	003-1-1
80000078	Box, Control 24V	20.00	pcs	17,000.00	340,000.00	THB	SPRN#10000017	PO80000045	014-3-4
80000080	Valve 2" - Tiger	100.00	pcs	400.00	40,000.00	THB	SPRN#10000018	PO80000046	005-2-2
80000104	Breaker, circuit	50.00	pcs	4,450.00	222,500.00	THB	SPRN#10000019	PO80000047	007-1-3
80000110	Filter	55.00	pcs	1,350.00	74,250.00	THB	SPRN#10000020	PO80000048	009-3-3
80000122	Gasket set 1.5" full set	200.00	pcs	590.00	118,000.00	THB	SPRN#10000021	PO80000041	010-2-4
80000130	Gasket set 2" full set	300.00	pcs	700.00	210,000.00	THB	SPRN#10000022	PO80000038	017-3-3
80000132	Gasket set 3" full set	250.00	pcs	1,350.00	337,500.00	THB	SPRN#10000023	PO80000039	013-3-2
80000139	O-Ring 1"	400.00	pcs	1,250.00	500,000.00	THB	SPRN#10000024	PO80000036	012-2-4
80000140	Sensor	35.00	pcs	8,580.00	300,300.00	THB	SPRN#10000025	PO80000035	020-1-1
80000142	Spring 2"	150.00	pcs	150.00	22,500.00	THB	SPRN#10000026	PO80000049	011-1-1
80000145	Switch green light	45.00	pcs	225.00	10,125.00	THB	SPRN#10000027	PO80000050	002-2-2
Total Spare Parts Rece		1,655.00	pcs	2,204,175.00	THB				

Total 13 items

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

Figure B.5. Daily Spare Parts Inventory Receipt Report.

GAP Manufacturing Co., Ltd.  
125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.

Monthly Spare Parts Consumption Report  
For the month of December, 2001

Production line #	Description	Spare part#	Description	Qty	UOM	Price per Unit	Total Amount	Currency	Ref. Document#	Location
HC-001-001	Haircare: Making system Mixing Tanks	80000080	Valve 2" - Tiger	10.00	pcs	400.00	4,000.00	THB	SPIN#90000005	005-2-2
		80000132	Gasket set 3" full set	12.00	pcs	1,350.00	16,200.00	THB	SPIN#90000011	013-3-2
		80000139	O-Ring 1"	15.00	pcs	1,250.00	18,750.00	THB	SPIN#90000024	012-2-3
		80000140	Sensor	5.00	pcs	8,580.00	42,900.00	THB	SPIN#90000030	020-1-3
		80000142	Spring 2"	25.00	pcs	150.00	3,750.00	THB	SPIN#90000031	011-1-4
Total Consumption:				67.00	pcs		85,600.00	THB		

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

Figure B.6. Monthly Spare Parts Consumption Report.



**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

**Spare Parts Inventory Report by Location**  
**As of December 15, 2001**

Location	Description	Spare part #	Description	Qty	UOM	Ref. Document#	Ref. Purchase Order
001-1-1	Rack#1-Floor#1-Bin#1	80000001	Adapter 3"	40.00	pcs	SPRN#10000015	PO80000040
001-1-2	Rack#1-Floor#1-Bin#2	80000050	Battery 4.5V	10.00	pcs	SPRN#10000016	PO80000037
001-1-3	Rack#1-Floor#1-Bin#3	80000078	Box, Control 24V	20.00	pcs	SPRN#10000017	PO80000045
001-1-4	Rack#1-Floor#1-Bin#4	80000140	Sensor	35.00	pcs	SPRN#10000025	PO80000035
001-2-1	Rack#1-Floor#2-Bin#1	80000080	Valve 2" - Tiger	50.00	pcs	SPRN#10000018	PO80000046
001-2-2	Rack#1-Floor#2-Bin#2	80000080	Valve 2" - Tiger	50.00	pcs	SPRN#10000018	PO80000046
001-2-3	Rack#1-Floor#2-Bin#3	80000080	Valve 2" - Tiger	50.00	pcs	SPRN#10000018	PO80000046
001-2-4	Rack#1-Floor#2-Bin#4	80000080	Valve 2" - Tiger	50.00	pcs	SPRN#10000018	PO80000046
001-3-1	Rack#1-Floor#3-Bin#1	80000132	Gasket set 3" full set	50.00	pcs	SPRN#10000023	PO80000039
001-3-2	Rack#1-Floor#3-Bin#2	80000132	Gasket set 3" full set	50.00	pcs	SPRN#10000023	PO80000039
001-3-3	Rack#1-Floor#3-Bin#3	80000132	Gasket set 3" full set	50.00	pcs	SPRN#10000023	PO80000039
001-3-4	Rack#1-Floor#3-Bin#4	80000132	Gasket set 3" full set	50.00	pcs	SPRN#10000023	PO80000039
<b>Total Spare Parts in Rack#1:</b>				<u>505.00</u>	<u>pcs</u>		

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

Figure B.7. Spare Parts Inventory Report by Location.

**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

**Spare Parts Discrepancy Report**  
**As of December 15, 2001**

Location	Description	Quantity in System			Quantity in Physical Counting			Discrepancy		
		Spare part #	Description	Qty	Spare part #	Qty		Quantity	Price per Unit	Amount
001-1-1	Rack#1-Floor#1-Bin#1	80000001	Adapter 3"	40.00	80000001	40.00		0.00	350.00	0.00
001-1-2	Rack#1-Floor#1-Bin#2	80000050	Battery 4.5V	10.00	80000050	10.00		0.00	1,500.00	0.00
001-1-3	Rack#1-Floor#1-Bin#3	80000078	Box, Control 24V	20.00	80000078	20.00		0.00	17,000.00	0.00
001-1-4	Rack#1-Floor#1-Bin#4	80000140	Sensor	35.00	80000140	35.00		0.00	8,580.00	0.00
001-2-1	Rack#1-Floor#2-Bin#1	80000080	Valve 2" - Tiger	50.00	80000080	50.00		0.00	400.00	0.00
001-2-2	Rack#1-Floor#2-Bin#2	80000080	Valve 2" - Tiger	50.00	80000080	50.00		0.00	400.00	0.00
001-2-3	Rack#1-Floor#2-Bin#3	80000080	Valve 2" - Tiger	50.00	80000080	45.00		5.00	400.00	2,000.00
001-2-4	Rack#1-Floor#2-Bin#4	80000080	Valve 2" - Tiger	50.00	80000080	55.00		(5.00)	400.00	(2,000.00)
001-3-1	Rack#1-Floor#3-Bin#1	80000132	Gasket set 3" full set	50.00	80000132	50.00		0.00	1,350.00	0.00
001-3-2	Rack#1-Floor#3-Bin#2	80000132	Gasket set 3" full set	50.00	80000132	35.00		15.00	1,350.00	20,250.00
001-3-3	Rack#1-Floor#3-Bin#3	80000132	Gasket set 3" full set	50.00	80000132	40.00		10.00	1,350.00	13,500.00
001-3-4	Rack#1-Floor#3-Bin#4	80000132	Gasket set 3" full set	50.00	80000132	50.00		0.00	1,350.00	0.00
		<b>Total Adjustment</b>						<b>25.00</b>		<b>33,750.00</b>

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

Figure B.8. Spare Parts Discrepancy Report.

**GAP Manufacturing Co., Ltd.**  
**125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.**

Spare Parts Out of Stock Report As of December 15, 2001						
Spare part #	Description	Balance	UOM	Safety Stock Level	Recovery Quantity	
80000001	Adapter 3"	40	pcs	50	10	
80000050	Battery 4.5V	50	pcs	50	0	
80000104	Breaker, circuit	45	pcs	50	5	
80000110	Filter	58	pcs	60	2	
80000140	Sensor	10	pcs	20	10	
80000145	Switch green light	10	pcs	20	10	

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

Figure B.9. Spare Parts Out of Stock Report.

GAP Manufacturing Co., Ltd.  
125 Moo 6, Bangna Trad km 14 Road, Bangpleeyai, Bangplee, Samutprakarn 10540.

Spare Parts Incoming List Report									
As of December 17, 2001									
Spare part #	Description	Order Quantity	UOM	Price per Unit	Order Amount	Currency	Ref. Purchase Order	Supplier #	Supplier Name
80000001	Adapter 3"	20.00	pcs	350.00	7,000.00	THB	PO80000040	S0000002	Thep Enterprise Co., Ltd.
80000050	Battery 4.5V	30.00	pcs	1,500.00	45,000.00	THB	PO80000037	S0000007	TECH Co.,Ltd.
80000078	Box,Control 24V	20.00	pcs	17,000.00	340,000.00	THB	PO80000045	S0000018	S.N.J. Multi Supply Ltd., Part.
80000140	Sensor	50.00	pcs	8,580.00	300,300.00	THB	PO80000035	S0000035	Namrung Industry Co., Ltd.
80000145	Switch green light	10.00	pcs	225.00	10,125.00	THB	PO80000050	S0000035	Namrung Industry Co., Ltd.

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

Figure B.10. Spare Parts Incoming List Report.



## **APPENDIX C**

### **DATABASE DESIGN**

Table C.1. Employee Database Table.

Field Name	Field Type	Length	Description
Emp_no	Int	8	Employee number
Emp_name	Varchar	20	Employee name
Emp_surname	Varchar	20	Employee surname
Emp_sex	Varchar	1	Employee sex (M=male, F=Female)
Emp_position	Varchar	15	Employee position
Emp_dept	Varchar	15	Employee department
Emp_add	Varchar	250	Employee home address
Emp_tel	Int	20	Employee telephone contact number
Emp_psswd	Varchar	15	Employee password

Table C.2. Spare Parts Master Data Database Table.

Field Name	Field Type	Length	Description
Sp_no	Int	8	Spare parts number
Sp_Desc	Varchar	45	Spare parts description
Sp_Qty	Int	15	Spare parts quantity
Sp_uom	Varchar	3	Unit of measure
Sp_safe	Int	4	Spare parts safety stock level
Sp_price	Int	9	Price per unit
Sp_cur	Varchar	5	Spare parts price currency
Sp_time	Int	3	Lead time to delivery spare parts
Sp_max	Int	4	Maximum spare parts keeping level
Sp_order	Int	6	Minimum quantity for placing purchase order
Emp_no	Int	8	Employee number



Table C.3. Spare Parts Transaction Database Table.

Field Name	Field Type	Length	Description
Tr_no	Int	10	Spare part transaction number
Tr_des	Varchar	30	Spare parts transaction description
Tr_type	Varchar	2	Spare parts transaction type (SR = receipt, SI = issue)
Sp_no	Int	8	Spare parts number
Tr_date	Date	15	Spare parts transaction date
Pur_no	Int	8	Purchase Order number
Maint_no	Int	8	Maintenance Order number
Loc_no	Int	12	Spare parts Location number
Emp_no	Int	8	Employee number
Tr_note	Varchar	100	Texts/ remarks of spare parts transaction

Table C.4. Supplier Database Table.

Field Name	Field Type	Length	Description
S_no	Int	8	Supplier number
S_name	Varchar	50	Supplier name
S_date	Date	10	Supplier master data create date
S_add	Varchar	250	Supplier address
S_tel	Int	20	Supplier telephone number
S_fax	Int	20	Supplier fax number
S_country	Varchar	20	Supplier country
S_mail	Varchar	20	Supplier e-mail address
S_tax	Int	15	Supplier tax number
S_credit	Int	3	Supplier credit term
S_contact	Varchar	50	Supplier contact person name
S_contact_tel	Int	20	Contact person telephone number
S_curr	Varchar	10	Supplier currency payment
S_note	Varchar	100	Texts/ remarks of Supplier

Table C.5. Purchase Order Database Table.

Field Name	Field Type	Length	Description
PO_no	Int	8	Purchase Order number
PO_date	Date	15	Purchase Order date
S_no	Int	8	Supplier number
Sp_no	Int	8	Spare parts number
Sp_uom	Varchar	3	Unit of measure
PO_qty	Int	6	Purchase Order quantity
PO_price	Int	9	Purchase Order price per unit
PO_curr	Varchar	10	Purchase Order currency
PO_amt	Int	15	Purchase Order amount
PO_del	Date	15	Purchase Order delivery date
PO_under	Percentage	2	Percentage allowed to submit under PO quantity
PO_over	Percentage	2	Percentage allowed to submit over PO quantity
Emp_no	Int	8	Employee number
PO_note	Varchar	100	Texts/ remarks of Purchase Order

Table C.6. Production Line Database Table.

Field Name	Field Type	Length	Description
Prod_no	Int	15	Production line number
Prod_des	Varchar	100	Production line description
Prod_dept	Varchar	15	Department of production line
S_no	Int	8	Supplier number
Maint_no	Int	8	Maintenance Order number
Prod_note	Varchar	100	Texts/ remarks of Production line

Table C.7. Maintenance Order Database Table.

Field Name	Field Type	Length	Description
Maint_no	Int	15	Maintenance Order number
Maint_des	Varchar	100	Maintenance Order description
Maint_Pstart	Date	15	Maintenance Order planned start date
Maint_Pfinish	Date	15	Maintenance Order planned finished date
Maint_Astart	Date	15	Maintenance Order actual start date
Maint_Afinish	Date	15	Maintenance Order actual finished date
Prod_no	Int	15	Production line number
Prod_des	Varchar	100	Production line description
Maint_note	Varchar	100	Texts/ remarks of Maintenance Order

Table C.8. Storeroom Storage Location Database Table.

Field Name	Field Type	Length	Description
Loc_no	Int	15	Storeroom Location number
Loc_des	Varchar	100	Storeroom Location description
Sp_no	Int	8	Spare parts number
Sp_Desc	Varchar	45	Spare parts description
Sp_Qty	Int	15	Spare parts quantity
Sp_uom	Varchar	3	Unit of measure
PO_no	Int	8	Purchase Order number
Emp_no	Int	8	Employee number



## **APPENDIX D**

### **PROCESS SPECIFICATION**



## PROCESS SPECIFICATION

Table D.1. Process Specification of Process 1.

Item	Description
Process Name:	Checking Stock Level of Spare Parts Inventory
Input:	Spare parts Stock balance
Output:	Spare parts Out of Stock report
Process:	<ol style="list-style-type: none"> <li>(1) Storeroom planner gets confirmation from operation staffs in completing all last shift transactions.</li> <li>(2) Storeroom planner goes to log on in the system for checking the spare parts stock balance.</li> <li>(3) Print out the spare part inventory balance report</li> <li>(4) Compare spare parts stock level with safety stock quantity in spare parts master data by each spare part.</li> <li>(5) List out spare parts that need to reorder.</li> <li>(6) Prepare spare parts out of stock report and send to purchasing staffs.</li> <li>(7) Purchasing staffs prepare purchase order with appropriate quantity based on spare parts out of stock report.</li> <li>(8) Sending purchase order to suppliers via facsimile and telephone to confirm delivery.</li> </ol>
Attachment:	(1) Data Store D3 – Spare Parts Inventory

Table D.2. Process Specification of Process 2.

Item	Description
Process Name:	Receiving Spare Parts
Input:	Purchase Order report Spare parts Incoming List report Spare parts Tax invoices
Output:	Copy Tax invoice Daily Spare Parts Incoming List report Copy Purchase Order
Process:	<ol style="list-style-type: none"> <li>(1) Purchasing staffs send Purchase Order report and Spare Parts Incoming List report to storeroom receiver.</li> <li>(2) Storeroom receiver file Purchase Order and Spare Parts Incoming List for reference.</li> <li>(3) Supplier sends spare parts to storeroom receiving area and inform storeroom receiver for verifying.</li> <li>(4) Storeroom receiver goes to have random checked quantities among Spare Parts Incoming List, Purchase order and delivery note.</li> <li>(5) If finding inequality or no quality spare parts, storeroom receiver need to contact purchase staff and supplier for spare parts replacement or canceling purchase order.</li> <li>(6) If spare parts are matched with both quantity and quality, storeroom receiver will sign on tax invoice and return copy to supplier.</li> <li>(7) Prepare Spare parts receipt note and submit original tax invoice, copy purchase order and receipt note to Finance and Accounting staffs</li> </ol>

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

Item	Description
Process Name:	Receiving Spare Parts
Input:	Purchase Order report Spare parts Incoming List report Spare parts Tax invoices
Output:	Copy Tax invoice Daily Spare Parts Incoming List report Copy Purchase Order
Process:	(8) Storeroom receiver keys receipt spare parts into system. (9) Bring spare parts to keep at appropriate location in storeroom.
Attachment:	(1) Data Store D1 – Employee (2) Data Store D2 – Spare Parts Master data (3) Data Store D3 – Spare Parts Inventory transaction (4) Data Store D4 – Supplier (5) Data Store D5 – Purchase Order (6) Data Store D7 – Storage Location

Table D.3. Process Specification of Process 3.

Item	Description
Process Name:	Supplying Spare Parts
Input:	<p>Spare parts Inventory data</p> <p>Production Line data</p> <p>Storage Location data</p> <p>Stock Issue Request</p> <p>Stock Return Request</p>
Output:	<p>Stock Issue Note</p> <p>Stock Return Note</p> <p>Spare parts</p>
Process:	<p>(1) Production staffs prepare stock issue request and submit to storeroom staff.</p> <p>(2) Storeroom staff view spare part availability in system based on requisition.</p> <p>(3) Prepares stock issue note and goes to appropriate location in bringing spare part to production staff based on request.</p> <p>(4) Issue spare parts to production line as replacement in appropriate section of production line.</p> <p>(5) Update transaction in system.</p> <p>(6) Production staffs prepare stock return request and submit to storeroom staff.</p> <p>(7) Storeroom staff check both quality and quantity spare parts</p>

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

Item	Description
Process Name:	Supplying Spare Parts
Input:	Spare parts Inventory data Production Line data Storage Location data Stock Issue Request Stock Return Request
Output:	Stock Issue Note Stock Return Note Spare parts
Process:	(8) Storeroom staff will prepare stock return note. (9) Spare parts will return back to storeroom. (10) Bring spare parts to keep at appropriate location. (11) Update transaction into system.
Attachment:	(1) Data Store D3 – Spare Parts Inventory transaction (2) Data Store D6 – Production Line (3) Data Store D7 – Storage Location (4) Data Store D8 – Maintenance Order



Table D.4. Process Specification of Process 4.

Item	Description
Process Name:	Physical Spare Part Checking
Input:	Spare Parts data Storage Location data
Output:	Spare Parts Discrepancy report
Process:	<ul style="list-style-type: none"><li>(1) Storeroom staff selects storage location that will do stock physical counting.</li><li>(2) Prepare the spare part counting list.</li><li>(3) Go to count spare parts at identified storage location.</li><li>(4) Fill number that had counted into system and comparing any discrepancy.</li><li>(5) Find the root cause of discrepancy and prepare spare parts discrepancy report.</li><li>(6) Submit to storeroom manager for approval.</li><li>(7) Key adjusting stock quantity in system.</li><li>(8) Send spare parts discrepancy report to Finance and Accounting staffs.</li></ul>
Attachment:	<ul style="list-style-type: none"><li>(1) Data Store D3 – Spare Parts Inventory transaction</li><li>(2) Data Store D7 – Storage Location</li></ul>

Table D.5. Process Specification of Process 5.

Item	Description
Process Name:	Preparing Monthly Report
Input:	Spare Parts Transaction Data Spare Parts Master Data Maintenance Order Data
Output:	Monthly Spare parts Inventory Report Monthly Spare parts Consumption Report
Process:	(1) Storeroom staffs download spare parts information from system. (2) Preparing and rearranging spare parts inventory and spare parts consumption report. (3) Submit to storeroom manager for verification and concurrence. (4) Submit to Managing Director and Production manager for reference.
Attachment:	(1) Data Store D3 – Spare Parts Inventory transaction. (2) Data Store D8 – Maintenance Order

Table D.6. Process Specification of Process 1.1.

Item	Description
Process Name:	Comparing Spare Parts Stock Level with Safety Stock
Input:	Spare parts stock balance data Material master data
Output:	Spare parts out of stock list
Process:	Comparing spare parts stock level from database
Attachment:	(1) Data Store D3 – Spare parts Inventory transaction

Table D.7. Process Specification of Process 1.2.

Item	Description
Process Name:	Preparing Out of Stock report
Input:	Spare Parts data Spare Parts Out of Stock List
Output:	Spare Parts Out of Stock Report
Process:	(1) Rechecking spare parts out of stock list with system. (2) Preparing spare parts out of stock report. (3) Send spare parts out of stock report to Purchase staffs.
Attachment:	-

Table D.8. Process Specification of Process 2.1.

Item	Description
Process Name:	Check Spare Parts quantity against PO
Input:	Supplier data Purchase Order report Spare parts Tax Invoice Spare parts Incoming List report
Output:	Spare parts request note Spare parts number
Process:	(1) Compare spare part number against Purchase Order and Spare parts incoming list report when supplier sends spare parts at storeroom. (2) Count quantity of spare parts against purchase order. (3) If not correct, inform purchase staff for receipt rejecting or replenishment on next shipment.

Table D.8. Process Specification of Process 2.1 (Continued).

Item	Description
Process Name:	Check Spare Parts quantity against PO
Attachment:	(1) Data Store D4 – Supplier (2) Data Store D5 – Purchase Order

Table D.9. Process Specification of Process 2.2.

Item	Description
Process Name:	Random Checking Spare Parts Quality
Input:	Spare Parts Purchase Order Spare Parts Master Data Tax Invoice
Output:	Receipt Note
Process:	(1) Check specification of spare parts with spare part master data and Purchase Order. (2) Randomly check quality of spare parts at least 15% of sending quantity from supplier's invoice. (3) If non-damaged items found, issue Receipt Note. (4) If finding any damaged items, informed purchasing staffs for replacement or rejecting receiving.
Attachment:	(1) Data Store D2 – Parts Master Data

Table D.10. Process Specification of Process 2.3.

Item	Description
Process Name:	Signing on Tax Invoice and Returning Documents
Input:	Receipt Note Tax Invoice Purchase Order
Output:	Copy Tax Invoice Tax Invoice Copy Purchase Order Receipt Note Record
Process:	<ol style="list-style-type: none"> <li>(1) Check and compare spare part against purchase order and tax invoice.</li> <li>(2) Checking correctness and completeness of tax invoice from supplier.</li> <li>(3) If amount matching, signing on tax invoice and return copy to supplier.</li> <li>(4) Sending original tax invoice, copy purchase order and copy of receipt note to Finance and Accounting staffs.</li> <li>(5) Filing original receipt note.</li> </ol>
Attachment:	-

Table D.11. Process Specification of Process 2.4.

Item	Description
Process Name:	Updating Spare Parts Record in System and Keeping at Proper Location
Input:	Spare Parts Receipt Note Record
Output:	Spare Parts
Process:	<ol style="list-style-type: none"> <li>(1) Checking spare part number against receipt note record.</li> <li>(2) Checking appropriate location that fit for storing spare parts.</li> <li>(3) Filling storage location number in receipt note record.</li> <li>(4) Store spare parts at designed location.</li> <li>(5) Update into system.</li> </ol>
Attachment:	<ol style="list-style-type: none"> <li>(1) Data Store D3 – Spare Parts Inventory Transaction</li> <li>(2) Data Store D7 – Storage Location</li> </ol>

Table D.12. Process Specification of Process 3.1.

Item	Description
Process Name:	Checking Spare Parts against Stock Issue Request
Input:	Spare Parts Issue Request Spare Parts Transaction data Storage Location data
Output:	Spare Parts Issue Note Spare Parts
Process:	<ol style="list-style-type: none"> <li>(1) Checking spare part number and quantity against spare parts issue request.</li> <li>(2) Finding spare parts availability, storage location in</li> </ol>



Table D.12. Process Specification of Process 3.1 (Continued).

Item	Description
Process Name:	Checking Spare Parts against Stock Issue Request
Input:	Spare Parts Issue Request Spare Parts Transaction data Storage Location data
Output:	Spare Parts Issue Note Spare Parts
Process:	system. (3) Prepare stock issue note with appropriate quantity and location. (4) Give to storeroom supply staffs in acquiring spare parts at designate location.
Attachment:	(1) Data Store D3 – Spare Parts Inventory Transaction (2) Data Store D6 – Production Line (3) Data Store D7 – Storage Location

Table D.13. Process Specification of Process 3.2.

Item	Description
Process Name:	Taking Spare Parts from Proper Location
Input:	Spare Parts Issue Note Spare Parts Transaction data Storage Location data
Output:	Spare Part Issue Note Record
Process:	Take spare parts aligned with quantity in Spare parts issue note from designate storage location.

Table D.13. Process Specification of Process 3.2. (Continued).

Item	Description
Process Name:	Taking Spare Parts from Proper Location
Attachment:	-

Table D.14. Process Specification of Process 3.3.

Item	Description
Process Name:	Issuing Spare Parts to Production Line and Update in System
Input:	Spare Parts Issue Note Record Spare Parts Transaction data Storage Location data
Output:	Spare Parts
Process:	<ol style="list-style-type: none"> <li>(1) Issuing physical spare parts to production line staffs against spare parts issue note.</li> <li>(2) Signing on spare parts issue note for completeness.</li> <li>(3) Updating quantity issue, appropriate maintenance order and designate storage location in system.</li> <li>(4) Filing spare parts issue note at file and keeping at cabinet for future reference.</li> </ol>
Attachment:	<ol style="list-style-type: none"> <li>(1) Data Store D3 – Spare Parts Inventory Transaction</li> <li>(2) Data Store D7 – Storage Location</li> <li>(3) Data Store D3 – Maintenance Order</li> </ol>

Table D.15. Process Specification of Process 3.4.

Item	Description
Process Name:	Checking Spare Part Quantity and Quality from Spare Part Return Request
Input:	Spare Parts Spare Parts Return Request Spare Parts Transaction data Storage Location data
Output:	Spare Parts Return Note
Process:	(1) Checking spare parts quantity based on request from production line. (2) Checking spare parts quality based on request from production line. (3) If step 1 and 2 are qualified, initiate prepare spare parts return note. (4) Passing document to storeroom supplying staffs.
Attachment:	*-

Table D.16. Process Specification of Process 3.5.

Item	Description
Process Name:	Checking Proper Storage Location Capacity for Keeping Spare Parts
Input:	Spare Parts Issue Note Spare Parts Transaction data Storage Location data
Output:	Spare Parts Issue Note Record
Process:	Checking availability of storage location in system for

Table D.16. Process Specification of Process 3.5 (Continued).

Item	Description
Process Name:	Checking Proper Storage Location Capacity for Keeping Spare Parts
Process:	required quantity receipt.
Attachment:	(1) Data Store D3 – Spare Parts Inventory Transaction (2) Data Store D7 – Storage Location.

Table D.17. Process Specification of Process 3.6.

Item	Description
Process Name:	Bringing Physical Spare Parts to Store at Proper Location
Input:	Spare Parts Spare Parts Return Note Record
Output:	Spare Part Transaction data *Storage Location data
Process:	(1) Signing on completeness of Stock Issue Note. (2) Bringing Physical Spare Parts to store at designate storage location in storeroom. (3) Updating receipt transaction into system.
Attachment:	(1) Data Store D3 – Spare Parts Inventory Transaction (2) Data Store D7 – Storage Location (3) Data Store D8 – Maintenance Order

Table D.18. Process Specification of Process 4.1.

Item	Description
Process Name:	Selecting Location for Physical Spare Parts Counting
Input:	Spare Parts Transaction data Storage Location data
Output:	Spare Parts Physical Counting List
Process:	Selection the amount of proper storage location for doing physical spare part counting.
Attachment:	Data Store D7 – Storage Location

Table D.19. Process Specification of Process 4.2.

Item	Description
Process Name:	Counting Physical Spare Parts at Designate Location
Input:	Spare Parts Physical Counting List
Output:	Spare Parts Physical Counting List Record
Process:	(1) Going to designate Location that identify in physical counting list. (2) Checking spare part specification code that identify in physical counting list. (3) If correct, count quantity of each spare part and filling amount into physical counting list. (4) If not, marking down the unmatched item in list for further adjustment. (5) When finished counting, sign on physical list record.
Attachment:	-

Table D.20. Process Specification of Process 4.3.

Item	Description
Process Name:	Comparing Physical Counting List with System Quantity
Input:	Spare Parts Physical Counting List Record
Output:	Spare Parts Stock Discrepancy List
Process:	<ul style="list-style-type: none"><li>(1) Keying physical count quantity into system.</li><li>(2) Compare and list any stock discrepancy between physical count quantity and system quantity.</li><li>(3) Do revise physical counting for each discrepancy.</li><li>(4) For any discrepancy left, going to check with history transaction against document file.</li><li>(5) For any unidentified reason of discrepancy, storeroom staff will prepare spare part discrepancy list.</li></ul>
Attachment:	<ul style="list-style-type: none"><li>(1) Data Store D3 – Spare Parts Inventory Transaction</li><li>(2) Data Store D7 – Storage Location</li></ul>

Table D.21. Process Specification of Process 4.4.

Item	Description
Process Name:	Asking Approval for Adjusting Stock in System.
Input:	Spare Parts Stock Discrepancy List
Output:	<p>Spare Parts Transaction data</p> <p>Spare Parts Location data</p>
Process:	<ul style="list-style-type: none"><li>(1) Submit spare parts stock discrepancy list to storeroom manager for approval.</li><li>(2) After approval, keying adjusting quantity into system.</li></ul>
Attachment:	<ul style="list-style-type: none"><li>(1) Data Store D3 – Spare Parts Inventory Transaction</li><li>(2) Data Store D7 – Storage Location</li></ul>





## **APPENDIX E**

### **DATA DICTIONARY**

DATA DICTIONARY

Table E.1. Data Dictionary of Spare Parts Stock Balance in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Parts Stock Balance	Data Flow	<p>*Date + Spare Parts Number + Quantity + Unit Of Measure *</p> <p>Spare Parts Number = * Digit Number *</p> <p>Order Quantity = * Digit Number *</p> <p>Unit Of Measure = [ piece ]</p> <p>Date = * DD+MM+YY*</p> <p>Digit Number = 0{number}9</p> <p>MM = 1 { number } 12</p> <p>DD = 1 { number } 31</p> <p>YY = 00 { number } 99</p>

Table E.2. Data Dictionary of Spare Parts Out of Stock List in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Parts Out of Stock List	Data Flow	<p>* Spare Parts Number + Spare Parts Description + Spare Parts Quantity + Unit of Measure + Safety Stock Level + Out of Stock Indicator *</p> <p>Spare Parts number = * Digit number *</p> <p>Spare Parts Description = * Character *</p> <p>Spare Parts Quantity = * Digit number *</p> <p>Unit of Measure = * [ piece ] *</p> <p>Safety Stock Level = * Digit number *</p> <p>Out of Stock Indicator = * Character   Y / N *</p> <p>Character = [ A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit number = 0 { number } 9</p> <p>Character   Y = Safety Stock Level – Spare Parts Quantity &gt; = 0</p> <p>Character   N = Safety Stock Level – Spare Parts Quantity &lt; 0</p>

Table E.3. Data Dictionary of Spare Parts Receipt Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Parts Receipt Note	Data Flow	<p>* Spare Parts Receipt Note number + Date + Spare Parts Number + Spare Parts Description + Quantity + Unit of Measure + Price of Unit + Total Amount + Currency + Purchase Order Number + Location*</p> <p>Spare Parts Receipt Note num = * Character + Digit Number *</p> <p>Date = * DD + MM + YY *</p> <p>Spare Parts Number = * Digit number *</p> <p>Spare Parts Description = * Character + Digit number *</p> <p>Quantity = * Digit number *</p> <p>Unit of Measure = * [piece] *</p> <p>Price of Unit = * Digit number *</p> <p>Total Amount = * [Digit number   Quantity * Price of Unit] *</p> <p>Currency = * Character *</p> <p>Purchase Order Number = * Character + Digit number *</p> <p>Location = * Character + Digit number *</p>

Table E.3. Data Dictionary of Spare Parts Receipt Note in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Spare Parts Receipt Note	Data Flow	Character = [ A-Z   0-9   /   &   % ] Digit Number = 0 { number } 9 MM = 1 { number } 12 DD = 1 { number } 31 YY = 00 { number } 99

Table E.4. 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 = * P O * Digit Number = 0 { number } 9

Table E.5. Data Dictionary of Supplier Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Supplier Information	Data Flow	<p>* 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 placement + Country + Payment currency + Tax ID*</p> <p>Supplier number = * Character + Digit Number *</p> <p>Supplier name = * [Company's name   Name of person ] *</p> <p>Company's name = * Character + Digit Number *</p> <p>Name of person = * Character *</p> <p>Supplier Address = * Address number + [ Road   Street ] + District + Province + City + Zip code *</p> <p>Address number = * Digital number + Character *</p> <p>Road = * Character + Digit number *</p> <p>Street = * Character + Digit number *</p> <p>District = * Character *</p>



Table E.5. Data Dictionary of Supplier Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier Information	Data Flow	<p>Province = * Character *</p> <p>City = * Character *</p> <p>Zip code = * Digital number *</p> <p>Supplier telephone number = * Digital number *</p> <p>Supplier fax number = * Digit number *</p> <p>E - mail = * Character + Digit number *</p> <p>Supplier contact person = * Name of person *</p> <p>Contact telephone number = * Digit number *</p> <p>Credit term = * Digit number *</p> <p>Minimum order placement = * Digit number *</p> <p>Country = * Character *</p> <p>Payment currency = * Character *</p> <p>Tax ID = * Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit number = 0{number}9</p>

Table E.6. Data Dictionary of Purchase Order Information in Data Flow Diagram.

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

Table E.6. Data Dictionary of Purchase Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	<p>District = * Character *</p> <p>Province = * Character *</p> <p>City = * Character *</p> <p>Zip code = * Digit number *</p> <p>Supplier telephone number = * Digit number *</p> <p>Supplier fax number = * Digit number *</p> <p>E-mail = * Character + Digit number *</p> <p>Spare parts number = * Digit number *</p> <p>Spare parts description = * Character *</p> <p>Qty = * Digit number *</p> <p>Price = * Digit number *</p> <p>Amount = * Digit number *</p> <p>Total amount = * Digit number *</p> <p>VAT = * Digit number *</p> <p>Shipment address = * Address number + [ Road   Street ] +</p> <p>District + Province + City + Zip code *</p>

Table E.6. Data Dictionary of Purchase Order Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Purchase Order Information	Data Flow	<p>Address number = * Digit number + Character *</p> <p>Road = * Character + Digit number *</p> <p>Street = * Character + Digit number *</p> <p>District = * Character *</p> <p>Province = * Character *</p> <p>City = * Character *</p> <p>Zip code * Digit number *</p> <p>Shipment Date = * DD + MM + YY *</p> <p>Authorized person = * Character *</p> <p>Payment term = * Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0 { number } 9</p> <p>MM = 1 { number } 12</p> <p>DD = 1 { number } 31</p> <p>YY = 00 { number } 99</p>

Table E.7. Data Dictionary of Supplier's Tax Invoice in Data Flow Diagram.

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

Table E.7. Data Dictionary of Supplier's Tax Invoice in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier's Tax Invoice	Data Flow	<p>Province = * Character *</p> <p>City = * Character *</p> <p>Zip code = * Digit number *</p> <p>Supplier telephone number = * Digit number *</p> <p>Supplier fax number = * Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character *</p> <p>Qty = * Digit number *</p> <p>Price = * Digit number *</p> <p>Amount = * Digit number *</p> <p>Total amount = * Digit number *</p> <p>VAT = * Digit number *</p> <p>Payment term = * Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Character = [ A-Z   0-9   /   &amp;   %   " ]</p>



Table E.7. Data Dictionary of Supplier's Tax Invoice in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Supplier's Tax Invoice	Data Flow	Digit Number = 0 { number } 9 DD = 1 { number } 31 MM = 1 { number } 12 YY = 00 { number } 99

Table E.8. Data Dictionary of Spare Part Number in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Number	Data Flow	Spare Part Number = * Digit number *

Table E.9. Data Dictionary of Spare Part Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Information	Data Flow	<p>* Spare part number + Spare part description + UOM + Safety stock number + Minimum stock placing order number + Lead time delivery + Maximum stock keeping number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part Description = * Character + Digit number *</p> <p>Safety stock number = * Digit number *</p> <p>Minimum stock placing order number = * Digit number *</p> <p>Lead time delivery = * Digit number *</p> <p>Maximum stock keeping number = * Digit number *</p> <p>Unit Of Measure = [ piece ]</p> <p>Character = [A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit number = 0 {number} 9</p>

Table E.10. Data Dictionary of Spare Parts Issue Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Parts Issue Note	Data Flow	<p>* Spare part number + Spare part Description + Qty + UOM + Date + Maintenance Order + Location *</p> <p>Spare part number = * Digit number *</p> <p>Spare part Description = * Character + Digit number *</p> <p>Qty = * Digit number *</p> <p>Date * DD + MM + YY *</p> <p>Maintenance Order = * Character + Digit number *</p> <p>Location = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit Number = 0 { number } 9</p> <p>DD = 1 { number } 31</p> <p>MM = 1 { number } 12</p> <p>YY = 00 { number } 99</p>

Table E.11. Data Dictionary of Spare Parts Return Note in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Parts Return Note	Data Flow	<p>* Spare part number + Spare part Description + Qty + UOM + Date + Maintenance Order + Location *</p> <p>Spare part number = * Digit number *</p> <p>Spare part Description = * Character + Digit number *</p> <p>Qty = * Digit number *</p> <p>Date * DD + MM + YY *</p> <p>Maintenance Order = * Character + Digit number *</p> <p>Location = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit Number = 0 { number } 9</p> <p>DD = 1 { number } 31</p> <p>MM = 1 { number } 12</p> <p>YY = 00 { number } 99</p>

Table E.12. Data Dictionary of Spare Part Number in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare part number	Data Flow	Spare part number = * Digit number * Digit number = 1 {number} 9

Table E.13. Data Dictionary of Storage Location Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Storage Location Information	Data Flow	Storage Location = * Character + Digit number * Character = [ - ] Digit number = 1 {number} 9

Table E.14. Data Dictionary of Production Line Number in Data Flow Diagram.

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

Table E.15. Data Dictionary of Production Line Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Production Line Information	Data Flow	* Production Line number + Production Line name + Production Department + Supplier number + Maintenance Order number * Production Line number = * Character + Digit number* Production Line name = * Character + Digit number * Production Department = * Character * Supplier number = * Character + Digit number * Maintenance Order number = * Character + Digit number



Table E.15. Data Dictionary of Production Line Information in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Production Line Information	Data Flow	Character = [ A-Z   0-9   /     &   %   -     ] Digit number = 1 {number} 9

Table E.16. Data Dictionary of Maintenance Order Number in Data Flow Diagram.

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

Table E.17. Data Dictionary of Maintenance Order Information in Data Flow Diagram.

Object Name	Object Type	Long Description
Maintenance Order Information	Data Flow	Maintenance Order Information = * Maintenance Order number + Maintenance Order Description + Planned Start Date + Planned Finished Date + Actual Start Date + Actual Finished Date + Production Line Order Number * Maintenance Order number = * Character + Digit number * Maintenance Order Description = *Character +Digit number* Planned Start Date = * DD + MM + YY * Planned Finished Date = * DD + MM + YY * Actual Start Date = * DD + MM + YY * Actual Finished Date = *DD + MM + YY * Production Line Number = * Character + Digit number * Character = [ A-Z   0-9   /   &   %   -   . ] Digit Number = 0 {number} 9 DD = 1 {number} 31 MM = 1 {number} 12 YY = 00 {number} 99

Table E.18. Data Dictionary of Physical Counting List in Data Flow Diagram.

Object Name	Object Type	Long Description
Physical Counting List	Data Flow	<p>Physical Counting List = * Physical counting control number + Physical counting description + Spare part number + Spare part description + Counting Quantity + UOM + Location *</p> <p>Physical Counting Control number = * Character + Digit number *</p> <p>Physical Counting description = * Character + Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Counting quantity = * Digit number *</p> <p>Unit of Measure = [ pieces ]</p> <p>Location = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   %   -   ]</p> <p>Digit Number = 0 { number } 9</p>

Table E.19. Data Dictionary of Daily Spare Parts Inventory Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Daily Spare Parts Inventory Report	Data Flow	<p>* Spare part number + Spare Part Description + Balance Quantity + UOM + Date *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Balance Quantity = * Digit number *</p> <p>UOM = [ piece ]</p> <p>Date = * DD + MM + YY *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0 { number } 9</p> <p>DD = 1 { number } 31</p> <p>MM = 1 { number } 12</p> <p>YY = 00 { number } 99</p>

Table E.20. Data Dictionary of Monthly Spare Parts Inventory Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Monthly Spare Parts Inventory Report	Data Flow	<p>* Spare Part Number + Spare Part Description + Beginning Qty + Receipt Qty + Issue Qty + Balance Qty + Unit of Measure *</p> <p>Spare Part number = * Digit number *</p> <p>Spare Part Description = * Character *</p> <p>Beginning Qty = * Digit number *</p> <p>Receipt Qty = * Digit number *</p> <p>Issue Qty = * Digit number *</p> <p>Balance Qty = * Digit number *</p> <p>Unit of Measure = * [ piece ] *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit number = 0 { number } 9</p>

Table E.21. Data Dictionary of Purchase Order Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Purchase Order Report	Data Flow	<p>* Purchase Order Number + Supplier Number + Supplier Name + Spare Parts Number + Spare Parts Description + Purchase Order Date + Order Quantity + Unit of Measure *</p> <p>Purchase Order number = * Character + Digit number *</p> <p>Supplier number = * Character + Digit number *</p> <p>Supplier name = * Character *</p> <p>Spare Parts number = * Digit number *</p> <p>Spare Parts Description = * Character + Digit number *</p> <p>Order Quantity = * Digit number *</p> <p>Unit Of Measure = [ piece ]</p> <p>Purchase Order Date = * DD + MM + YY *</p> <p>Character = [ A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit Number = 0 { number } 9</p> <p>DD = 1 { number } 31</p> <p>MM = 1 { number } 12</p> <p>YY = 00 { number } 99</p>



Table E.22. Data Dictionary of Stock Card Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Stock Card	Data Flow	<p>* Tax ID + Spare Part number + Spare Part Description + Unit of Measure + Date + Reference number + Quantity In + Quantity Out + Quantity Balance *</p> <p>Tax ID = * Digit number *</p> <p>Spare Part number = * Digit number *</p> <p>Spare Part Description = * Character + Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Date = * DD + MM + YY *</p> <p>Reference number = * Character + Digit number *</p> <p>Quantity In = * Digit number *</p> <p>Quantity Out = * Digit number *</p> <p>Quantity Balance = * Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit number = 1 { number } 9</p>

Table E.22. Data Dictionary of Stock Card Report in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Stock Card Report	Data Flow	DD = 1 { number } 31 MM = 1 { number } 12 YY = 00 { number } 99

Table E.23. Data Dictionary of Daily Spare Part Inventory Receipt Report in Data Flow Diagram.

Object Name	Object Type	Long Description
	Data Flow	* Spare Part number + Spare Part Description + Qty + Unit Of Measure + Price per unit + Total Amount + Currency + Reference document number + Purchase Order number + Location + Date * Spare Part number = * Digit number * Spare Part Description = * Character + Digit number * Qty = * Digit number *

Table E.23. Data Dictionary of Daily Spare Part Inventory Receipt Report in Data Flow Diagram (Continued).

Object Name	Object Type	Long Description
Daily Spare Part Inventory Receipt Report	Data Flow	Unit of Measure = [ piece ] Price per unit = * Digit number * Total Amount = * Digit number * Currency = * Character * Reference document number = * Character + Digit number * Purchase Order number = * Character + Digit number * Location = * Character + Digit number * Date = * DD + MM + YY * Character = [ A-Z   0-9   /     &   % ] Digit Number = 0 { number } 9 DD = 1 { number } 31 MM = 1 { number } 12 YY = 00 { number } 99

Table E.24. Data Dictionary of Monthly Spare Part Consumption Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Monthly Spare Part Consumption Report	Data Flow	<p>* Production Line number + Production Line Description + Spare Part number + Spare part Description + Qty + Unit of Measure + Price per unit + Total amount + Currency + Reference document number + Location number *</p> <p>Production Line number = * Character + Digit number *</p> <p>Production Line Description = * Character + Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Qty = * Digit number *</p> <p>Price per unit = * Digit number *</p> <p>Total amount = * Digit number *</p> <p>Currency = * Character *</p> <p>Reference document number = * Character + Digit number *</p> <p>Location number = * Character + Digit number *</p> <p>Character = = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0 { number } 9</p>

Table E.25. Data Dictionary of Spare Part Inventory Report by Location in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Inventory Report by Location	Data Flow	<p>* Location number + Location description + Spare Part number + Spare part Description + Qty + Unit of Measure + Reference document number + Purchase Order number *</p> <p>Location number = * Character + Digit number *</p> <p>Location description = * Character + Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Qty = * Digit number *</p> <p>Reference document number = * Character + Digit number *</p> <p>Purchase order number = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0 {number} 9</p>

Table E.26. Data Dictionary of Spare Part Discrepancy Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Discrepancy Report	Data Flow	<p>* Location number + Location description + Spare Part number + Spare part Description + Qty + Price per unit + Total amount *</p> <p>Location number = * Character + Digit number *</p> <p>Location description = * Character + Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Qty = * Digit number *</p> <p>Price per unit = * Digit number *</p> <p>Total Amount = * Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0{number}9</p>



Table E.27. Data Dictionary of Spare Part Out of Stock Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Out of Stock Report	Data Flow	<p>* Spare Part number + Spare part Description + Balance Quantity + Unit of Measure + Safety stock quantity + Stock recovery quantity*</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Balance quantity = * Digit number *</p> <p>Safety stock quantity = * Digit number *</p> <p>Stock recovery quantity = * Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0 {number} 9</p>

Table E.28. Data Dictionary of Spare Part Incoming List Report in Data Flow Diagram.

Object Name	Object Type	Long Description
Spare Part Incoming List Report	Data Flow	<p>* Spare Part number + Spare part Description + Order Quantity + Unit of Measure + Price per unit + Order amount + Currency + Purchase Order number + Supplier number + Supplier name *</p> <p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Order quantity = * Digit number *</p> <p>Price per unit = * Digit number *</p> <p>Order amount = * Digit number *</p> <p>Currency = * Character *</p> <p>Purchase Order number = * Character + Digit number *</p> <p>Supplier number = * Character + Digit number *</p> <p>Supplier name = * Character + Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0{number}9</p>

Table E.29. Data Dictionary of Data Store 1: Employee.

Object Name	Object Type	Long Description
D1 Employee	Data Store	<p>* Employee number + Name + Surname + sex + Position + Department + Address + Telephone number + Password *</p> <p>Employee number = * Digit number *</p> <p>Name = * Character *</p> <p>Surname = * Character *</p> <p>Sex = * Character *</p> <p>Position = * Character *</p> <p>Department = * Character *</p> <p>Address = * Address number + [ Road   Street ] + District + Province + City + Zip code*</p> <p>Address number = * Digit number + Character *</p> <p>Road = * Character + Digit number *</p> <p>Street = * Character + Digit number *</p> <p>District = * Character *</p> <p>Province = * Character *</p> <p>City = * Character *</p>

Table E.29. Data Dictionary of Data Store 1: Employee (Continued).

Object Name	Object Type	Long Description
D2 Spare Parts Master Data	Data Store	Zip code * Digit number * Supplier telephone number = * Digit number * Password = * Character + Digit number * Character = [ A-Z   0-9   /   &   % ] Digit Number = 0 {number} 9

Table E.30. Data Dictionary of Data Store 2: Spare Parts Master Data.

Object Name	Object Type	Long Description
D2 Spare Parts Master Data	Data Store	<p>* Spare part number + Spare part description + Quantity + UOM + Safety stock number + Price per unit + Currency + Minimum stock placing order number + Lead time delivery + Maximum stock keeping number + Employee number + Supplier number + Supplier name*</p> <p>Spare part number = * Digit number *</p> <p>Spare part Description = * Character + Digit number *</p> <p>Quantity = * Digit number *</p> <p>Safety stock number = * Digit number *</p> <p>Price per unit = * Digit number *</p> <p>Currency = * Character *</p> <p>Minimum stock placing order number = * Digit number *</p> <p>Lead time delivery = * Digit number *</p> <p>Maximum stock keeping number = * Digit number *</p> <p>Employee number = * Digit number *</p> <p>Supplier number = * Character + Digit number *</p>

Table E.30. Data Dictionary of Data Store 2: Spare Parts Master Data (Continued).

Object Name	Object Type	Long Description
D2 Spare Parts Master Data	Data Store	<p>Supplier name = * Character + Digit number *</p> <p>Unit Of Measure = [ piece ]</p> <p>Character = [A-Z   0-9   /   &amp;   %   " ]</p> <p>Digit number = 0 {number} 9</p>

Table E.31. Data Dictionary of Data Store 3: Spare Part Transaction Data.

Object Name	Object Type	Long Description
D3 Spare Part Transaction Data	Data Store	<p>* Transaction number + Transaction description + Transaction type</p> <p>+ Spare part number + Transaction date + Purchase Order number</p> <p>+ Maintenance Order number + Spare part Location number +</p> <p>Employee number *</p> <p>Transaction number = * Character + Digit number *</p> <p>Transaction description = * Character + Digit Number *</p> <p>Transaction type = * Character *</p>



Table E.31. Data Dictionary of Data Store 3: Spare Part Transaction Data (Continued).

Object Name	Object Type	Long Description
D3 Spare Part Transaction Data	Data Store	Purchase Order number = * Character + Digit number * Maintenance Order number = * Character + Digit number * Spare part location number = * Character + Digit number * Employee number = * Digit number * Character = [ A-Z   0-9   /   &   % ] Digit Number = 0 {number} 9

Table E.32. Data Dictionary of Data Store 4: Supplier Master Data.

Object Name	Object Type	Long Description
D4 Supplier Master Data	Data Store	* Supplier number + Supplier name + Supplier Date + Supplier Address + Supplier telephone number + Supplier fax number + E- mail + Supplier contact person + Contact person telephone number + Credit term + Country + Payment currency + Tax ID*

Table E.32. Data Dictionary of Data Store 4: Supplier Master Data (Continued).

Object Name	Object Type	Long Description
D4 Supplier Master Data	Data Store	<p>Supplier number = * Character + Digit Number *</p> <p>Supplier name = * [Company's name   Name of person ] *</p> <p>Company's name = * Character + Digit Number *</p> <p>Name of person = * Character *</p> <p>Supplier Date = * DD + MM + YY *</p> <p>Supplier Address = * Address number + [ Road   Street ] + District + Province + City + Zip code *</p> <p>Address number = * Digital number + Character *</p> <p>Road = * Character + Digit number *</p> <p>Street = * Character + Digit number *</p> <p>District = * Character *</p> <p>Province = * Character *</p> <p>City = * Character *</p> <p>Zip code = * Digital number *</p> <p>Supplier telephone number = * Digital number *</p> <p>Supplier fax number = * Digit number *</p>

Table E.32. Data Dictionary of Data Store 4: Supplier Master Data (Continued).

Object Name	Object Type	Long Description
D4 Supplier Master Data	Data Store	<p>E – mail = * Character + Digit number *</p> <p>Supplier contact person = * Name of person *</p> <p>Contact telephone number = * Digit number *</p> <p>Credit term = * Digit number *</p> <p>Minimum order placement = * Digit number *</p> <p>Country = * Character *</p> <p>Payment currency = * Character *</p> <p>Tax ID = * Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit number = 0 { number } 9</p> <p>DD = 1 { number } 31</p> <p>MM = 1 { number } 12</p> <p>YY = 00 { number } 99</p>

Table E.33. Data Dictionary of Data Store 5: Purchase Order.

Object Name	Object Type	Long Description
D5 Purchase Order	Data Store	<p>* Purchase Order number + Purchase Order date + Supplier number + Spare part number + UOM + Quantity + Price per unit + Currency + Amount + Delivery date + Percentage under quantity tolerance + Percentage over quantity tolerance + Employee number *</p> <p>Purchase Order number = * Character + Digit number *</p> <p>Purchase Order date = * DD + MM + YY *</p> <p>Supplier number = * Character + Digit number *</p> <p>Spare part number = * Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Quantity = * Digit number *</p> <p>Price per unit = * Digit number *</p> <p>Currency = * Character *</p> <p>Amount = * Digit number *</p> <p>Delivery date = * DD + MM + YY *</p> <p>Percentage under quantity tolerance = * Digit number *</p> <p>Percentage over quantity tolerance = * Digit number *</p>

Table E.33. Data Dictionary of Data Store 5: Purchase Order (Continued).

Object Name	Object Type	Long Description
D5 Purchase Order	Data Store	Employee number = * Digit number * Character = [ A-Z   0-9   /   &   % ] Digit Number = 0 { number } 9 MM = 1 { number } 12 DD = 1 { number } 31 YY = 00 { number } 99

Table E.34. Data Dictionary of Data Store 6: Production Line.

Object Name	Object Type	Long Description
D6 Production Line	Data Store	* Production number + Production description + Production department + Supplier number + Maintenance Order number * Production number = * Character + Digit number * Production description = * Character + Digit number *

Table E.34. Data Dictionary of Data Store 6: Production Line (Continued).

Object Name	Object Type	Long Description
D6 Production Line	Data Store	<p>Production department = * Character *</p> <p>Supplier number = * Character + Digit number *</p> <p>Maintenance Order number = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0{number}9</p>

Table E.35. Data Dictionary of Data Store 7: Storeroom Storage Location.

Object Name	Object Type	Long Description
D7 Storeroom Storage Location	Data Store	<p>* Location number + Location description + Spare part number + Spare part description + Spare part quantity + Unit of Measure + Purchase Order number + Employee number *</p> <p>Location number = * Character + Digit number *</p> <p>Location description = * Character *</p>



Table E.35. Data Dictionary of Data Store 7: Storeroom Storage Location (Continued).

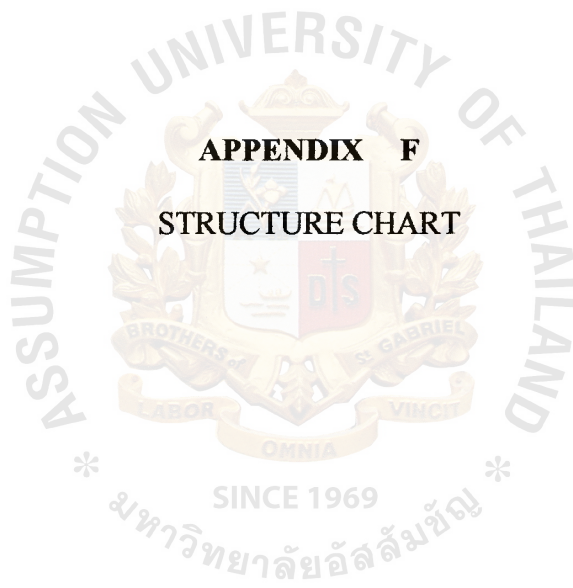
Object Name	Object Type	Long Description
D7 Storeroom Storage Location	Data Store	<p>Spare part number = * Digit number *</p> <p>Spare part description = * Character + Digit number *</p> <p>Spare part quantity = * Digit number *</p> <p>Unit of Measure = [ piece ]</p> <p>Purchase Order number = * Character + Digit number *</p> <p>Employee number = * Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0{number}9</p>

Table E.36. Data Dictionary of Data Store 8: Maintenance Order.

Object Name	Object Type	Long Description
D8 Maintenance Order	Data Store	<p>* Maintenance order number + Maintenance order description + Maintenance planned start date + Maintenance planned finished date + Maintenance actual start date + Maintenance actual finished date + Production line number + Production line description *</p> <p>Maintenance order number = * Character + Digit number *</p> <p>Maintenance order description = * Character + Digit number *</p> <p>Maintenance planned start date = * DD + MM + YY *</p> <p>Maintenance planned finished date = * DD + MM + YY *</p> <p>Maintenance actual start date = * DD + MM YY *</p> <p>Maintenance actual finished date = * DD + MM + YY *</p> <p>Production line number = * Character + Digit number *</p> <p>Production line description = * Character + Digit number *</p> <p>Character = [ A-Z   0-9   /   &amp;   % ]</p> <p>Digit Number = 0{number}9</p>

Table E.36. Data Dictionary of Data Store 8: Maintenance Order (Continued).

Object Name	Object Type	Long Description
D8 Maintenance Order	Data Store	DD = 1 { number } 31 MM = 1 { number } 12 YY = 00 { number } 99



## **APPENDIX F**

### **STRUCTURE CHART**

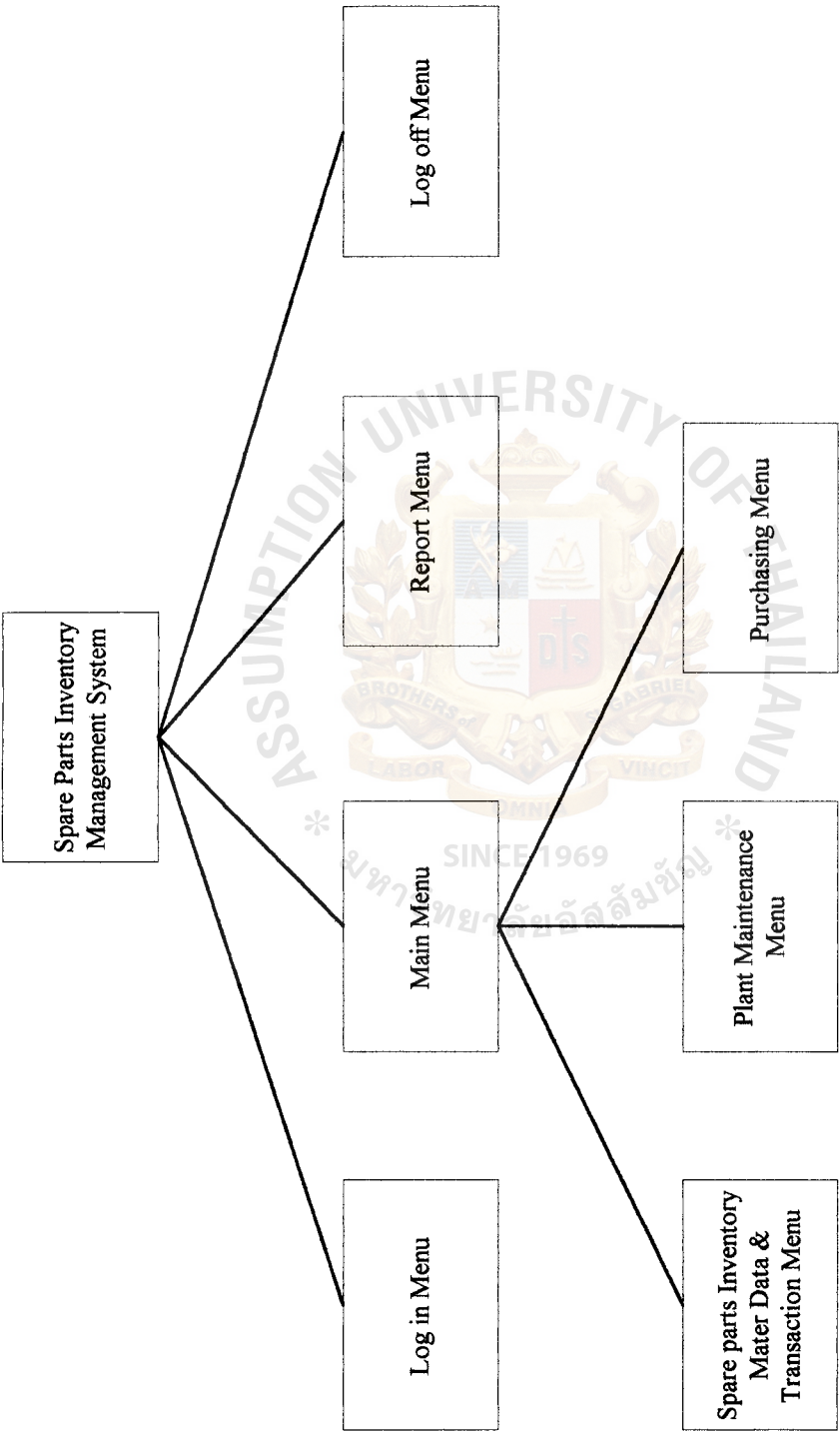


Figure F.1. Structure Chart of Main Menu.

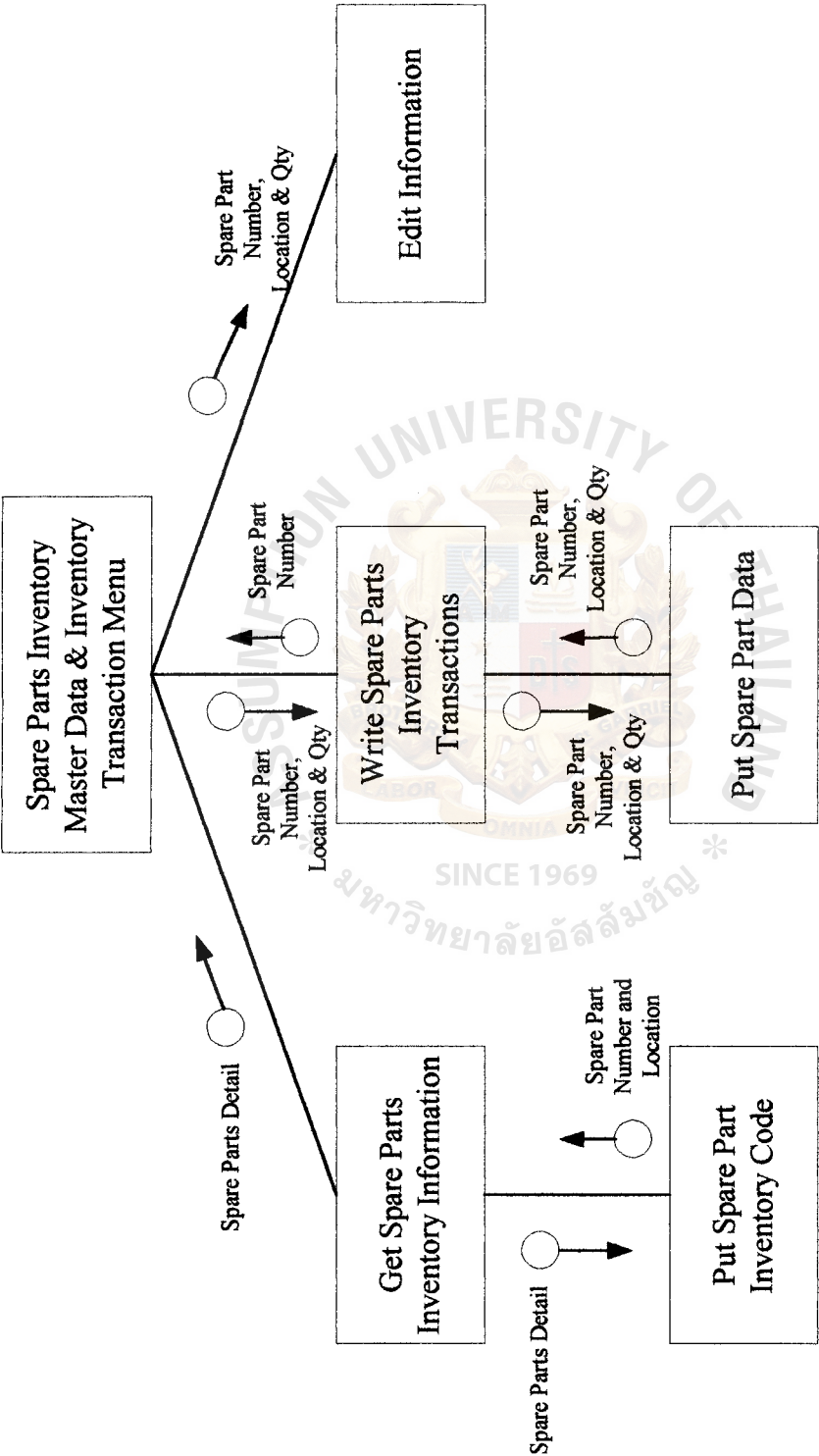


Figure F.2. Structure Chart of Spare Parts Inventory Menu.



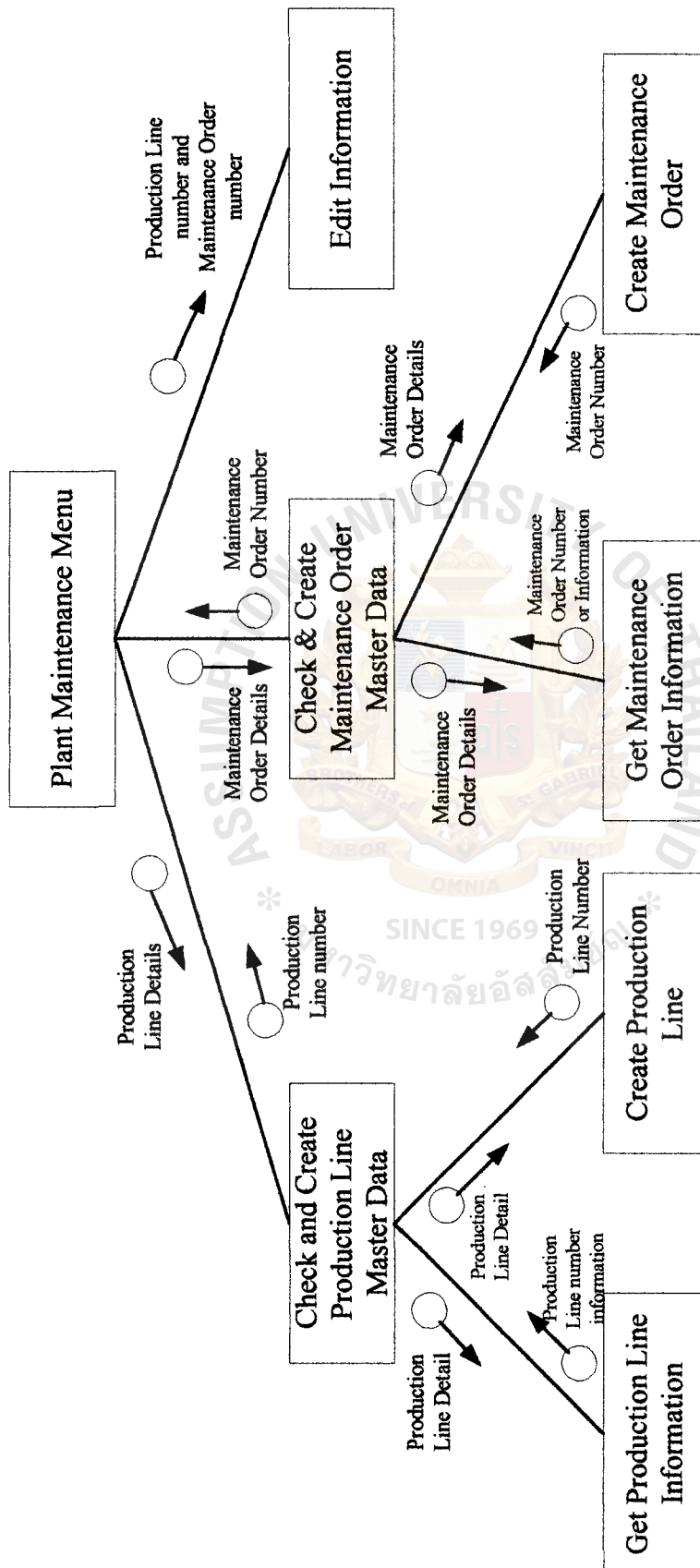


Figure F.3. Structure Chart of Plant Maintenance Menu

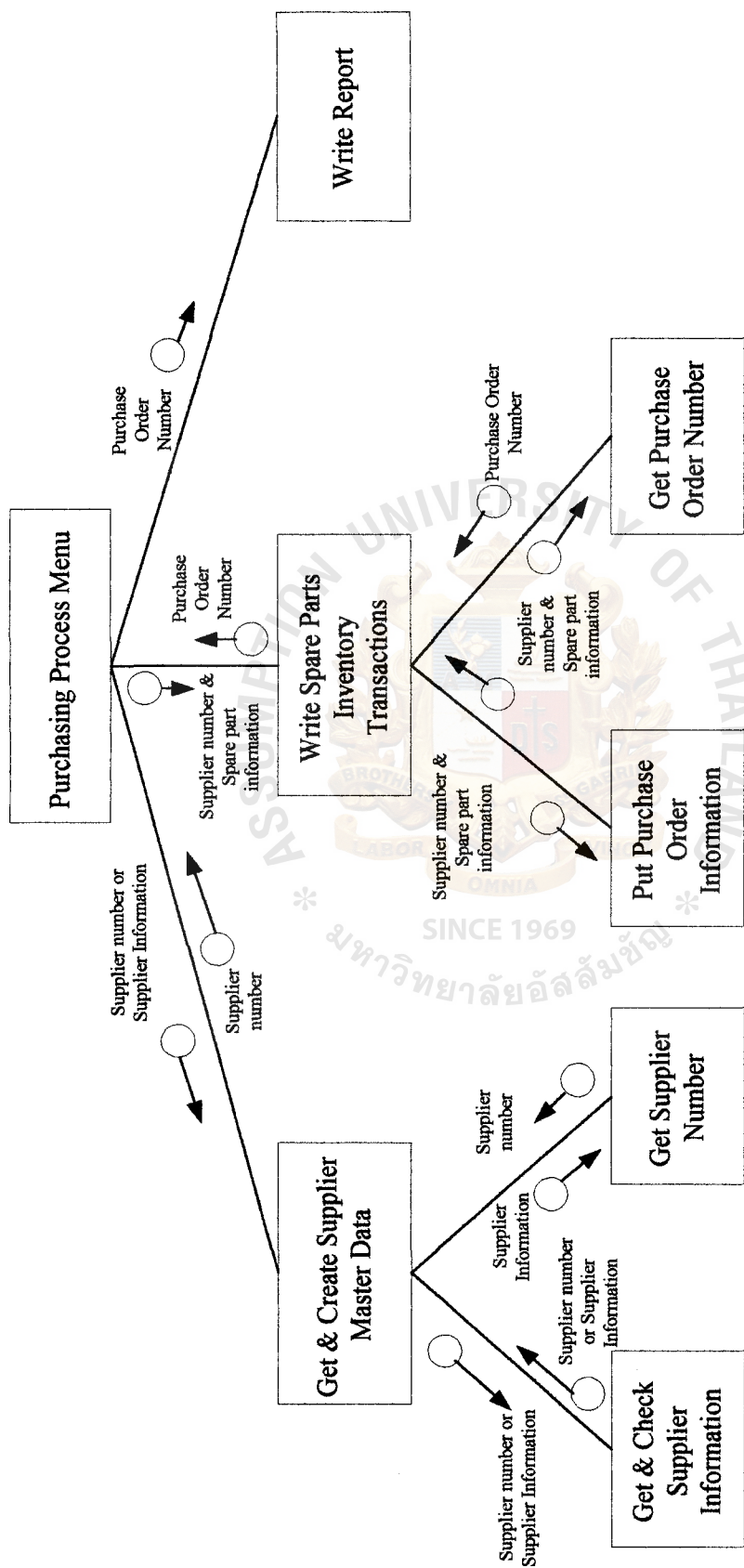


Figure F.4. Structure Chart of Purchasing Process Menu



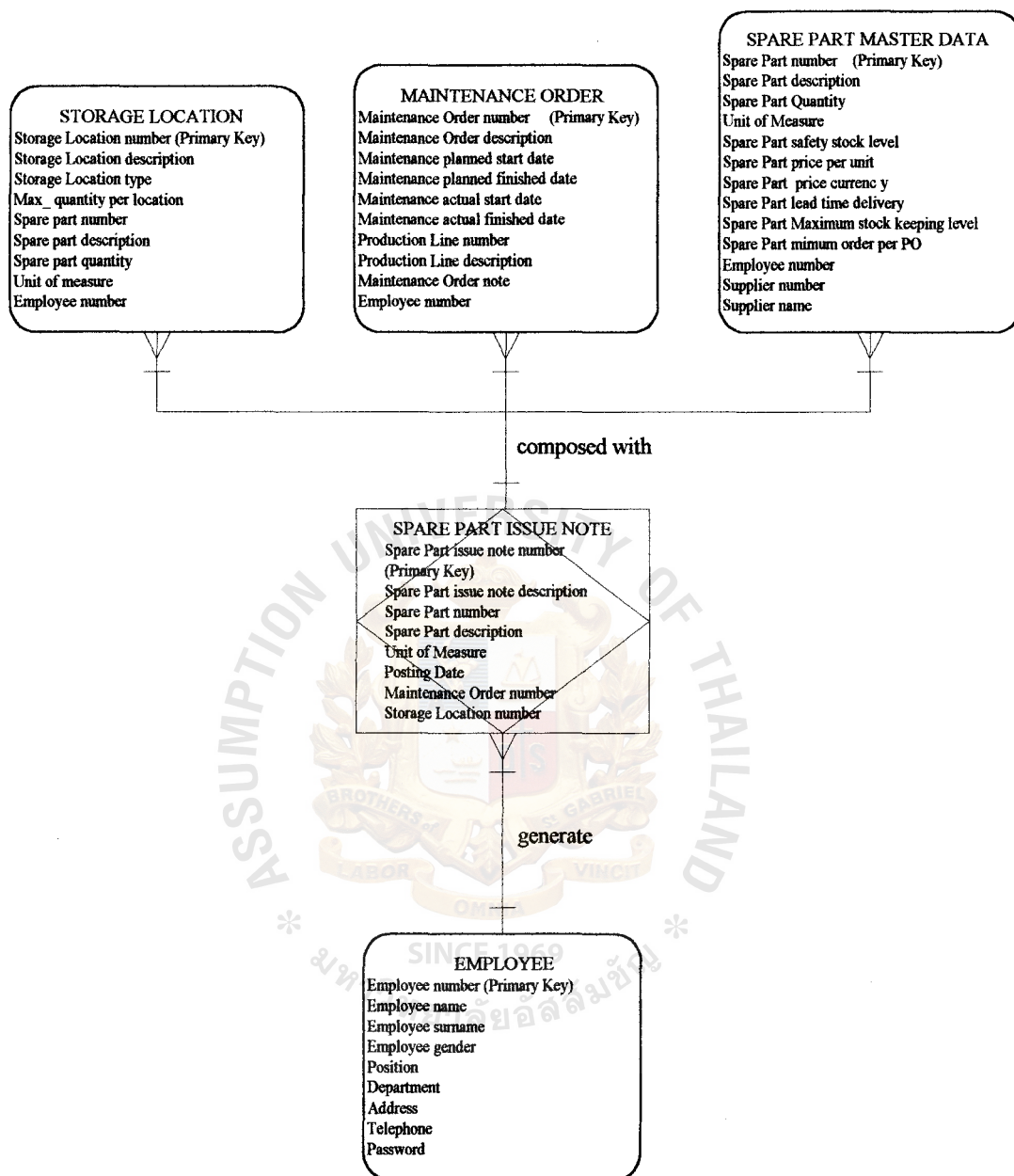


Figure G.1. ER Diagram of the Proposed System: Session 1.

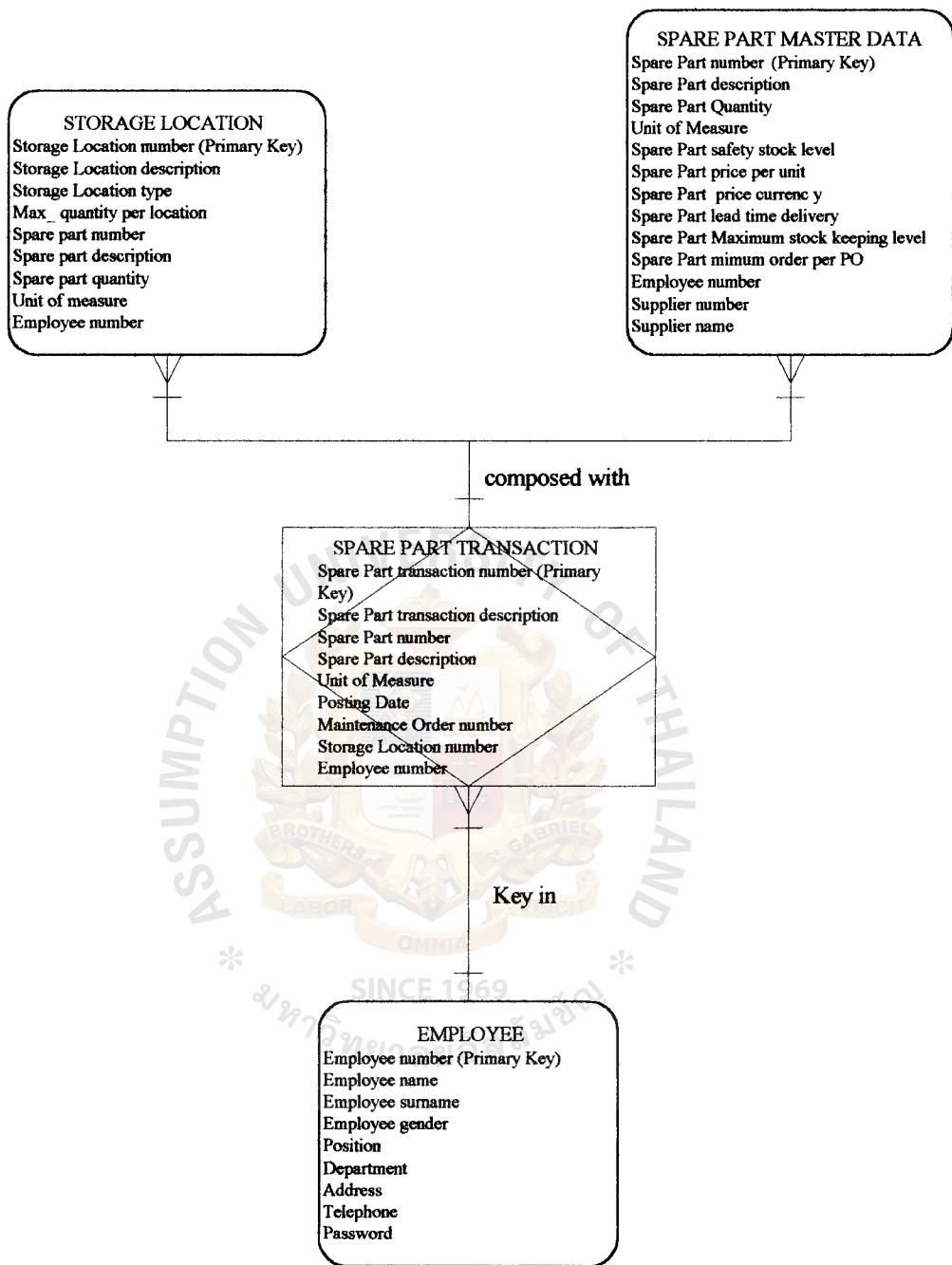


Figure G.2. ER Diagram of the Proposed System: Session 2.

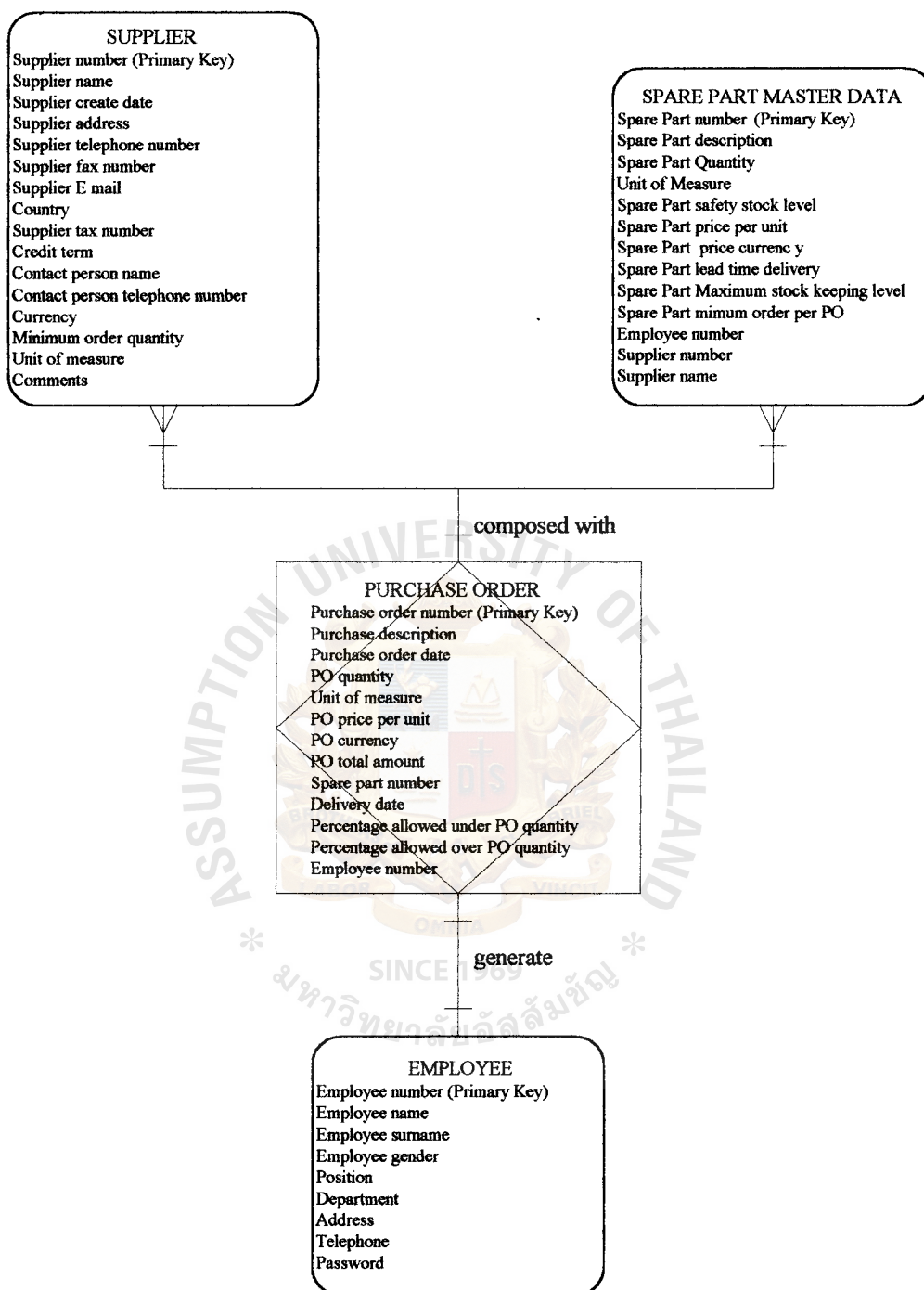


Figure G.3. ER Diagram of the Proposed System: Session 3.



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