

**THE INFORMATION SYSTEM APPLICATION FOR  
MANUFACTURING OF ALUMINUM EXTRUSION;  
CASE STUDY: P.M. PRODUCE CO., LTD**



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THE INFORMATION SYSTEM APPLICATION FOR MANUFACTURING OF  
ALUMINUM EXTRUSION; CASE STUDY: P.M. PRODUCE CO., LTD

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ABSTRACT

P.M. Produce Co., Ltd is an aluminum extrusion company. The company production scheduling is based on the decision of an experienced production manager. Sometimes the decision making process can be very time-consuming and many mistakes may occur from human errors.

The objective of this research is to design and develop a client-server database application prototype for production of aluminum extrusion at manufacturing department of P.M. Produce Co., Ltd. The system will help worker in each department and will help the production manager to manage the database and schedule the manufacturing efficiently.

The prototype was developed by using the fundamental of the Software Development Life Cycle (SDLC) as a basis. The result of this study is a prototype of a production client-server application designed for aluminum extrusion industries. There are six main modules: (1) Finished Product Module, (2) Sales Module, (3) Raw Material Module, (4) Die Module, (5) Manufacturing Module and (6) Administration Module. This prototype works properly under the client-server model and supports tasks for workers in each department involve in the production system.

KEY WORDS : PRODUCTION / DATABASE / ALUMINIUM EXTRUSIONS  
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### บทคัดย่อ

บริษัทพี.เอ็ม.โพรดิวส์ จำกัดเป็นบริษัทที่ผลิตอลูมิเนียมเส้น การวางแผนการผลิตของบริษัทนั้นขึ้นอยู่กับความคิดเห็นโดยใช้ประสบการณ์ของผู้จัดการฝ่ายผลิต ซึ่งในบางโอกาสนั้นการวางแผนการผลิตนั้นจะต้องใช้เวลามากและยังอาจเกิดข้อผิดพลาดขึ้นมากมายเนื่องจากความผิดพลาดของบุคคล

วิทยานิพนธ์ฉบับนี้มีวัตถุประสงค์เพื่อออกแบบและพัฒนาระบบต้นแบบระบบสารสนเทศสำหรับเพิ่มประสิทธิภาพทางการผลิต โดยใช้ไคลเอนต์-เซิร์ฟเวอร์ค้ำเบสแอฟปริเคชัน ในการผลิตอลูมิเนียมเส้นของแผนกการผลิตของบริษัท ซึ่งจะช่วยพนักงานในแผนกต่างๆ ให้สามารถจัดการฐานข้อมูล และผู้จัดการฝ่ายผลิตสามารถจัดการตารางการผลิตได้อย่างรวดเร็ว

การพัฒนาต้นแบบดังกล่าวดำเนินตามหลักการของ Software Development Life Cycle (SDLC) ผลการวิจัยคือระบบต้นแบบการจัดการผลิตโดยโปรแกรมประยุกต์ ที่ใช้สำหรับโรงงานผลิตอลูมิเนียมเส้น ซึ่งประกอบด้วยโมดูลหลักๆจำนวน 6 โมดูลคือ (1) ระบบการจัดการสินค้าสำเร็จคงคลัง (Finished Product Module), (2) ระบบการจัดการการขาย (Sales Module), (3) ระบบการจัดการวัตถุดิบ (Raw Material Module), (4) ระบบการจัดการแม่พิมพ์ (Die Module), (5) ระบบการจัดการการผลิต (Manufacturing Module) และ (6) ระบบการจัดการผู้ใช้ระบบ (Administration Module) ระบบต้นแบบนี้ทำงานได้ดีในรูปแบบของโปรแกรมระบบเครือข่าย (Client-Server Application) และรองรับงานสำหรับพนักงานทุกคนที่เกี่ยวข้องกับระบบการผลิต

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Nowadays, the manufacturing industry is becoming more competitive with an increasing pressure from international competition and customer demands for reliable on-time deliveries, low cost and consistent quality. Moreover, specifically designed product has also been one of the main forces. This is partly a result of an evolution of information technology. The development of information system management has helped to respond the increase in human needs. The Information Technology which changes quickly and inevitably makes the information become an important factor in the competition. Therefore, businesses have to adjust themselves to ensure that they can survive.

For the aluminum industry, the business transaction is involved in the production planning. Companies have to schedule activities in such a way that resources that are available will be used in an efficient way. Besides, the scheduling helps to meet shipping dates committed to the customers. After the production plan has been completed, the company will produce the products for delivering to the customers or selling continuously.

Also, the manufacturing companies need highly flexible information systems that are able to represent their firmly established and often very specific extensions or modifications of standard information structures related to production scheduling.

### 1.2 Statement of Problem

P.M. Produce CO., LTD is a family based company. The company business is to producing the aluminum extrusion. P.M. Produce CO., LTD has been

making a good profit for 7 years. However the company production scheduling is based on the decision of experienced production manager.

To make such a decision, the manager requires finished product, sales, raw material and extrusion dies information. This information has not yet systematically handled.

Sometimes the decision making process can be very time-consuming and many mistake may occur from human errors. These mistakes include wrong production plan and delay in production delivery that the company reputation and reliability is definitely effected.

### **1.3 Objective of Study**

The main purpose of this system is to help the officer in recording and retrieving the business information efficiently and to provide decision-making supports for manager.

The objective of this study is defined as follow:

- To enhance the production scheduling system in the company for efficiently and utilizing.
- To analyze and design database.
- To use SQL command to manipulate specific data.
- To design program application by using graphic user interface on a windows environment.
- To design client-server application for retrieving and displaying.
- To produce standard summary reports.

### **1.4 Scope of Study**

The application prototype will be used in helping and providing information for P.M. Produce CO., LTD's manager and officers.

The scope of this system is define as follow:

- The concept of scheduling and database of the productivity of aluminum extrusion are used to create the application prototype of P.M. Produce CO., LTD.

- The application prototype is client-server application that use Visual Basic 6 as a tool to create a graphic user interface and SQL Server 2000 as a database server.

### **1.5 Expected Result**

There are two main components that is the result of this implementation:

- The database application is designed to centralized all related data storage.
- The client-server application is able to retrieve and display information on-screen and also help in product scheduling.

Such a system will help the officer in manufacturing department to retrieve accurate information and easily plan. Also help workers in other department that involve in manufacturing to easily manage the information.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Database

All modern databases [1,2,3] are relational. Information presented in a single database can be linked to another, thereby enriching the learning experience. This approach is different from using traditional file system. In a relational database, many records from two or more database files can be merged on the fly. For instance, an art professor can create separate databases for his course: one containing images of many paintings, another housing artists' biography, and a third storing critics of different paintings. It is beneficial for an art student to learn to appreciate paintings by gathering information on the artist's background, other works, and related critics. In a relational database, all three databases could be linked so those users could retrieve all information at once.

#### 2.2 Client-Server Application

Client-server [4] refers to the way which software components interact to form a system. The client requires some resource. The server provides the resource. There is no requirement that the client and server must reside on the same machine. In practice, it is quite common to place a server at one site in the local area network and the clients at the other site as shown in Figure 2.1. The client manages the user interface and the application logic, acting as sophisticated workstation on which to run database applications. The client takes the user's request, checks the syntax and generates database requests in SQL or another database language appropriate to the application logic. It then transmits the message to the server, waits for a response, and formats the response for the end-user. The server accepts and processes the database requests, then transmits the results back to the client. The

processing involves checking authorization, ensuring integrity, maintaining the system catalog, and performing query and update processing. In addition, it also provides concurrency and recovery control.



Figure 2.1 A Sample of Client-Server Application

There are many advantages to this type of architecture. For example:

- It enables wider access to existing database.
- Increased performance. If the clients and server reside on different computers then different CPUs can be processing applications in parallel. It should also be easier to tune the server machine if its only task is to perform database processing.
- Hardware costs may be reduced. It is only the server that requires storage and processing power sufficient to store and manage the database.
- Communication costs are reduced. Applications carry out part of the operations on the client and send only requests for database access across the network, resulting in less data being sent across the network.

- Increased consistency. The server can handle integrity checks, so that constraints need be defined and validated only in the one place, rather than having each application program perform its own checking.

Client-server applications work well in department-scale applications with low numbers of users (under 100), a single database, and secure, fast networking. For example, a client-server application would be a good solution for a workgroup whose function is to enter product orders. Another example is a design department that shares one set of designs within its group of engineers.

### **2.3 Introduction to ADO**

Microsoft ActiveX Data Objects (ADO) [4] is a development interface for OLE DB. ADO replaces previous database programming interfaces, such as DAO (Data Access Objects) and RDO (Remote Data Objects).

#### **ADO Compared to Other Data Access Methods**

Although applications can use Data Access Objects (DAO) and Remote Data Objects (RDO) in Visual Basic 6.0, ADO is the data-access method Microsoft recommends for new applications.

All of these data access methods are COM interfaces and can be used from a variety of tools, including Microsoft Visual Basic, Microsoft Access, and Microsoft Office. However, there are many advantages of the ADO. For example:

- ADO can access all types of data, whereas RDO and DAO access only relational data.
- The ADO object model is not as complex as that of RDO or DAO and therefore is easier to use, with less coding required.
- ADO combines the best features of RDO and ADO and will eventually replace them.

- ADO is the standard data access object model across Microsoft tools, including Visual Basic, Access, Office, and Microsoft Internet Information Server.

## 2.4 Introduction to Visual Basic

Visual Basic [4] has greatly expanded the BASIC language for modern development. Visual Basic's integrated development environment (IDE) combines the code editor, debugger and visual designer into one easy to use system. Visual Basic's code editor features automatic syntax highlighting and color-coding. Color-coding helps in finding syntactical errors and aids in learning the language. Visual Basic's Designer makes creating forms as simple as drag-and-drop. Visual Basic's debugger aids in finding and fixing errors in your Visual Basic code. Visual Basic enables strong Rapid application development (RAD) in the area of databases. Visual Basic simplifies developing both desktop and client-server applications. With Visual Basic programmers can work with Access, SQL, ODBC and many other data sources.

## 2.5 Introduction to SDLC

The system development life cycle (SDLC) [5,6] is an organized set of activities used to guide those involved through the development of an information system. The many activities of the SDLC can be grouped into five major phases:

1. Planning Phase: The planning phase for a project begins when the steering committee receives a project request. During the planning phase, four major activities are performed: review project requests, prioritize project requests, commit resources to approved projects, and identify a project development team for each approved project.
2. Analysis Phase: The analysis phase is divided into the feasibility study and detailed analysis. The feasibility study determines whether or not the problem or enhancement identified in a project request is worth pursuing. Detailed analysis involves studying the current system in

depth, identifying the user's wants and needs, and recommending a solution. Detailed analysis sometimes is called logical design because the proposed solution is developed without regard to specific hardware or software

3. Design Phase: The design phase consists of acquiring the essential hardware and software and designing all of the details of the system to be implemented. Acquiring essential hardware and software involves identifying technical specifications, soliciting vendor proposals, testing and evaluating vendor proposals, and making a decision. Once the data and process requirements have been identified, detailed design specifications are developed for the components of the proposed solution. Detailed design, sometimes called physical design, specifies the hardware and software for automated procedures. Designs are developed for the databases, inputs, outputs, and programs.
4. Testing & Implementation Phase: The purpose of the implementation phase is to construct the new system and deliver it to the users. Program development follows six steps called the program development life cycle (PDLC). Once the program is developed, the new system is installed and tested. Three types of tests are performed: system test, integration test, and acceptance test. Users must be trained properly on the system's functionality and educated in the new principles or theories that help them understand the system. The final activity in the implementation phase is to convert to the new system from the old one.
5. Support Phase: The purpose of the support phase is to provide continuous assistance for a system and its users after it is implemented. During the support phase, a post implementation review is conducted to determine if the new system is performing according to users' expectations. Errors and potential system enhancements are

identified. Performance is monitored to determine if the system is inefficient at any point and if the inefficiency is causing a problem.

## **2.6 Introduction to Inventory Management**

### **What it is:**

An inventory management [7,8] is useful for balancing the conflicting costs and pressures that argue for both low and high inventories and determine appropriate inventory levels. The primary reason for keeping inventories low is that inventory represents a temporary monetary investment in goods on which a firm must pay interest. Inventory holding cost is the variable cost of keeping items on hand, including interest, storage and handling, taxes, insurance and shrinkage. When these components change with inventory levels, so does the holding cost.

### **2.6.1 Safety stock inventory.**

Companies should hold safety stocks to avoid customer service problems and the hidden costs of unavailable components. Safety stocks are desirable when suppliers fail to deliver the desired quantity on the specified date with acceptable quality or when the manufactured items have significant amounts of scrap or rework. Their inventory ensures that operations are not disrupted when such problems occur and will allow subsequent operations to be continued.

To create safety stock, an order for delivery from a firm places earlier than the item needed. Therefore, the replenishment order arrives ahead of time and gives a cushion against uncertainty.

## **2.7 Introduction to Production Scheduling**

Scheduling [7] is short-term plans designed to implement the master production schedule. Scheduling focuses on how best to use existing capacity and taking into account technical production constraints.

Scheduling [8] is a decision-making process that exists in most manufacturing and production systems as well as in most information-processing

environments, and has as a goal the optimization of one or more objectives. The functions as shown in Figure 2.2 must be performed in scheduling and controlling a production operation.

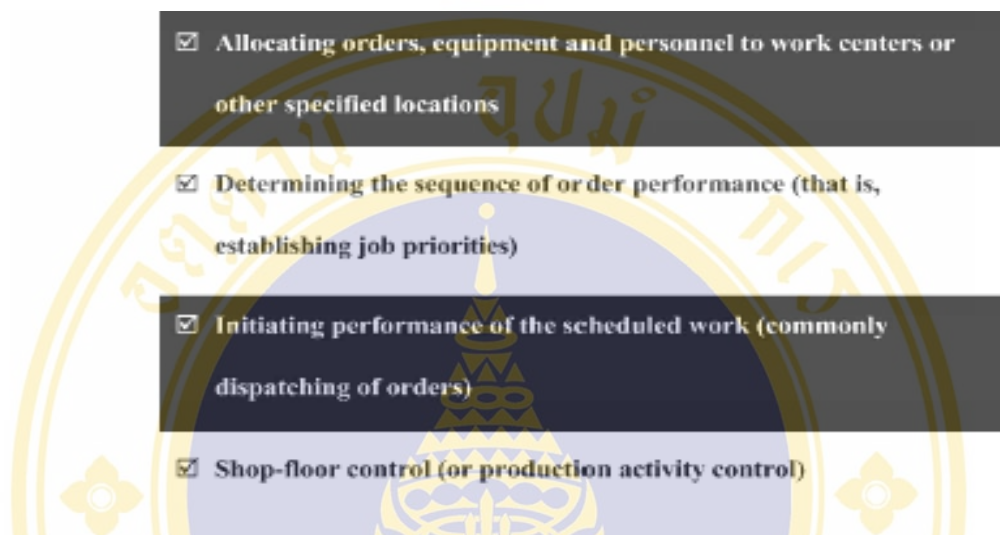


Figure 2.2 Functions, Which Must be Performed in Scheduling and Controlling a Production Operation

In general, a manufacturing system orders should be released and has to be translated into specific jobs with associated due dates. The jobs often have to be processed by the machines in a work center in a given order or sequence. Jobs may have to wait for processing on machines that are busy. The preemption may occur when high-priority jobs arrive at the machines and have to proceed immediately. Also, unexpected events such as machine breakdowns, or foreseen events such as standard maintenance activities, have always to be taken into consideration because they may have major impact on the schedules. Figure 2.3 presents a typical diagram of the information flow in a manufacturing/production system.

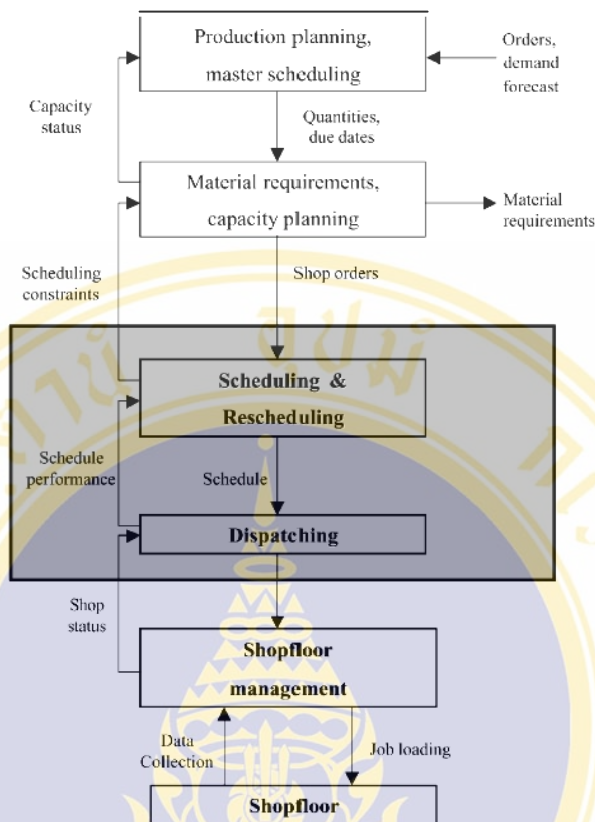


Figure 2.3 A Typical Diagram of the Information Flow in a Manufacturing/Production System

## 2.8 Introduction to Aluminium Extrusion

Aluminium [9] is the second most widely used metal after iron. This is due to its favorable properties, in particular, low weight, high strength, recyclability, malleability, simplicity of fabrication, corrosion resistance, and its thermal and electrical conductivity. Aluminium is also the world’s most abundant metal, and the third most plentiful element being oxygen and silicon. It is not however found in its pure form, but as orange-brown called “bauxite” named after the French village of Las Baux, where it was first discovered in 1821.

The main sources of bauxite are Australia, Jamaica, Ghana, French, Africa and India. To produce aluminium the bauxite must first be refined to give

alumina. Aluminium is almost unique amongst other materials, as it can be recycled over and over again without and change to its characteristics.

### **The extrusion process**

Extrusion is a manufacturing method for producing shapes of a standard cross section, which can then be fabricated further into more complex shapes. There are two main types of extrusion process, direct and indirect. P.M. Produce CO., LTD use only direct extrusion (as shown in Figure 2.4).

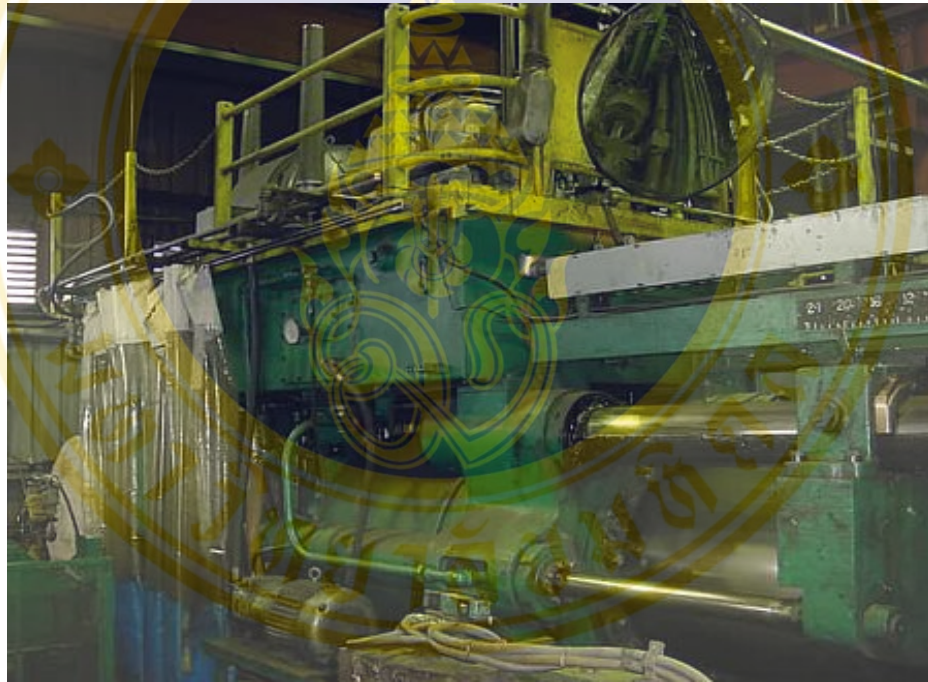


Figure 2.4 An Direct Extrusion Machine



Figure 2.5 Aluminium Billet



Figure 2.6 Extrusion Dies



Figure 2.7 Extrusion Dies



Figure 2.8 Aluminium Extrusion



Figure 2.9 Aluminium Extrusion

### **Principle of extrusion**

Initially, the aluminium alloy is formed into billets (as shown in Figure 2.5) by the foundry. The billets are then heated in a furnace to achieve the required extruding temperature, 450-500 Celsius. The billet is then loaded into a container of the extrusion machine, and squeezed through a extrusion die (as shown in Figure 2.6-2.7). After the extrusion process, the section of aluminium extrusion (as shown in Figure 2.8-2.9) are cut into the require length.

## **2.9 Related Work**

There are some researches about production techniques, but most of those researches are focus in the concept of management than the real life implementation. The examples of previous research are

1. Work Plan : Database for Work Package Production Scheduling [9]

This research is implementing by using Microsoft Access as an application and database.

## 2. Collection and Analysis of Shop Floor Data Using a Spreadsheet [10]

This research is implementing by using Spreadsheet to collect the data for the system.

Thus, their applications are designed to verify those concepts only. Though, these applications are easy to implement in programming. They are not for the middle and big organization.

In this research, the system is designed to be practical. This system can be implemented for real in both middle and big organizations. It is stable yet flexible with one centralized database server and client-server application. Data can be easily accessed via the company's network. However, the weak point of this system may be less complicated in terms of the management concept.

For those applications available in the market such as SAP and ORACLE database are not desirable for aluminium production industry. They may be efficient but their costs are too high. Moreover, many adjustment are required to satisfy the production scheduling environment.

## CHAPTER 3 RESEARCH METHODOLOGY

### Procedures of Research Methodology

In order to achieve all research objectives previously mentioned, this study follows a systems development life cycle (SDLC) as shown in Figure3.1, which is systematic and orderly approach to solve system problems and develop a prototype.

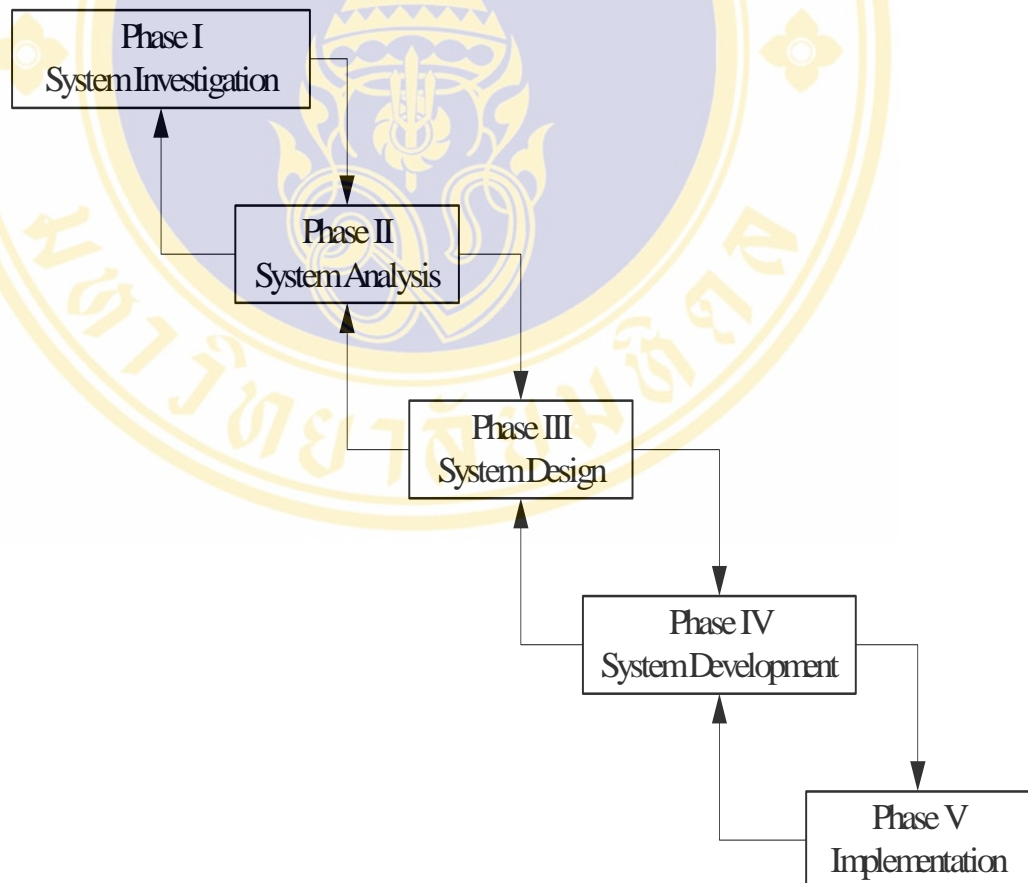


Figure 3.1 System Development Life Cycles Diagram

### 3.1 System Investigation

The system investigation is often called the feasibility study or system survey. In this phase, the developer studies the existing system to find the problem feasibility and objectives of this research

*The problems:* There are a lot of processes in the manufacturing of aluminum. Each process, some data are collected and stored in paper form and the rest are not. It is hard to use the data for planning the manufacturing of the product because the required data may not be kept or may be lost. At the present, the production manager is responsible for the production scheduling. This method takes a long time and the mistake may occur in the decision to choose the production plan. The products are delivered slowly or inaccurately. This affect to the reputation and reliability of company.

*Objectives:* To develop the information system, the system should provide the database that can be utilized to store data of the manufacturing, inventory, raw material, tools (extrusion dies) and the product's information. It also provides the application that can be used to add, update, and view the data and perform the scheduling function.

### 3.2 System analysis

This phase contains two main tasks that will be used to design the system.

#### 3.2.1 Data Collection

The purpose of data collection is to collect and prepare data for system analysis stage, the activities into the following step:

##### **User Interview & Collecting Requirements**

Requirement gathering was done via 2 main media: (1) interview the current system and (2) collect paper and report forms.

The current set of data includes information on finished product, extrusion die, raw material, customer, customer order, employee which are kept in paper forms. The collection of varied reports can help in the analysis of user requirements as well.

### **Investigating Current System**

The current filing system is still primitive (i.e. reports are collected in folders and cabinets). The documents are only filed and retrieved by the person in charge for specific subjects. There is still no central data center at this point. Thus, to retrieve specific information, one needs to contact the person responsible for that particular topic.

The current production planning is still primitive too. The production manager has to schedule the daily manufacturing plan manually.

#### **3.2.2 Analysis**

The purpose of the System Analysis Phase is to study and analyze the problem, its causes and effects. Identification and analysis of the requirements that must be fulfilled by any successful solution. The System Analysis Phase can also be broken-down and reordered the activities into the following step:

##### **User Profile**

The expected users are managers and officers in this system.

**General User** : managers and workers in the factory.

**Production Manager** : the production manager of the aluminium factory.

##### **Problem Overview**

As mentioned above, after studying and analyzing P.M. Produce CO., LTD's business operations through interviews and form collections, a list of major problems underlying the company's system can be categorized as follows:

##### 1) File Management Systems Problem

Many inaccuracies in data collecting process.

Some information lost in data collecting process.

##### 2) Production Scheduling Problem

Miss calculation in production process.

Raw material shortage.

### 3.2.3 The new system requirement

In collecting information on P.M. Produce CO., LTD and interviewing the users, a list of requirements was formulated to assist the programmer in developing the system. The requirements are as follows:

- The system shall be able to quickly retrieve and display information.
- The system shall be able to update the information easily. User-friendliness is also required.
- The system shall be able to plan the product schedule.
- The system shall store finished product, sales, extrusion dies, raw material, machine and employee information.
- The system shall keep a record of customers.
- The system shall store relevant scheduling information (i.e. Supplier Company).
- The system shall keep detailed purchase order.
- The system shall store information of production that is producing by the company. Such information will help in preparing for report.
- Access to the system to the business staff shall be as follows:
  - a) Administrator; the administrator shall be able to view, to update and to delete all data in administrator module.
  - b) User; the user shall be able to view and retrieve data.
  - c) Production manager, the production manager shall be able to plan the product schedule, view and retrieve data.
- The system shall be able to store the required information.
- The system shall increase the operational efficiency of the company.
- The system shall produce relevant up-to-date and accurate reports to management in a timely fashion.

## 3.3 System design

The purpose of System Design is to identify the feasible target solution, and to design the system for developing the prototype of the proposed system.

### 3.3.1 Data flow diagram

### The Context Data Flow Diagram

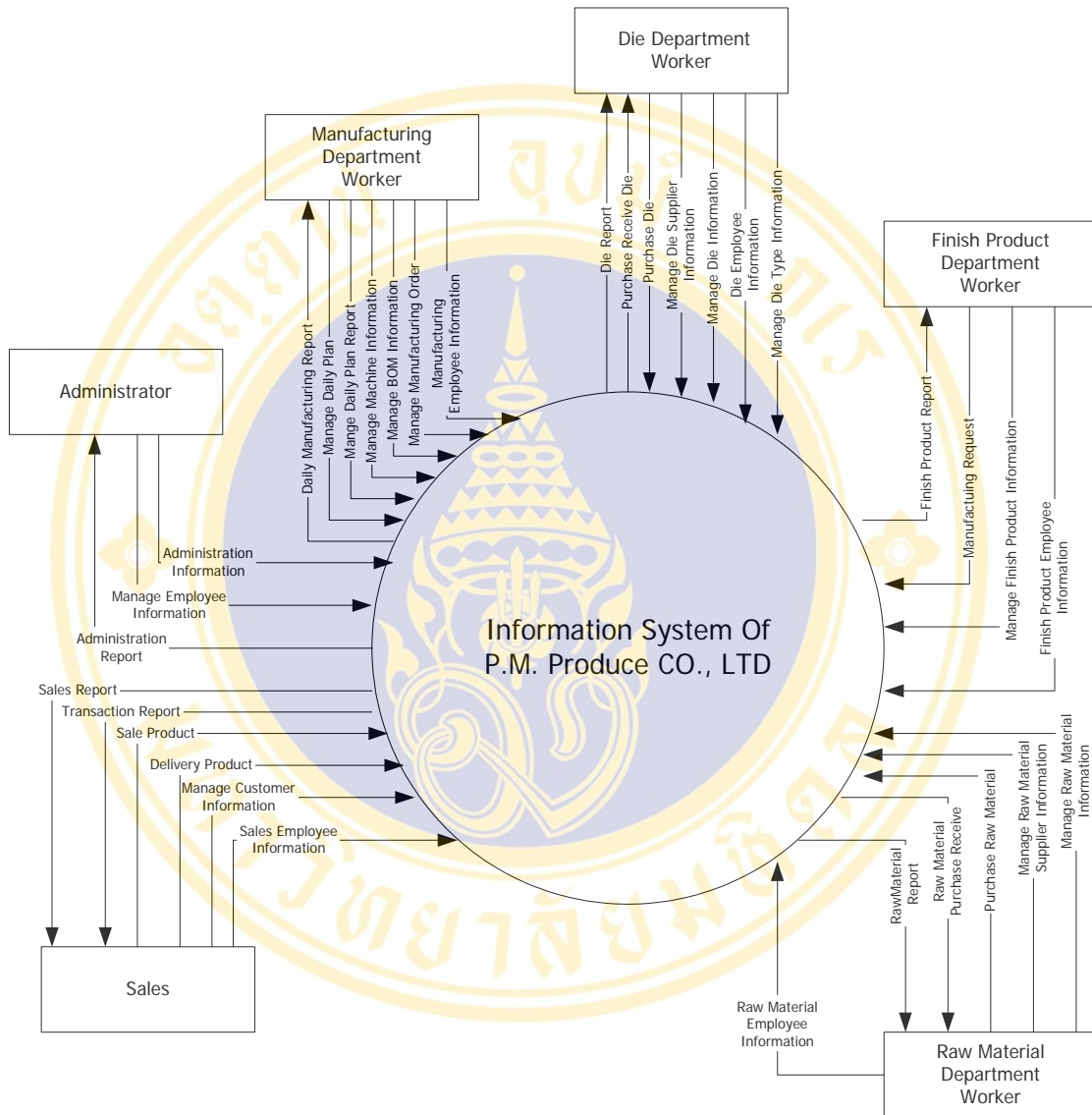


Figure 3.2: Context Diagram : Information System of P.M. Produce CO., LTD

### Context Diagram

From the context data flow diagram, the system divides into six major modules. There are; Finish Product Module, Sales Module, Raw Material Module, Die

Module, Manufacturing Module and Administration Module. The detail of each module will shown deeply in the next level of data flow diagram.

1. Finished product department worker responsibilities are to:
  - Manage the finished product information.
  - Request for manufacturing finished product.
  - Approve for the manufacturing finished product that below buffer stock.
2. Sales responsibilities are to:
  - Manage customer information.
  - Manage customer order information.
  - Manage delivery order information.
3. Raw material department worker responsibilities are to:
  - Manage raw material supplier information.
  - Manage raw material information.
  - Purchase raw material.
4. Extrusion die's department worker responsibilities are to:
  - Manage die supplier information.
  - Manage the die type information.
  - Manage die information.
  - Purchase the die.
5. Manufacturing department's worker responsibilities are to:
  - Make the bill of materials for the product.
  - Manage machine information.
  - Change customer order into manufacturing order.
  - Manage manufacturing order information.
  - Manage the daily plan information.
6. Administrator responsibilities are to:
  - Manage the employee information.
  - Assign the control access level to the employee.

**Finish Product Module**

**Level 1 : The process of Information System of P.M. Produce CO., LTD**

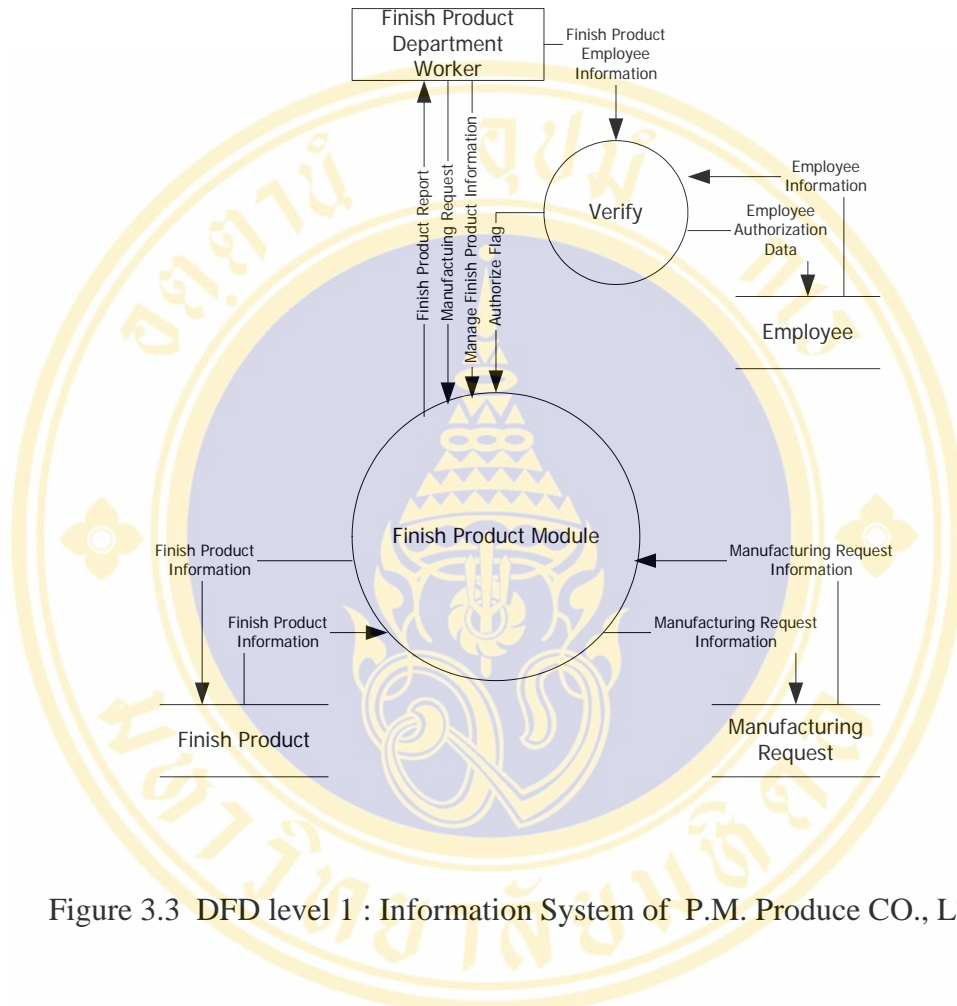


Figure 3.3 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the finish product module.

Process : Finished product modules

- Manage finish product Information.
- Request for manufacturing.
- Generate finish product report.

## Level 2 : The process of Finish Product Module

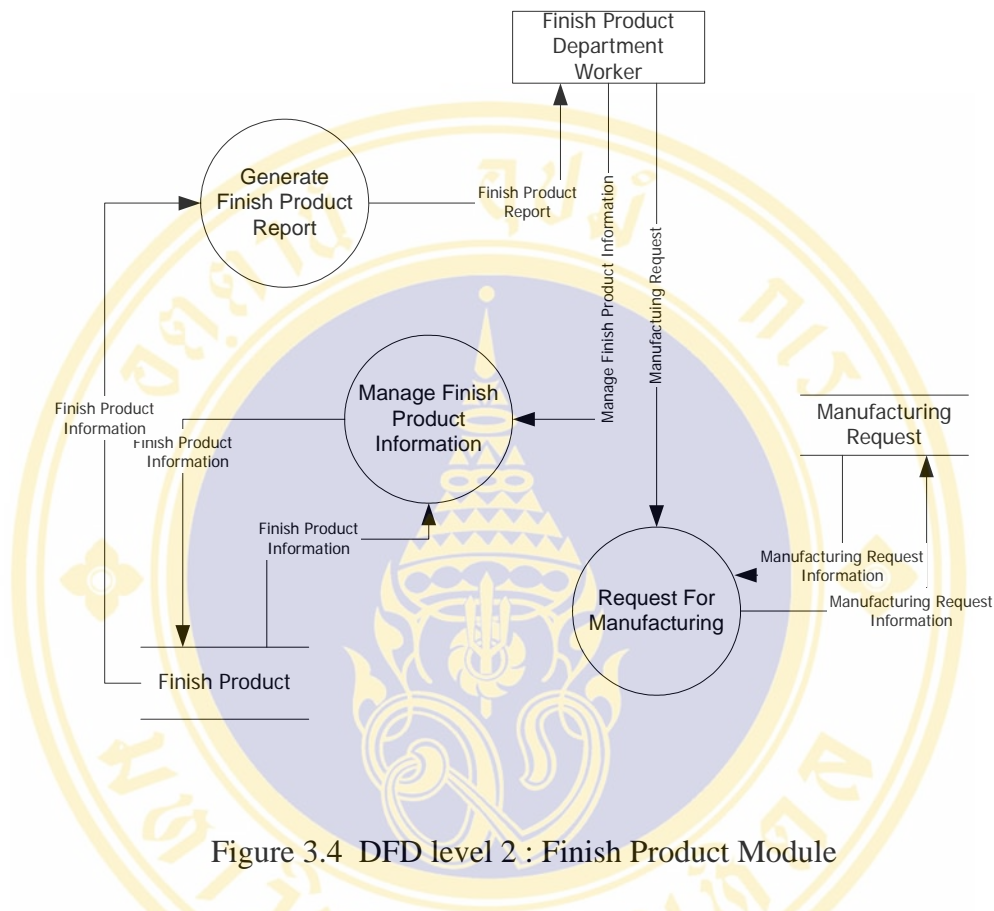


Figure 3.4 DFD level 2 : Finish Product Module

### DFD Level 2: Finish Product Module

Process : Manage finish product information

- Add the finish product information.
- Update the finish product information
- View the finish product information.

Process : Request for manufacturing

- Approve for the manufacturing request to support safety stock.

Process : Generate Finished Product Report

- Generate finished product report for the finished product department worker and manager.

**Sales Module**

**Level 1 : The process of Information System of P.M. Produce CO., LTD**

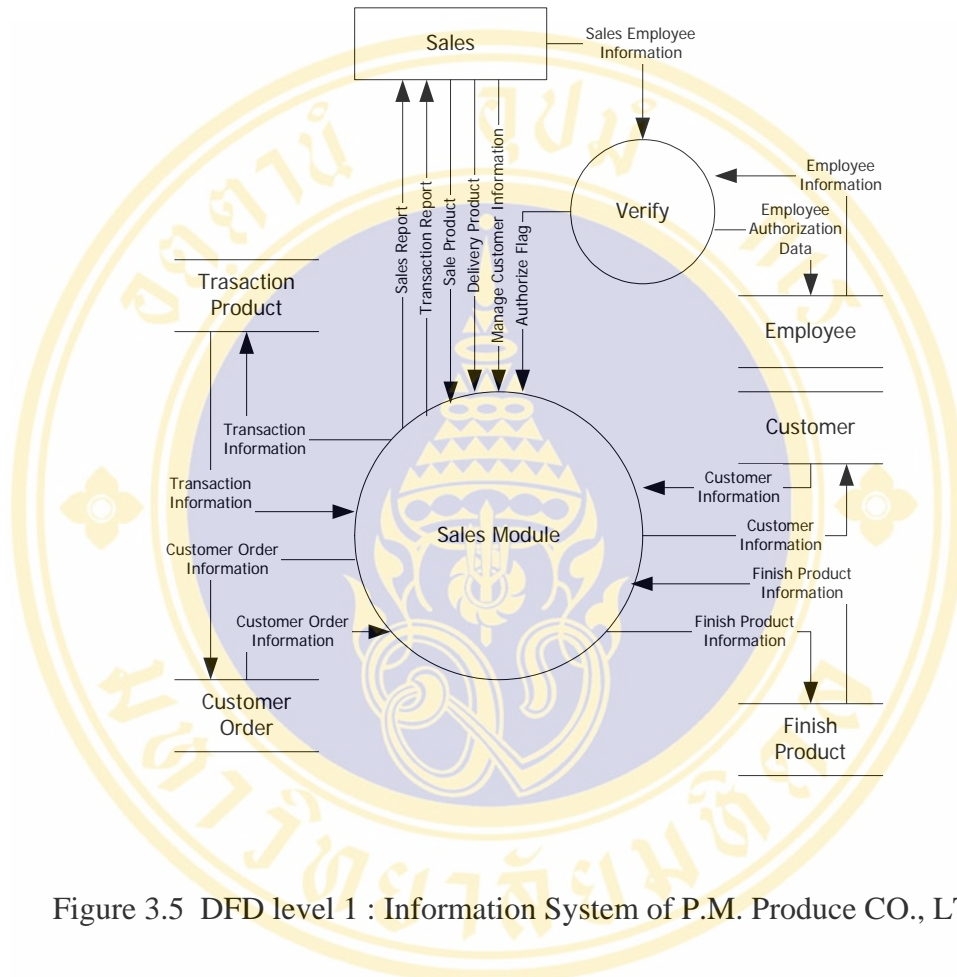


Figure 3.5 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the sales module.

Process : Sales modules

- Manage customer information.
- Sale product.
- Generate sale report.
- Delivery order.
- Generate Transaction Report.

**Level 2 : The process of Sales Module**

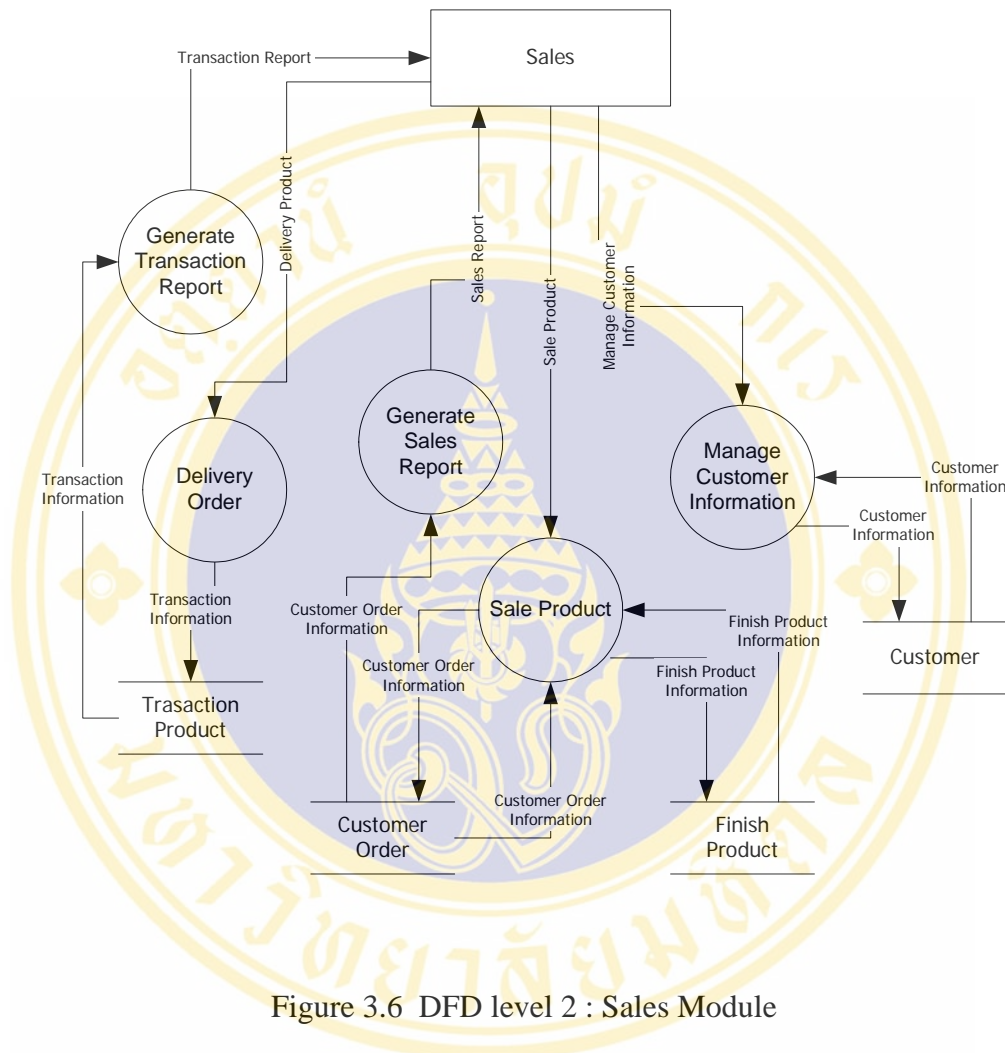


Figure 3.6 DFD level 2 : Sales Module

**DFD Level 2: Sales Module**

Process : Manage customer information

- Add customer information into customer database.
- Update customer information into customer database.
- View customer information from customer database.

Process : Sale Product

- Add customer’s purchase order to customer order database

Process : Generate Sale Report

- Quote the price of equipments/wages for production and installation.  
List of equipments/man-hours required will come from technical data sheet.
- Submit price proposal to customer for consideration.

Process : Delivery Order

- Add the delivery order to the delivery transaction product database.

Process : Generate Transaction Report

- Generate transaction report of the delivery order for sales department worker and manager.

### Raw Material Module

#### Level 1 : The process of Information System of P.M. Produce CO., LTD

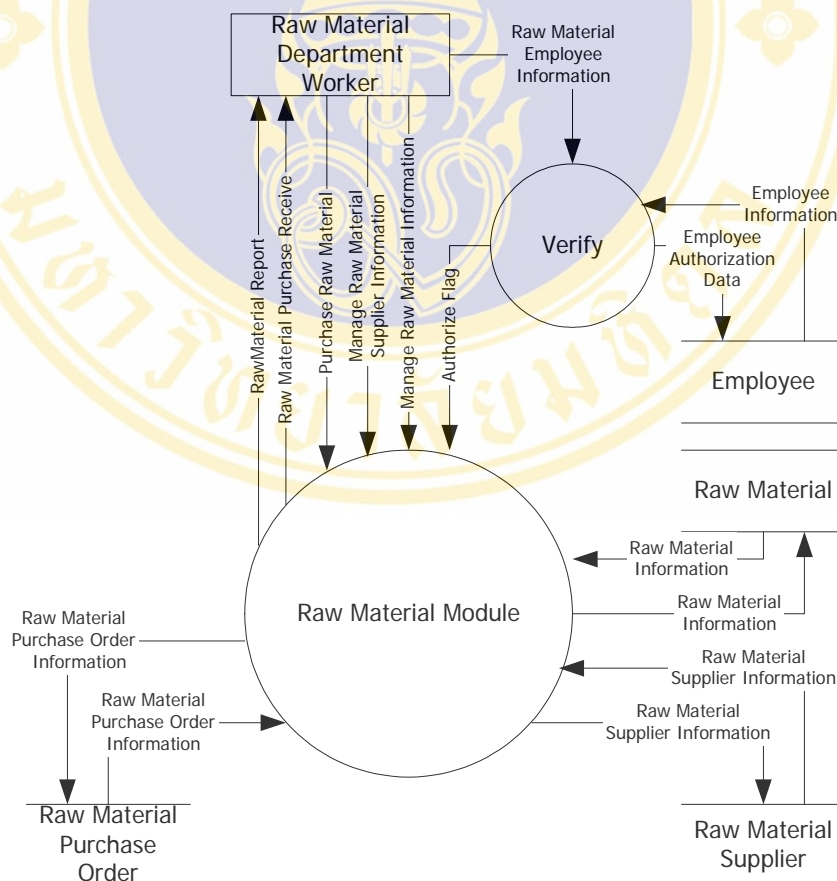


Figure 3.7 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the raw material Module.

Process : Raw Material modules

- Manage raw material information.
- Manage raw material supplier information.
- Purchase the raw material.
- Manage the raw material purchase receive.
- Generate raw material report.

**Level 2 : The process of Raw Material Module**

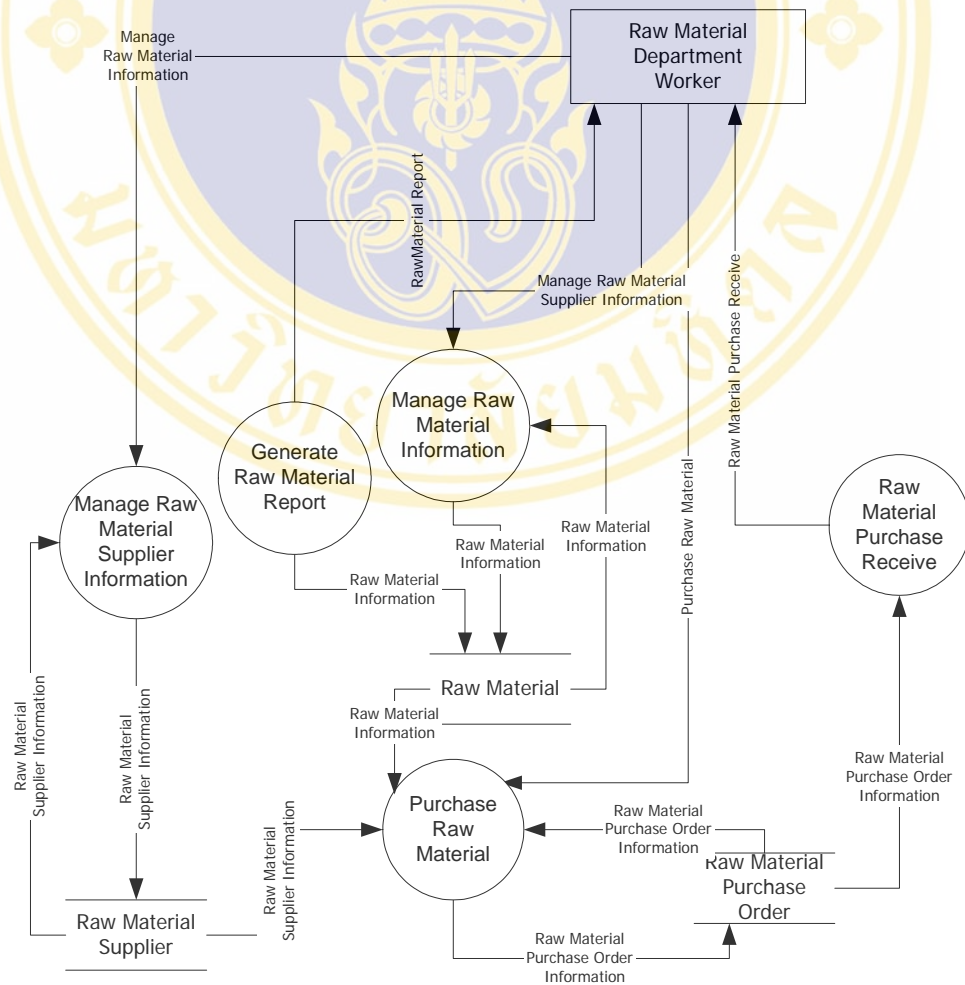


Figure 3.8 DFD level 2 : Raw Material Module

## **DFD Level 2: Raw Material Module**

Process : Manage Raw Material Information

- Add the raw material information.
- Update the raw material information.
- View the raw material information.

Process : Manage Raw Material Supplier Information

- Add the raw material supplier information.
- Update the raw material supplier information.
- View the raw material supplier information.

Process : Purchase Raw Material

- Add the purchase order of raw material to raw material purchase order database.

Process : Raw Material Purchase Receive

- Add raw material to the raw material database.
- Change the status of raw material purchase order.

Process : Generate Raw Material Report

- Generate raw material report for raw material department worker and manager.

## **Die Module**

**Level 1 : The process of Information System of P.M. Produce CO., LTD**

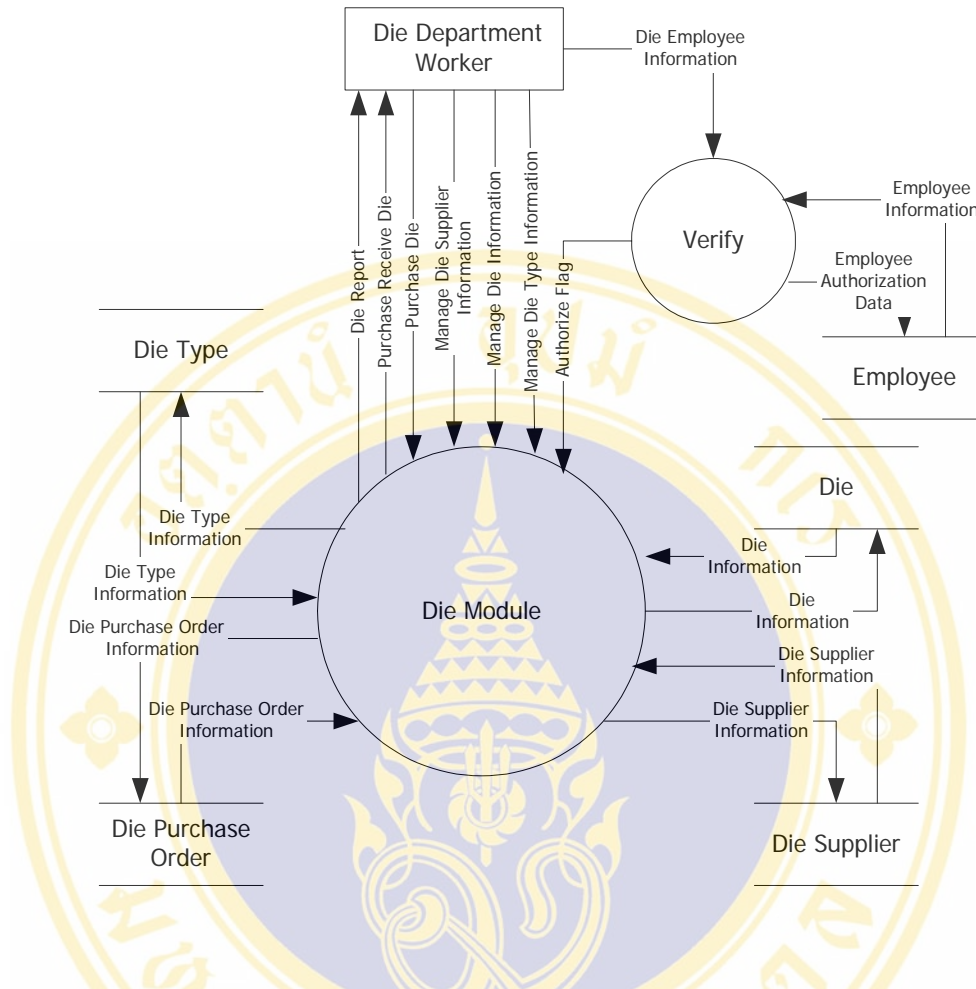


Figure 3.9 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System Of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the die module

Process : Raw Material modules

- Manage die type information.
- Manage die supplier information
- Manage die information.
- Purchase die.
- Die purchase receive.
- Generate die report.

**Level 2 : The process of Die Module**

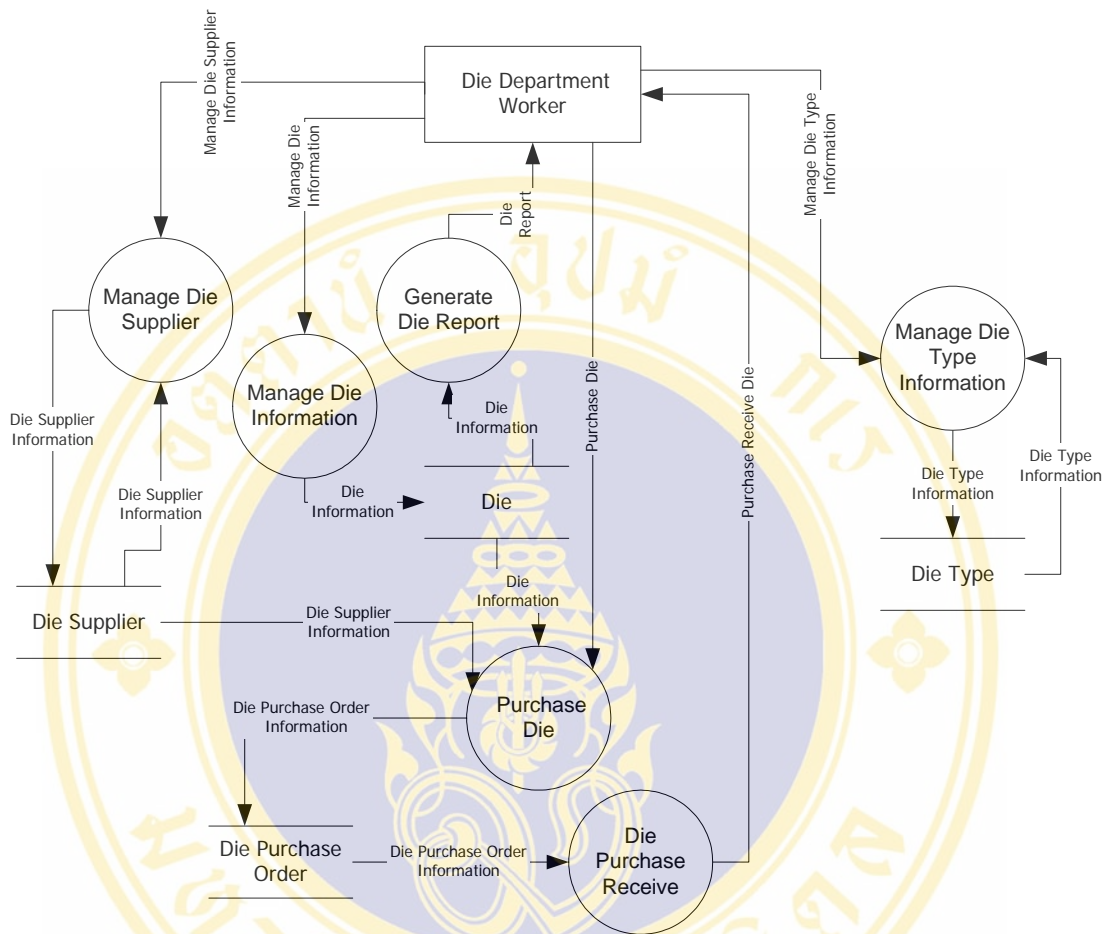


Figure 3.10 DFD level 2 : Die Module

**DFD Level 2: Die Module**

Process : Manage Die Type Information

- Add the die type information.
- Update the die type information.
- View the die type information.

Process : Manage Die Supplier Information

- Add the die supplier information.
- Update the die supplier information.
- View the die supplier information.

Process : Manage Die Information

- Add the die information.

- Update the die information.
- View the die information.

Process : Purchase Die

- Manage the die purchase order.

Process : Die Purchase Receive

- Add die information into die database
- Change the status of the die purchase order.

Process : Generate Die Report

- Generate die report for the die department worker and manager.

### Manufacturing Module

#### Level 1 : The process of Information System of P.M. Produce CO., LTD

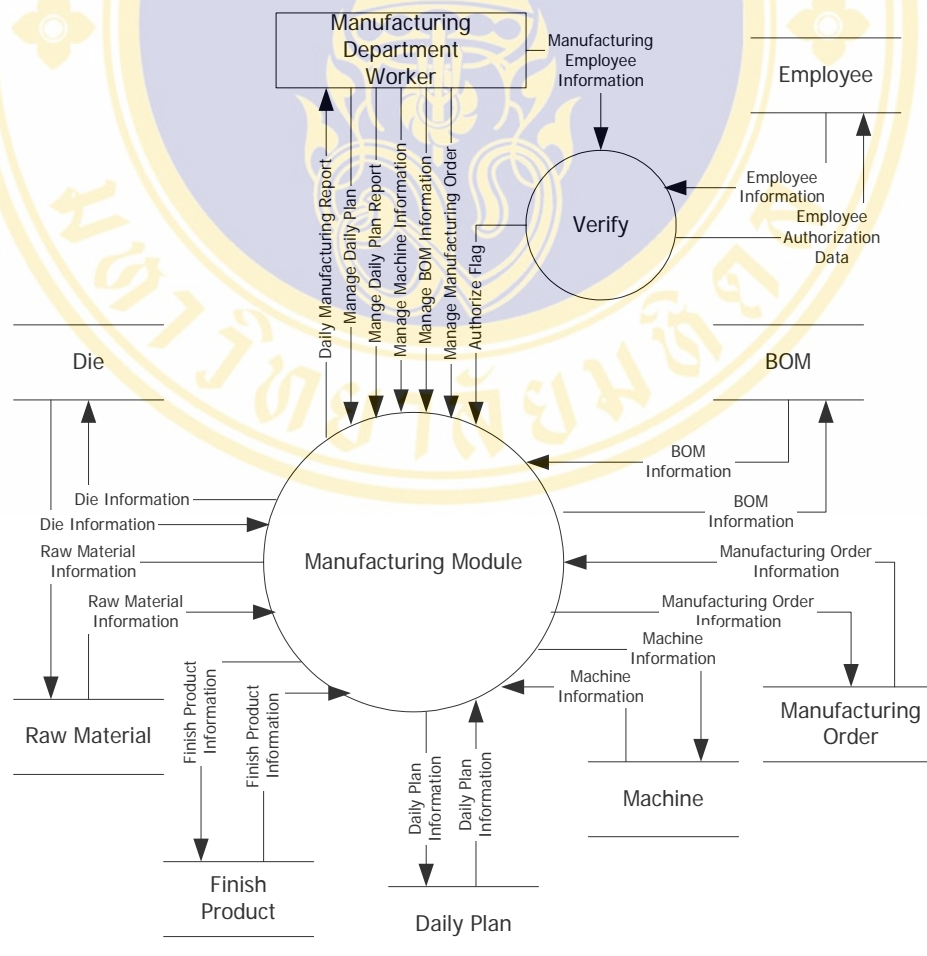


Figure 3.11 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the manufacturing module.

Process : Manufacturing modules

- Manage the machine information.
- Manage bill of material information.
- Create manufacturing order.
- Create daily manufacturing plan.
- Manufacturing report.
- Generate daily manufacturing report.

**Level 2 : The process of Manufacturing Module**

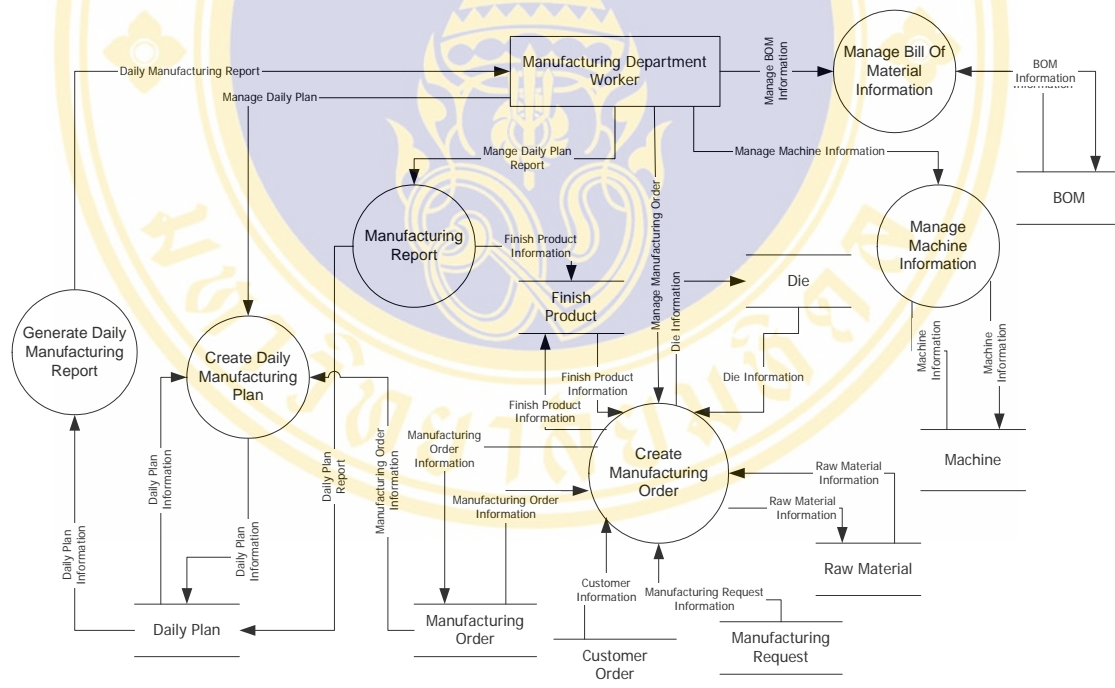


Figure 3.12 DFD level 2 : Manufacturing Module

**DFD Level 2: Manufacturing Module**

Process : Manage the machine information

- Add machine information.
- Update machine information.

- View machine information.

Process : Manage bill of material information

- Add bill of material information.
- Update bill of material information.
- View bill of material information.

Process : Create manufacturing order

- Change the customer order into manufacturing order.
- Calculate for the raw material that will be use.
- Reserve for the die that will be use.

Process : Create daily manufacturing plan

- Create daily manufacturing plan for each machine from the manufacturing order and store into the daily plan database.

Process : Manufacturing report

- Add the manufacturing report to the daily plan database.

Process : Generate daily manufacturing report

- Generate daily manufacturing report for manufacturing department worker and manager.

**Administration Module**

**Level 1 : The process of Information System of P.M. Produce CO., LTD**

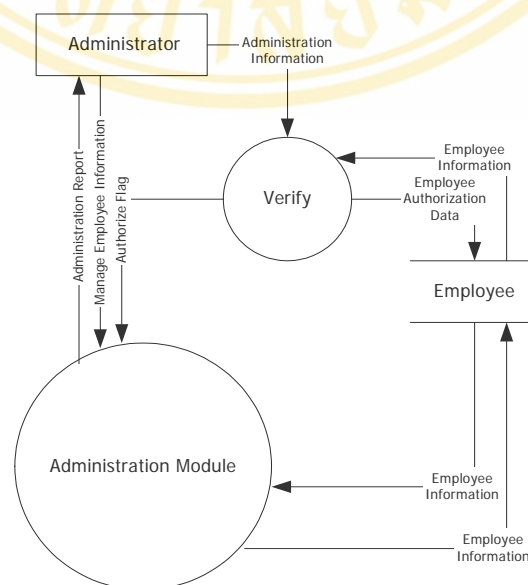


Figure 3.13 DFD level 1 : Information System of P.M. Produce CO., LTD

**DFD level 1: Information System of P.M. Produce CO., LTD**

Process : Verify

- Verify for the legitimate user of the administration module

Process : Administration module

- Manage employee information.
- Generate employee report.

**Level 2 : The process of Administration Module**

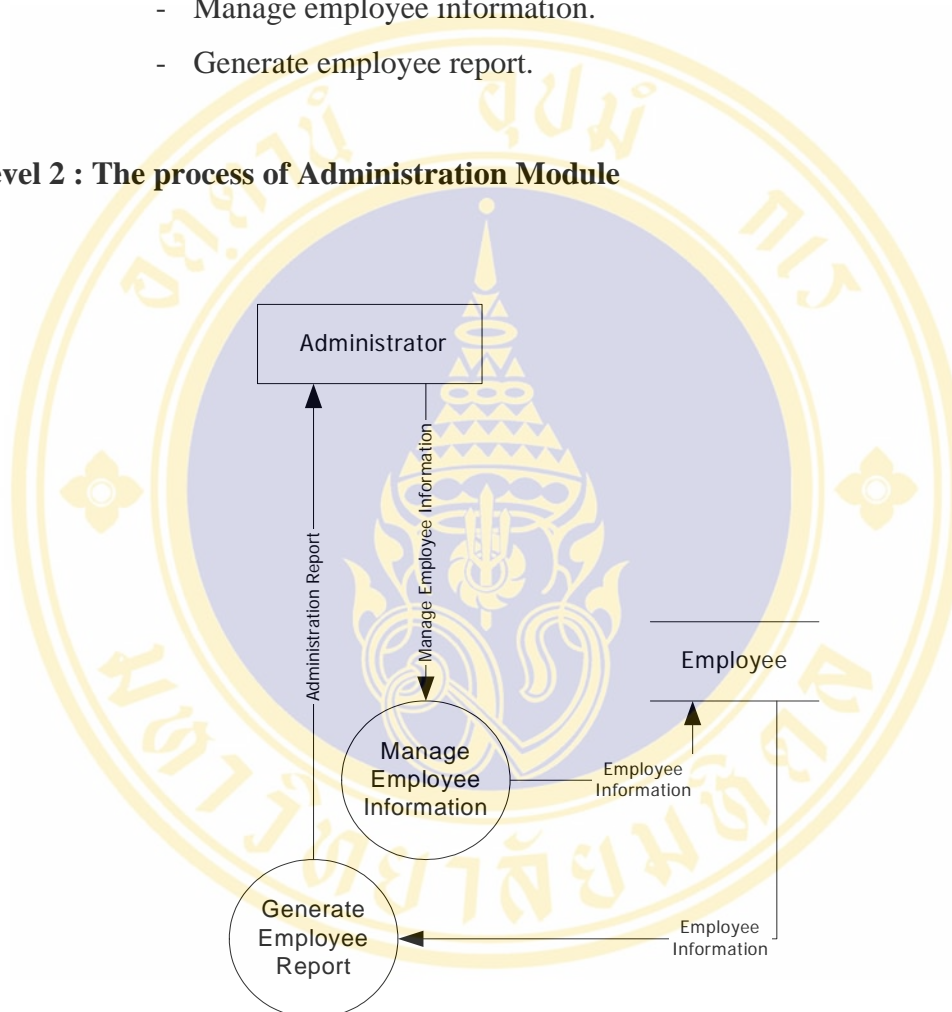


Figure 3.14 DFD level 2 : Administration Module

**DFD Level 2: Manufacturing Module**

Process : Manage employee information

- Add the employee information and manage the level of access information.
- Update the employee information.
- View the employee information.

**Process : Generate Employee Report**

- Generate the employee report for administration department worker and manager.

**3.3.2 Database Design**

The purpose of this section is to prepare technical design specification for BIS' database that will be adaptable to future requirements and expansion. Relational database management system is used to support the development of a prototype of the proposed BIS by using Microsoft SQL Server 2000 for data storage. Information will be stored in a collection of tables that are related via foreign keys.

**- The Entity Relationship Data Model**

The ER-Diagram as shown in Figure 3.15 illustrates the entities, their corresponding relationships, and attributes used in developing the prototype.

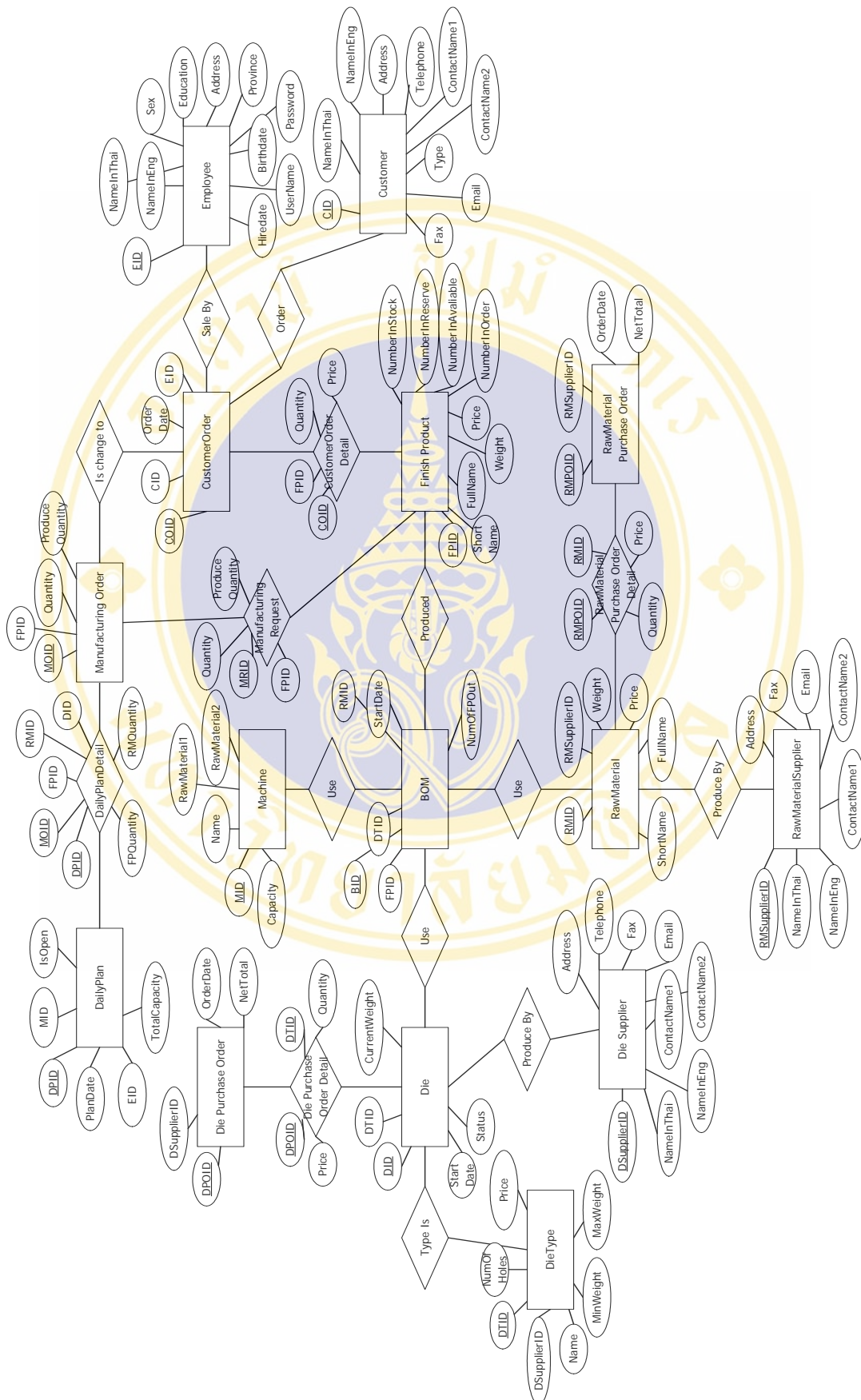


Figure 3.15 Entity Relationship Diagram of the Prototype

### - Normalization

Normalization is a technique used to organize data attributes by grouping them into stable, flexible and adaptive entities. It is a three-step technique that places the data model into first normal form, second, and third normal forms. The database schema has already been normalized into the third normal form.

## 3.4 Research Tool

### 3.4.1 Hardware

#### Server (minimum require specification)

Computer/ Processor	PC with a Pentium II, 233 MHz or higher processor.
Memory	64 MB of RAM (128 MB or higher recommended).
Hard Disk	4 GB
Drive	CD-ROM drive
Display	VGA or higher-resolution monitor; Super VGA recommended
Operating System	Microsoft Windows NT 4.0 or later operating system.
Peripheral/ Miscellaneous	Mouse or compatible pointing device. Keyboard. LAN Card 10/100

#### Client (minimum require specification)

Computer/ Processor	PC with a Pentium, 166MHz or higher processor.
Memory	32 MB of RAM (64 MB or higher recommended).
Hard Disk	2 GB
Drive	CD-ROM drive
Display	VGA or higher-resolution monitor; Super VGA recommended
Operating System	Microsoft Windows 98 SE or later operating system.
Peripheral/ Miscellaneous	Mouse or compatible pointing device. Keyboard. LAN Card 10/100

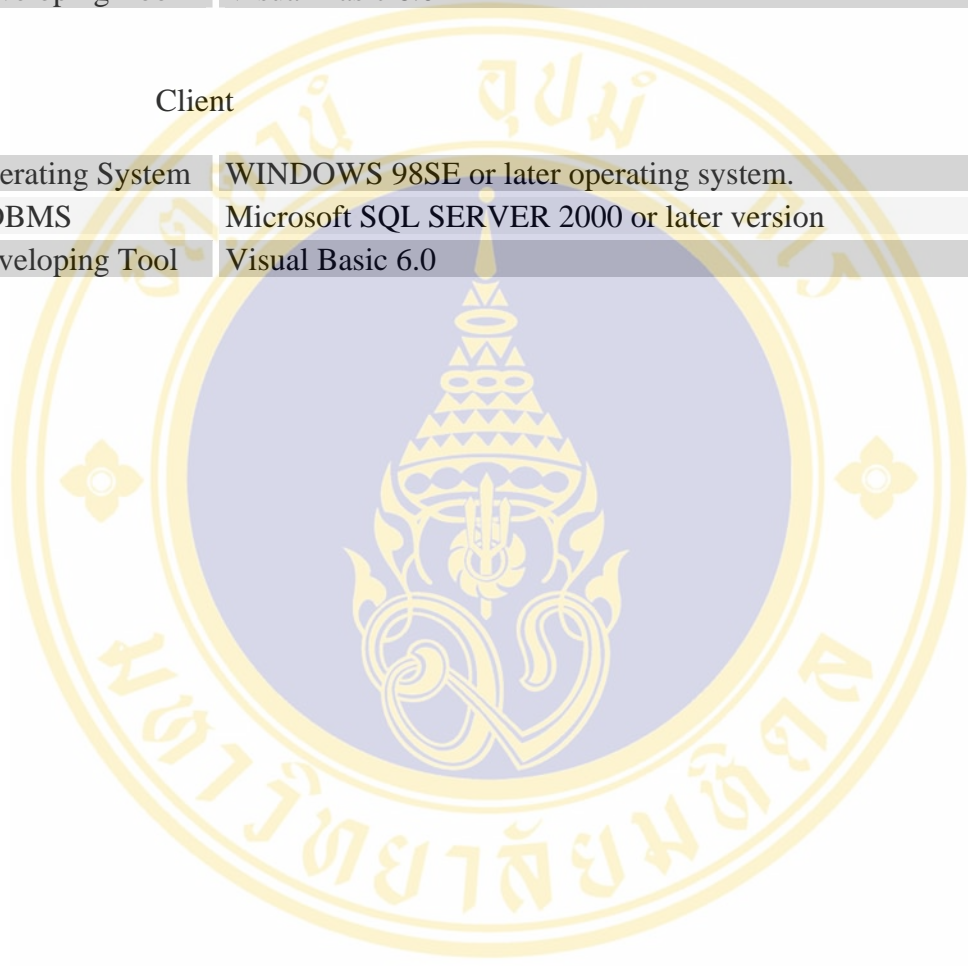
### 3.4.2 Software

#### Server

Operating System	Microsoft Windows NT 4.0 or later operating system.
RDBMS	Microsoft SQL SERVER 2000 or later version
Developing Tool	Visual Basic 6.0

#### Client

Operating System	WINDOWS 98SE or later operating system.
RDBMS	Microsoft SQL SERVER 2000 or later version
Developing Tool	Visual Basic 6.0



## CHAPTER 4

### RESULTS

#### System Development

After studying and analyzing the system, a list of major problems can be categorized as follows:

- Production Scheduling Problem
- File Management Systems Problem

This chapter focuses on the result of the prototype and how the prototype solves the problem mentioned earlier.

#### 4.1 Database

In the Research Methodology Chapter, we present the Entity Relationship Data Model of the system that is the first step in the Relational Database Model developing process, in order to design database in the physical level.

##### 4.1.1 The Relational Database

Relational database is commonly used in the market. Information presented in a single database can be linked to another. In such databases, many records from two or more database files can be merged; all databases can be linked so users could retrieve all information at once.

The Database tables displayed in Appendix A are designed in a relational database, using Microsoft SQL Server 2000 as database server. Figure 4.1 depicts the various entity relationships.

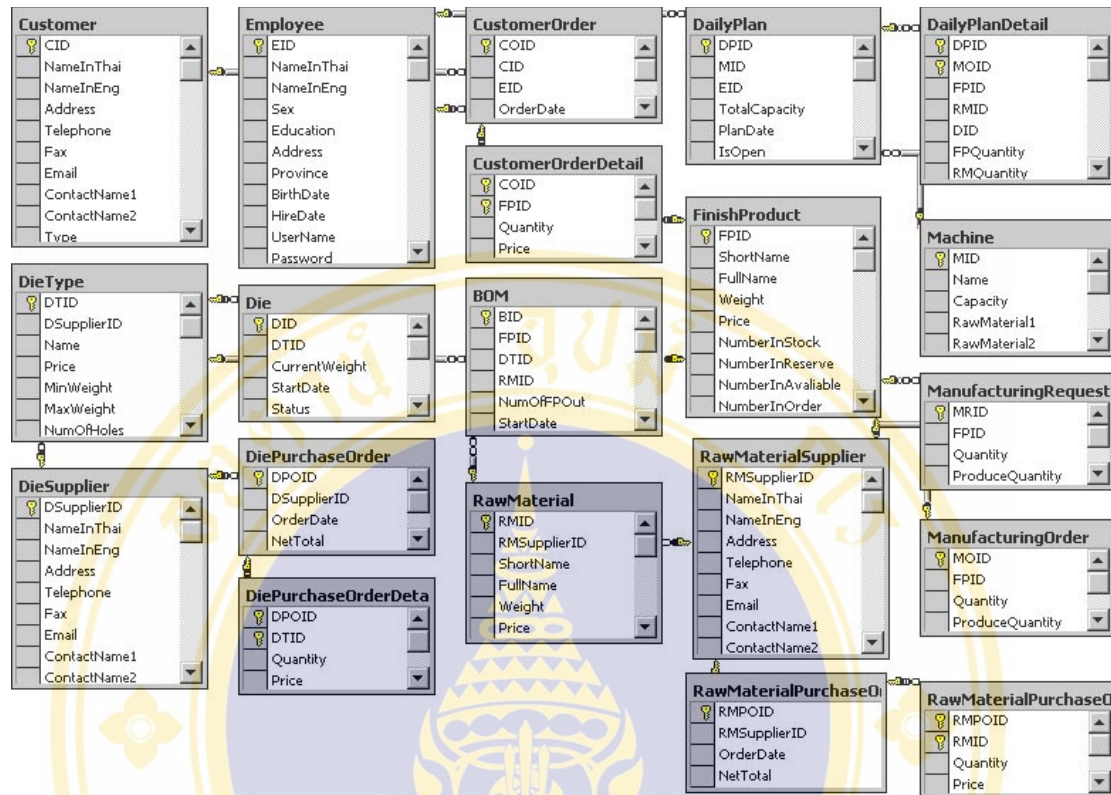


Figure 4.1 The Relational Database Diagram of Information System of P.M. Produce CO., LTD

## 4.2 Application

In designing the prototype application, data-accessing problem (i.e. gathering information to produce a report used to be tedious task ,a lot of time was spent to retrieve information) has been taken into consideration by using client-server technology; the system will help decrease the turn-around time in accessing and processing information.

### 4.2.1 Client-server Application

The system uses client-server technology to provide business system. This technology can run client application on Windows platform supporting web viewing. This allows the many of user to access to the system anywhere network connection is allowed.

In using client-server technology to produce the prototype system, there are two components: (1) client application program (2) database server. The

client application program is programming using a programming language called Visual Basic 6 or VB6 and the database server for this system is Microsoft SQL Server 2000.

In this Application, six types of users were defined: finished product worker, sales, raw material worker, die worker, manufacturing worker and administrator.

The flowchart of the login process of the prototype application is shown as Figure 4.2. The workers can access to the modules that they have been granted as shown in Figure 4.3. These modules are separated into six modules as listed below.

- Finished product module

In this module, the worker can add, update and search for the finished product in the inventory. This module can generate the report and check the status of the finished products as shown in Figure 4.4

- Sales module

In this module, the worker can add the sales order of the customer into the order database. The worker can also use it to add or edit the customer data into the database as shown in Figure 4.5

- Raw material inventory module

In this module, the worker can add, update and search for the raw material in the inventory. This module can generate the report and check the status of the raw material products as shown in Figure 4.6

- Die module

In this module, the worker can add, update and search for the extrusion die in the database. The workers can also use it for checking the status of the extrusion die and generating the report for the manager as shown in Figure 4.7

- Manufacturing module

In this module, the worker has the activity to input the daily report data into the manufacturing database. The application must be able to scheduling the daily manufacturing plan and can be edited as shown in Figure 4.8

- Administration module

In this module, the administrator who is protecting the system has the activity to add, update and search the data of the worker and grant the permission for each user as shown in Figure 4.9

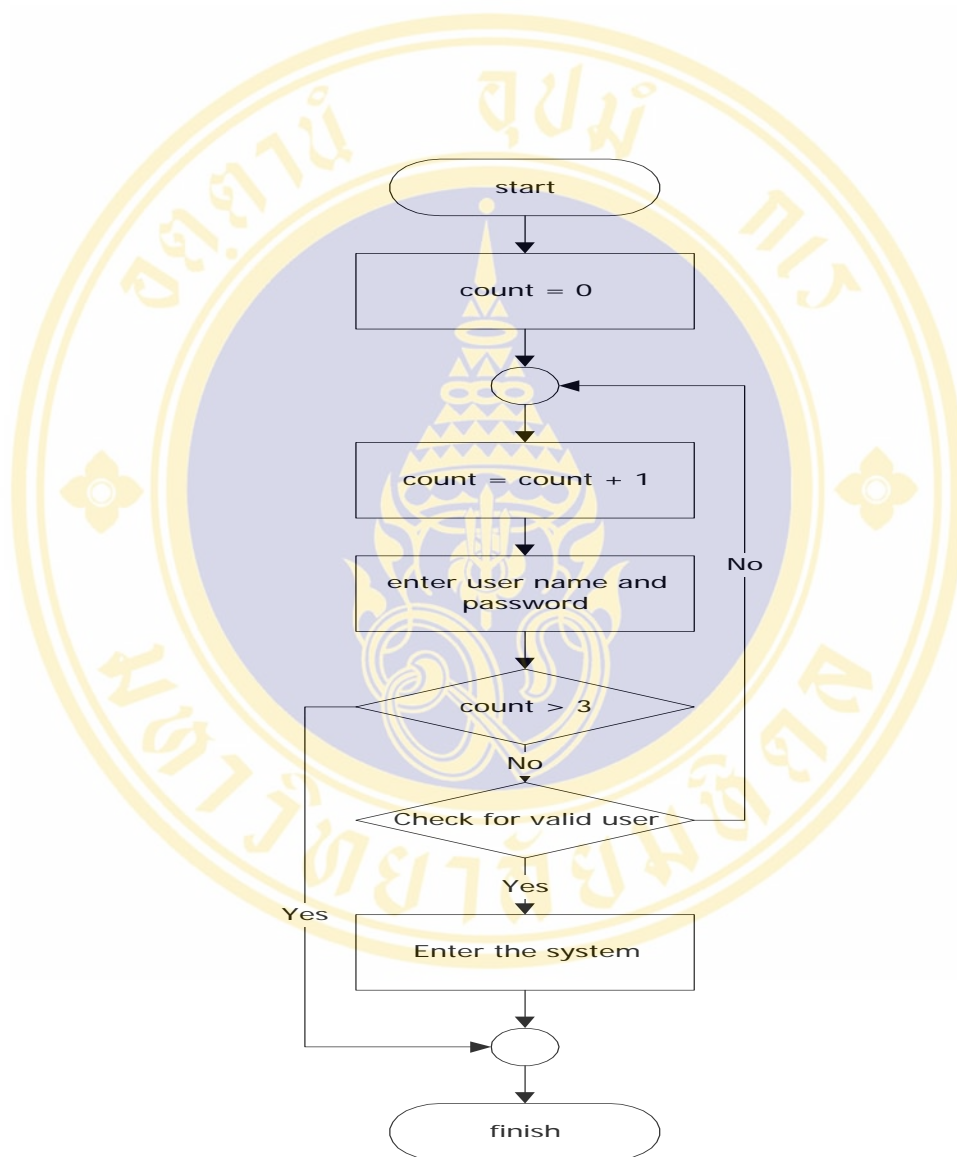


Figure 4.2 Flow Chart of the system of P.M. Produce CO., LTD

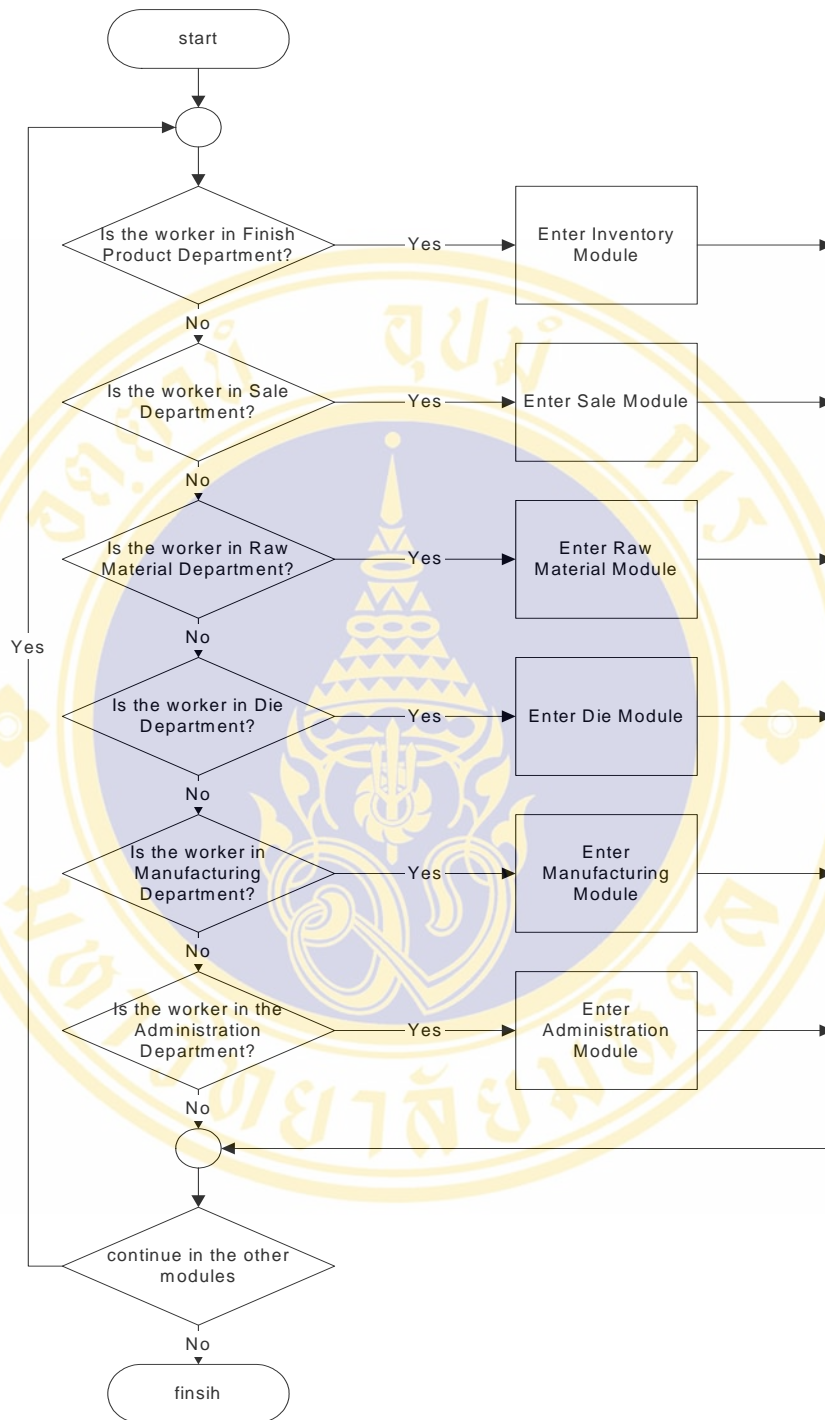


Figure 4.3 Flow Chart of the system of P.M. Produce CO., LTD

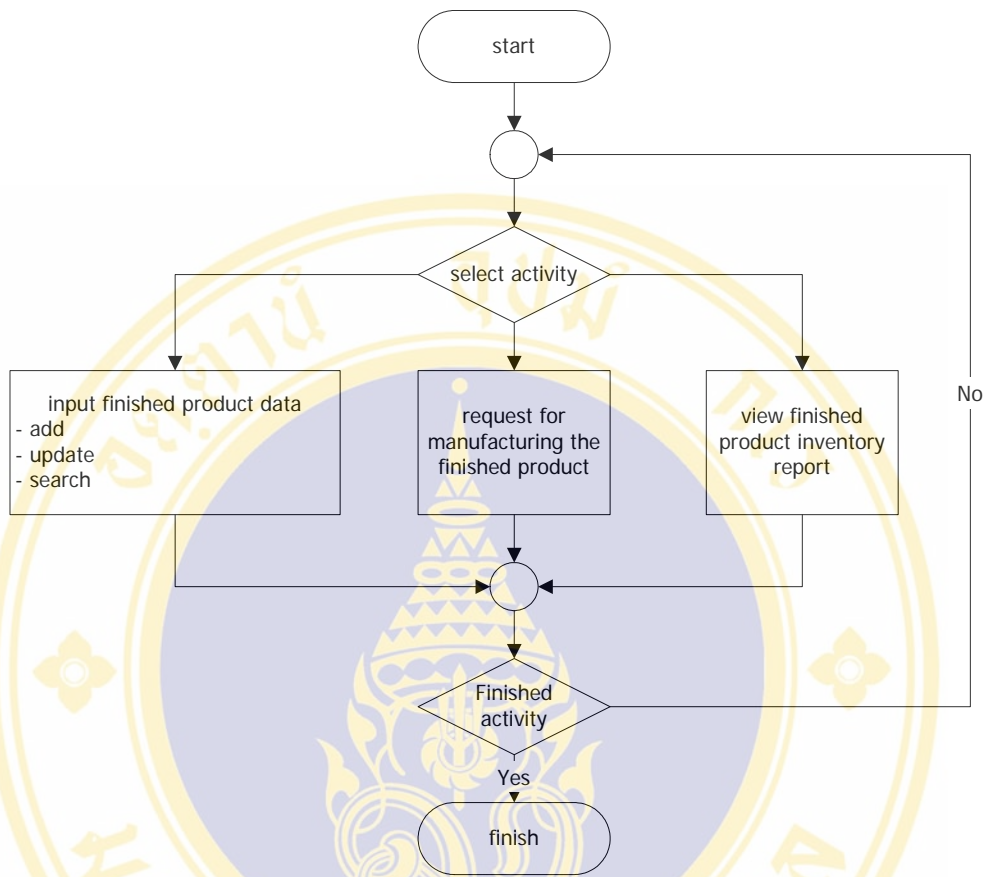


Figure 4.4 Flow Chart of Finished Product Module

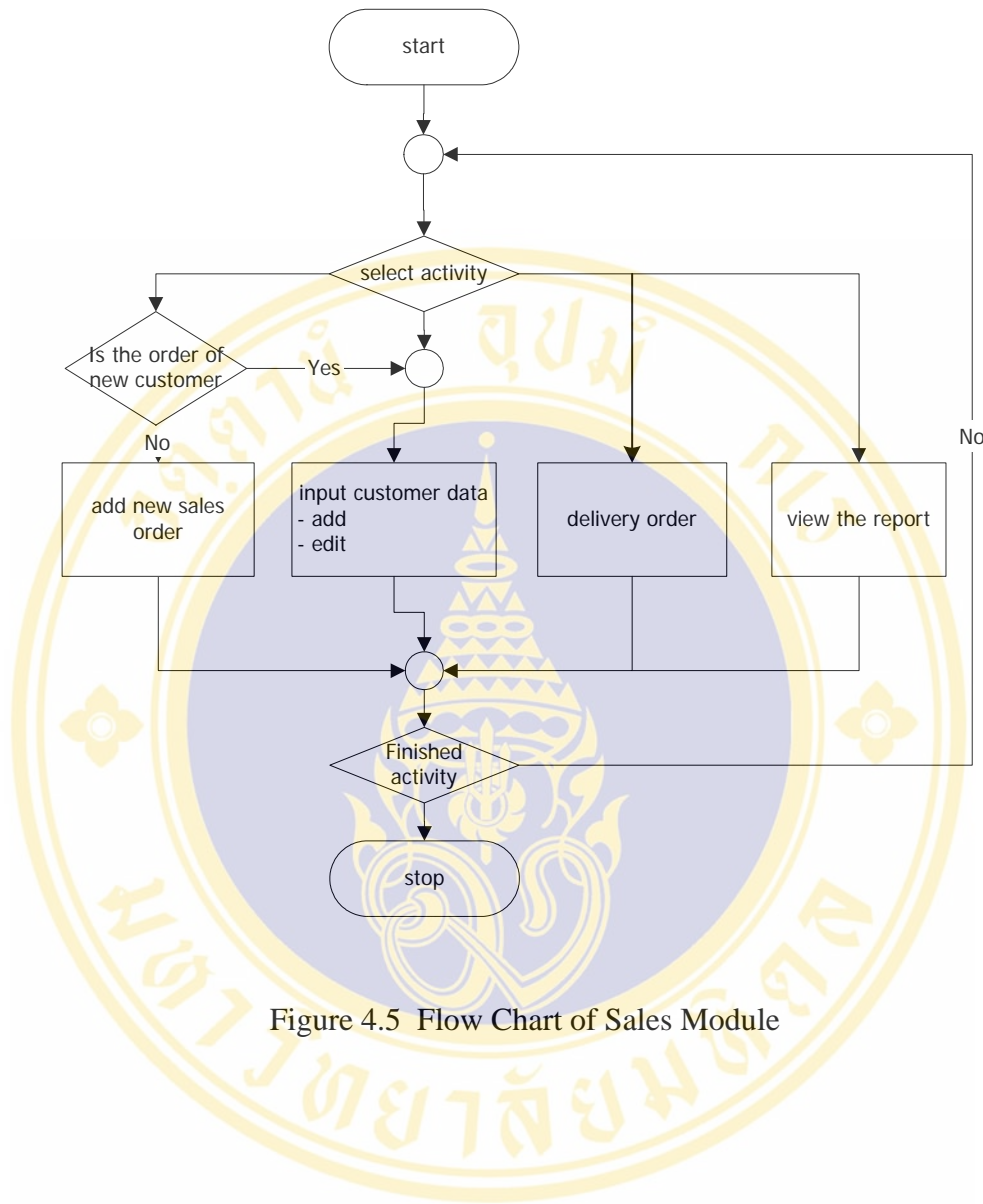


Figure 4.5 Flow Chart of Sales Module

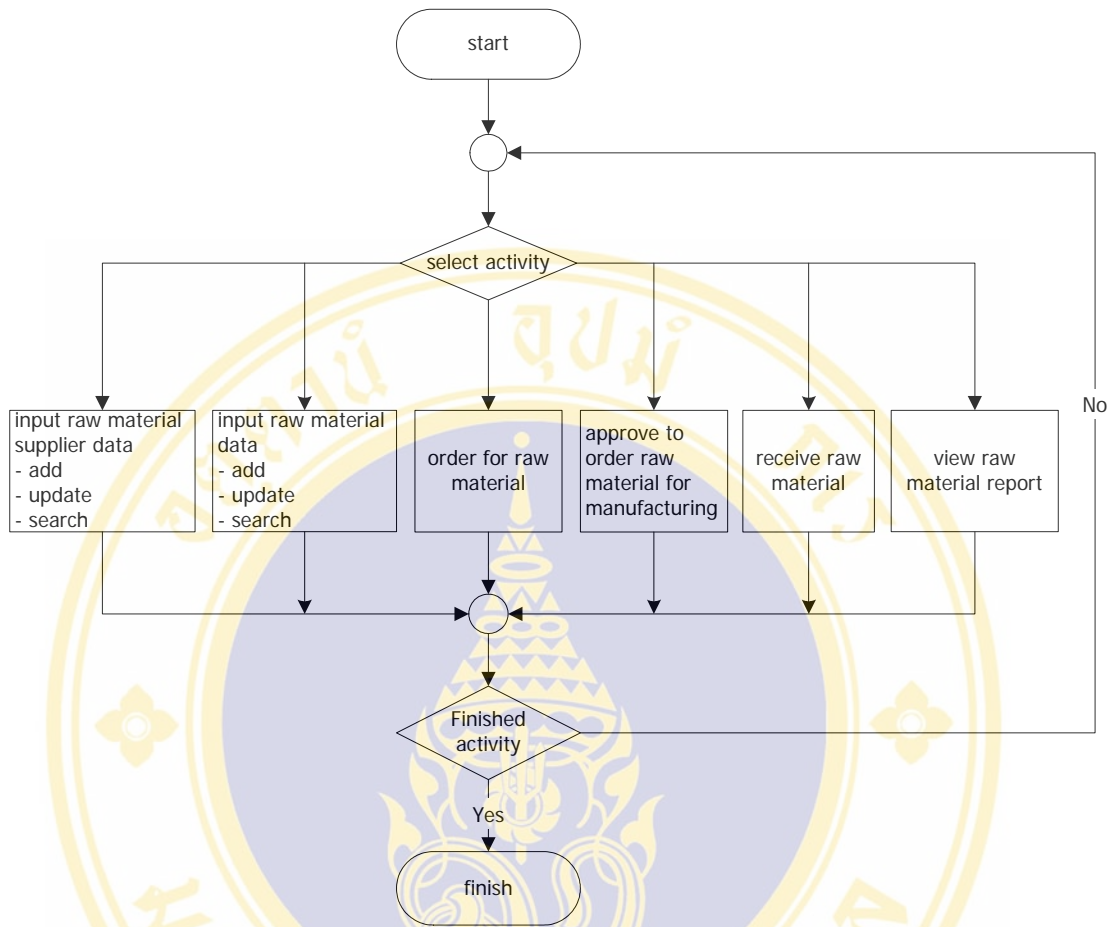


Figure 4.6 Flow Chart of Raw Material Module

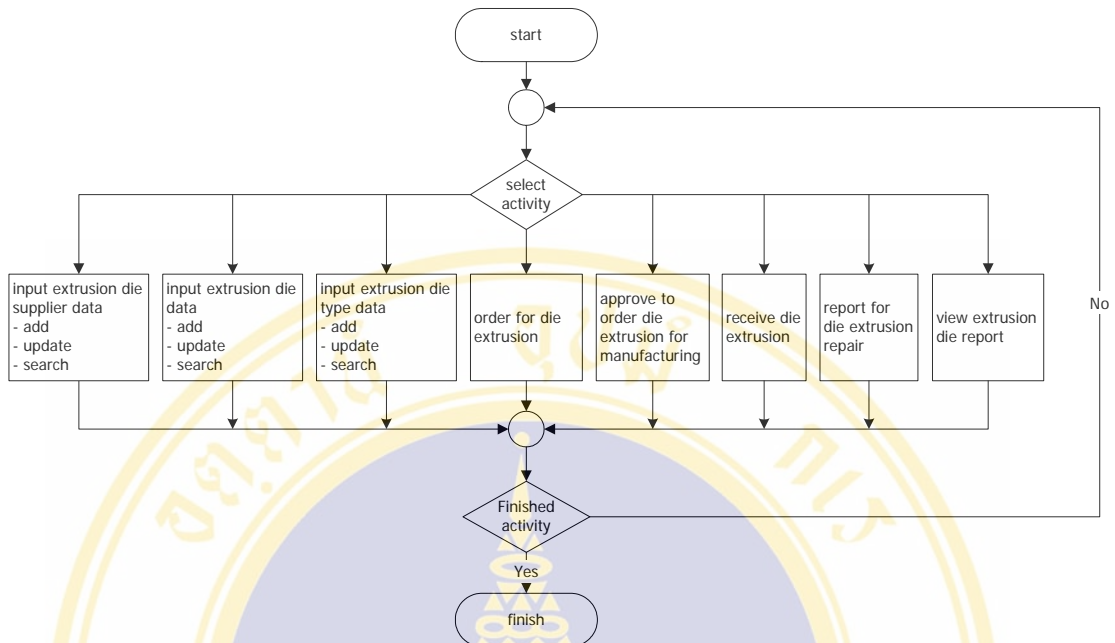


Figure 4.7 Flow Chart of Die Module

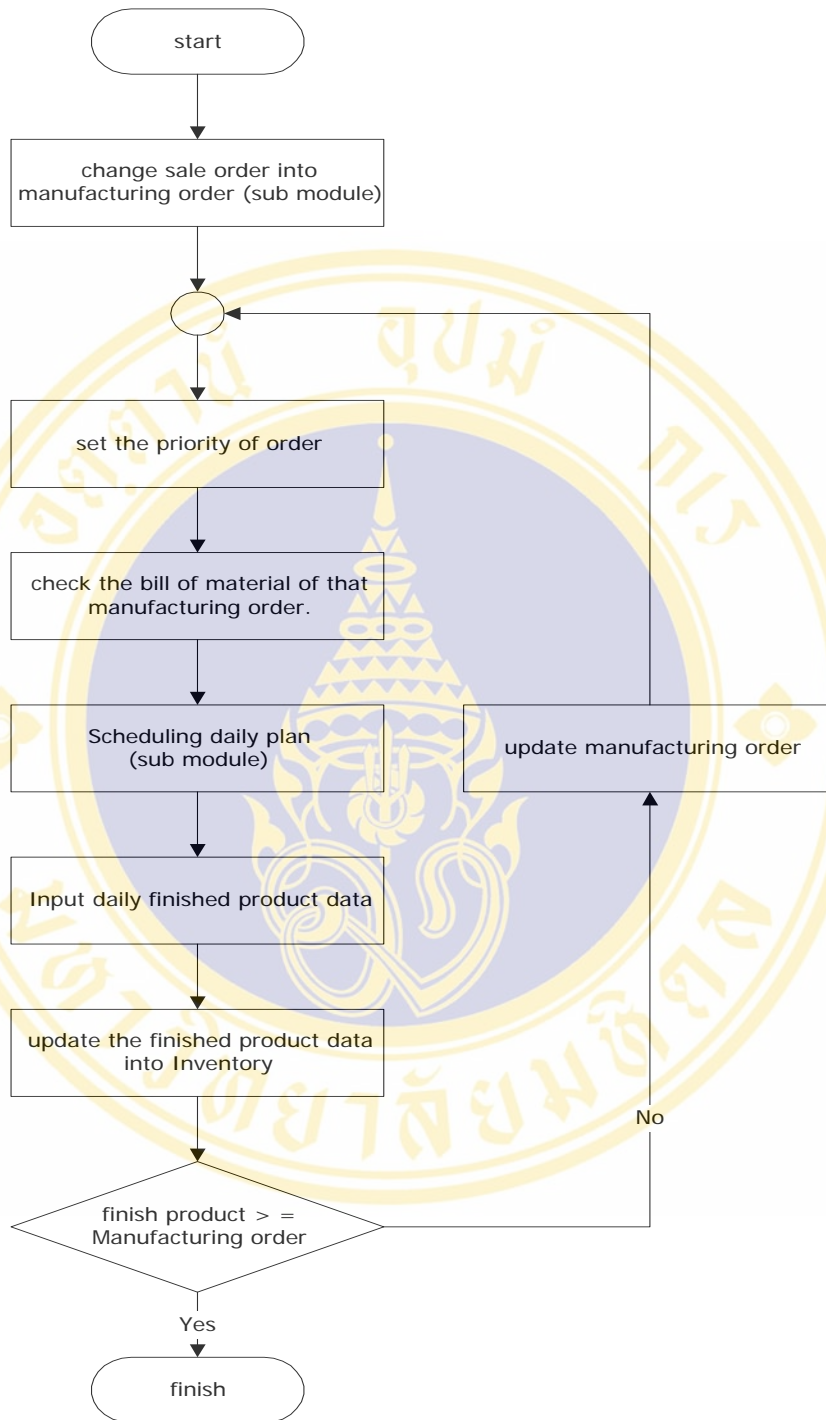


Figure 4.8 Flow Chart of the Manufacturing Module

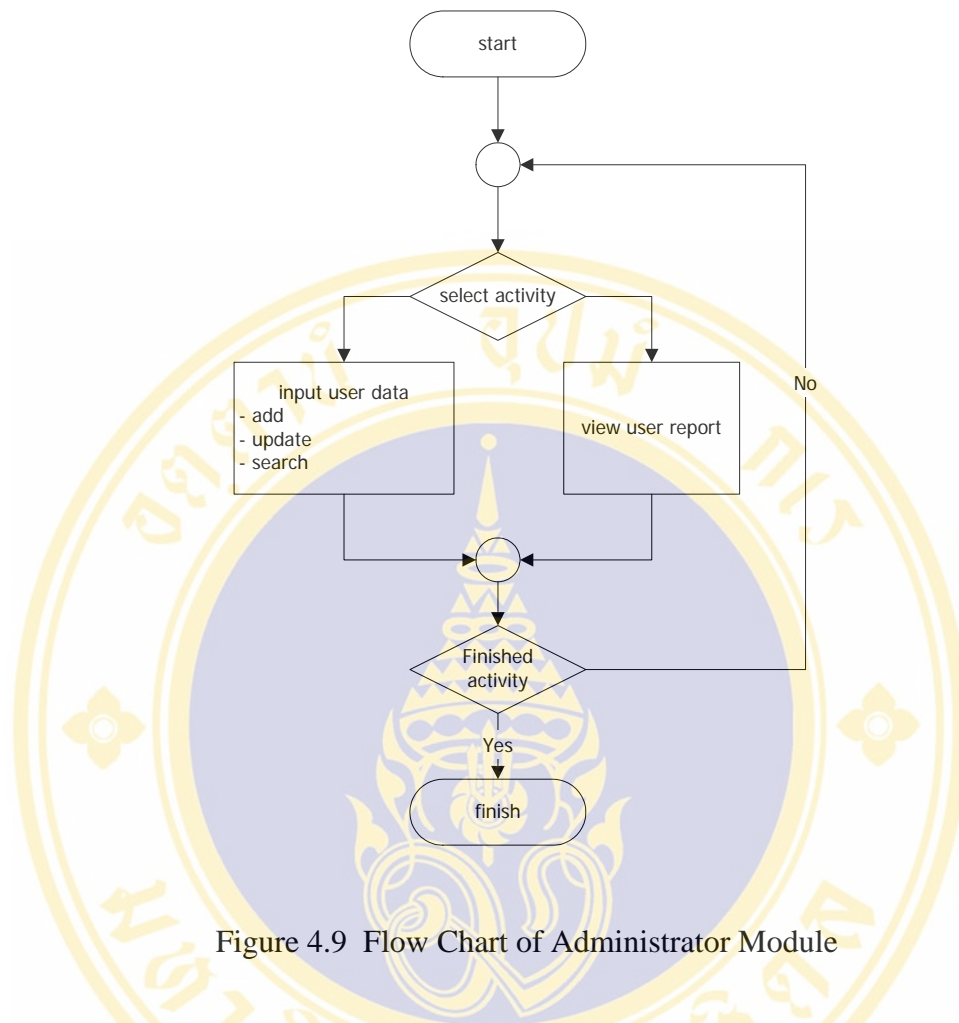


Figure 4.9 Flow Chart of Administrator Module

### 4.2.2 Interface Diagram of the system

The user interface diagrams of the developing system are illustrated in Figure 4.10-4.16 respectively.

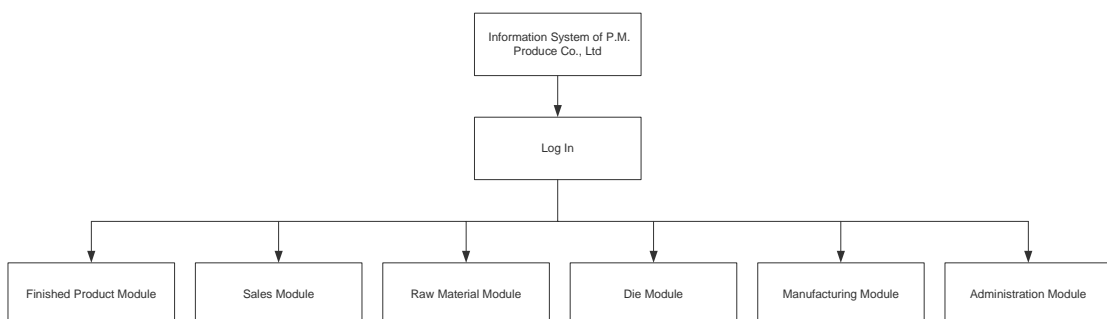


Figure 4.10 Interface Designing Diagrams of Developing Information System

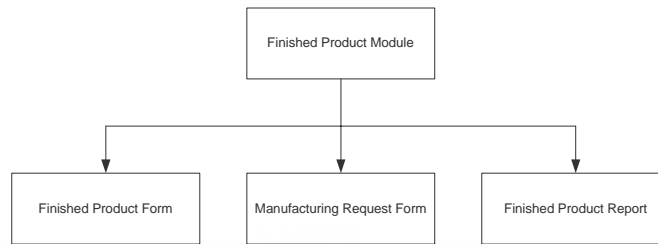


Figure 4.11 Interface Designing Diagrams of the Finished Product Module

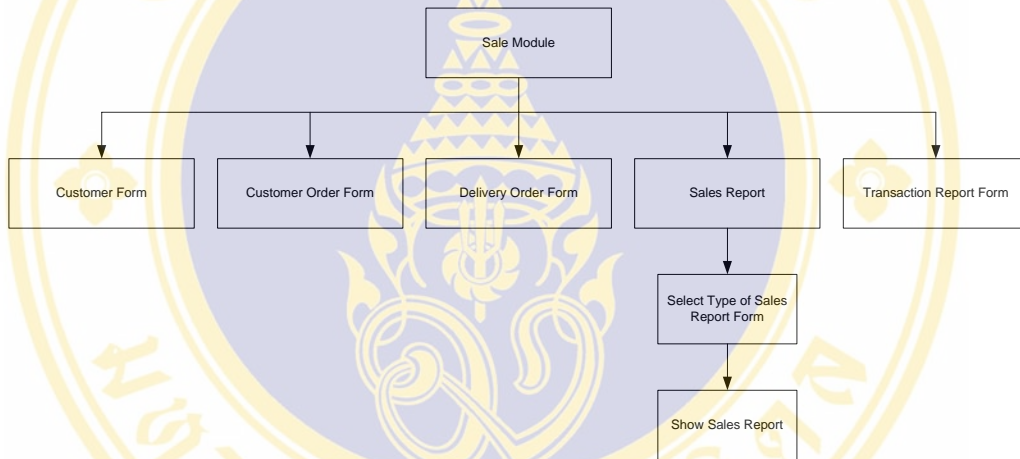


Figure 4.12 Interface Designing Diagrams of Sales Module

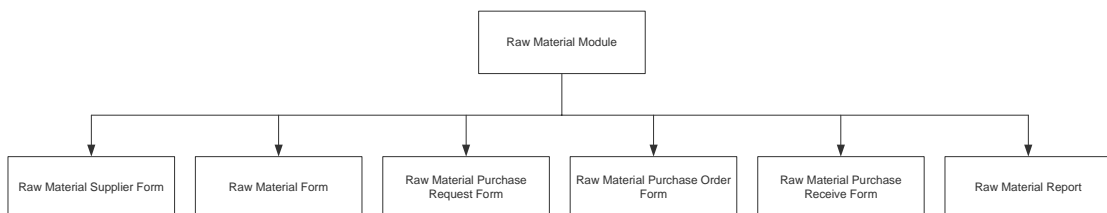


Figure 4.13 Interface Designing Diagrams of the Raw Material Module

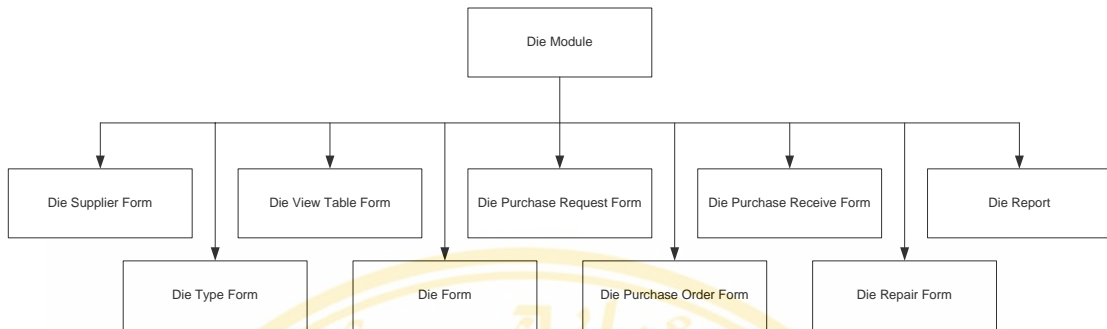


Figure 4.14 Interface Designing Diagrams of the Die Module

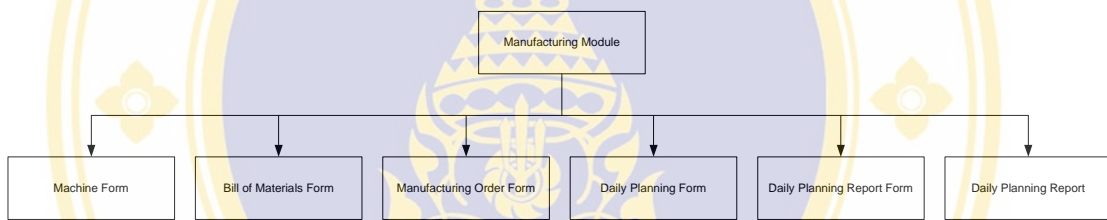


Figure 4.15 Interface Designing Diagrams of the Manufacturing Module

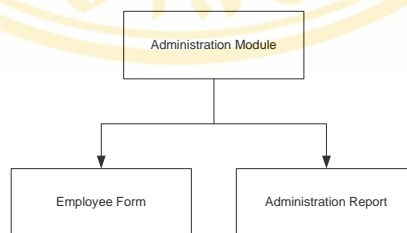


Figure 4.16 Interface Designing Diagrams of the Administration Module

### 4.2.3 User Interface of the application

The user of the client-server application must be logging into the program before the user can use the program. These process forms are illustrated in Figure 4.17 and 4.18. The application is divided into 6 modules by user access level.

- Finished Product Module
- Sales Module
- Raw Material Module
- Die Module
- Manufacturing Module
- Administration Module

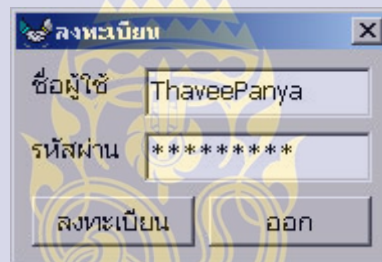


Figure 4.17 Login Form

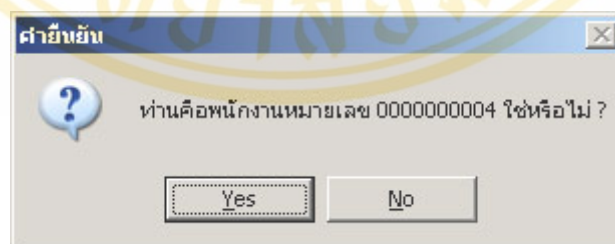


Figure 4.18 Login Confirmation Form

### - Finished Product Module

After the user logging into the program, if the user is a finished product department worker, the user has right to do with application of finished product department. There are finished product form, manufacturing request form and finished product report. These application forms are illustrated in Figure 4.19-4.22 respectively.

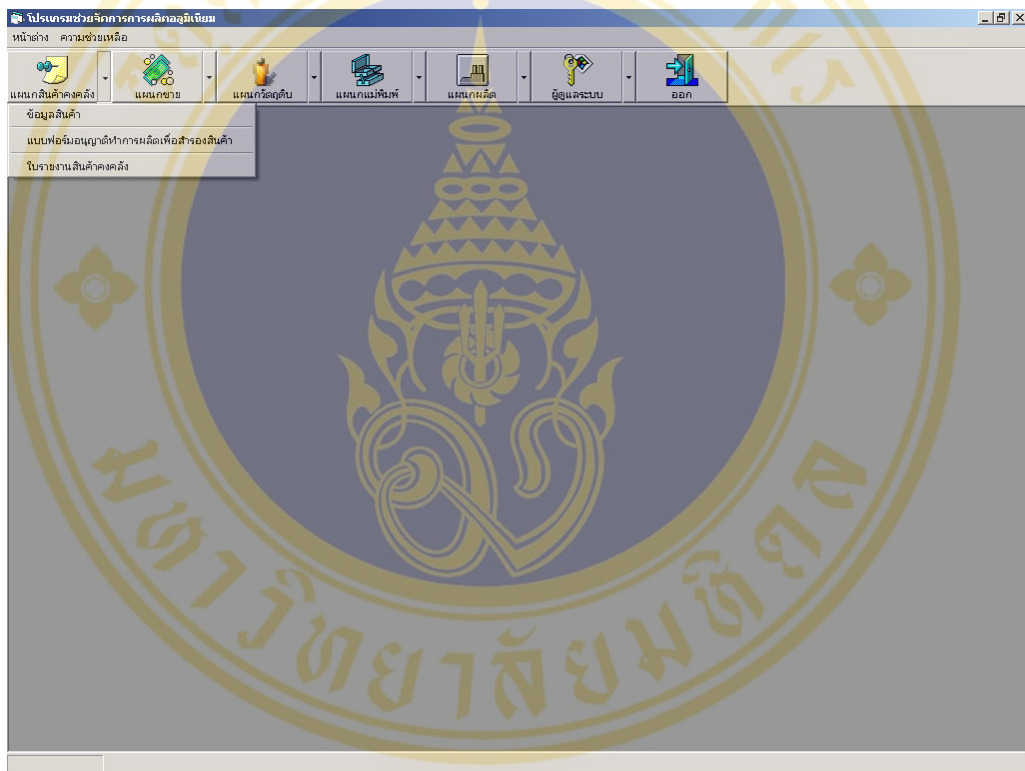
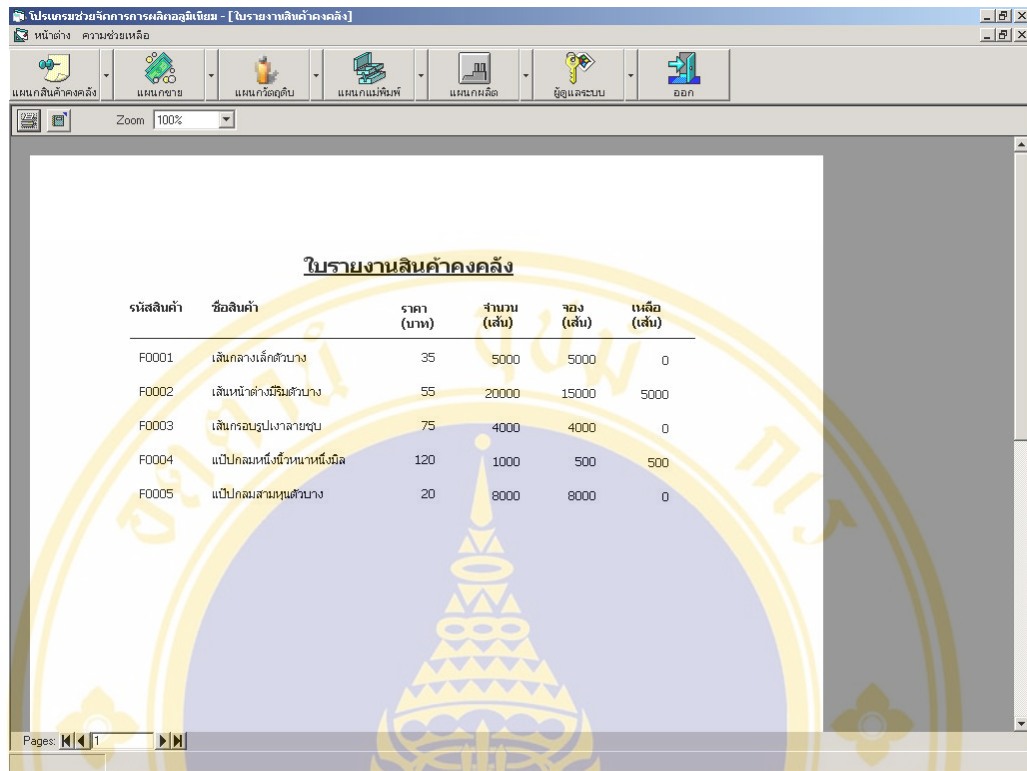


Figure 4.19 Menu of Finished Product Module

Figure 4.20 Finished Product Form

รหัสใบขออนุญาต	ชื่อสินค้า	จำนวน	
MR-000000001	เสืกกลางเล็ก	10000	
MR-000000002	กรอบรูป.งาสาม	20000	
MR-000000003	แป้นพิมพ์สามรุ่นบาง	20000	
MR-000000004	เสืกหน้าต่างวีริม	50000	

Figure 4.21 Manufacturing Request Form



รหัสสินค้า	ชื่อสินค้า	ราคา (บาท)	จำนวน (เส้น)	คง (เส้น)	หนังสือ (เส้น)
F0001	เส้นกลางเล็กตัวบาง	35	5000	5000	0
F0002	เส้นทำต่างพิมพ์ตัวบาง	55	20000	15000	5000
F0003	เส้นกรอบรูปเงาฉายชุด	75	4000	4000	0
F0004	แป็บกลสมหนึ่งนิ้วหน้าหนึ่งมิล	120	1000	500	500
F0005	แป็บกลสมสามหน้าตัวบาง	20	8000	8000	0

Figure 4.22 Finished Product Report

### - Sales Module

After the user logging into the program, if the user is a sales the user has right to do with application of sales department. There are customer form, customer order form, delivery order form sales report and transaction report. These application forms are illustrated in Figure 4.23-4.29 respectively.



Figure 4.23 Menu of Sales Module

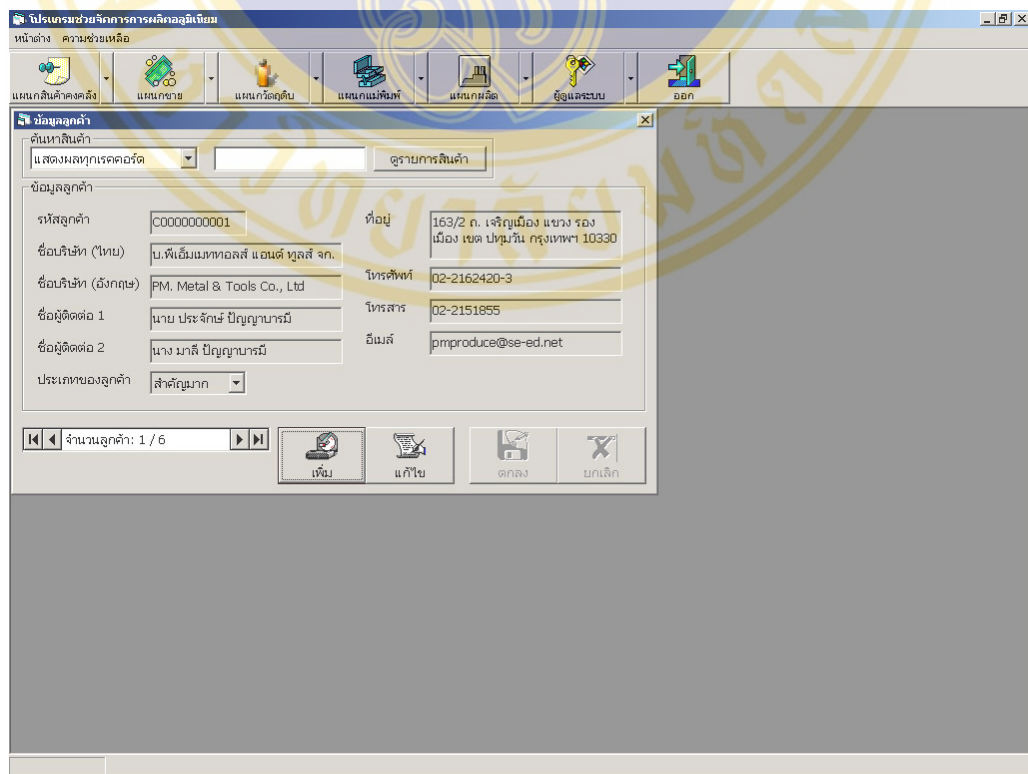


Figure 4.24 Customer Form

โปรแกรมช่วยจัดการการค้าปลีกอัตโนมัติ

หน้าต่าง ความช่วยเหลือ

หมายเลขรายการขาย : 0000000005 วันที่ : 22 พฤษภาคม 2547

ข้อมูลลูกค้า  
รหัสลูกค้า : C0000000001 บริษัท : บ.พีเอ็มเอทออลส์ แอนด์ ทูลส์ จก.  
ผู้ติดต่อ 1 : นาย ประจักษ์ ปัญญาบารมี ที่อยู่ : 163/2 ถ. เจริญเมือง แขวง รongเมือง เขต ปทุมวัน กรุงเทพฯ 10330  
ผู้ติดต่อ 2 : นาง มาลี ปัญญาบารมี

รายการสินค้า

รหัสสินค้า	ชื่อสินค้า	ราคา (บาท)	จำนวน (เส้น)	รวมเป็นเงิน (บาท)	เพิ่ม
F0004	แป้ปกกลมหนึ่งหน้าหนึ่งมิล	120	1	120	
F0001	เส้นกลางเล็กตัวบาง	35	1000	35000	
F0002	เส้นหน้าต่างมีริมตัวบาง	55	1000	55000	
F0003	เส้นกรอบรูปเงาหลายซุง	75	1000	75000	

รหัสพนักงานขาย : 0000000004 รวมทั้งสิ้น : 165,000.00

Figure 4.25 Customer Order Form

โปรแกรมช่วยจัดการการค้าปลีกอัตโนมัติ

หน้าต่าง ความช่วยเหลือ

จัดส่งสินค้า

หมายเลขใบสั่งซื้อ รหัสใบ CO : 0000000001

บริษัทตัวแทนจำหน่าย

ชื่อบริษัท : บ.พีเอ็มเอทออลส์ แอนด์ ทูลส์ จก. ผู้ติดต่อ 1 : นาย ประจักษ์ ปัญญาบารมี ข้อมูลใบสั่งซื้อ  
ที่อยู่ : 163/2 ถ. เจริญเมือง แขวง รongเมือง เขต ปทุมวัน กรุงเทพฯ 10330 ผู้ติดต่อ 2 : นาง มาลี ปัญญาบารมี วันที่รับสินค้า : 11/03/2546  
เบอร์โทรศัพท์ : 02-2162420-3 นาง มาลี ปัญญาบารมี วันที่รับสินค้า : 22/05/2547  
รวม : 875,000.00 บาท

รุ่น	ชื่อสินค้า	จำนวน	ราคารวม
F0001	เส้นกลางเล็กตัวบาง	5000	175000
F0002	เส้นหน้าต่างมีริมตัวบาง	10000	550000
F0003	เส้นกรอบรูปเงาหลายซุง	2000	150000

บันทึกส่งฐานข้อมูล

Figure 4.26 Delivery Order Form



Figure 4.27 Sales Report Select Form

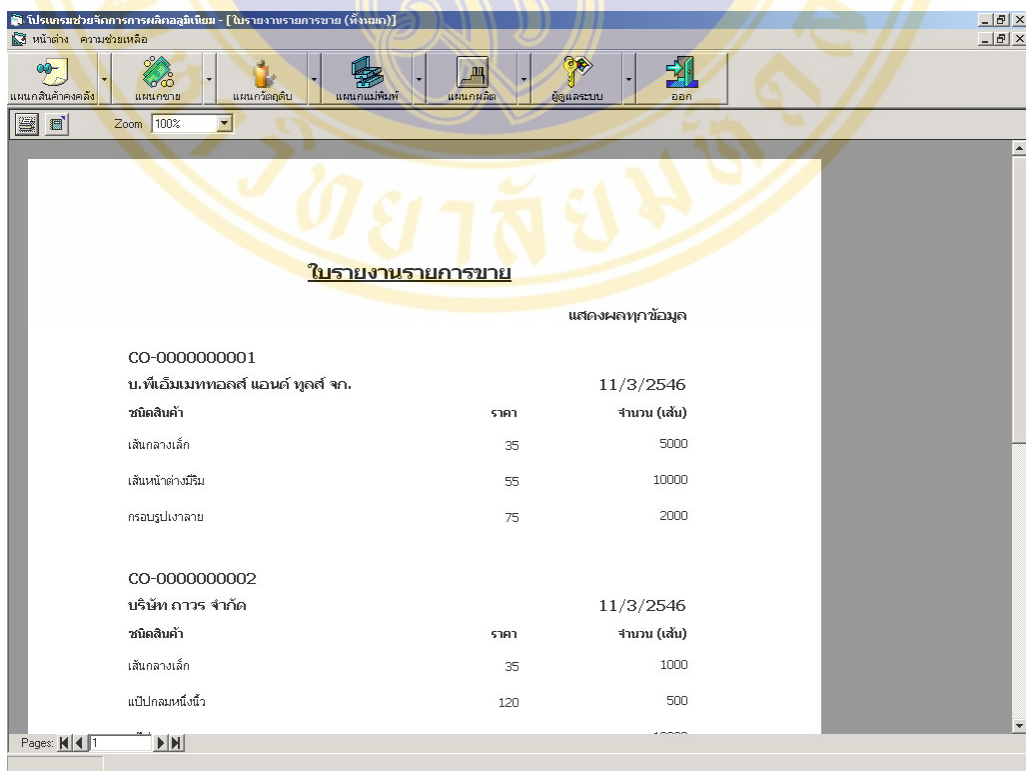


Figure 4.28 Sales Report

วันที่	เอกสารอ้างอิง	ชื่อสินค้า	ปริมาณ (เส้น)
22/5/2004	CO-000000001	เส้นกลางเล็กสีน้ำตาล	5000
22/5/2004	CO-000000001	เส้นหน้าต่างมีริมสีน้ำตาล	10000
22/5/2004	CO-000000001	เส้นกรอบโป่งลายขุ่น	2000

Figure 4.29 Transaction Report

### - Raw Material Module

After the user logging into the program, if the user is a raw material department worker the user has right to do with application of raw material department. There are raw material supplier form, raw material form, raw material purchase request form, raw material purchase order form, raw material purchase receive form and raw material report. These application forms are illustrated in Figure 4.30-4.36 respectively.

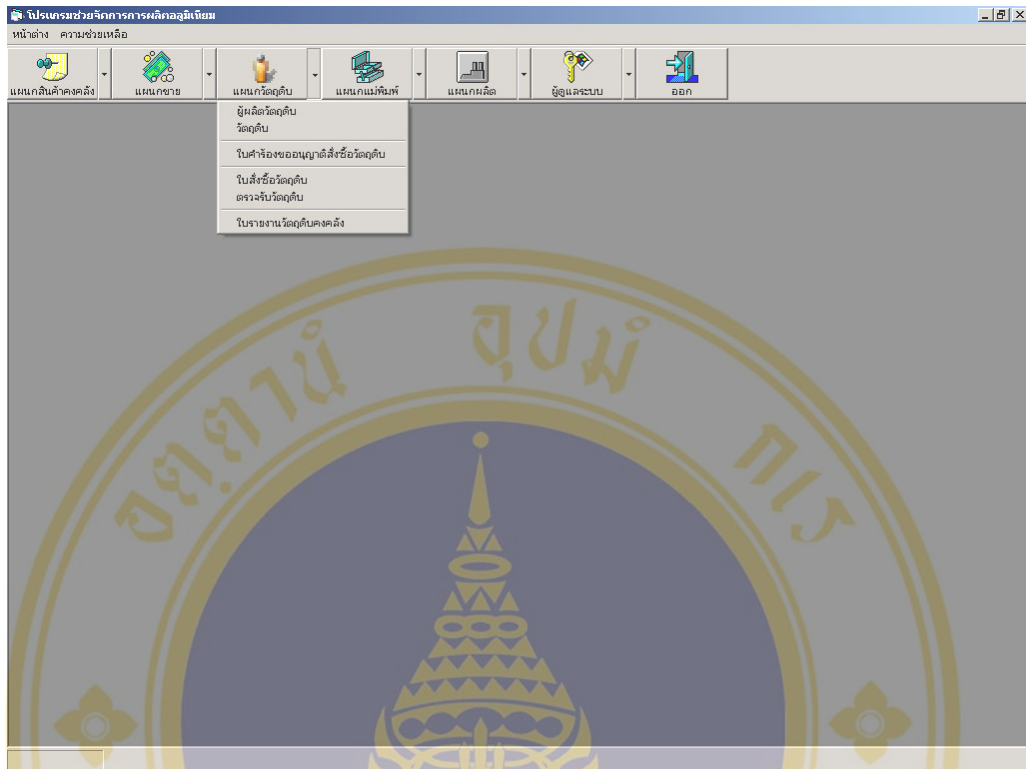


Figure 4.30 Menu of Raw Material Module

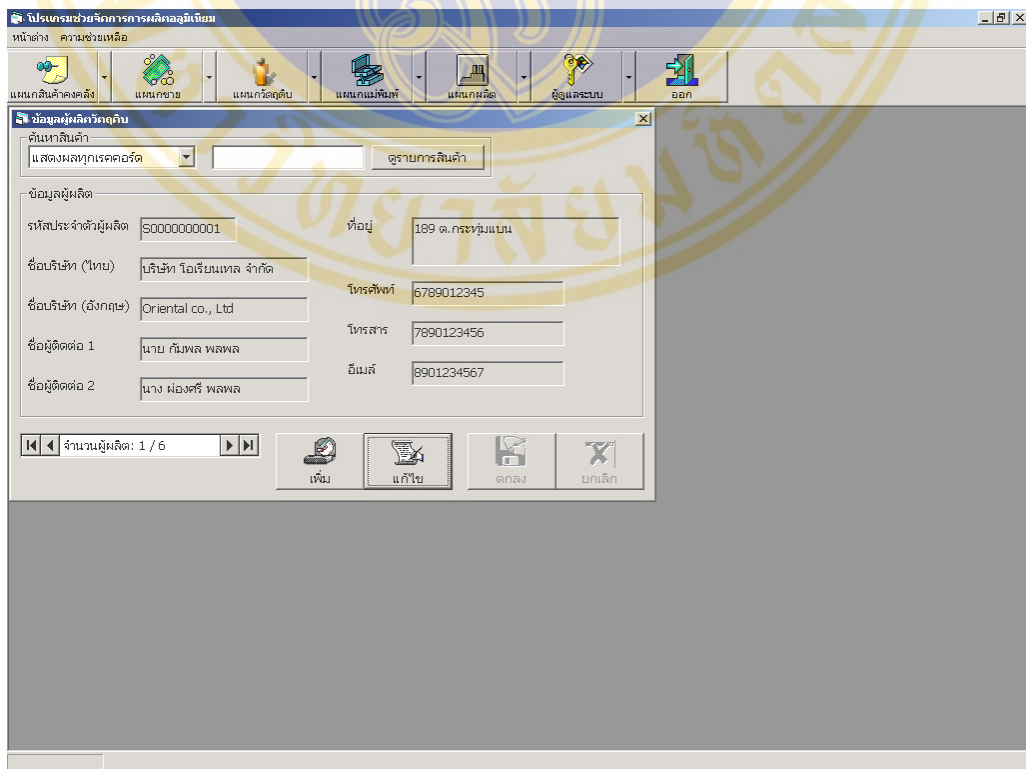


Figure 4.31 Raw Material Supplier Form

โปรแกรมช่วยจัดการการผลิตภูมิปัญญา  
หน้าต่าง ความช่วยเหลือ

ข้อมูลวัตถุดิบ

ค้นหาสินค้า  
แสดงผลทุกเรคคอร์ด

ดูรายการสินค้า

ข้อมูลทั่วไป

รุ่นสินค้า: R0000000001

น้ำหนักแห้ง: 14

ตัวแทนจำหน่าย: บริษัท โอเรียนแทล จำกัด

ชื่อแบบสั้น: บิลเลขมาตรฐานสินค้า

ชื่อแบบยาว: บิลเลขมาตรฐานสินค้าขยวลิปสินธุ์

ปริมาณสินค้า

ราคาขาย ณ ปัจจุบัน :	750	ปริมาณรวมทั้งหมด :	10104
ปริมาณที่สั่งซื้อ :	1000	ปริมาณจอง :	34
จำนวนสินค้าที่น้อยที่สุด :	1000	ปริมาณคงเหลือ :	10070

อยู่ระหว่างการสั่งซื้อเพื่อสำรองสินค้า

จำนวนรายการวัตถุดิบ: 1 / 4

Figure 4.32 Raw Material Form

โปรแกรมช่วยจัดการการผลิตภูมิปัญญา  
หน้าต่าง ความช่วยเหลือ

ใบคำร้องเพื่อสั่งซื้อวัตถุดิบ

รหัสใบขออนุญาต	ชื่อสินค้า	จำนวน
RMPR-0000000001	บิลเลขมาตรฐานสินค้า	1000

อนุญาต

ออก

Figure 4.33 Raw Material Purchase Request Form

โปรแกรมช่วยจัดการการผลิตภูมิเขียม

หน้าต่าง ความช่วยเหลือ

แผนกสินค้าคงคลัง แผนกขาย แผนกวัสดุ แผนกแม่พิมพ์ แผนกผลิต ชั่งและระบบ ออก

ในสิ่งซื้อวัตถุดิบ

หมายเลขใบสั่งซื้อวัตถุดิบ : 000000007 วันที่ : 22 พฤษภาคม 2547

ข้อมูลผู้ขาย  
รหัสผู้ขาย : S000000001 บริษัท : บริษัท โอเรียนเทิล จำกัด  
ผู้ติดต่อ 1 : นาย กัมพล พลพล ที่อยู่ : 189 ต.กระทุ่มแบน  
ผู้ติดต่อ 2 : นาง มิ่งศรี พลพล

รายการวัตถุดิบ

รหัสวัตถุดิบ	ชื่อวัตถุดิบ	ราคา (บาท)	จำนวน (หน่วย)	รวมเป็นเงิน (บาท)	เพิ่ม
R000000004	บิลเลตขนาดสี่นิ้วยาวสิบเอ็ดนิ้ว	660	100	66000	
R000000001	บิลเลตขนาดสี่นิ้วยาวสิบห้านิ้ว	750	100	75000	
R000000002	บิลเลตขนาดสี่นิ้วยาวสิบห้านิ้ว	760	100	76000	

รหัสพนักงานขาย : 000000004 รวมทั้งสิ้น : 151,000.00

บันทึกการกรอกข้อมูล  
พิมพ์ใบสั่งซื้อ  
คำนวณค่าสินค้า  
ลบรายการสั่งซื้อ  
ออก

Figure 4.34 Raw Material Purchase Order Form

โปรแกรมช่วยจัดการการผลิตภูมิเขียม

หน้าต่าง ความช่วยเหลือ

แผนกสินค้าคงคลัง แผนกขาย แผนกวัสดุ แผนกแม่พิมพ์ แผนกผลิต ชั่งและระบบ ออก

แบบฟอร์มตรวจรับวัตถุดิบตามใบสั่งซื้อ

หมายเลขใบสั่งซื้อ รหัสใบสั่งซื้อ : RMPO-000000005

บริษัทตัวแทนจำหน่าย  
ชื่อบริษัท : บริษัท โอเรียนเทิล จำกัด ผู้ติดต่อ 1 : นาย กัมพล พลพล  
ที่อยู่ : 189 ต.กระทุ่มแบน ผู้ติดต่อ 2 : นาง มิ่งศรี พลพล  
เบอร์โทรศัพท์ : 6789012345

ข้อมูลใบสั่งซื้อ  
วันสั่งซื้อ : 10/03/2546  
วันรับสินค้า : 22/05/2547  
รวม : 750.00 บาท

รุ่น	ชื่อสินค้า	จำนวน	ราคารวม
R000000001	บิลเลตยาวสิบห้านิ้ว	1	750

บันทึกหลักฐานข้อมูล  
ออก

Figure 4.35 Raw Material Purchase Receive Form

**ใบรายงานวัตถุดิบคงคลัง**

รหัสวัตถุดิบ	ชื่อวัตถุดิบ	น้ำหนัก (กก.)	จำนวน (แท่ง)	คง (แท่ง)	เหลือ (แท่ง)
R0000000001	บัลลูนขนาดสี่นิ้วยาวสิบสี่นิ้ว	14	10104	368	9736
R0000000002	บัลลูนขนาดสี่นิ้วยาวสิบห้านิ้ว	15	10611	2779	7832
R0000000003	บัลลูนขนาดสี่นิ้วยาวสิบนิ้ว	10	1500	1438	62
R0000000004	บัลลูนขนาดสี่นิ้วยาวสิบเอ็ดนิ้ว	11	1200	502	698

Figure 4.36 Raw Material Report

### - Die Module

After the user logging into the program if the user is a die department worker the user has right to do with application of die department. There are die supplier form, die type form, die form, die purchase request form, die purchase order form, die purchase receive form, die repair form and die report. These application forms are illustrated in Figure 4.37-4.46 respectively.

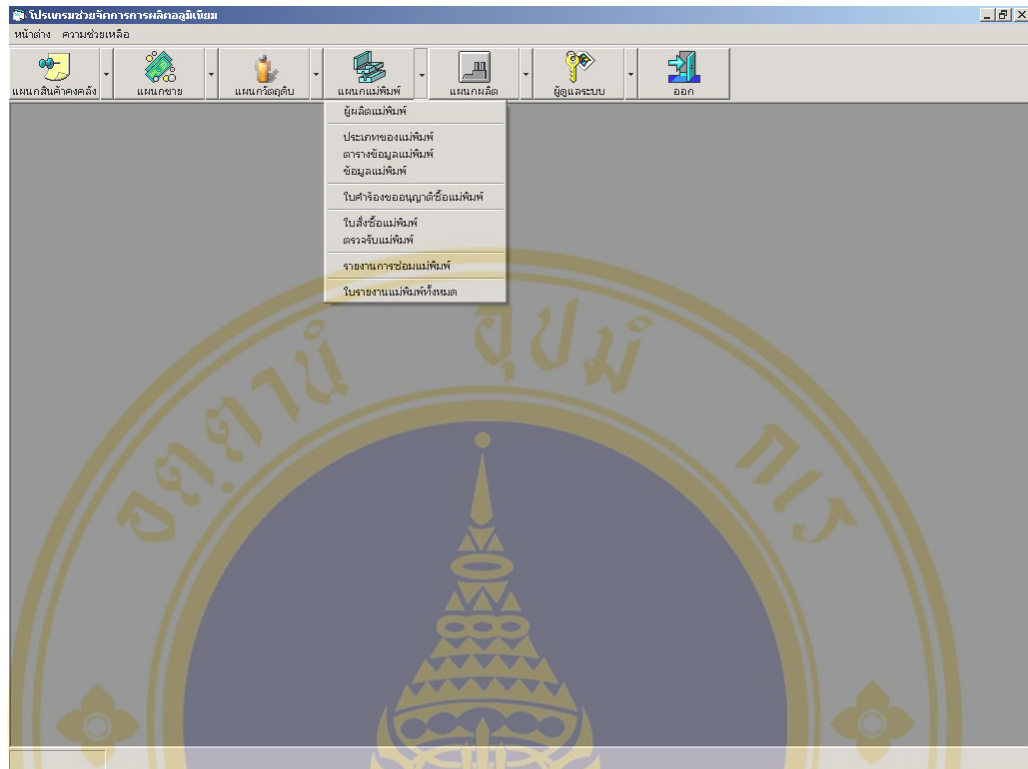


Figure 4.37 Menu of Die Module

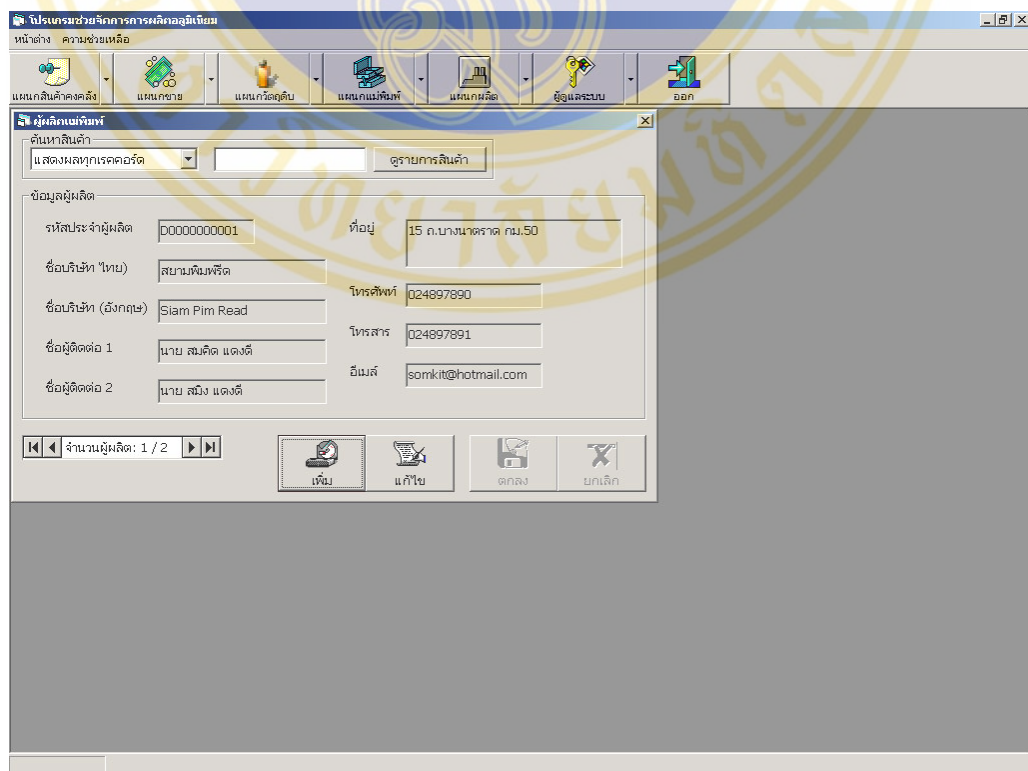


Figure 4.38 Die Supplier Form

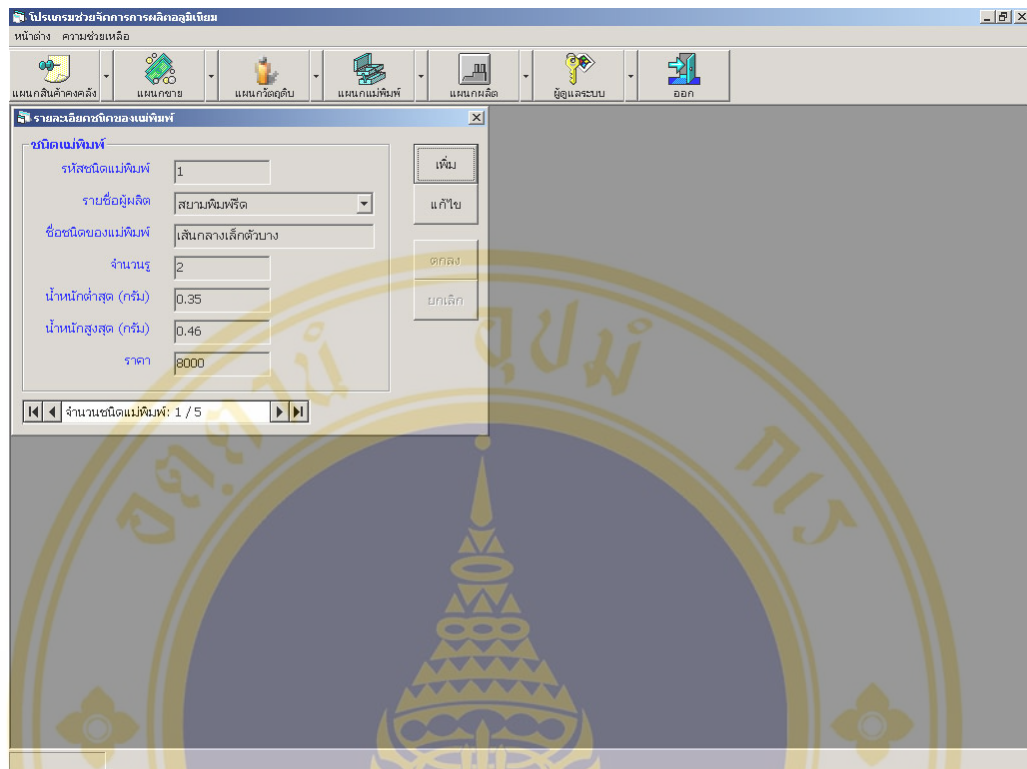


Figure 4.39 Die Type Form

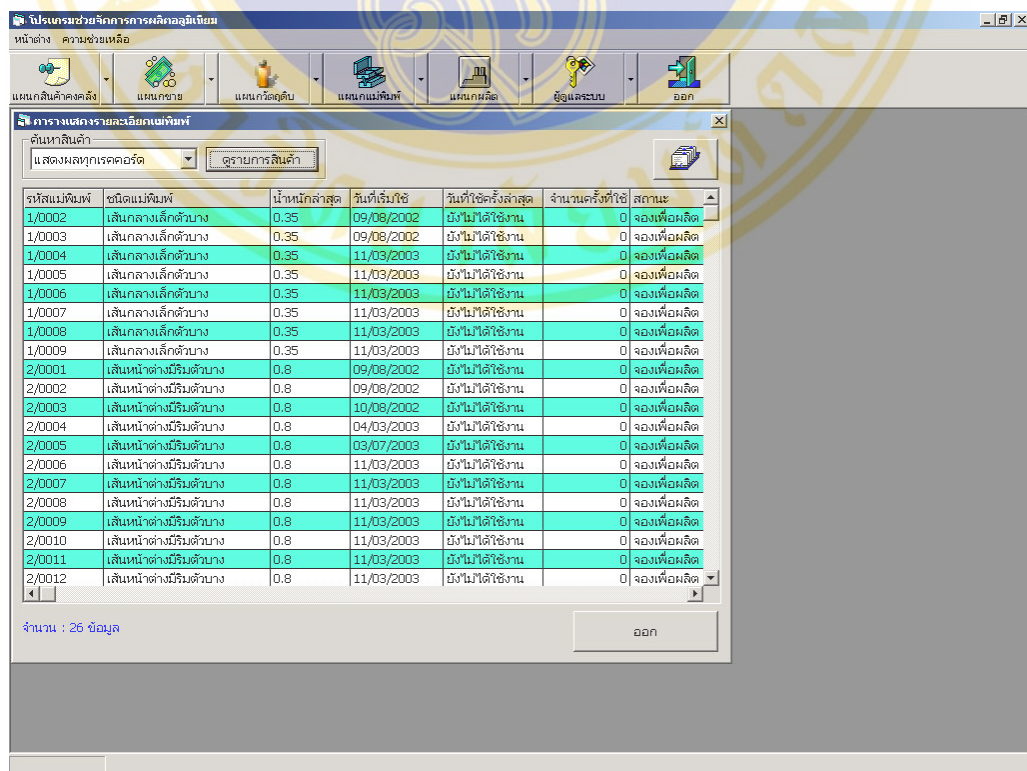


Figure 4.40 Die Table Form

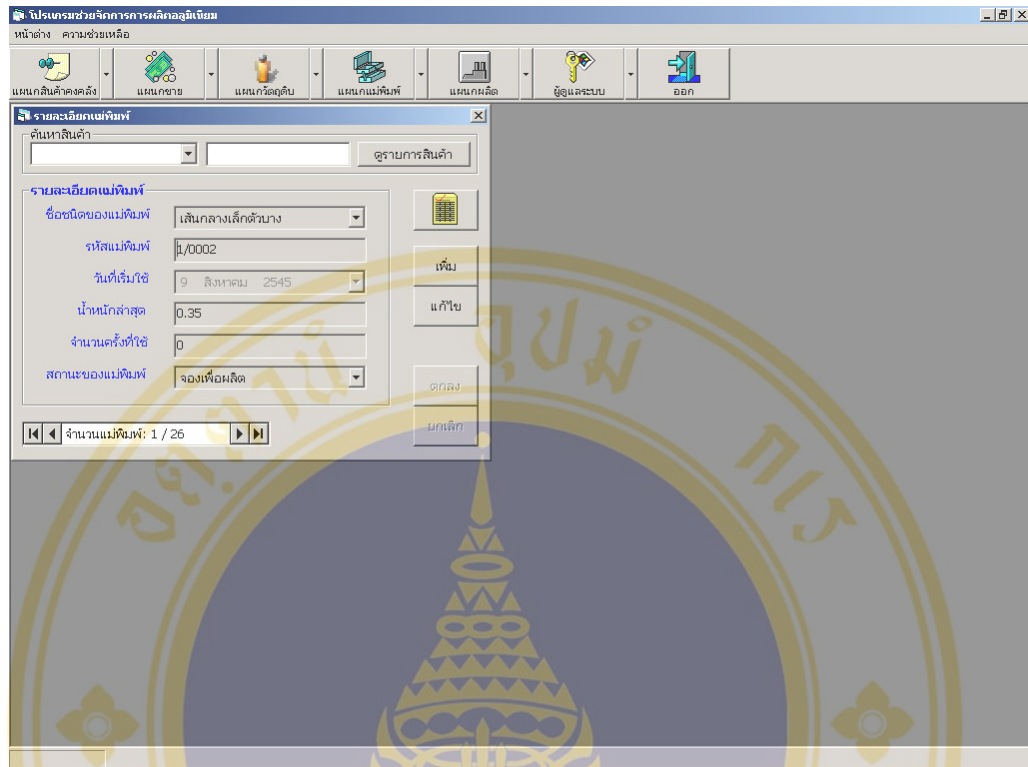


Figure 4.41 Die Form

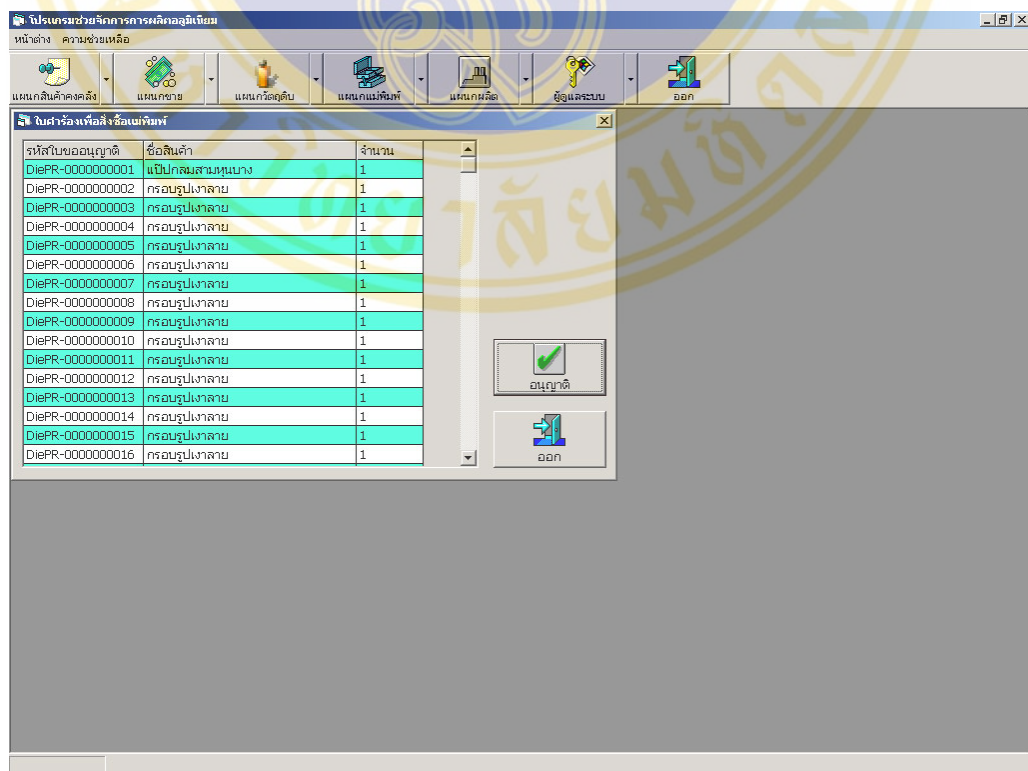


Figure 4.42 Die Purchase Request Form

โปรแกรมช่วยจัดการการผลิตของดีเยี่ยม  
หน้าต่าง ความช่วยเหลือ

หมายเลขใบสั่งซื้อแม่พิมพ์ : 0000000003 วันที่ : 22 พฤษภาคม 2547

ข้อมูลผู้ขาย  
รหัสผู้ขาย : 00000000001 บริษัท : สยามพิมพ์ขีด  
ผู้ติดต่อ 1 : นาย สมคิด แดงดี ที่อยู่ : 15 ถ.บางนาตราด กม.50  
ผู้ติดต่อ 2 : นาย สมิง แดงดี

รายการแม่พิมพ์  
รหัสชนิดแม่พิมพ์ : 5 ชื่อชนิดแม่พิมพ์ : แป้นพิมพ์สามเหลี่ยม ราคา : 7500 จำนวน : 10 รวมเป็นเงิน : 75000

รหัสชนิดแม่พิมพ์	ชื่อชนิดแม่พิมพ์	ราคา	จำนวน	รวม
1	เส้นกลางเล็กตัวบาง	8000	10	80000
2	เส้นหน้าต่างมีริมตัวบาง	8500	10	85000

รหัสพนักงานขาย : 0000000004 รวมทั้งสิ้น : 165,000.00

Figure 4.43 Die Purchase Order Form

โปรแกรมช่วยจัดการการผลิตของดีเยี่ยม  
หน้าต่าง ความช่วยเหลือ

แบบฟอร์มตรวจรับแม่พิมพ์จากใบสั่งซื้อแม่พิมพ์

หมายเลขใบสั่งซื้อ รหัสใบสั่งซื้อ : DiePO-0000000002

บริษัทตัวแทนจำหน่าย  
ชื่อบริษัท : สยามพิมพ์ขีด ผู้ติดต่อ 1 : นาย สมคิด แดงดี  
ที่อยู่ : 15 ถ.บางนาตราด กม.50 ผู้ติดต่อ 2 : นาย สมิง แดงดี  
เบอร์โทรศัพท์ : 024897890

ข้อมูลใบสั่งซื้อ  
วันสั่งซื้อ : 10/03/2546  
วันรับสินค้า : 22/05/2547  
รวม : 20,000.00 บาท

รหัสใบ DiePO	รุ่น	ชื่อสินค้า	จำนวน	ราคารวม
DiePO-0000000002	1	เส้นกลางเล็กตัวบาง	2	20000

Figure 4.44 Die Purchase Receive Form

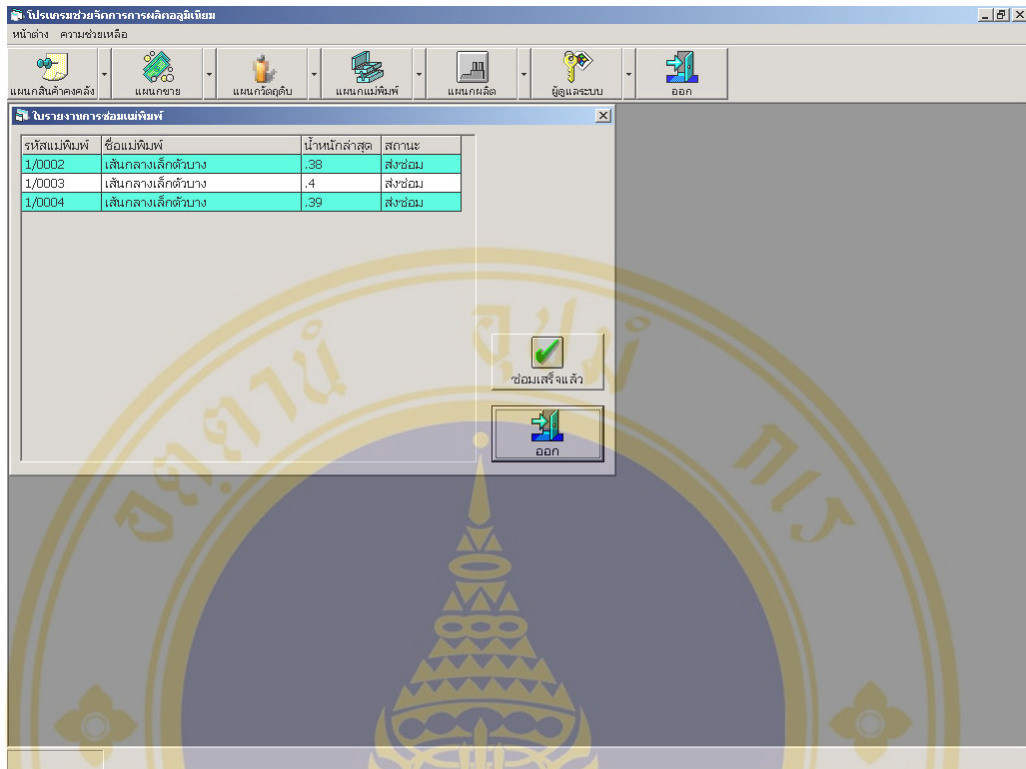


Figure 4.45 Die Repair Form

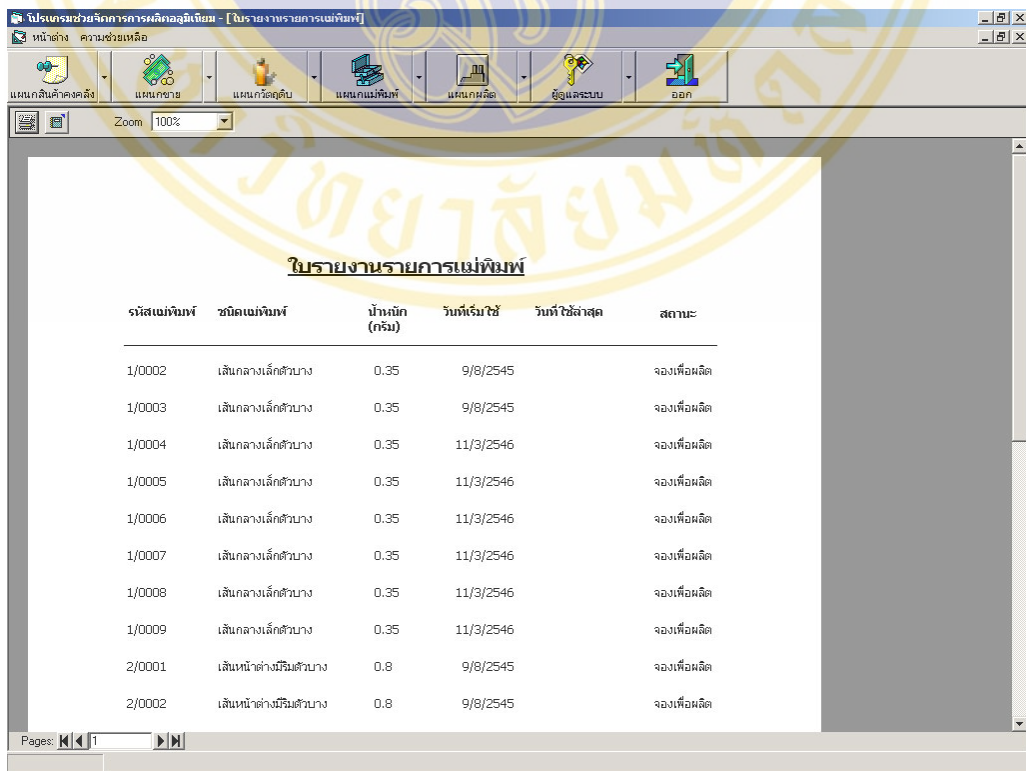


Figure 4.46 Die Report

### - Manufacturing Module

After the user logging into the program, if the user is a manufacturing department worker the user has right to do with application of manufacturing department. There are machine form, bill of materials form, manufacturing order form, daily plan manufacturing form, daily plan manufacturing feedback form and daily manufacturing report. These application forms are illustrated in Figure 4.47-4.53 respectively.

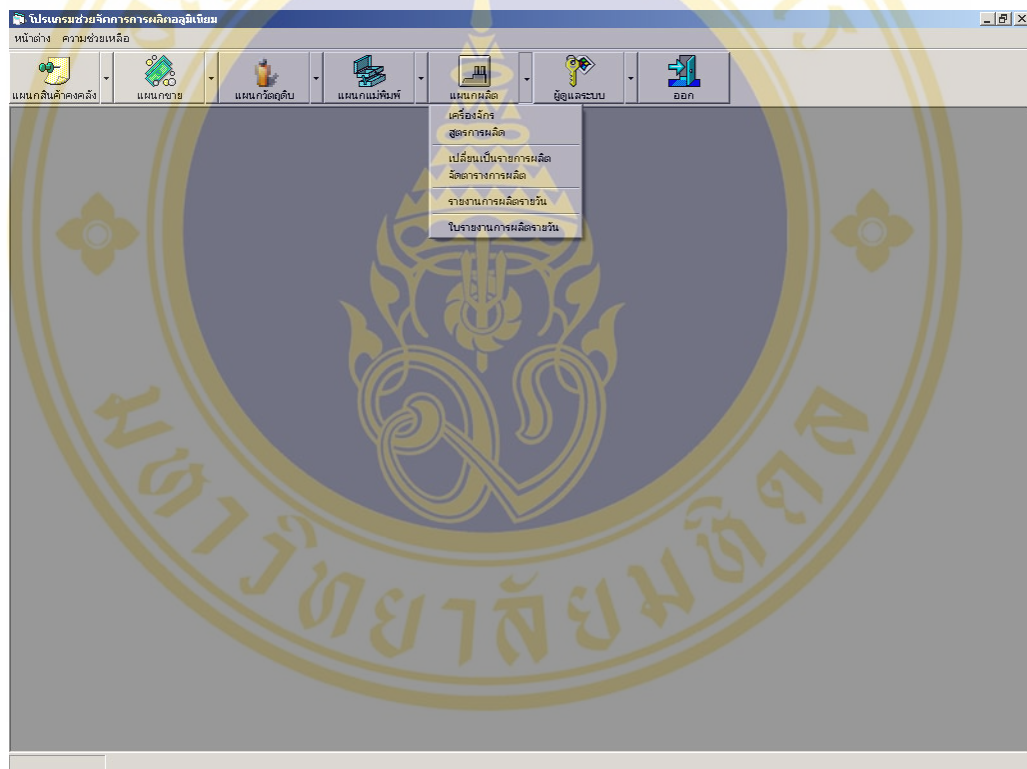


Figure 4.47 Menu of Manufacturing Module

โปรแกรมช่วยจัดการการผลิตคอมพิวเตอร์

หน้าต่าง ความช่วยเหลือ

รายละเอียดเครื่องคอมพิวเตอร์ใหม่

รหัสเครื่องจักร : MC-000000001

ชื่อเครื่อง : เครื่องชุด 660 ดีเบอ์หนึ่ง

จังหวัด 1 : ปทุมธานี

จังหวัด 2 : ปทุมธานี

กำลังการผลิตต่อวัน : 3000

จำนวนเครื่องจักร: 1 / 2

Figure 4.48 Machine Form

โปรแกรมช่วยจัดการการผลิตคอมพิวเตอร์

หน้าต่าง ความช่วยเหลือ

รายละเอียดสูตรการผลิต

สูตรการผลิตที่ : BOM-000000001

ชื่อสินค้า : เส้นกลางเล็กตัวบาง

วันที่เริ่มใช้ : 8 สิงหาคม 2545

ประเภทแม่พิมพ์ที่ใช้ : เส้นกลางเล็กตัวบาง

ขนาด Billet ที่ใช้ : ปิลเลตขนาดสี่เหลี่ยมยาวสิบนิ้ว

จำนวนสินค้าที่จะได้ (เส้น) : 30

จำนวนสูตรการผลิต: 1 / 5

คำนวณเส้นลวดที่จะได้

Figure 4.49 Bill of Materials Form

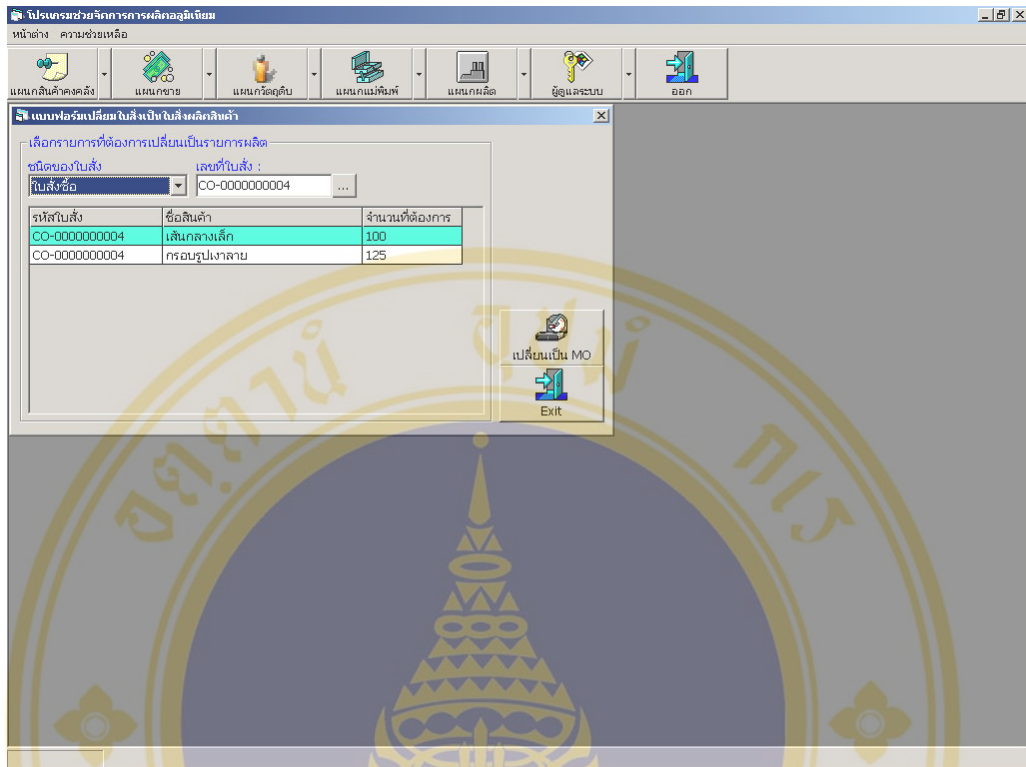


Figure 4.50 Manufacturing Order Form

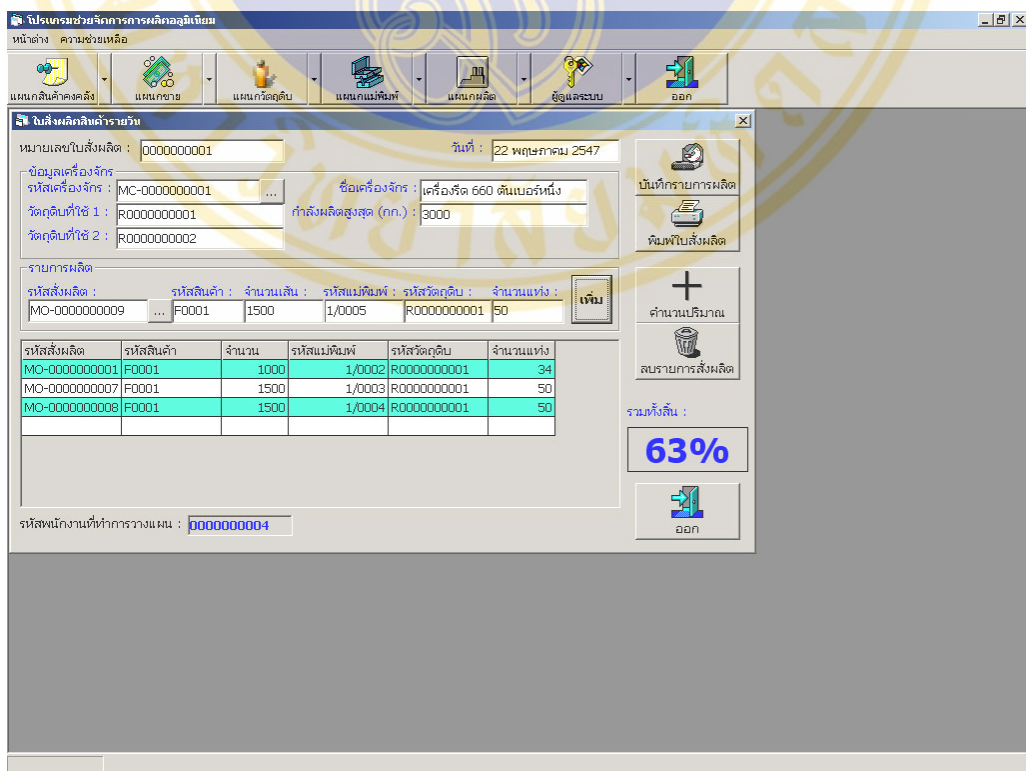


Figure 4.51 Daily Manufacturing Plan Form

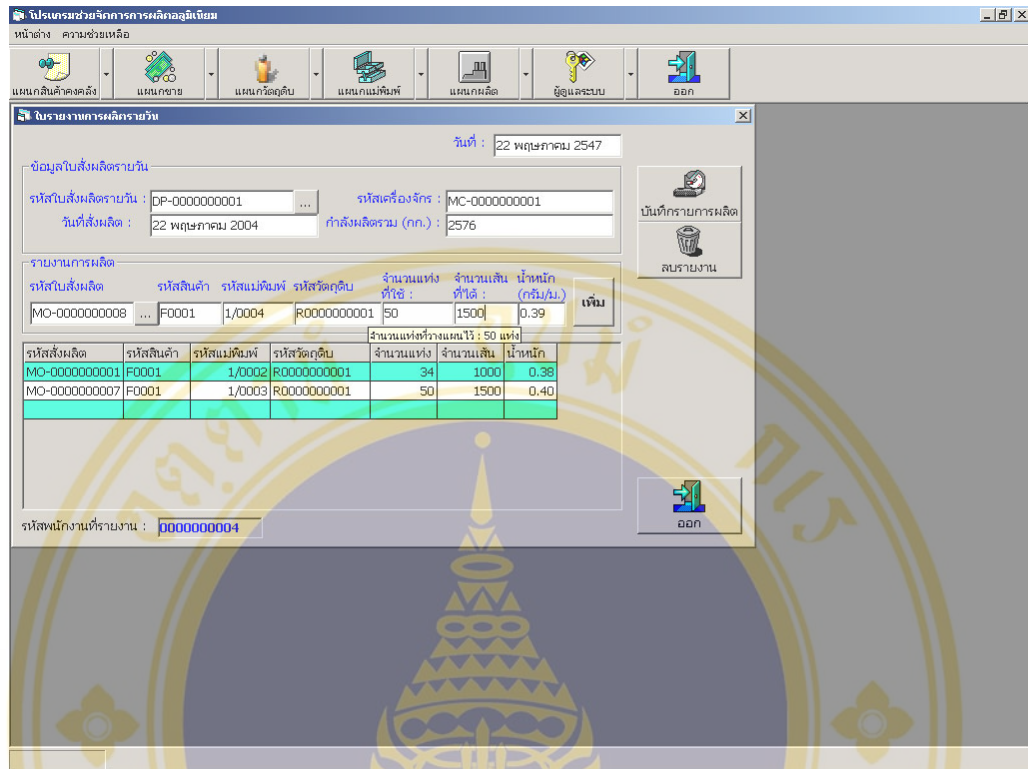


Figure 4.52 Daily Manufacturing Plan Feedback Form

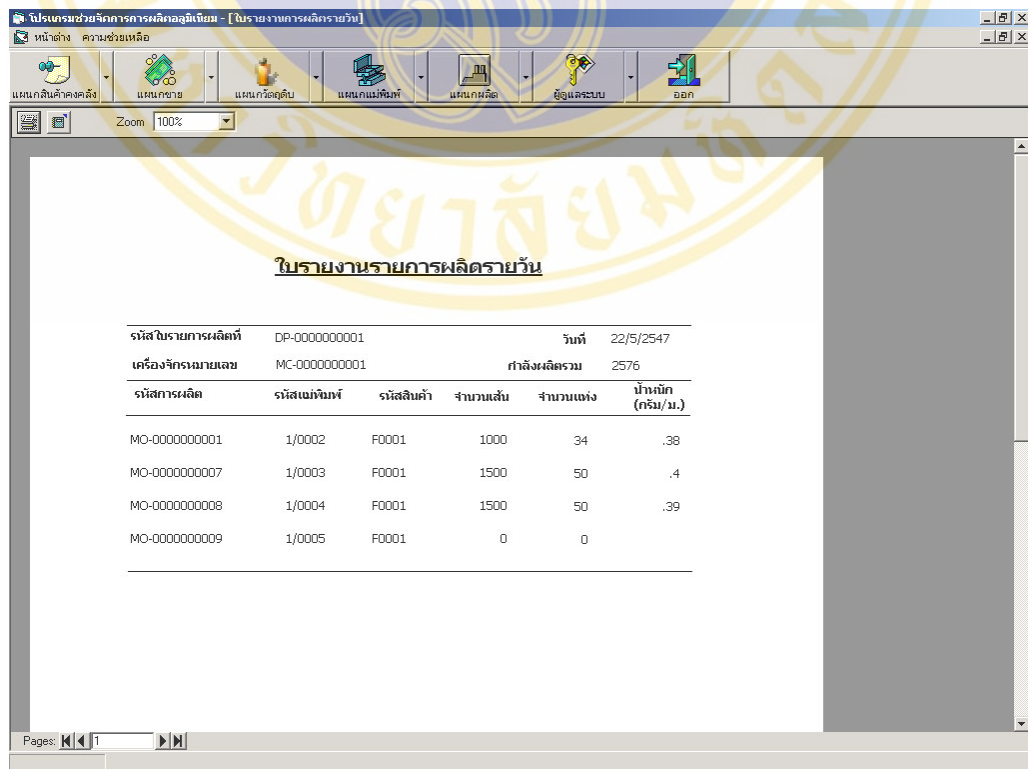


Figure 4.53 Daily Manufacturing Report

### - Administration Module

After the user logging into the program, if the user is a administrator the user has right to do with application of administration department. There are administration form and administration report. These application forms are illustrated in Figure 4.54-4.57 respectively.

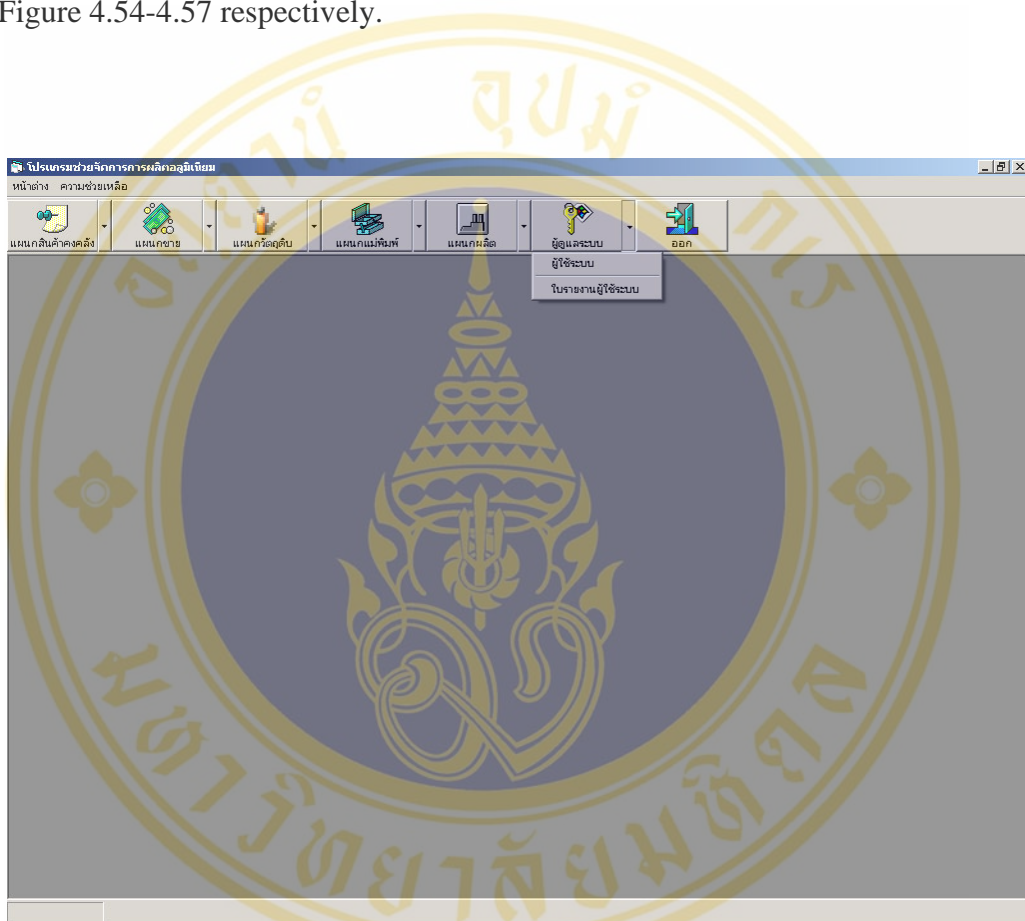


Figure 4.54 Menu of Administration Module

Figure 4.55 Administration Form

Figure 4.56 Administration Form

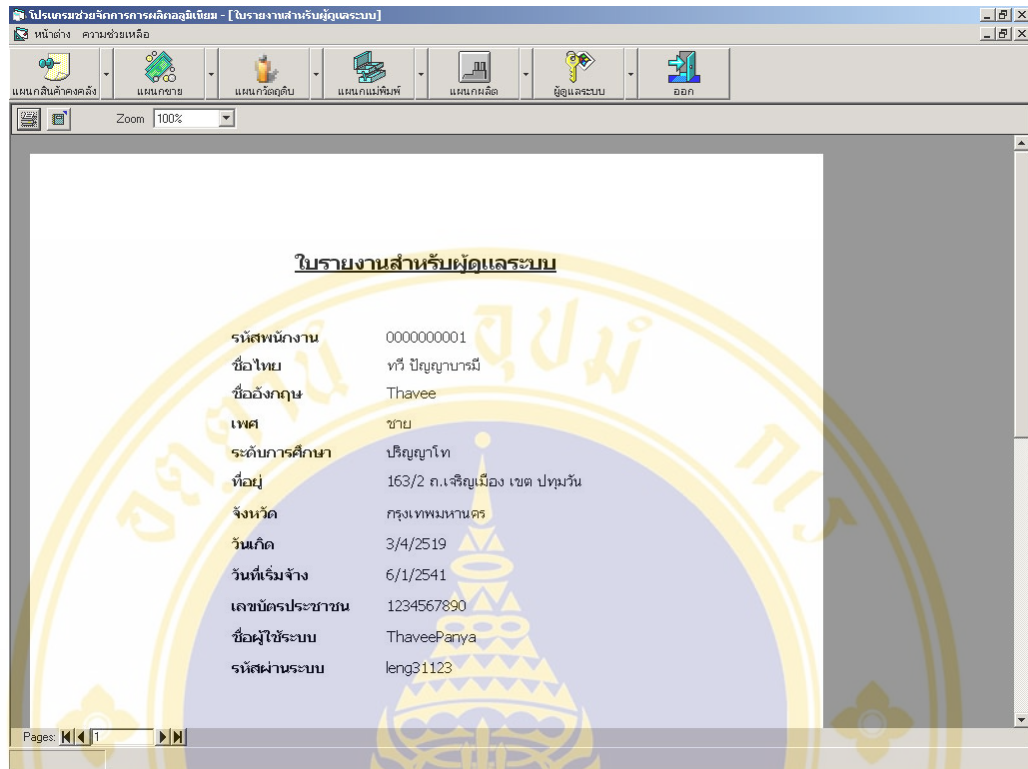


Figure 4.57 Administration Report

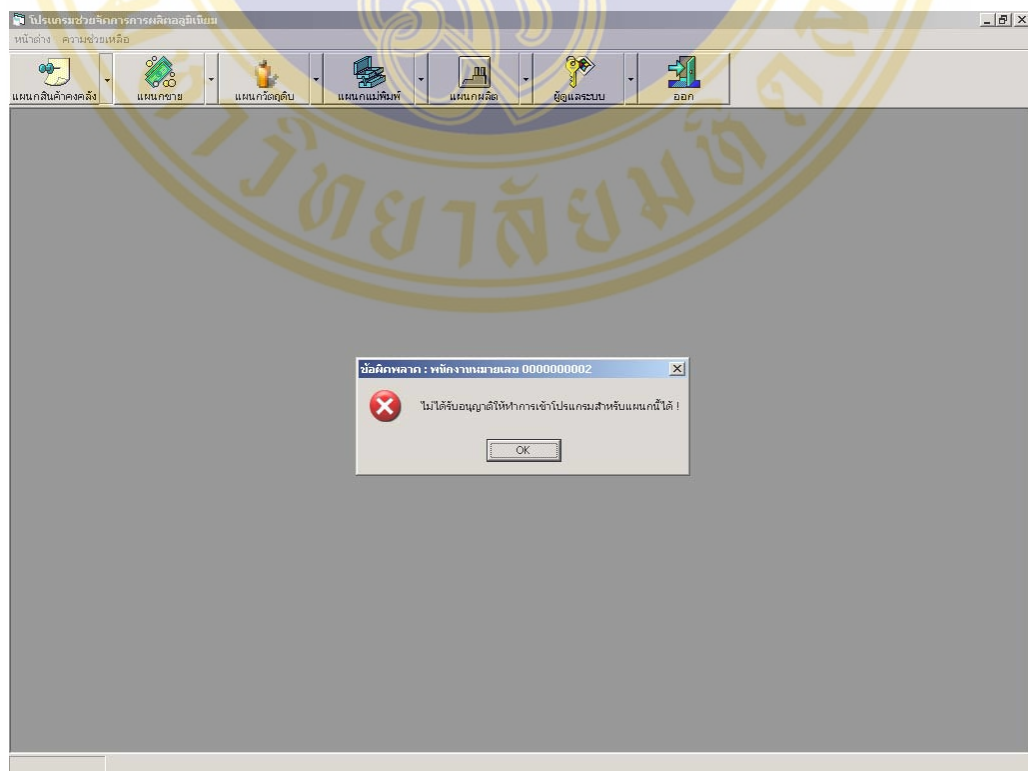


Figure 4.58 Message Box Indicate the Error

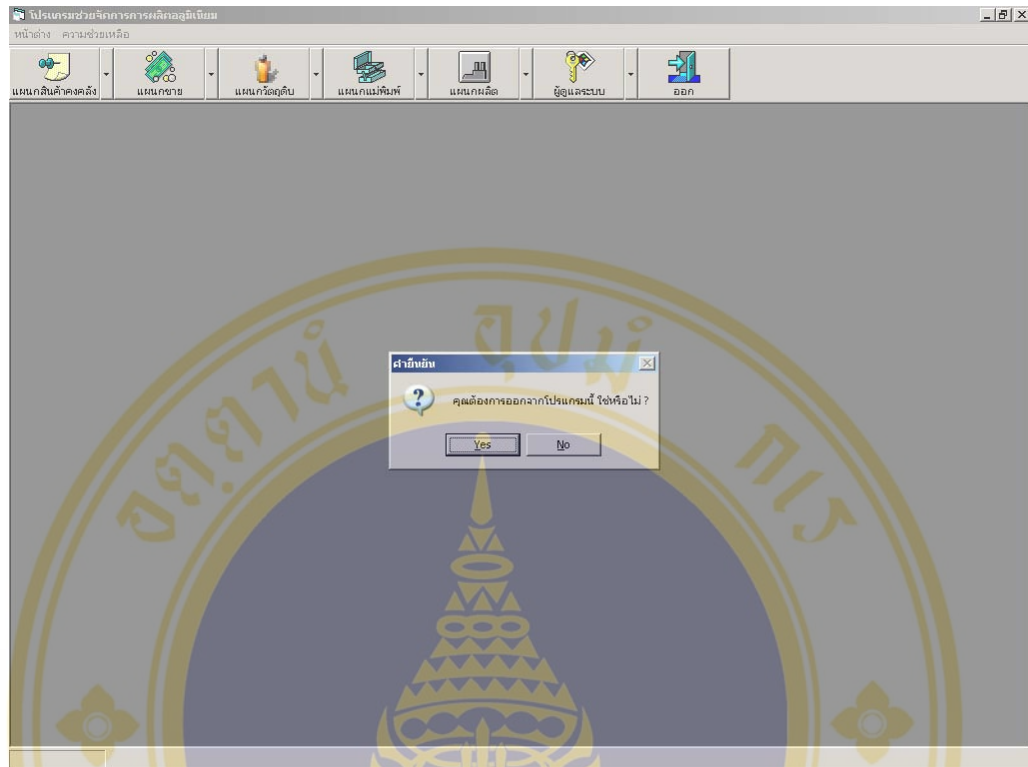


Figure 4.59 Log Out Confirmation

For security reasons, some users are not allowed to access every module in the system. If users try to access those unauthorized modules, the message box shown in Figure 4.58 will be displayed. Log out confirmation message will be displayed as shown in Figure 4.59, if users want to quit the program.

## Implementation & Testing

### 4.3 System Testing

System testing is an important part of the Software Development Life Cycle. It makes sure that all components are working according to user and developer specifications/requirements. System testing actually consists of two major parts: integration testing and acceptance testing, which will be explained as follows:

### **4.3.1 Integration Testing**

Integration testing checks the “workability” of the overall system. The test plan is reviewed by the user (general user, administrator) and developer. The testing plan includes the following steps:

Performance testing: the performance issues associated with transaction processing, to test speed of execution, which includes sequential access of sequential and random files to testing the response times.

Storage Testing: tests the ability of the system data storage

User Testing: tests how well the system can detect human errors. If invalid data is keyed, the program will return error message asking the user to reenter the previous data element. Before a program is executed, a confirmation will be displayed on screen.

### **4.3.2 Acceptance Testing**

Acceptance testing is reviewed by the users (general user, administrator), to check, how well the system satisfies user information needs, and collect user recommendation about the system. (The test plan and developer.) The components of the new system acceptance test are: accuracy, adequacy, speed of execution, reliability, user Interface, completeness of main features, completeness of auxiliary features, maintainability, security and error handling.

## CHAPTER 5

### DISCUSSION

The System was developed to support the operation and production scheduling of the P.M. Produce Co., Ltd. The developing system focuses on supporting the company's production scheduling and the require information. Thus, it may not provide a complete solution to the other division. The incomplete solution can also be explained by some technological and development limitations. However, while designing and implementing the information system, future system expansion (e.g. additional functions) was taken into consideration. Therefore, the developing system will be able to reach the needs of users at any given time by integrating modules to the applications. The system consists of two main components: (1) the database server and (2) the client prototype application.

In this section we will discuss the different aspects of these two main components. Security issues will also be discussed.

#### 5.1 Database

1. In terms of database connectivity, the system uses the ADO (ActiveX Data Object) technology functions to process the data.

2. The current database system used is MS SQL Server 2000. This particular characteristic will benefit the business operations by allowing the system to upgrade its database when needed.

3. The database of developing system therefore stores and reports information on production scheduling and all related data. Thus, this database contains complete and up-to-date information of all department of the company.

4. These following information are systematically stored in the database, finished product, customer, customer order, raw material, raw material purchase order, die, die type, die purchase order, bill of material (BOM) and daily plan.

## 5.2 Application

1. The system is consists of six modules. Each module is treated individually by a worker of that department.

2. The aspect of the prototype application can also be observed in the development of the application. The system uses client-server technology to provide solutions to P.M. Produce Co., Ltd. This technology is easy to develop, and programs can be run on the computer with Windows platform.

3. The application is implemented on Windows platform which is very user friendly. Moreover with the aid of network connection, users can access to the client program anywhere. Users do not necessarily have to only work on the terminals where this application is installed.

4. The client application program is written using a programming language called Visual basic 6. This application can be run on Windows platform, process the input, and sends information back to store into the database server. Such methods minimize the workload of the server by using the client terminal to validate and calculate the user data before sending it to the server.

5. The client application program is very helpful for each department to manage its information. For example customer information, purchasing request, customer order, raw material purchase order and die purchase order can be managed by this program. More over all data stored in a centralized database can be utilized for production planning in aluminium manufacturing process.

6. The new prototype system and application have much better performance than the previous manual version. It effectively manage multiple and complicated tasks. The human errors are dramatically minimized.

## 5.3 Security

In designing the system, a decentralized use of the system has been taken into consideration by using client-server technology and a proper database connection. However, by using client-server application, security becomes an important issue. Only the verified user can access the system. The system will check for the password before authorize the user to use the application. If an incorrect

password is applied more than three times the system will be terminate that user. The level of access to the database is controlled by the administrator.



## CHAPTER 6

### CONCLUSION AND RECOMMENDATION

#### 6.1 Conclusion

Though the company's data has always been more than abundant the problems faced was the unavailability of the information. Each department has data related to its operations, but to gather information for a particular activity takes time and the management is often presented with inaccurate, outdated or incomplete data.

P.M. Produce CO., LTD's information system was designed and developed to solve the information storage within the company, as well as creating a database used for production schedule. Four main advantages resulted from the implementation of the system are listed as follow.

1. It is a database for worker from the business system to store information under the same standard. In the past, the problem was the diverse method of storing information and the missing of information and sometimes confusing storage locations. By standardizing and localizing the pertinent data, the system also minimizes the workload of the staff by reducing or redundant work process.

2. Gathering required information for a production planning involving several people from different department in a timely manner used to be a challenge. If the person in charge of that information happens to be absent, no one would be able to retrieve the information since the data source would be unknown to other workers. Thus, storing such standardized data in a local database can help the user search for relevant and accurate information efficiently.

3. Furthermore, having a complete source of information available can help generate better reports to the management. The reports would be more accurate. This system will allow the management to gather enough relevant or general information for production scheduling.

4. In addition, the new system will help decrease the turn-around time in production scheduling. The system will be frequently updated and all changes being retrievable, generating complete and up-to-date information.

The information system, once in plane, will be able to facilitate the workflow of the P.M. Produce CO., LTD. The system is able to share information, standardize data format and generate well organized report. There are also other benefits from the systems architecture: easy to understand and customize. The developed system answers to the current needs of the users.

## 6.2 Recommendation

The new system was developed to fulfill the immediate need for a central database and a solution for the production schedule. At this point, the staff at the company is responsible for managing the information in the system. In order to reach the highest efficiency of the system, some practical trainings are required for all workers.

Also, as mentioned earlier, this information system has a high level of flexibility due to its architecture (i.e. based on client-server). Such system can be expendable to fulfill the needs of users from a different point of view or for other purposes. (e.g. define a new function to support the sales, etc.) . The gathered information may be helpful in other related fields.

In addition this system could be the beginning of a new information system. Having a holistic view of the business activities, production scheduling may be planned with completed and up-to-date information to make decisions.

The new prototype information system provides a solution to the company's information sharing and production scheduling problems. However, its limit has not been reached yet. Thus, further development of the system could bring more benefits to the organization.

The prototype information system could be more efficient, if a function to manage the inventory of finished product, raw material and die are added into the system. Users will be able to locate where these items are stored in the factory.

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11. Mani Jeramy. *Collection and Analysis of Shop Floor Data Using a Spreadsheet*, BPICS Control Journal, June/July, pp27-28, 1995



Table 1 Table Structure of CustomerOrder

Table name: CustomerOrder							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	COID	Customer Order Identifier	Character	X(12)	-	Unique	Primary Key
2.	CID	Customer Identifier	Character	X(12)	-	-	-
3.	EID	Employee Identifier	Character	X(12)	-	-	-
4.	OrderDate	Order Date	Date	99-99-9999	-	-	-

Table 2 Table Structure of CustomerOrderDetail

Table name: CustomerOrderDetail							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	COID	Customer Order Identifier	Character	X(12)	-	-	Primary Key
2.	FPID	Finish Product Identifier	Character	X(12)	-	-	Primary Key
3.	Quantity	Quantity of Finish Product Order	Character	X(10)	-	-	-
4.	Price	Price Of Finish Product	Character	X(10)	-	-	-

Table 3 Table Structure of Customer

Table name: Customer							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	CID	Customer Identifier	Character	X(12)	-	Unique	Primary Key
2.	NameInThai	Customer Name In Thai	Character	X(50)	-	-	-

Table 3 Table Structure of Customer (Continued)

Table name: Customer							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
3.	NameInEng	Customer Name In English	Character	X(50)	-	-	-
4.	Address	Address	Character	X(50)	-	-	-
5.	Telephone	Telephone	Character	X(10)	-	-	-
6.	ContactName1	Contact Name1	Character	X(25)	-	-	-
7.	ContactName2	Contact Name2	Character	X(25)	-	-	-
8.	Type	Customer Type	Integer	-	-	-	-
9.	Fax	Facsimile	Character	X(10)	-	-	-
10.	Email	Electronic Mail	Character	X(20)	-	-	-

Table 4 Table Structure of Employee

Table name: Employee							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	EID	Employee Identifier	Character	X(12)	-	Unique	Primary Key
2.	NameInThai	Employee Name In Thai	Character	X(50)	-	-	-
3.	NameInEng	Employee Name In English	Character	X(50)	-	-	-
4.	Sex	Sexual	Character	X(6)	-	-	-
5.	Education	Education	Character	X(20)	-	-	-
6.	Address	Address	Character	X(50)	-	-	-
7.	Province	Province	Character	X(10)	-	-	-
8.	Birthdate	Birth Date	Date	99-99-9999	-	-	-

Table 4 Table Structure of Employee (Continued)

Table name: Employee							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
9.	Hiredate	Hire Date	Date	99-99-9999	-	-	-
10.	Username	Username	Character	X(10)	-	-	-
11.	Password	Password	Character	X(10)	-	-	-

Table 5 Table Structure of Machine

Table name: Machine							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	MID	Machine Identifier	Character	X(12)	-	Unique	Primary Key
2.	Name	Machine Name	Character	X(50)	-	-	-
3.	Capacity	Production Capacity	Character	X(10)	-	-	-
4.	RawMaterial1	Raw material 1	Character	X(50)	-	-	-
5.	RawMaterial2	Raw material 2	Character	X(50)	-	-	-

Table 6 Table Structure of FinishProduct

Table name: FinishProduct							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	FPID	Finish Product Identifier	Character	X(12)	-	Unique	Primary Key
2.	ShortName	Finish Product Short Name	Character	X(30)	-	-	-
3.	FullName	Finish Product Full Name	Character	X(50)	-	-	-
4.	Weight	Weight	Character	X(10)	-	-	-

Table 6 Table Structure of FinishProduct (Continued)

Table name: FinishProduct							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
5.	Price	Finish Product Price	Character	X(10)	-	-	-
6.	NumberIn Stock	Stock Quantity	Character	X(20)	-	-	-
7.	NumberIn Reserve	Reserve Quantity	Character	X(20)	-	-	-
8.	NumberIn Available	Available Quantity	Character	X(20)	-	-	-
9.	NumberIn Order	Order Quantity	Character	X(20)	-	-	-

Table 7 Table Structure of BOM

Table name: BOM							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	BID	Bill Of Material Identifier	Character	X(12)	-	Unique	Primary Key
2.	FPID	Finish Product Identifier	Character	X(12)	-	-	-
3.	DTID	Die Type Identifier	Character	X(12)	-	-	-
4.	RMID	Raw Material Identifier	Character	X(12)	-	-	-
5.	NumOfFPOut	Quantity of Finish Product	Character	X(10)	-	-	-
6.	StartDate	Start Date	Date	99-99-9999	-	-	-

Table 8 Table Structure of ManufacturingOrder

<b>Table name: ManufacturingOrder</b>							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	MOID	Manufacturing Order Identifier	Character	X(12)	-	Unique	Primary Key
2.	FPID	Finish Product Identifier	Character	X(12)	-	-	-
3.	Quantity	Require Quantity	Character	X(10)	-	-	-
4.	Produce Quantity	Produce Quantity	Character	X(10)	-	-	-

Table 9 Table Structure of ManufacturingRequest

<b>Table name: ManufacturingRequest</b>							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	MRID	Manufacturing Request Identifier	Character	X(12)	-	Unique	Primary Key
2.	FPID	Finish Product Identifier	Character	X(12)	-	-	-
3.	Quantity	Require Quantity	Character	X(10)	-	-	-
4.	Produce Quantity	Produce Quantity	Character	X(10)	-	-	-

Table 10 Table Structure of DailyPlan

<b>Table name: DailyPlan</b>							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DPID	Daily Plan Identifier	Character	X(12)	-	Unique	Primary Key
2.	MID	Machine Identifier	Character	X(12)	-	-	-
3.	EID	Employee Identifier	Character	X(12)	-	-	-

Table 10 Table Structure of DailyPlan (Continued)

Table name: DailyPlan							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
4.	TotalCapacity	Total of Capacity	Character	X(12)	-	-	-
5.	PlanDate	Date of Plan	Date	99-99-9999	-	-	-
6.	IsOpen	Status of Daily Plan	Integer	-	-	-	-

Table 11 Table Structure of DailyPlanDetail

Table name: DailyPlanDetail							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DPID	Daily Plan Identifier	Character	X(12)	-	-	Primary Key
2.	MOID	Manufacturing Order Identifier	Character	X(12)	-	-	Primary Key
3.	FPID	Finish Product Identifier	Character	X(12)	-	-	-
4.	RMID	Raw Material Identifier	Character	X(12)	-	-	-
5.	DID	Die Identifier	Character	X(12)	-	-	-
6.	FPQuantity	Finish Product Quantity	Character	X(10)	-	-	-
7.	RMQuantity	Raw Material Quantity	Character	X(10)	-	-	-

Table 12 Table Structure of DiePurchaseOrder

Table name: DiePurchaseOrder							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DPOID	Die Purchase Order Identifier	Character	X(12)	-	Unique	Primary Key
2.	DSupplierID	Die Supplier Identifier	Character	X(12)	-	-	-
3.	OrderDate	Order Date	Date	99-99-9999	-	-	-
4.	NetTotal	Total Price Of Die Purchase Order	Character	X(10)	-	-	-

Table 13 Table Structure of DiePurchaseOrderDetail

Table name: DiePurchaseOrderDetail							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DPOID	Die Purchase Order Identifier	Character	X(12)	-	-	Primary Key
2.	DTID	Die Type Identifier	Character	X(12)	-	-	Primary Key
3.	Quantity	Quantity of Die Purchase Order	Character	X(10)	-	-	-
4.	Price	Price Of Die Purchase Order	Character	X(10)	-	-	-

Table 14 Table Structure of Die

Table name: Die							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DID	Die Identifier	Character	X(12)	-	Unique	Primary Key
2.	DTID	Die Type Identifier	Character	X(12)	-	-	-
3.	CurrentWeight	Die Current Weight	Character	X(10)	-	-	-
4.	StartDate	Die Start Date	Date	99-99-9999	-	-	-
5.	Status	Status of Die	Integer	-	-	-	-

Table 15 Table Structure of DieType

Table name: DieType							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	DTID	Die Purchase Order Identifier	Character	X(12)	-	Unique	Primary Key
2.	DSupplierID	Die Supplier Identifier	Character	X(12)	-	-	-
3.	Name	Die Type Name	Character	X(25)	-	-	-
4.	Price	Die Type Price	Character	X(10)	-	-	-
5.	MinWeight	Die Type Min Weight	Character	X(10)	-	-	-
6.	MaxWeight	Die Type Max Weight	Character	X(10)	-	-	-
7.	NumOfHoles	Number Of Die Type Holes	Character	X(10)	-	-	-

Table 16 Table Structure of DieSupplier

<b>Table name: DieSupplier</b>							
<b>No.</b>	<b>Field Name</b>	<b>Label</b>	<b>Data Type</b>	<b>Format</b>	<b>Default</b>	<b>Data Valid</b>	<b>Remark</b>
1.	DSupplierID	Die Supplier Identifier	Character	X(12)	-	Unique	Primary Key
2.	NameInThai	Die Supplier Name In Thai	Character	X(50)	-	-	-
3.	NameInEng	Die Supplier Name In English	Character	X(50)	-	-	-
4.	Address	Address	Character	X(50)	-	-	-
5.	Telephone	Telephone	Character	X(10)	-	-	-
6.	ContactName1	Contact Name1	Character	X(25)	-	-	-
7.	ContactName2	Contact Name2	Character	X(25)	-	-	-
8.	Fax	Facsimile	Character	X(10)	-	-	-
9.	Email	Electronic Mail	Character	X(20)	-	-	-

Table 17 Table Structure of RawMaterialPurchaseOrder

<b>Table name: RawMaterialPurchaseOrder</b>							
<b>No.</b>	<b>Field Name</b>	<b>Label</b>	<b>Data Type</b>	<b>Format</b>	<b>Default</b>	<b>Data Valid</b>	<b>Remark</b>
1.	RMPOID	Raw Material Purchase Order Identifier	Character	X(12)	-	Unique	Primary Key
2.	RMSupplierID	Raw Material Supplier Identifier	Character	X(12)	-	-	-

Table 17 Table Structure of RawMaterialPurchaseOrder (Continued)

Table name: RawMaterialPurchaseOrder							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
3.	OrderDate	Order Date	Date	99-99-9999	-	-	-
4.	NetTotal	Total Price Of Raw Material Purchase Order	Character	X(10)	-	-	-

Table 18 Table Structure of RawMaterialPurchaseOrderDetail

Table name: RawMaterialPurchaseOrderDetail							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	RMPOID	Raw Material Purchase Order Identifier	Character	X(12)	-	-	Primary Key
2.	RMID	Raw Material Identifier	Character	X(12)	-	-	Primary Key
3.	Quantity	Quantity of Raw Material Purchase Order	Character	X(10)	-	-	-
4.	Price	Price Of Raw Material Purchase Order	Character	X(10)	-	-	-

Table 19 Table Structure of RawMaterial

Table name: RawMaterial							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	RMID	Raw Material Identifier	Character	X(12)	-	Unique	Primary Key
2.	RMSupplierID	Raw Material Supplier Identifier	Character	X(12)	-	-	-
3.	ShortName	Raw Material Short Name	Character	X(25)	-	-	-
4.	FullName	Raw Material Full Name	Character	X(50)	-	-	-
5.	Weight	Raw Material Weight	Character	X(10)	-	-	-
6.	Price	Raw Material Price	Character	X(10)	-	-	-

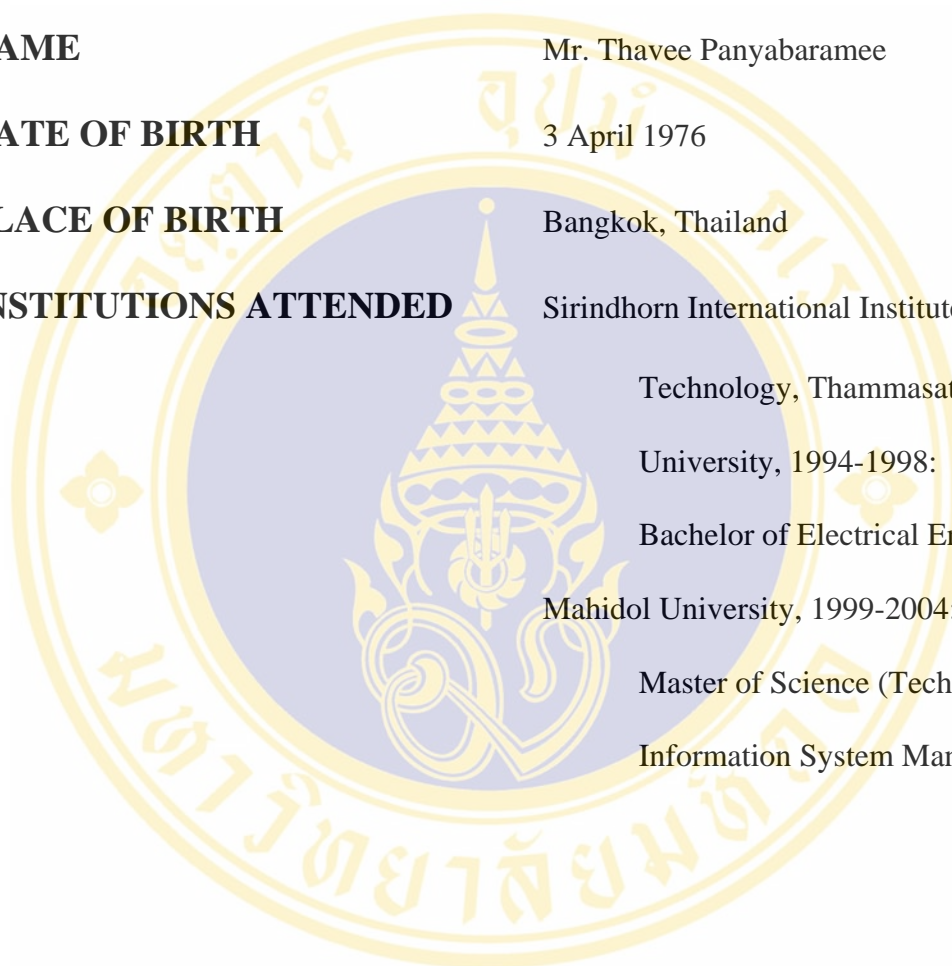
Table 20 Table Structure of RawMaterialSupplier

Table name: RawMaterialSupplier							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
1.	RMSupplierID	Raw Material Supplier Identifier	Character	X(12)	-	Unique	Primary Key
2.	NameInThai	Raw Material Supplier Name In Thai	Character	X(50)	-	-	-
3.	NameInEng	Raw Material Supplier Name In English	Character	X(50)	-	-	-
4.	Address	Address	Character	X(50)	-	-	-

Table 20 Table Structure of RawMaterialSupplier (Continued)

Table name: RawMaterialSupplier							
No.	Field Name	Label	Data Type	Format	Default	Data Valid	Remark
5.	Telephone	Telephone	Character	X(10)	-	-	-
6.	ContactName1	Contact Name1	Character	X(25)	-	-	-
7.	ContactName2	Contact Name2	Character	X(25)	-	-	-
8.	Fax	Facsimile	Character	X(10)	-	-	-
9.	Email	Electronic Mail	Character	X(20)	-	-	-

## BIOGRAPHY



<b>NAME</b>	Mr. Thavee Panyabaramee
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