Chapter 5

Development of Product Data Management System

It has become obvious that the Relational Database Management System is needed to support the engineering decision at estimation standard time in the case study. There are enormous benefits and concerns as has already been mentioned in the previous chapter. After the author has defined product data logically, the purpose of this chapter is then to discuss at the physical database choice, design, and development.

5.1 Physical Database Choices

5.1.1 Company Available Packages

Currently, the company is using a commercial ERP system, named MFG/Pro a package developed by 3rd party (Qad, 1997, http://www.qadcom). However the engineering departments are facing with two problems:

1) The ERP application does not exactly meet engineering requirement in standard time estimation,

2) Since the company has only invested 16-seat (users) license, meaning that a maximum of 16 people are able to log on to the system at a time, which often occupied by those from other departments, unable the engineers to log on to the system in order to retrieve data for their work to flow.

For these reasons, a new Relational Database Management System is required.

5.1.2 Market Available Packages

Having skimmed through 3rd party, there are many Relational Database Management Systems available in the market that could support standard time estimation such as:

1) **Maynard Operation Sequence Technique (MOST)** – this is one of a well-known computerized Predetermined Time System, an outgrowth of Methods-Time Measurement (MTM). Maynard (1997, http://www.hbmaynard.com), the developer, claimed that MOST enable the engineers to establish standard time of at least five times faster than with original MTM, with little if any sacrifice in accuracy. However, the company don't want a built-in database but the company wants to introduce its own standard time data based on task (using 20 years of experience in development of legacy standard data) rather than base on motion as MOST provides. Therefore, this choice is eliminated.

2) **Planning of Activities, Resources and Technology (PART)** – is one of leading software programs classified as a generative Computer-Aided Process Planning system (CAPP), which can generate the process plan and calculate production time automatically or interactively. PART improves machining efficiency by allowing planners to attach manufacturing tolerance information. These tolerances determine the accuracy needed for machining and are essential factor in selecting the best machines and tools to do the jobs. Although, this generative approach naturally desirable as the process plans can be generated easily, rapidly and consistently. However, the development of a generative CAPP system is a very complex task, and requires a long term investment. For example, this PART system project from Technomatix Technologies Ltd (2003, http://www.technometix.com) was sponsored by the Dutch Ministry of Economic Affairs at the University of Twente, in the Netherlands with a total budget of $3 million and twelve full time researchers working for four years from 1987 to 1991. Therefore this choice is eliminated.

3) **TeamPDM** – is one of the many commercial PDM solutions, which is distributed by IBM for CATIA Solutions (1999, http://www.catia.com). However, its application is more suited to the companies that employ large scale of CAD system, which is exactly is not suitable for the company in the case study since the company is only a manufacturer not the designer. This choice is also eliminated.

None of these solutions, developed based on a RDBMS system, fit to the case study's requirement nor do they neither affordable nor economical. Hence, the author along with a team of engineers would together design and develop in house Relational Database Management System for the standard time estimation process. As is recommended by Wang (1991: *Computer-Aided Process Planning*) that standard time databases should have a link to smart user interface e.g. PDM system that describe the process knowledge such as handbooks, standards, and practical experience. This is why author has decided to propose a PDM system as the solution for the company in this case study.

5.2 Design of Product Data Management System

As the author has defined product data logically in Chapter 4 and has decided to go ahead with an in-house development of PDM system rather than invest in 3rd party applications. The PDM program will be developed using Microsoft Visual Basic, the product database is stored in Microsoft Access, and reports will be generated through Microsoft Excel.
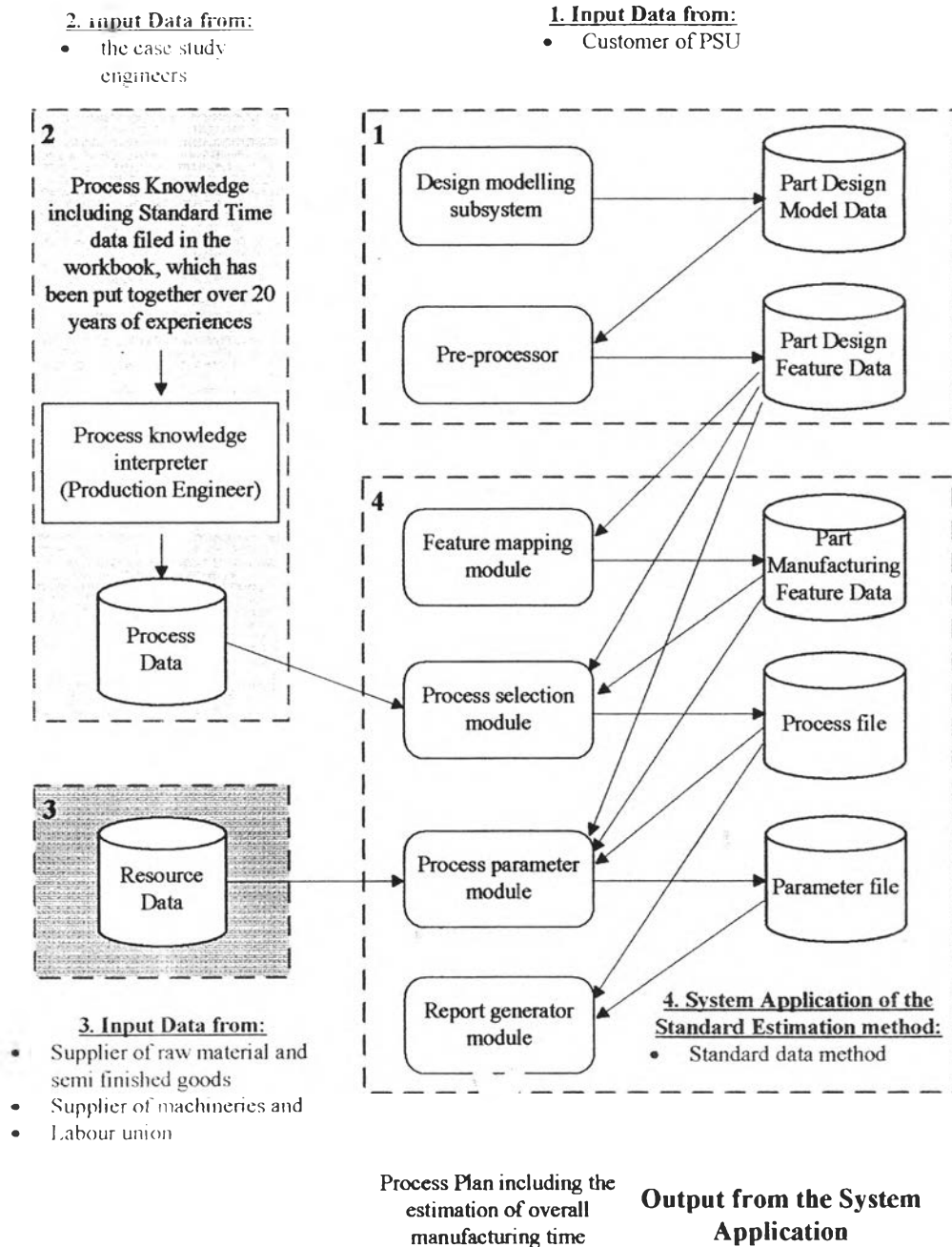

Figure 5.1: Application of Standard Time Estimation Method in Product Data Management System
Source: Adapted from Wang (1991: *Computer-Aided Process Planning*)

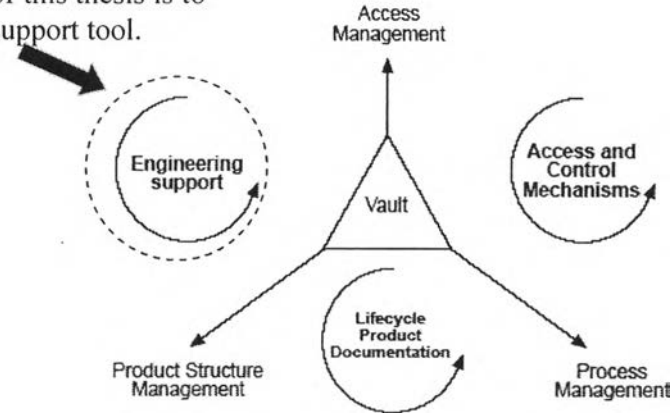**The purpose of the PDM system for the case study of this thesis is to be an engineering support tool.

Figure 5.2: Functionality of Product Data Management

Source: Sackett J. & Bryan M. (1998, *Framework for the development of a PDM strategy*)
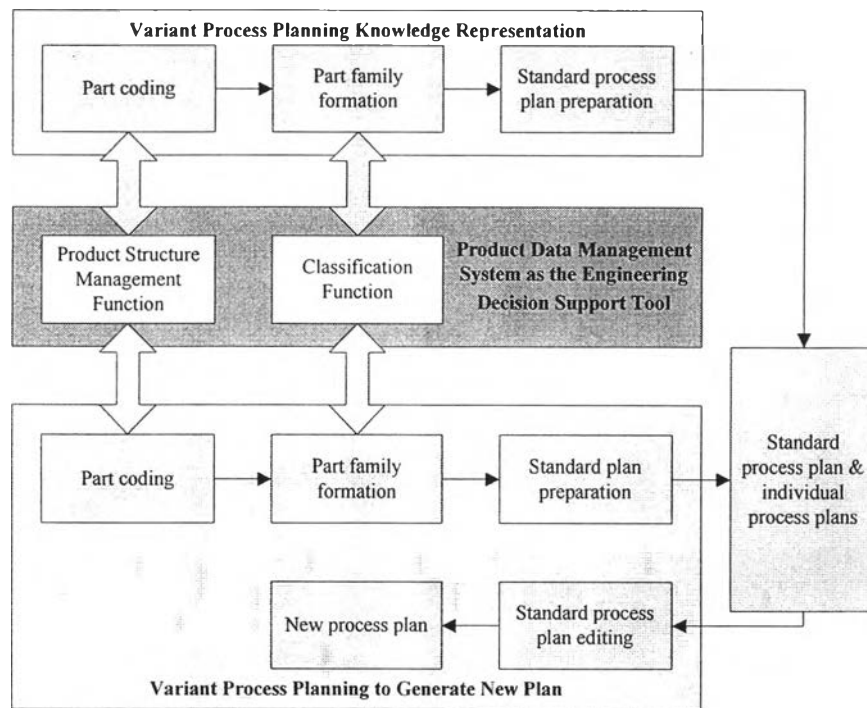

Figure 5.3: Selected Functions of PDM to Support the Estimation of Standard Time under the Variant Process Planning Approach

Based on Figure 5.1. the application of Standard Time Estimation Method in the Product Data Management System of this Thesis consists of the following functions,

1) Estimate Standard Time
    1.1 Feature Mapping Module
    1.2 Process Selection Module
    1.3 Process Parameter Module
2) Search Product Data.
    2.1 Customer Order Data
    2.2 Model Design Data
    2.3 Part Process Data
    2.4 Part Maker Data
    2.5 Machine Data
    2.6 Standard Process Data
    2.7 Standard Time Data
    2.8 Standard Cost Data
3) Add/Edit Product Database
4) Print Reports

Based on Figure 5.2, among the 3 main useful purposes of PDM, this thesis's scope is mainly focused on being an engineering support tool for Production Engineers in the case study. Therefore, the major selected user functions of PDM to support the production engineers in estimating of standard times are:

1) Product Structure Management Function
2) Classification Function

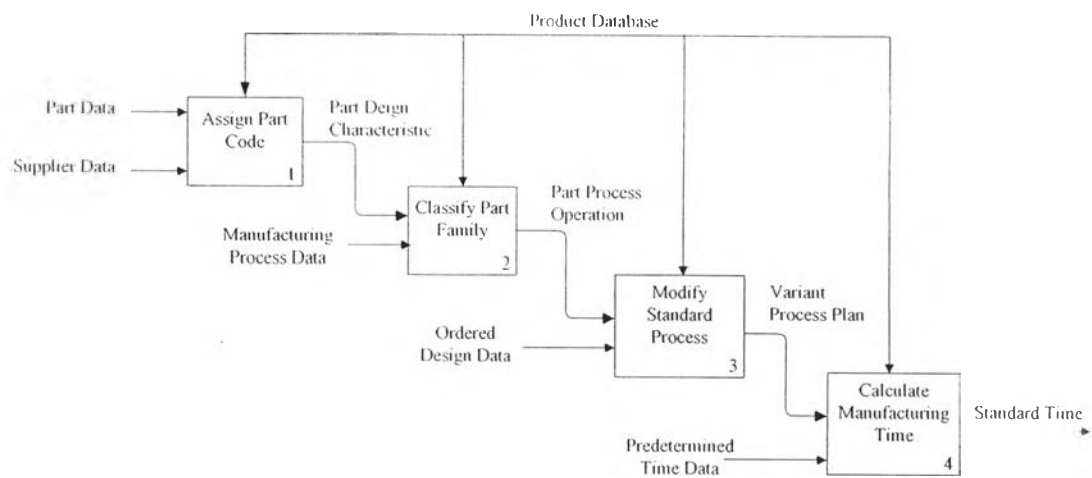The author links these major functions of PDM to the Variant Process Planning approach (VPP) as shown in Figure 5.3.

Figure 5.4: IDEF-0

5.3 Development of Product Data Management System

5.3.1 PDM Data Vault

Product data needed in the PDM vault to support Production Engineers of the case study in making estimation of standard times are design, process, and resource-related information as shown below with their relationships:
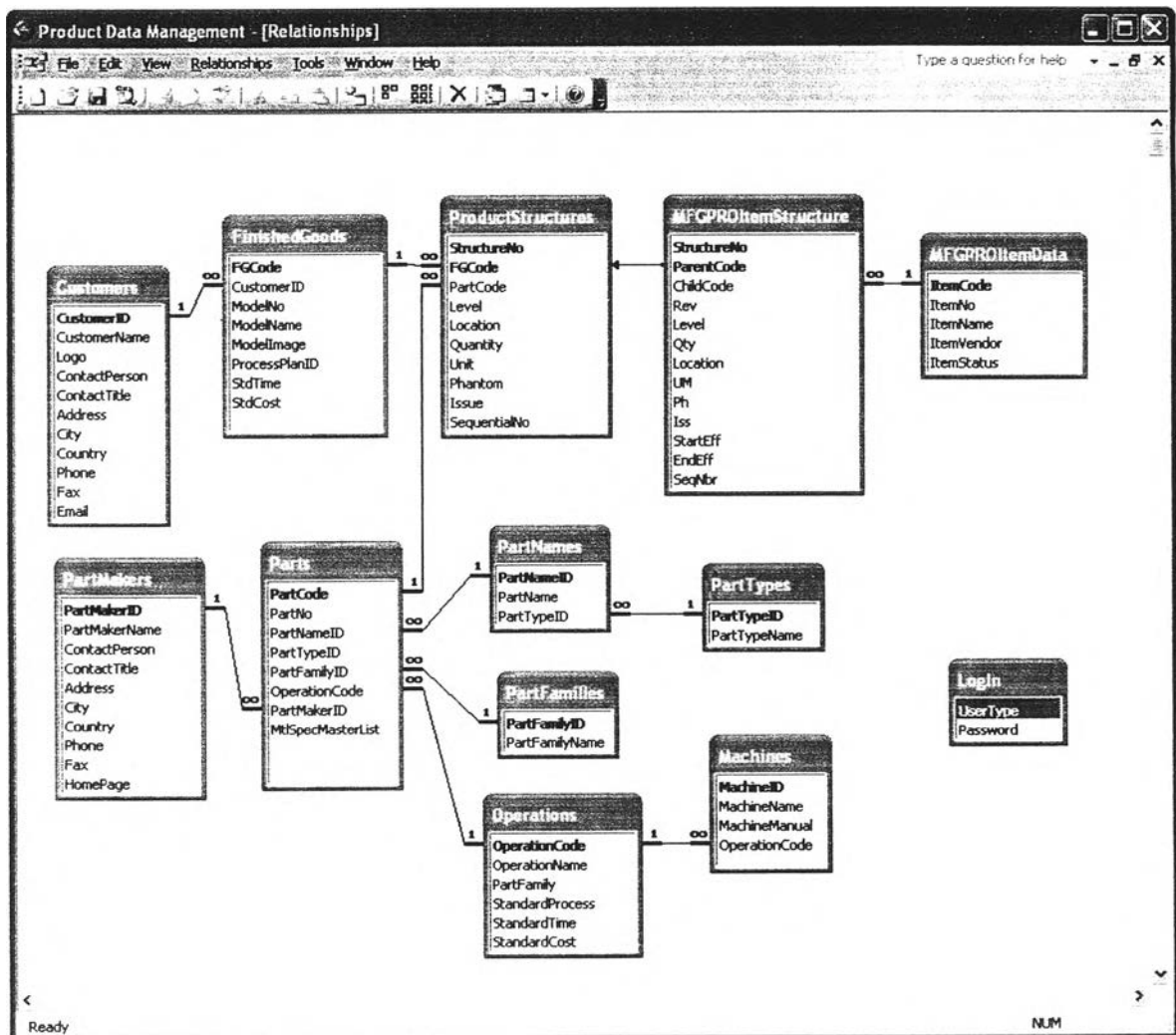

Figure 5.5: Relational Product Database of the PDM system for the Case Study

5.3.2 PDM Log In

To preserve integrity and confidentiality of legacy data, the author designs that program users will have to first indicate their workgroup type. For viewing purpose only, the USER option should be selected. For data and database administration purpose, the ADMINISTRATOR option should be selected and entering password is required. By identifying workgroup as ADMINISTRATOR, the ability to edit both data and database is granted. Clicking on the EXIT button, the PDM program will shut down. Clicking on the ENTER button, the link will lead to the MAIN MENU page of the program.
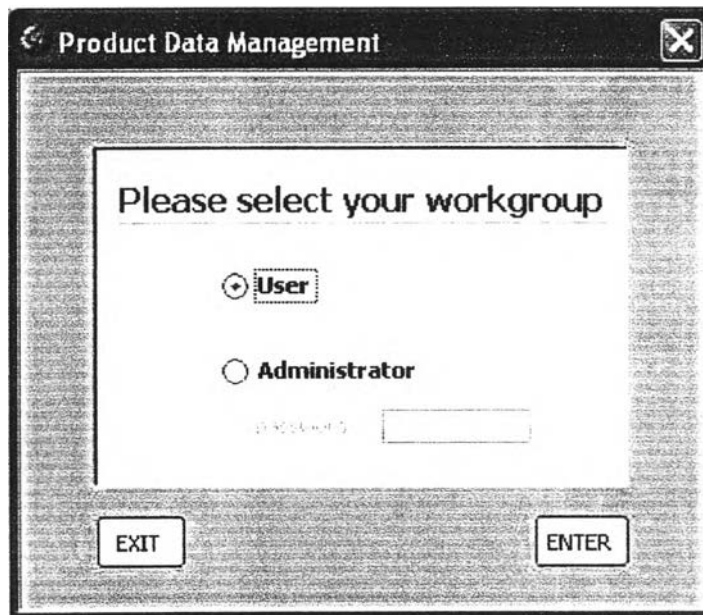
Figure 5.6: Log-In Interface of the PDM system for the Case Study

5.3.2 PDM Main Menu

On the MAIN MENU interface, there are 4 further links as shown below. To estimate standard for new PSU model, click on the CLOCK button. To search catalogue of historical part data, click on the BINOCULAR button. For the administrator to manage product database, click on the WRENCH button. To print the process plan and parts list in order to forward to shop-floor staff for pre-production schedule, click on the REPORT button.
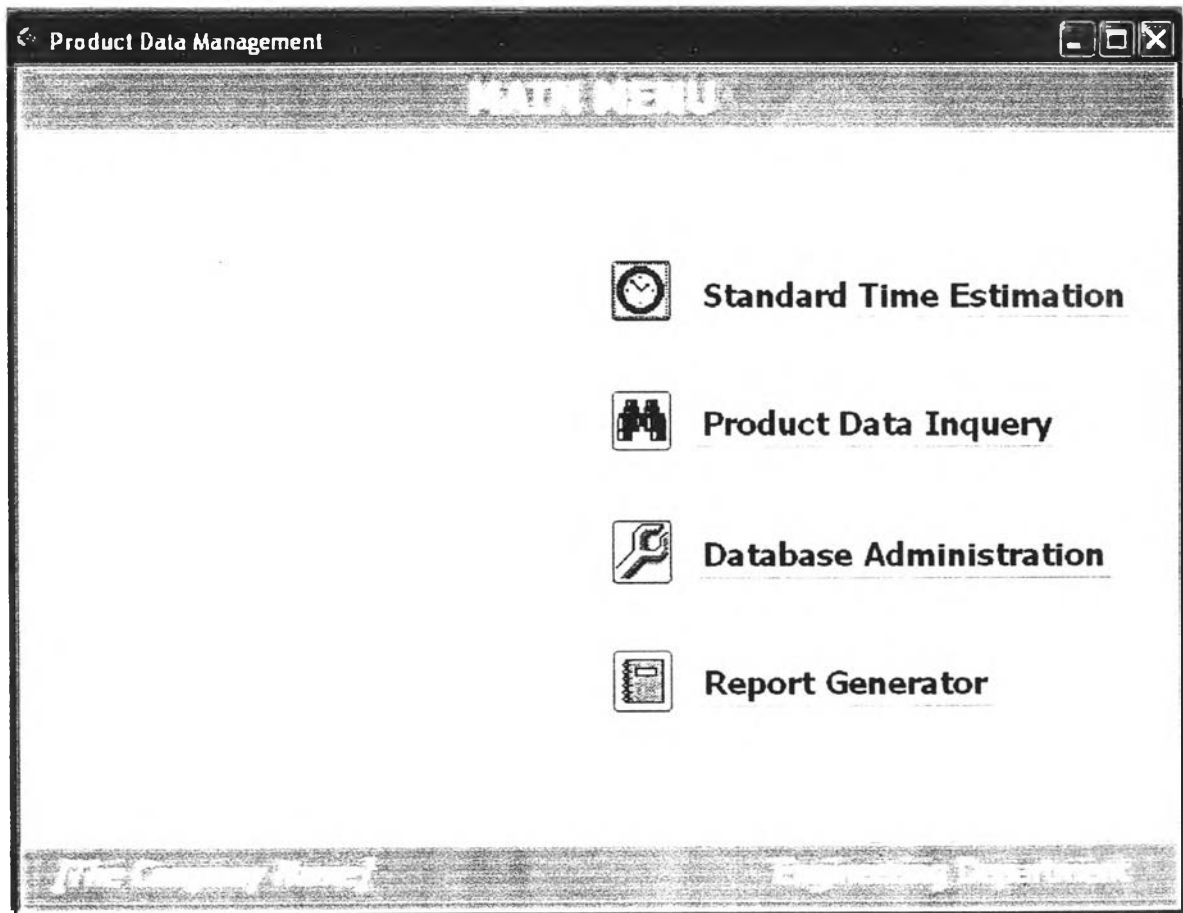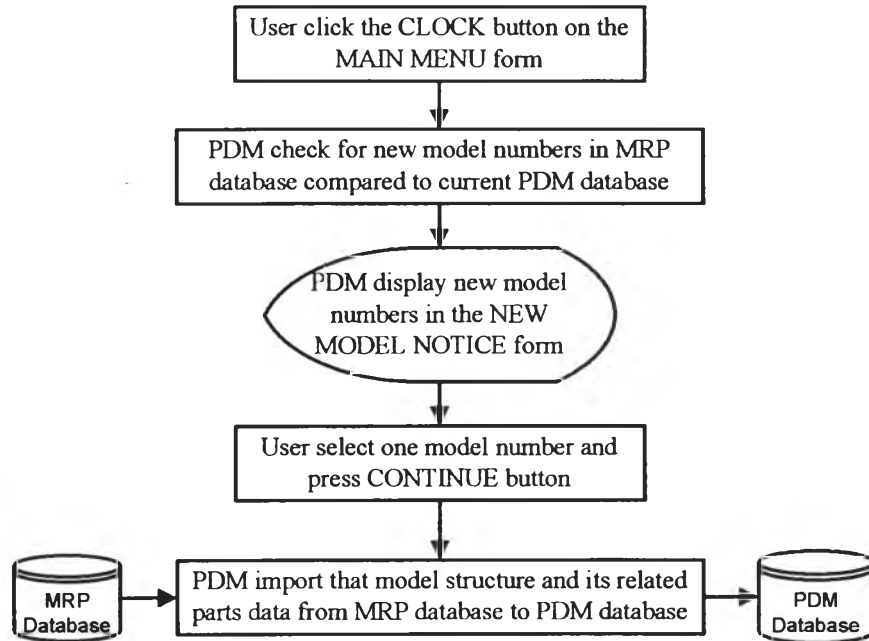

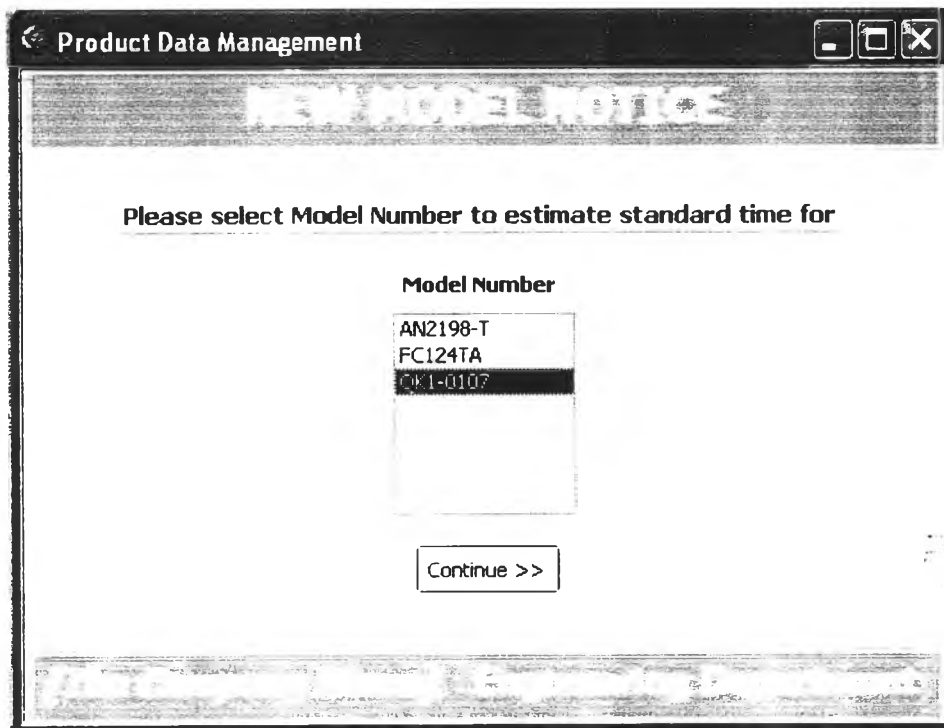**Figure 5.7: Main Menu of the PDM system for the Case Study**

5.3.3 Standard Time Estimation

N.B. refer to Figure 5.5
- Import model structure from Table_MFGPROItemStructure in MRP to Table_ProductStructures in PDM
  - Import related part data from Table_MFGPROItemData in MRP to Table_Parts in PDM

(a) PDM utility function

(b) PDM user function

Figure 5.8: New Model Notice Form
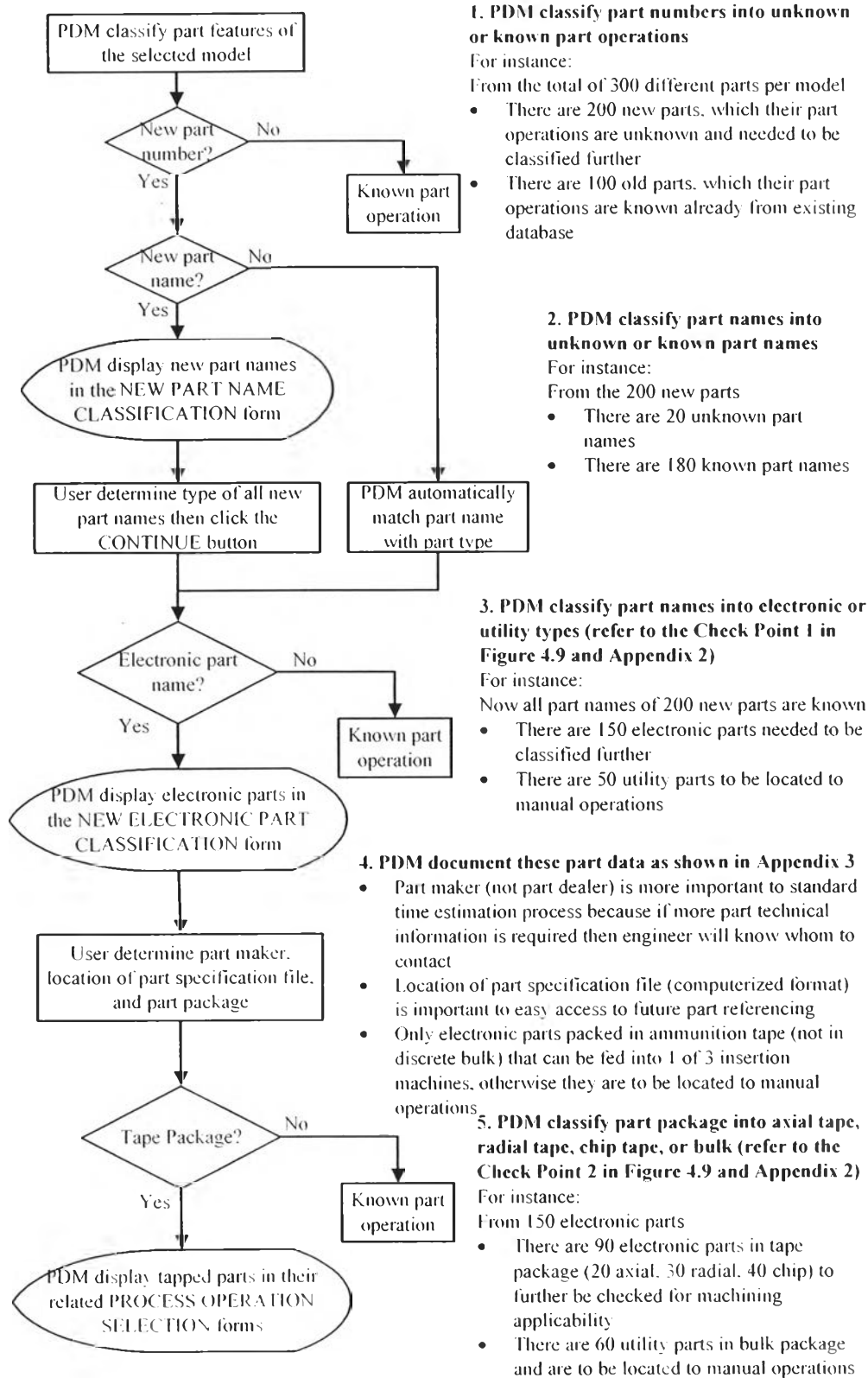
5.3.3.1 Feature Mapping Module

Flowchart boxes (left column):

- PDM classify part features of the selected model
- New part number? — No → Known part operation; Yes ↓
- New part name? — No →; Yes ↓
- PDM display new part names in the NEW PART NAME CLASSIFICATION form
- User determine type of all new part names then click the CONTINUE button
- PDM automatically match part name with part type
- Electronic part name? — No → Known part operation; Yes ↓
- PDM display electronic parts in the NEW ELECTRONIC PART CLASSIFICATION form
- User determine part maker, location of part specification file, and part package
- Tape Package? — No → Known part operation; Yes ↓
- PDM display tapped parts in their related PROCESS OPERATION SELECTION forms

Right column descriptions:

1. PDM classify part numbers into unknown or known part operations
For instance:
From the total of 300 different parts per model
- There are 200 new parts, which their part operations are unknown and needed to be classified further
- There are 100 old parts, which their part operations are known already from existing database

2. PDM classify part names into unknown or known part names
For instance:
From the 200 new parts
- There are 20 unknown part names
- There are 180 known part names

3. PDM classify part names into electronic or utility types (refer to the Check Point 1 in Figure 4.9 and Appendix 2)
For instance:
Now all part names of 200 new parts are known
- There are 150 electronic parts needed to be classified further
- There are 50 utility parts to be located to manual operations

4. PDM document these part data as shown in Appendix 3
- Part maker (not part dealer) is more important to standard time estimation process because if more part technical information is required then engineer will know whom to contact
- Location of part specification file (computerized format) is important to easy access to future part referencing
- Only electronic parts packed in ammunition tape (not in discrete bulk) that can be fed into 1 of 3 insertion machines, otherwise they are to be located to manual operations

5. PDM classify part package into axial tape, radial tape, chip tape, or bulk (refer to the Check Point 2 in Figure 4.9 and Appendix 2)
For instance:
From 150 electronic parts
- There are 90 electronic parts in tape package (20 axial, 30 radial, 40 chip) to further be checked for machining applicability
- There are 60 utility parts in bulk package and are to be located to manual operations

Figure 5.9: Feature Mapping Module

Product Data Management

NEW PART NAME CLASSIFICATION FORM

Please select between Electronic Type or Utility Type for each part name

	Part Name	Part Type
	Flux	Utility Part
	IC	Electronic Part
▶	Red Paint	Utility Part ⌄
	Switching Diode	Electronic Part
	transistor	Electronic Part

Record: |◀ ◀ 3 ▶ ▶| of 5

<< Back   Continue >>

Figure 5.10: New Part Name Classification Form

Figure 5.11: New Electronic Part Classification Form

5.3.3.2 Process Selection Module

Figure 5.12: Example of Process Selection Form

5.3.3.3 Process Parameter Module

For example, after the form in Figure 5.12 is completed, then PDM will document the results as shown in Figure 5.13. Once all new parts noticed are added to PDM system, engineers should refer to Appendices I in order to estimate standard time for each operation.

AI-120 RADIAL AUTO INSERT PART				
Location	Part name	Part No	Code No	Solder Pt

Total No. Of Radial Auto Insert Solder Point =
Total No. of Radial Auto Insert Part =

AI-121 SPECIAL RADIAL AUTO INSERT PART				
Location	Part name	Part No	Code No	Solder Pt

Total No. Of Special Radial Auto Insert Solder Point =
Total No. Special of Radial Auto Insert Part =

Figure 5.13: Example of Part Family Forms

5.3.4 Product Data Query

5.3.4.1 Customer Order Data

The Figure directly below illustrates to the user, the history model as ordered by selected customer name. The information of past order shows the "Model No", which the unique numbers are given by various external customers and an in-house finished goods "FG-Code" unique coding used internally. This page also shows customers' details, including contact address, email (click on "mail to customer" button to bring up email page shown in Figure 5.15) and numbers in case of direct contact concerning the design and production.
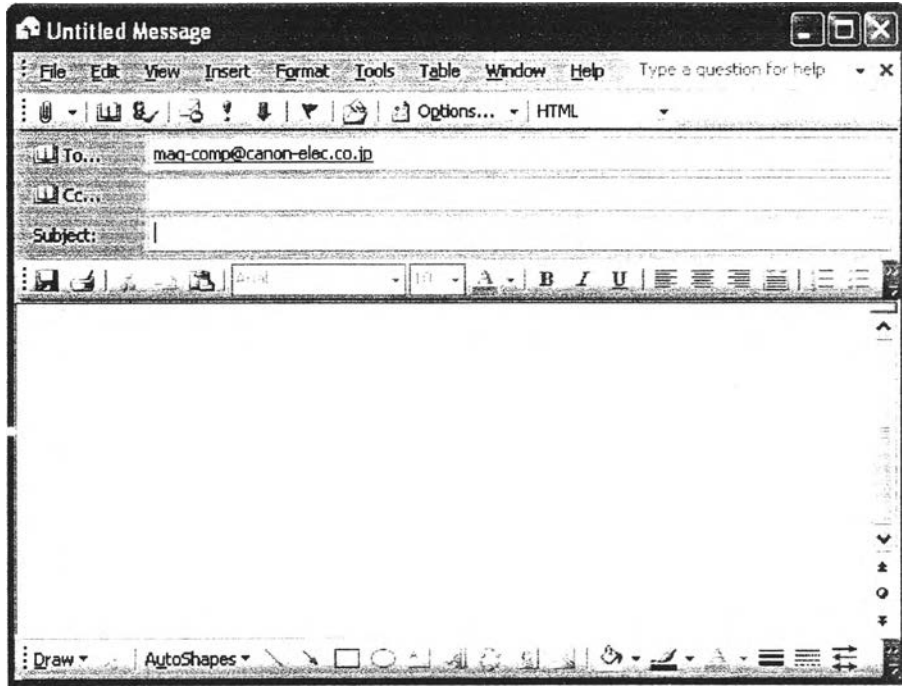

Figure 5.14: Customer Order Data

Figure 5.15: Email to Customer Page

5.3.4.2 Model Design Data

When click on the "View Model Detail" on the Customer Order Data page as shown in previous page, will bring up the Model Design Data shown below. The Model Design Data page brings up the detail of time and cost to manufacture according to specific customized design model order, which is also shown next to the model details the part structure showing the specific layout and design of customized model.

Figure 5.16: Model Design Data

5.3.4.3 Part Process Data

PDM compare each model from MFG/PRO to model numbers in PDM Database. Then PDM import new model structure and related data from MFG/PRO to PDM database. PDM will provide specification documents, guidelines, and series of questions to help engineers locating part to operation. According to Section 4.3 or Appendix 2 (Guideline for Location Parts to Process Operations), there are types of tapped parts as follow;

1) Axial lead tapped parts
2) Radial lead tapped parts
3) Chip tapped parts

Once the Engineer had done checking for part's machining applicability with one of the following machine;

1) Axial insertion machine
2) Radial insertion machine
3) Chip insertion machine

The Part Operation Codes are kept as shown in Figure 5.16 for future utilization, so there will be less reinventing the wheel. The larger database consisting of necessary historical part data, the faster PDM can determine suitable operation for future new parts. Hence the standard time estimation process can be improved.
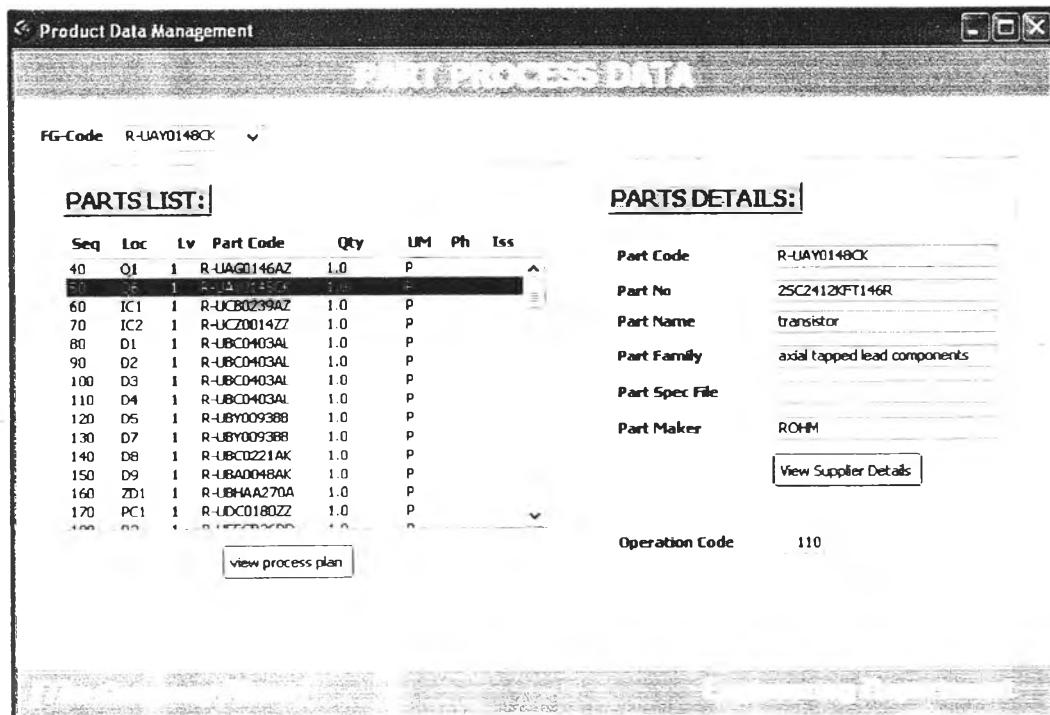

Figure 5.17: Process Data