ระบบสารสนเทศแบบออนไลน์สำหรับแผนกผลิต

นายชีเหวย หลาน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต

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ON-LINE SHOP FLOOR INFORMATION SYSTEM

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ข่าวสารข้อมูลของการผลิตเป็นส่วนสำคัญของธุรกิจด้านการผลิต โดยทำอย่างไรให้รู้อย่างแน่ชัดว่าข้อมูลข่าวสารนั้นถูกต้องเพื่อนำไปสู่ผู้ปฏิบัติได้ทำอย่างถูกต้องและทำอย่างไรที่จะรู้ข้อมูลของการผลิต ณ เวลานั้น และส่วนที่ต้องการข้อมูลของธุรกิจด้านการผลิต

ระบบการบริหารฐานข้อมูลและเทคโนโลยีของโครงข่าย เป็นเรื่องที่สำคัญมากสำหรับองค์กร โดยเฉพาะอย่างยิ่งกับบริษัทผู้ผลิต ซึ่งถ้านำมาประยุกต์ใช้ได้ก็สามารถที่จะลดค่าใช้จ่ายลงได้และยังสามารถที่จะปรับปรุงระบบข้อมูลด้านคุณภาพ

ส่วนที่ได้บรรยายนี้ไม่ได้กล่าวถึงการเขียนโปรแกรมฐานข้อมูล แต่จะบรรยายเกี่ยวกับการนำระบบการจัดการฐานข้อมูลไปใช้ โดยจะกล่าวถึงปัญหาที่อาจเกิดขึ้นในงานเอกสารการผลิตและการแจ้งข้อมูลข่าวสารของปัญหาและวิธีการแก้ไข

โดยผลของวิทยานิพนธ์นี้ ระบบข้อมูลข่าวสารของการผลิต (Shop Floor Information System) ถูกพัฒนาใช้กับบริษัทผลิตจอคอมพิวเตอร์และเครื่องคอมพิวเตอร์

ระบบข้อมูลข่าวสารของการผลิต (Shop Floor Information System) จะอยู่บนพื้นฐานของระบบฐานข้อมูลและเทคโนโลยีของโครงข่าย โดยข้อมูลของระบบนี้จะมีด้วยกันหลายส่วน เช่น ข้อมูลการผลิต ข้อมูลคุณภาพ ข้อมูลสินค้าคงคลัง เป็นต้น แต่อย่างไรก็ตามวิทยานิพนธ์นี้ได้วิจัยส่วนของข้อมูลการผลิตและข้อมูลคุณภาพเท่านั้น

เมื่อเปรียบเทียบระบบที่ได้พัฒนาขึ้นกับระบบที่มีอยู่แล้ว ปรากฏว่าสามารถที่จะลดค่าใช้จ่ายที่เป็นปัญหาในการผลิตได้มาก

ภาควิชา ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต	ลายมือชื่อนิสิต……..
สาขาวิชา การจัดการทางวิศวกรรม	ลายมือชื่ออาจารย์ที่ปรึกษา……
ปีการศึกษา 2543	ลายมือชื่อที่ปรึกษาร่วม……..-……

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Manufacturing information plays a crucial role in manufacturing business. How to confirm the right information reach to right person and how to feedback real time manufacturing information to right person are part of key areas in manufacturing business.

Database management system and network technologies are very important for an organization, especially for manufacturing company. If applied appropriately, the operating cost can be significantly reduced and quality data system can be improved.

This thesis is not a technical report on how to write database software programme. It concentrates on how to apply database management. The thesis tries to identify the possible problems of manufacturing documentation and feedback information problems and come out a solution pattern.

As a result of the thesis, a shop floor information system was developed and implemented in a monitor and computer manufacturing company.

The shop floor information system is based on data base management system and network technology. The shop floor information has many types such as production data, quality data, inventory data, so on and so forth. However, in this thesis, only production data and quality data are researched.

The comparison between the production performance from the developed method and existing method shows that operating cost was significantly reduced.

Department…The Regional Centre for Manufacturing Systems Engineering…Student's signature……..…...
Field of study…Engineering Management……..Advisor's signature……..…..
Academic year……2000……Co-advisor's signature…-.……

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CHAPTER 1

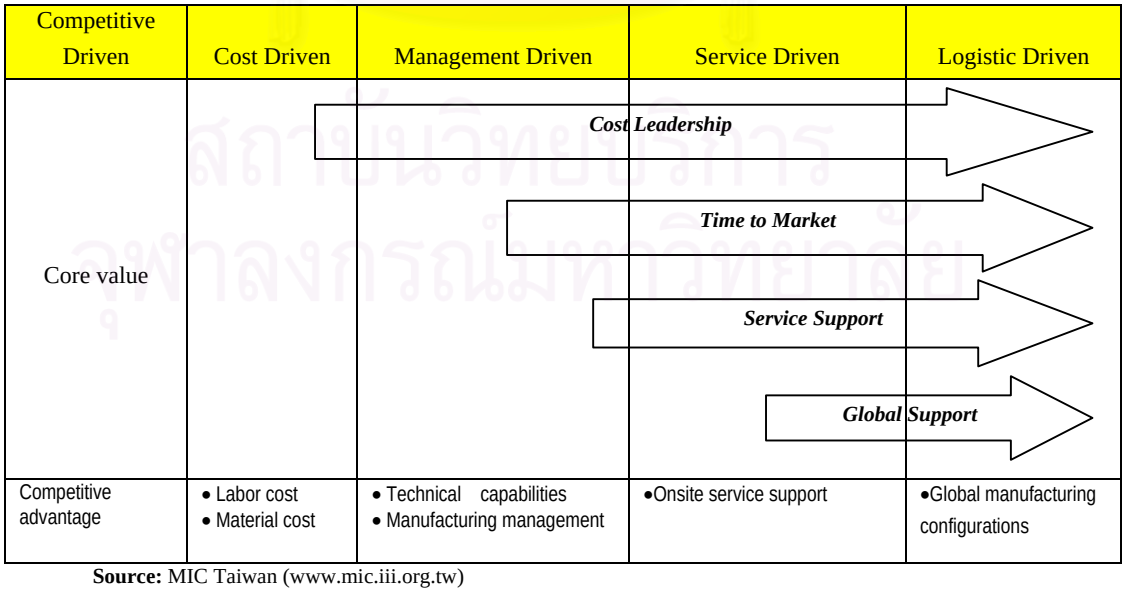
INTRODUCTION

In this chapter, the thesis background is discussed. After that, problems are pointed out in order to solve the problems in this thesis. Objective and scope are identified in order to give a boardline of the research. Methodology applied is introduced. Finally the expected result and key performance index is established.

1.1 Thesis background

In monitor and computer manufacturing industry, the competence driven factors such as cost leadership and global manufacturing configurations force manufacturing company set up manufacturing base in developing countries when the design and marketing in developed countries.

For manufacturers, the quality, time to market and cost become three key successful factors to win the market. As per the market survey, the competence driven factors for IT products are shown as figure 1.1



Source: MIC Taiwan (www.mic.iii.org.tw)

Figure 1.1 The competence driven factors for IT products

For cost and logistics reasons, the PC makers moved the major manufacturing base from USA, German, Japan to Korea, Taiwan then to Malaysia, Thailand, Indonesia, Mainland China. The current configuration is that the marketing and design function are in Korea, Japan or Taiwan while the main manufacturing base is in developing countries.

In manufacturing side, as marketing requires the production pattern is small batch but various models, the production must produce different models in shop floor and the model change is usually 2 or 3 times per shift. The manufacturing is in a product layout with typically over 100 operators in a total 190 metre conveyor.

The way to handle the document to respond to this becomes important. The process requires each operator must have latest instructions and change notices related to his/her job.

To meet quality and cost requirement, management need to know quality data and production data in the shop floor. The ways to get real time information become important.

Many manufacturing firms have Management Information System. Basically it consists of marketing information system, financial information system, human resource information system and manufacturing information system. The manufacturing information system usually consists of material requirement planning (MRP) for production planning and inventory control, and capacity requirement planning (CRP), as shown as figure 1.2

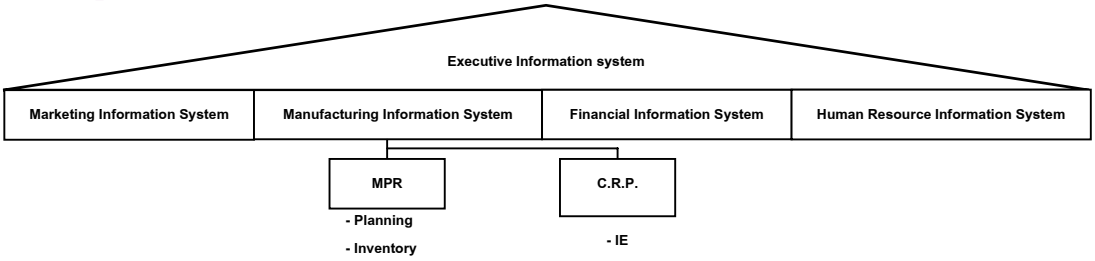


Figure 1.2 Management information system

In brief, the information access, transfer and handling in manufacturing company are very important.

1.2 Problems

1.2.1 The information problems in factory usually are,

1) Outdated document is used in shop floor.
2) Information reaches the production manager but not reach to shop floor.
3) Shop floor does not know some change notices which are related to them.
4) Manager can not know the real time information (quality and output quantity).
5) Operator or repairman usually records data, and then the quality people collect data and raise report. The report may have error because of many hands writing data and many people involved.
6) Different department may collect and process similar data.

1.2.2 Above problems will lead to following results,

1) Incorrect document or lost document in shop floor may lead to wrong product thus rework and customer complaints occur.
2) Manager and supporting function can not get real time information therefore can not take prompt action.
3) More manpower to write the data, collect data and summarize the report, it is wasteful. Moreover, some errors may occur during the data writing, collecting and processing.

4) Different departments may collect and process similar data, therefore the repeat job occurs and it is no value added.

1.3 Objective of the research

The objective of the research is to apply database management system and computer network technology to develop a so-called “on line shop floor information system” to enable production shop floor get document reference check list on computer and the shop floor information can be timely reached to manager and supporting staff.

1.4 Scope of the research

This research will concentrate on shopfloor manufacturing document (such as BOM, Works Instruction, etc.) control and shop floor information (quality, output quantity, etc.) system, in a manufacturing company.

However, the EDI will not be included in this project.

The implementation of the research will be on certain production lines first to ensure its validation. The solution may also be applied to the rest of the production lines, depending on the requirement.

This research is done in a computer/monitor manufacturing company, it may also be applied in other electronics companies.

1.5 Methodology

The methodology consist of:

1) Study the existing shop floor information system.
2) Develop an on-line shop floor information system.

3) Implement the system compare the results from the improvements, using the criteria identified on 1.7.

1.6 Expected benefit

1) Shop floor can get real time manufacturing document list therefore can ensure getting right document for the right product.
2) Management and supporting staff can get real time shop-floor information therefore can take prompt action where necessary.

1.7 The key performance index

1) Rework cost because of wrong manufacturing document used.
2) Manpower reduction and data error times.
3) Compensation reduction from customers

1.8 The theory applied will be,

1) Database management system.
2) Network technology.
3) System selection technique.

1.9 Research procedure

1) Study related literature.
2) Collect knowledge from expert and document.
3) Analyze information and review.
4) Develop the solution methodology.
5) Implement the system.

6) Write up thesis and submit thesis form.

7) Final examination.

CHAPTER 2

LITERATURE SURVEY

There are some subjects and techniques on shop floor information system. Basically they include database management system (DBMS), network technology and system selection technique. Also, some general information technology issues will be discussed. Several applications of shop floor information system will also be introduced.

The following are theory that may be beneficial for accomplishing the research. They are general ideas that can be applied to help solving the problem.

2.1 Idea about Management Information System

2.1.1 Turban, Mclean, Wetherbe, (1996).

As a powerful tool, information technology plays a crucial role in today's business. Major technological trends are as below,

1) The cost-performance advantage of computers over manual labor is increasing.
2) Information highways will be available with fiber optics providing large capacities.
3) Networked computers and client/server architecture will be the predominant architecture.
4) Graphical and other user-friendly interfaces dominate PCs.
5) Capacities of storage will increase significantly.
6) Multimedia use will increase significantly.
7) Emerging computer technologies, especially artificial neural computing and expert systems, will increase in importance.

8) Object-oriented programming will be widely accepted.

9) Compactness and portability of computers will continue.

10) Distributed databases will be an integral part of a corporate-wide client/server computing environment.

In fact, this has already be justified by current practice.

2.1.2 Kroenke, Hatch (1994)

Many company introduced management information system. In a manufacturing company, the process and data flow can be shown as figure 2.1

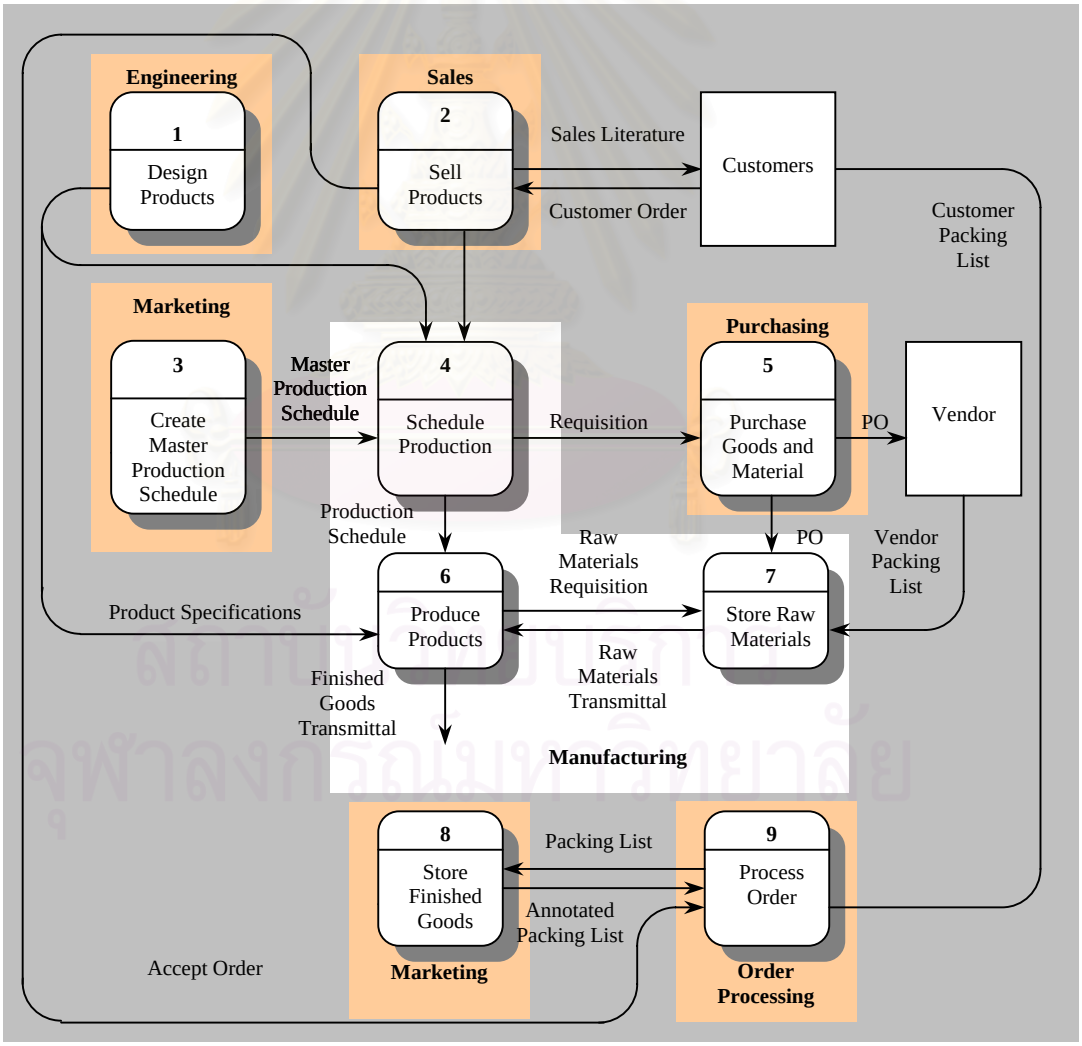


Figure 2.1 Manufacturing process and data flow

2.2 Data base and database management system

2.2.1 What is a database.

According to Stair (1992), a database is an organized collection of facts and information. An organization's database can contain facts and information on customers, employees, inventory, computer's sales information, etc… It is believed that a database is one of the most valuable and important parts of a computer-based information system.

2.2.2 Data management.

Data management has two basic pattern, traditional approach and database approach.

2.2.2.1 Traditional approach

Simply, data can be managed via files. All records associated with specific applications can be collected and managed in a specific application file. The traditional approach is shown as figure 2.2

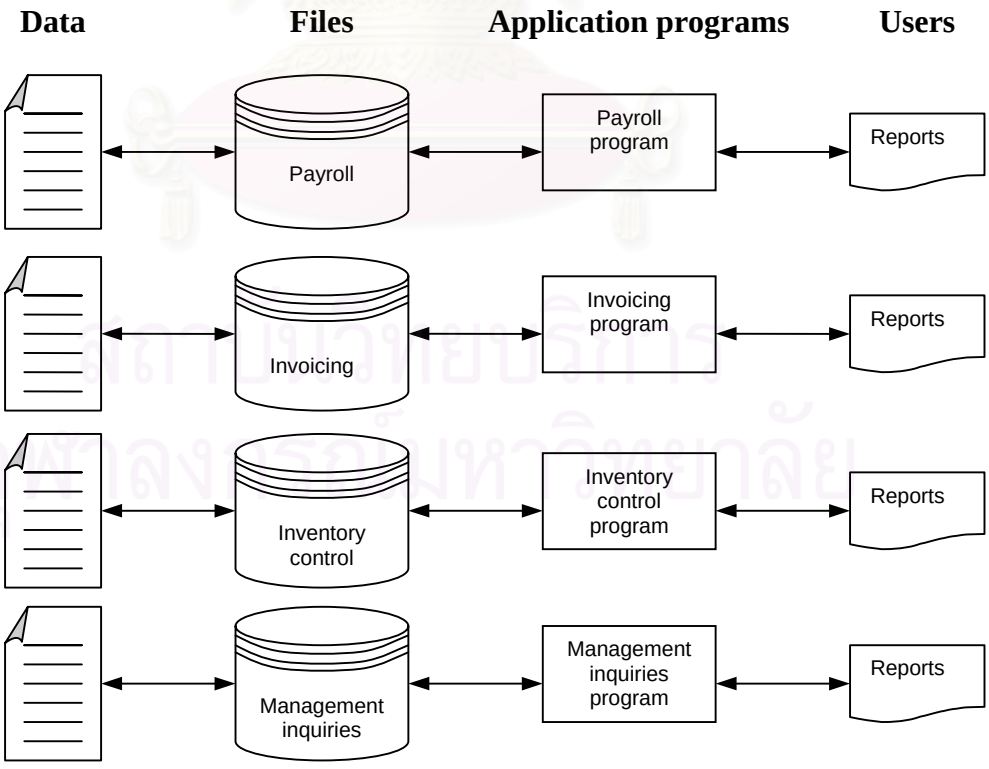


Figure 2.2 Traditional data management approach

The advantage of this approach is easy, cheap and low vulnerability to data error (because only one file is accessed and used at a time). It may be suitable for individuals to simply store a list of data.

However, this approach has many limitations. In fact, the business data are often related. If use the traditional approach, one or more data files are created and used for every application. In the meanwhile, the same data are used in several different files by different applications. This will cause the data duplication (redundancy), the files are independent and are not integrated. Moreover, the users may be required for training on each program thus they can use each application programs

Advantage of traditional approach	**Disadvantage of traditional approach**
Easy	Data duplication
Low cost	No integration
Low vulnerability to data error	Data dependence
May be suitable for individuals or small group of people	User need training for each programme

2.2.2.2 Database approach

As the data used by businesses are often related, database and database management was developed to store and manage the data in an easy and efficient way.

A database approach is that all related data are shared by multiple application programs. Each application uses a collection of data files that are related together in the database.

The example for DBMS can be shown as figure 2.3

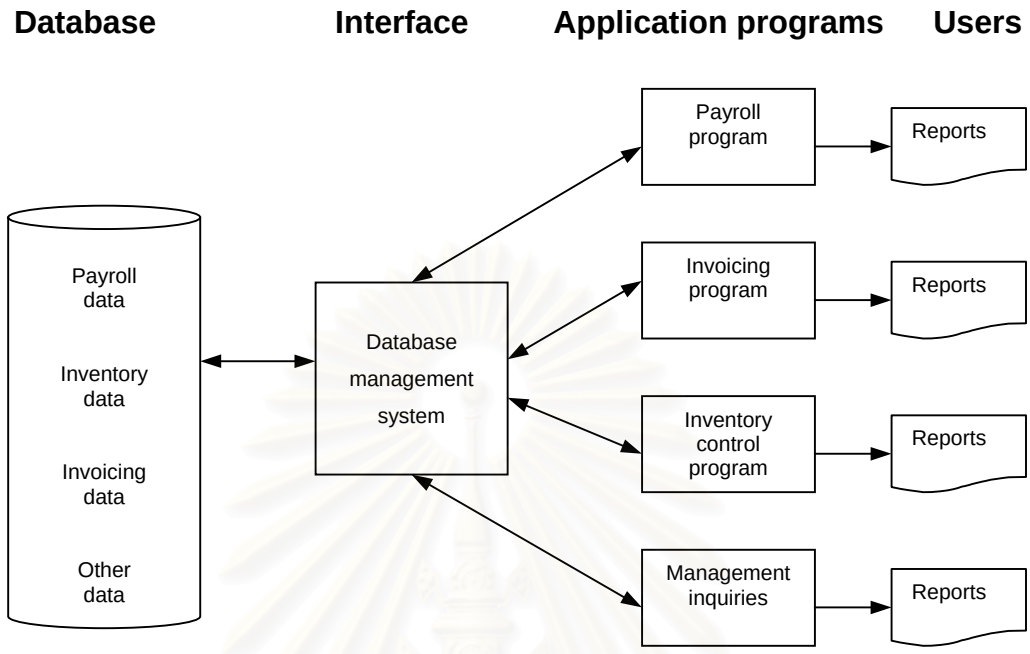


Figure 2.3 DBMS sample

2.2.2.3 What is database management system (DBMS)

DBMS is software that organizes, catalogs, stores, retrieves, and maintains data in a database, Henry (1994).

If we have a database, we only need purchase or write one DBMS which needs to be maintained, documented, or learned by users. If we build a common database, all users can share all data files, related data among files.

All files and data are preserved through a security system. Duplication, no integration and data dependence can be greatly reduced.

However, DBMS still have disadvantages. Usually database and DBMS can become quite complex and requires specialized designers and programmers to implement database. Also, when the DBMS fails to work or have limited capability, either no one can access the data or the users are rustically to the

capability. Previously DBMS was very expensive, no become cheaper if compared to its capability and price.

In long run, the advantage of DBMS outweigh the disadvantage. It is the general trend, Lucas, Jr. (1994).

Advantage of DBMS	Disadvantage of DBMS
Data redundancy reduced	Highly complex and require specialized designers
Data integrity improved	Relatively expensive
Data security improved	Vulnerable to hardware failure
Data consistency maintained	
Easy data access and use	
Data are dependent of the application programs	
In long run, advantage overweigh disadvantage	

2.2.2.4 S.E. Hutchison & S.C. Sawyer, “Computer and Information Systems”

Database is large group of stored, interrogated (cross-referenced) data that can be retrieved and manipulated to produce information, Database Management System (DBMS) can allow users to create, maintain, and manipulate an integrated base of business data to produce relevant management information. A DBMS represents the interface between the user and the computer’s operating system and database, allows storage of large amounts of data that can be easily cross-indexed, retrieved, and manipulated to produce information for management reports.

A DBMS can minimize data redundancy, allow easy file updating, maximise data integrating and independence, simplify maintenance, increase user productivity and data security, and standardize data definitions.

However, DBMS requires complex planning and expertise to create and maintain, moreover, a through framework of policies and procedures must be established to ensure copies of the database files are made on a regular basis, to prevent the loss of the current version of the database file.

2.3 Client / Server Architecture

The most probably common way to share devices, data and programs is through a local area network (LAN). The local area network is a network to connect computer systems and various devices that need to communicate with each other and that are grouped closely together, as in a single building or a campus.

LAN has four basic elements, the media (type of wire), the topology (layout of the network), the signaling method and the access method.

There are three major architectures for LANs, namely ring, star and bus. It can be shown as figure 2.4

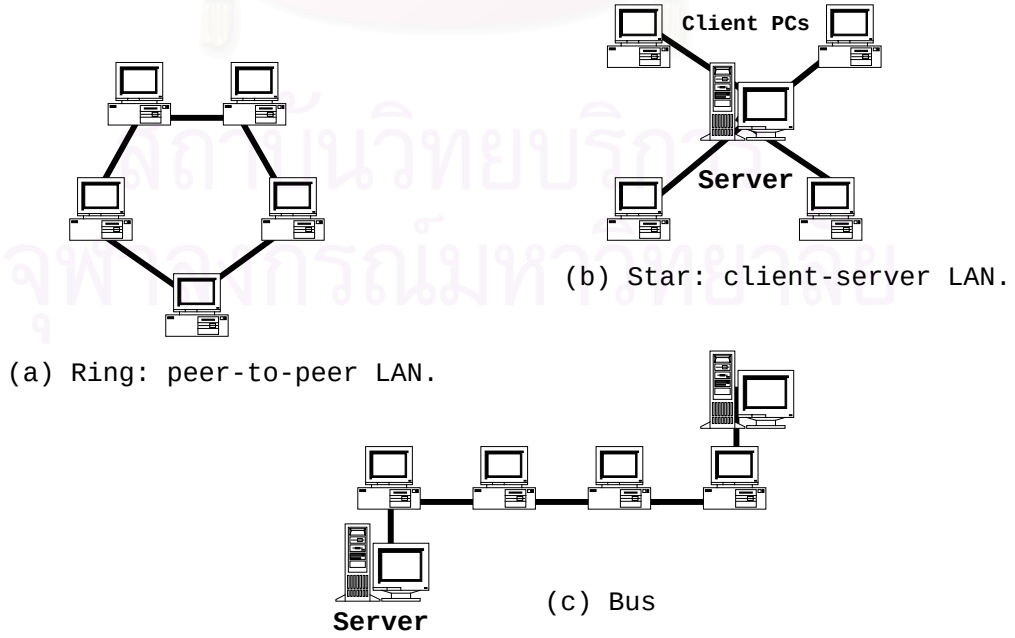


Figure 2.4 Major architecture for LAN: ring, star and bus

The client/server architecture is probably most favorable and widely applied. This architecture has changed the way people work in an organization. A client is computer (PC or workstation, etc…) which is linked to network and used to access shared network resources. A server is a machine which is used to server the clients (PC or workstation, etc…).

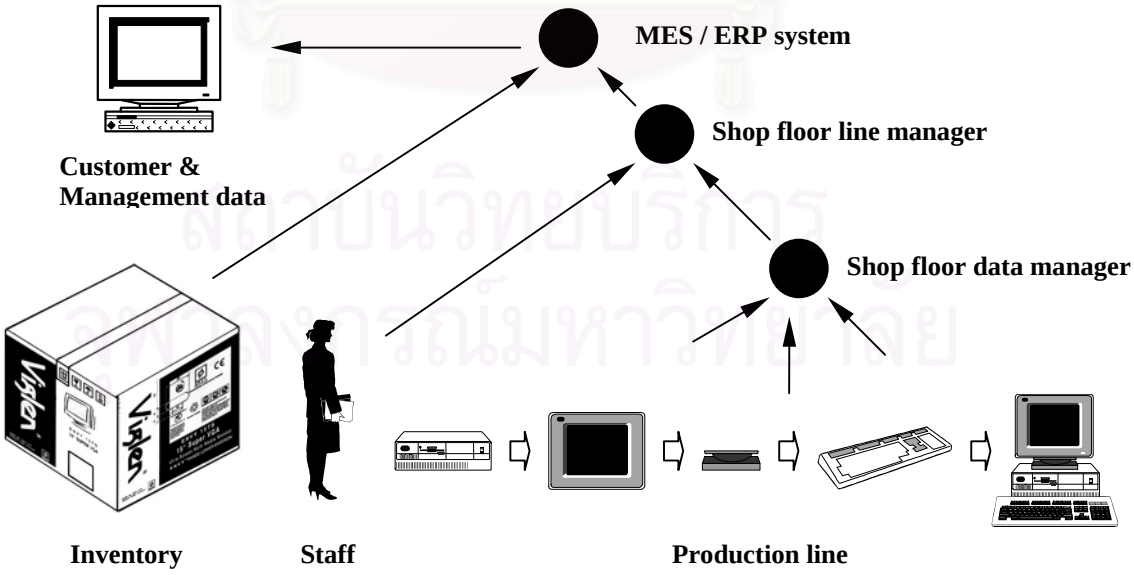
A database server can provide a large database, client PC can access the database from the server.

The benefits of the client/server architecture are,

1) Sharing. The client, usually a PC, can share more expensive devices (the servers).
2) Maximizing the utilization of computer resources.

If require; the LAN can be extended to an enterprise wide client/server architecture. Through architecture, all authorized users can access to corporate data, applications, servers, e-mail, and real-time flows of data. In brief, an organization can, maximize the value of information by increasing its availability.

One sample of client/server architecture are shown as figure 2.5



Source: Modified from "Applying MES technology in PCB Assembly", on "Electronics Engineer", September 2000.

Figure 2.5 Apply management executive system in PCB assembly.

Holford (1999) raised an example in PCB assembly. Many PCB shops do not use shop floor control technology beyond what is available in limited form in the shop floor module of an MRP/ERP system. But some, often those who do both PCB and box build assembly in the same facility, have begun to extend the reach of MES to embrace production management on SMT lines. The creation of routings required to support MES sharpens discipline in the management of the line. And while they do not track every board, tracking “milestone” boards gives plant management greater visibility into the overall process flow among all operations. Management can access that information at their fingertips at system monitors, helping them gauge the status of the board run, and more accurately anticipate when the line will be available for a new run.

2.4 System building and its alternatives

According to Laudon (1998), some organizations “are designing and building some applications entirely on their own, they are also turning to rapid application development tools, software packages, external consultants and other strategies to reduce time, cost, and inefficiency.

Generally, we have four methods to develop an information system or part of it,

2.4.1 System life cycle. It is suitable for complex medium or large system projects. The life cycle has six stages: project definition, system study, design, programming, installation and post implement.

It is a very formal approach to build system. The process is sequential and is reviewed step by step therefore the quality can be ensured. It is nowadays used for building large transaction processing system (TPS) and management information system (MIS).

However, it still has limitations. It is resource intensive become it need a lot of time to gather information, prepare specification, sign off document, etc… It is also inflexible and inhibits changes. Therefore it is not suitable for decision oriented applications.

Advantage	Disadvantage
Formal approach. Can meet highly structured and well defined requirement. Tight control on developing process.	Very resource intensive. Inflexible and inhibits change. Not suitable for decision-oriented application.

Suitable: large systems

Not suitable: small desktop system

2.4.2 Prototyping

Prototyping is a working version of an information system or part of it. This method is very useful when the requirement is uncertainly. It is also valuable for the end-user interface as user needs and behavior are not entirely predictably. Also, this method encourages end-user involvement.

However, prototyping is not suitable for large system which requires careful requirement analysis, structured design methodology and detailed document.

Advantage	Disadvantage
Flexible Fast End user friendly	Limited to smaller application. Limited to decision oriented application.

Suitable: large systems

Not suitable: small desktop system

2.4.3 Application software package

Application software package is a set of prewriting, preceded application software programs that are commercially available for sales or lease.

As many organization have common information requirement such as inventory control, attendance record, etc…, packages become much popular. As package vendor already developed most portion of the system, therefore the development of a new system can be faster and cost should be reduced. Moreover, the resources needed to develop a new system can be reduced as most common requirement already was fixed in advance.

However, package is still a type of commercial software. It can not or is difficult to achieve very high level technical quality. Further more, as the package usually concentrate on common requirement, therefore it is not customer tailor made. In order to meet unique requirement, a minor modification may be required. However, the source code change is not permitted.

Advantage	**Disadvantage**
Save resource. Quickly develop new system. Reliable.	May not meet unique requirement. Can't change customer source code.

Suitable: common requirement system such as inventory control

Not suitable: high level technical system

2.4.4 End user development

This approach is that end user develop system with assistance from technical specialist. Special fourth-generation software tools can support this

approach. End user can create many applications by themselves and the speed is usually faster than traditional system.

This can improve requirement determination as the end user develop their own system, they fully involve the system development and the output should be satisfied. Further more, the user can control the system development process and reduce the possible schedule delay.

However, this method has some risks. As the system is own developed with limited technical specialist support, it may lack quality assurance standard and control. The fourth generation tools is relatively inefficient, when large files are used, the system will become slow.

Advantage	**Disadvantage**
Vendor involvement and satisfaction. Improve requirement decision. Easily control develop process Flexible.	Quality may not be ensured. Capability limitation.

Suitable: small to medium system development

Not suitable: large system, high quality system

2.4.5 Outsourcing

Sometimes the organization does not want to use internal resource to build system, they can require outside vendor which specializes the system development to perform the job. As the information technology accounts for about halt of most large organization's capital expenditure, outsourcing becomes popular.

If apply appropriately, outsourcing can be a win win deal. In one hand, the organization can save cost but get demand service, on the other hand, the

outsourcing provider can benefit from economies of scale. In addition, most outsourcing provider can give good service quality, is flexible. The organization can also free human resource and financial capital.

However, as outsourcing will depends on the provider, if we can not appropriately selectly, we will lose control and are dependent on vendor's viability.

Advantage	**Disadvantage**
Cost saving	May lose control
Good service quality	Dependent on vendor
Flexible	Trade secrets may leak out
Save human resource	
Save capital	

Suitable: for those who can manage outsourcing well

Not suitable: for those very critical applications

2.4.6 In summary, several system methods can be applied depending on the situation. Each method has its pros and cons, therefore, each of them has its suitability and no suitable. This can be shown as table 2.1

Table 2.1 System building and its alternative

	Advantage	Disadvantage	Suitable	Not suitable
System life cycle	Formal approach Can meet highly structured and well defined requirement. Tight control on developing process.	Very resource intensive. Inflexible and inhibits change. Not suitable for decision-oriented application	Large system	Small desktop system
Prototyping	Flexible Fast End user friendly	Limited to smaller application. Limited to decision oriented application.	Large system	Small desktop system
Application software package	Save resource. Quickly develop new system. Reliable.	May not meet unique requirement. Can't change customer source code.	Common requirement system such as inventory control.	High level technical system.
End user development	Vendor involvement and satisfaction. Improve requirement decision. Easily control develop process. Flexible	Quality may not be ensured. Capability limitation.	Small to medium system development.	Large system, high quality system.
Outsourcing	Cost saving Good service quality Flexible Save human resource Save capital	May lose control Dependent on vendor Trade secrets may leak out.	For those who can manage outsourcing well.	For those very critical applications

2.5 Shop floor information system applications

2.5.1 Shine Wave Corp., "shop floor information system" (1998)

Many shop-floor company encountered the problem on the shop-floor information timely processed and accessed by management and supporting staff. To overcome this, some companies introduced so-called "Shop Floor Information System" (SFIS). The SFIS can receive and process shop-floor output and quality information along the manufacturing process and can also be integrated with MPR and CRP to perform other tasks, based on the demand.

The benefits for such a system are,

1) Real time.
2) Paperless.

3) Tracking the history data.
4) Monitoring the production progress
5) The database is open to authorized users therefore the information can be necessarily shared.

2.5.2 www.lighthouse-sys.co.uk

Some companies applied “Manufacturing Execution Systems”. Shopfloor-online is one of the application. It is the link between MRP/ERP planning system. This system can help on followings,

1) Reduce manufacturing cycle time.
2) Reduce data entry time.
3) Reduce work in process.
4) Reduce lead times.
5) Improve product quality.
6) Eliminate paperwork.

The big advantage for this system is “sharing information”.

Shopfloor-online is able to bring all the manufacturing information together and present it in an appropriate form to all those that need it, from operators on the shopfloor, to supervisors, production people and quality people. No longer will you suffer from information which is difficult to get hold of, late, and often inaccurate.

2.5.3 www.sarbrook.com

An organization need to employ to integrate the source and distribution of information. This information must be reliable, up-to-date and readily accessible.

Information is the lifeblood of an organization. How to manage the information may be the difference between success and failure.

WinSPEX system is a document control system. This system can identify and gain a competitive advantage, increase efficiency and performance, control cost and profitability, and maintain control and accountability.

Benefits of using WinSPEX™ are as below,

1) Real time access to the latest information.
2) Workgroup collaboration.
3) Reduced costs (materials, time).
4) Information control and standardization.
5) Reduced time to market.
6) Increased productivity.
7) Accurate and most current information.
8) Compliance with laws and regulations.

Due to the ability to access and extract detailed specification data from their WinSPEX system, an international manufacturer of health, beauty care, and food products was able to easily and quickly analyze their existing corrugated materials for potential cost savings. As a result, over $450,00 in savings were projected in materials purchase costs for year 2002.

2.5.4 www.advantech.com.tw

Advantech Co., Ltd., a Taiwan company implemented a shopfloor information system in year 2000 and make gains.

As each individual product enters the Advantech manufacturing process (such as a SBC), it is given a unique Bar Code label that allows the product to be scanned with a bar code scanner and information to be continuously gathered on that particular product. At every stage in the manufacturing process, this serial number is scanned in and automatically input into the Shop Floor Information System. This SFIF seamlessly integrates into the entire manufacturing information system. From real time quality control, to packaging and shipping information, to RMA and warranty information, this serial number can be accurately traced and the relevant information that is needed can be easily gathered. Some advantages of the SFIS are shown below.

1) Extremely easy to use.
2) Efficient digital record for instant product history access.
3) Improved WIP tracking and control.
4) Built-in QC features (checks and verifications).
5) Easier/faster production line changeover time.
6) More efficient RMA control (i.e. 2 year warranty).

CHAPTER 3

BACKGROUND AND PROBLEM ANALYSIS

In this chapter, a company was selected as a case study for this thesis. Company background and problem related to shop floor information will be identified. The problems will be analyzed.

3.1 Background

3.1.1 Company profile

In this research, I take a monitor and computer manufacturing company as a case study.

TTL was established in 1990. Its main product is colour monitor, all-in-one system (computer and monitor combination, like Internet PC but have additional function such as telephone) and colour television chassis. It produces colour monitor for big OEM customers and process all-in-one system for a big IT company, it also produces colour television chassis for a England company. The production has four sections,

1) Auto-Insertion section.
2) Chassis section.
3) Final assembly section.
4) Plastics moulding injection section.

The Auto-Insertion and Plastics moulding injection section work 24 hours per day with 2 shifts. The chassis section and final assembly section usually work 9 hours per day, but work 24 hours per day with 2 shifts in peak business season.

The total employees in TTL are 2,400 persons.

3.1.2 Product description

The factory produce monitor, all-in-one system and colour television chassis.

1) Monitor is the video display terminal of computer.
2) All-in-one system is the combination of computer and monitor. It is a type of Internet computer with telephone function.
3) Colour television chassis is one part of colour television.

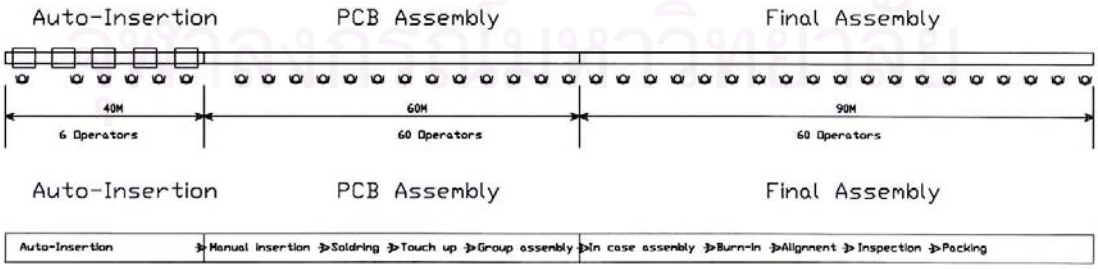
In terms of customers, all of them are export market. Customers are very strict on Front of Screen performance, safety, reliability and cosmetic issues.

The product is very price sensitive. Therefore, cost control is very important for the manufactures.

The product must be guaranteed in one year after product delivered to OEM customer. OEM customer takes responsibility on after-sale-service. If the product failed within guarantee period, a very high compensation will be charged to the manufacturer.

3.1.3 Process description

The production process consists of 3 main steps a shown in figure 3.1



Line	:	190 meter long
Operator	:	More than 120 people
Instructions	:	More than 300 pages for one model

Figure 3.1 Manufacturing flow in a PC/Monitor factory

3.1.3.1 Auto-Insertion process is to insert component into PWB by auto insertion machine. Usually one line consists of 5 machine with total 40 meter long, 6 operators are required.

3.1.3.2 PCB assembly process is to complete component insertion then pass solder bath for soldering. After that a special touch up will be applied to big size component. The last step is to test and assemble all boards together to form a chassis. One line is 60 metre long, 60 operators are required.

3.1.3.3 Final assembly is the process to transform the chassis and other parts to be complete set. It consists of in case assembly, burn in, alignment, inspection and packing. One line is 90 metre long, 60 operator is required.

All the process will be directed by manufacturing instruction, namely Works Instruction (WI), Inspection Instruction (II), Process change Notice (PCN), Alignment Software (Align S/W) and Concession Notes.

3.2 Problem analysis: Existing shopfloor information handling method.

3.2.1 Existing shopfloor information method

Shopfloor information has many types. In this thesis, we will only consider manufacturing document and shopfloor production output information and quality information.

Current document control flow is shown as figure 3.2

Manufacturing Document Control Flow

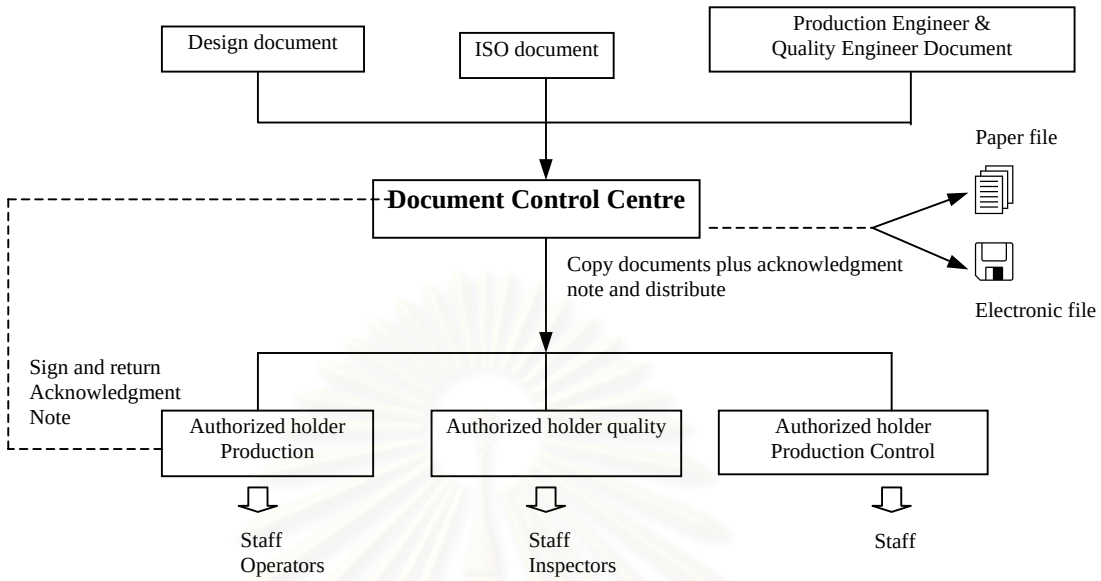


Figure 3.2 The manufacturing document control flow

The design document, ISO document and production engineer/Quality engineer document will distribute to document control centre. Document control centre will distribute concerning documents to each department per its standard operating procedure. After each department received the document and confirm its completeness, the acknowledgment note is signed and returned to document control centre. Then each department will distribute the documents to concerning operators or staffs.

During the production, each production line will perform daily record and repair report then quality department will perform inspection report. Afterwards, all these records will be summarized to production report and quality report. They will be reported in daily production meeting. Then production or supporting department will take corrective action accordingly. This flow is shown as figure 3.3

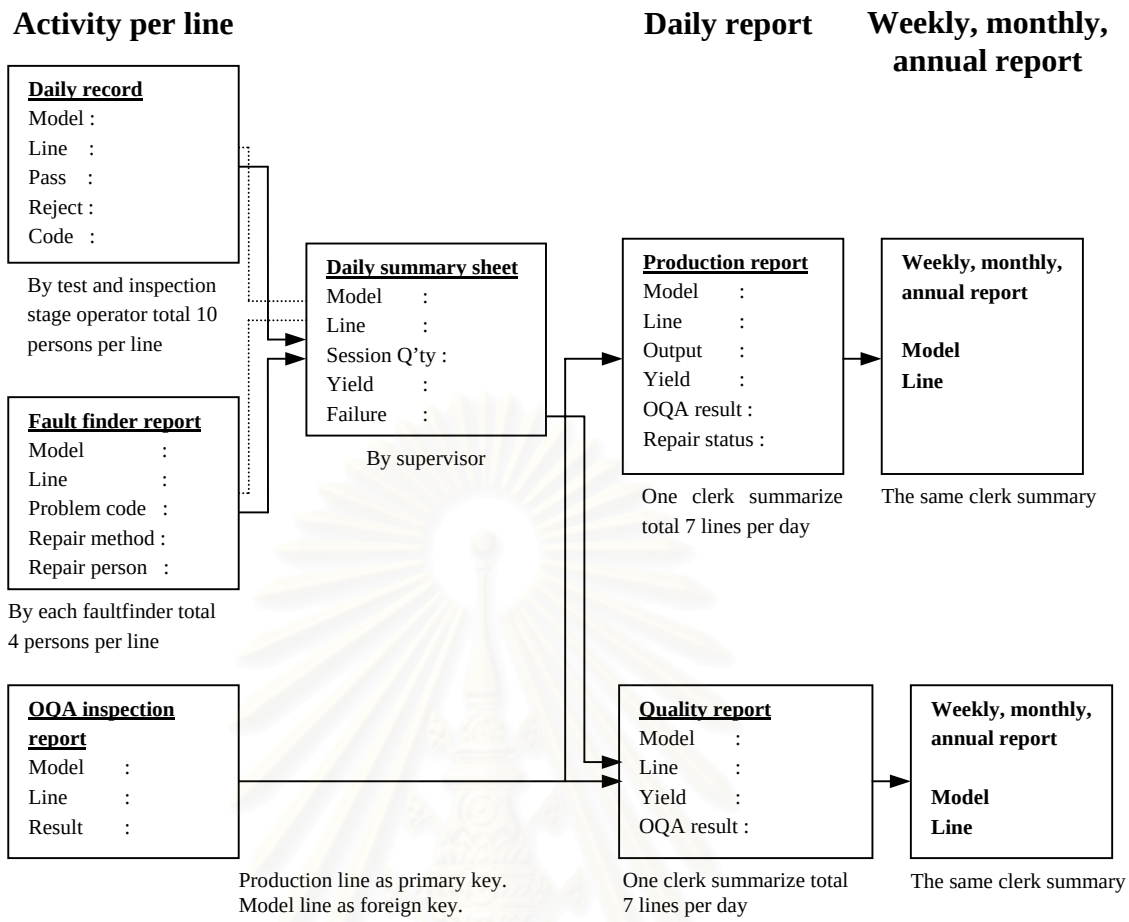


Figure 3.3 Current shop floor information system

3.2.2 The related regulation for the shop floor information.

3.2.2.1 Each department will only has one set of document except production department. For production department, each production line will has one sets of documents regardless of day shift or night shift. In case more document is required, then production department will require them from document control centre.

3.2.2.2 For shopfloor information, each line will assign certain clerk to collect data from the shopfloor. Then the clerk will send the data to production centre and quality department to summarize them and come out a report.

3.2.3 Advantage and disadvantage of existing method.

3.2.3.1 Advantage

1) The route is very clear.
2) Central controlled document can make certain that each area centre contains the latest version of document.

3.2.3.2 Disadvantage

1) Only experienced staff can handle this job.
2) As the data was manually recorded and handled by many process, the report may be error because of wrong data.
3) The data is not real time.

3.2.4 Problem analysis

On current document control system, we can see there are no linkage between area centre and shopfloor operators. As a result, shopfloor may hold old version document or lack appropriate document. For example, document control centre already issued the document such as PCN to production department, but production manager may not immediately pass it to shopfloor operator.

On shopfloor information side, as more people involved, the data may have error. And more seriously, as the data system is not real time, the corrective action may be delayed.

Above problems will lead to following results,

1) Incorrect document or incomplete document in shop floor may lead to wrong product thus rework and customer complaints occur.
2) Manager and support function can not get real time information therefore can not take prompt action.

3) More manpower to write the data, collect data and summarize the report, it is wasteful. Moreover, some errors may occur during the data writing, collecting and processing.
4) Different departments may collect and process similar data, therefore the repeat job occurs and it is no value added.
5) Late action because the shop floor date is not real time.

The problems and results can be illustrated as figure 3.4

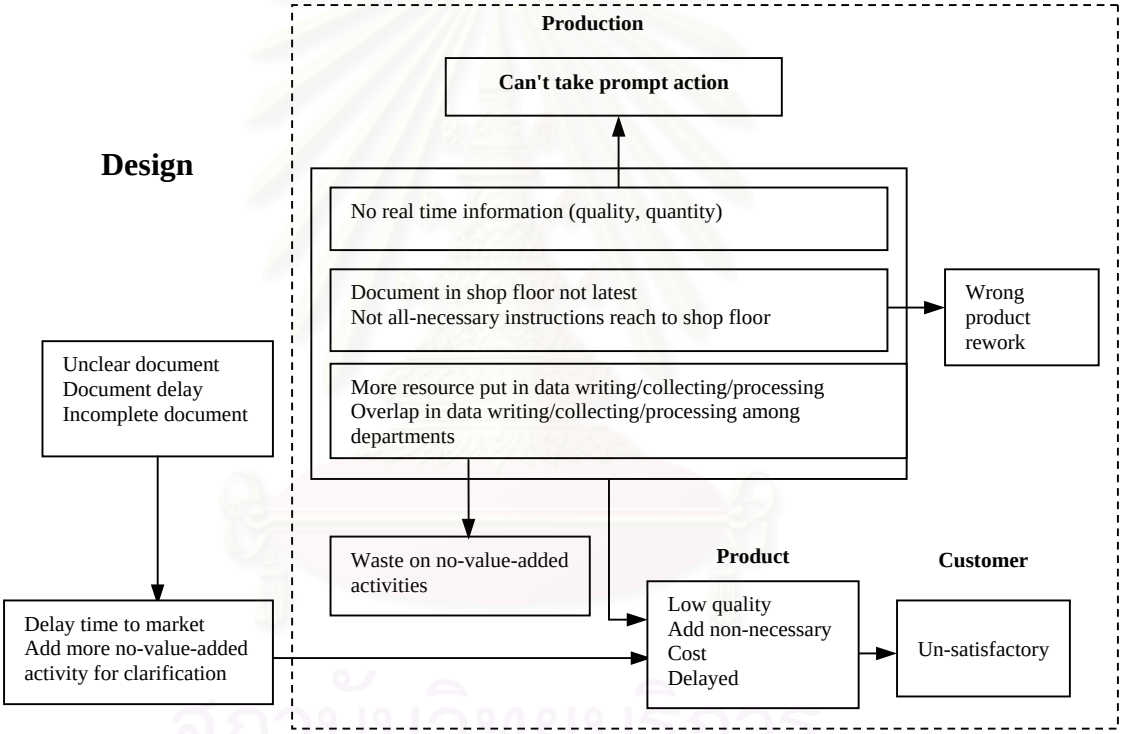


Figure 3.4 Problem and its affects from current system

3.3 Review of current system

3.3.1 Document in shop floor

The document control process is that headquarter R&D issue controlled document through R&D's document control centre to overseas manufacturing factories document control centre.

After production engineer and quality engineer study these document, they will issue works instruction, inspection instruction and process change notice to shop floor. Shop floor performs the job based on these manufacturing instructions. As each production line have over 100 operators and conveyor limitation, all manufacturing instructions are hanged in front of them in a paper format, not on display terminal. All instructions are distributed along 190 metre long production line. If incorrect documents are used in shop floor, the wrong product will be produced and is very difficult to control.

3.3.2 Shop floor information

On the whole process, there may usually need over 100 operators. Key manufacturing information such as pass/reject, reject reason, repair data, output quantity will be recorded manually in the process. For example, production supervisor will record the output quantity, pass/reject rate, repair technician will record repair data, and quality engineer record quality data. All these data will be collected by quality data clerk and production clerk who will summarize the data and distribute the report to concerned people. The whole process may take minimum 1 day. As the data is not the real time, therefore, the correct action is delay as the information is already one day behind. Also, as the data are recorded by hand writing, some records are not clear to read, some records are not in standard format therefore difficult to process.

Moreover, the data reliability depends on whether they are recorded. If the defects are not recorded the reporting quality data is biased.

3.3.3 Loss caused by above problems.

In 1999 TTL has a overall 60 million Baht (about 1.5 million USD) profit. However, TTL suffered a 22.2 millions Baht (about 500,000 USD) loss and also cause negative image from some customers because of shop floor information

handling problems. They can be separated into two categories: Tangible loss and in-tangible loss.

1) Tangible loss

In house rework	: 1 million Baht
Air flight to	
Catch delivery	: 6 millions Baht
Call back container	: 0.2 millions Baht
Customer claim quality charge	: 15 millions Baht
Total	: 22.2 millions Baht

2). In-tangible loss

Customer complaints and un-satisfactories from some important customers.

CHAPTER 4

APPLYING ON LINE SHOP FLOOR INFORMATION SYSTEM

In this chapter, “On line shop floor information system” is developed. The system consists of “shop floor document control system” and “shop floor information system”. Then the implementation will be discussed.

4.1 On line shop floor information system outline

The on line shop floor information system can be illustrated as figure 4.1

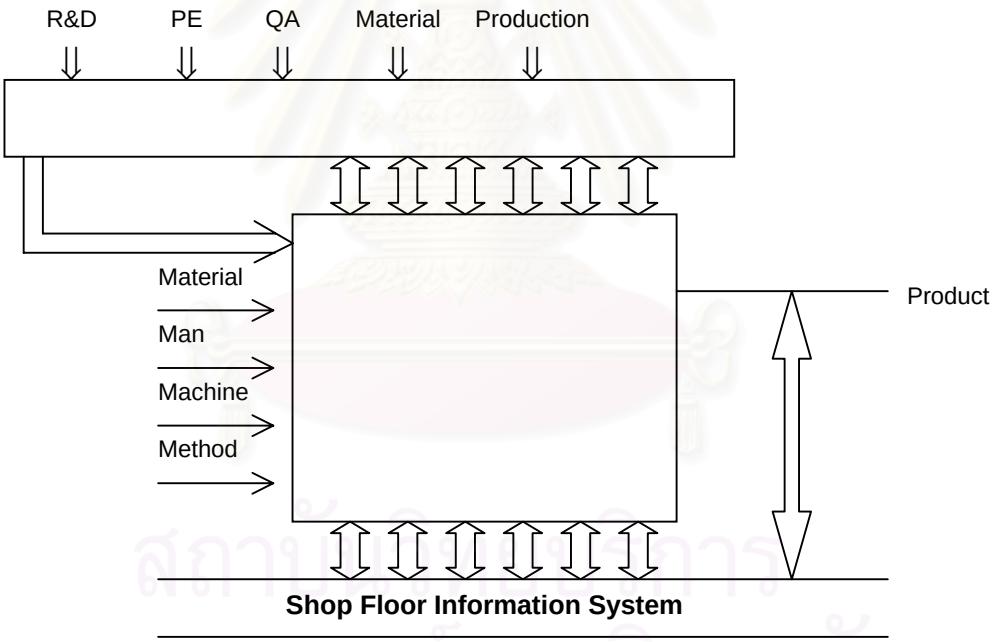


Figure 4.1 Structure of on line shop floor information system

The system consists of shop floor document control system and shop floor information system. Shop floor document control system can ensure right operator can have right document whole shop floor information system can ensure right person can get real time information.

4.1.1 Shop floor document control system

A shop floor document control system provides data enquiring menu to shop floor and quality control person. Authorized end user can access the data then compare them against actual documents on hand. From the comparison, they can know how many documents should be applied and what is the latest revision. If they find some document is in the system but they do not have it on hand, then they will require it either from production manager or document control centre. Through this, the feedback loop will be closed can reduce mistakes caused by wrong documents.

For the system, we can consider either buy in a existing system or develop a new system on this.

The hardware, as TTL already have client/server architecture, therefore, we can utilize current server plus some terminal which can be accessed by shopfloor personnel to check the availability and the lasted version of documents.

The software, we can use dBase, Lotus or Access windows. As we already have Access Windows, we can use it to develop the system.

Shop floor document enquiry menu can be as figure 4.2

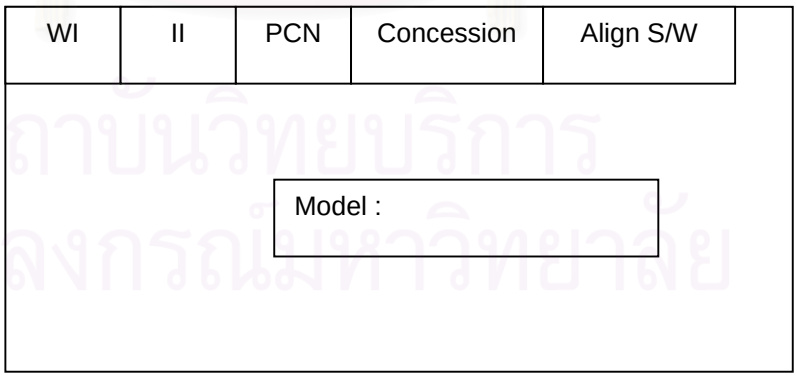


Figure 4.2 Proposed enquiry menu

When we would like to check the documents, we can select model name then click the items you want.

From this, the shopfloor operators can know the latest version of works instruction is being used, and any other special instructions are available.

Typically, five types of document are used in shop floor

1) Concession Notes	:	Deviation from BOM but waive for certain quantity of production.
2) Process Change Notice (PCN)	:	A memorandum issued to production and related department on process change. PCN is usually based on Engineering Change Notice, concession or general process improvement but authorized by production engineer.
3) Works Instruction (WI)	:	Works Instruction is a document issued by production engineer on how to perform the job in shopfloor.
4) Inspection Instruction (II)	:	Inspection Instruction is a document issued by quality engineer on how to inspect product.
5) Alignment Software (S/W)	:	Alignment S/W are software used in shopfloor. The version control is the key.

If above information can be accessed and double checked, then the shopfloor can know whether they use the correct documents.

Shopfloor and other departments can also access document menu to check other information.

Through this, we can have a tool to ensure shopfloor can get correct document.

The close-loop process is as figure 4.3

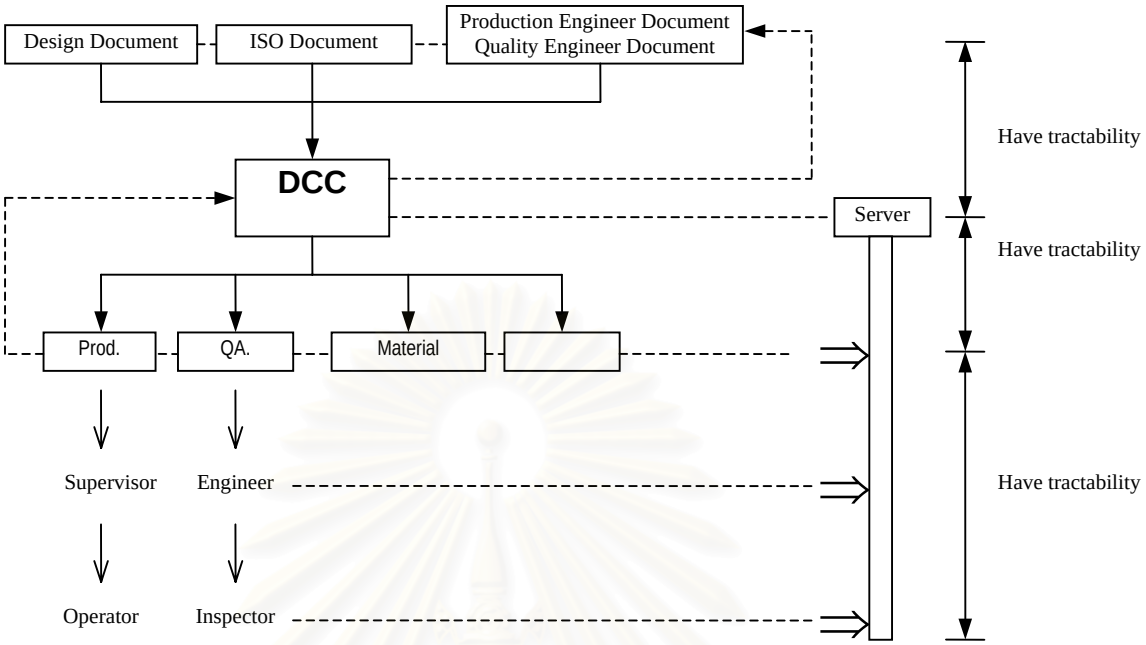


Figure 4.3 Close loop of document process

Through such kind of system, the shopfloor can access the data from document centre. The data flow is as shown on figure 4.4

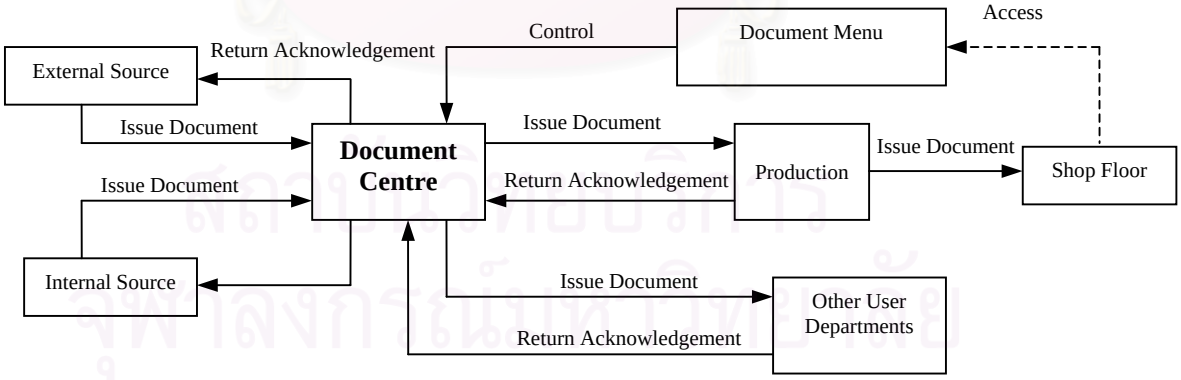


Figure 4.4 Data flow of shop floor document system

4.1.2 Shop floor information system

Typically in shopfloor, the quality, quantity information is very important for the operation management. For most companies, the current practice is

that several stations along the flow are selected and operator or QA people record the quantity they produced and how many passed, how many rejected and the code for the reject. Production people and quality people will collect these data, process them then issue to concerned people.

This will have following problems,

1) The response time is slow. The full process may take one day to reach to responsible people.
2) The data depends on manual record. This may have errors. Some records may be illegible.
3) More people involve in this and waste manpower.

In order to solve this problem, a so-called shopfloor information control system can be developed as shown on figure 4.5

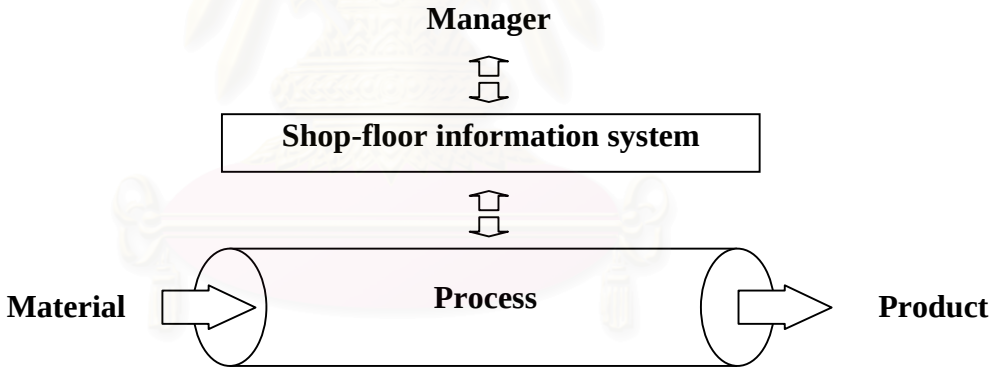


Figure 4.5 Shop floor information system

Through this system, the real time data can be obtained, and immediate corrective action can be taken where necessary.

If we review traditional shop floor information, we can see that the data was recorded by shopfloor operator and line QC. Then the reports are submitted to production office and QA office. Both departments then developed the data then report in the production meeting. Actions are then taken.

The flow is as figure 4.6 and the lead time is typically one day.

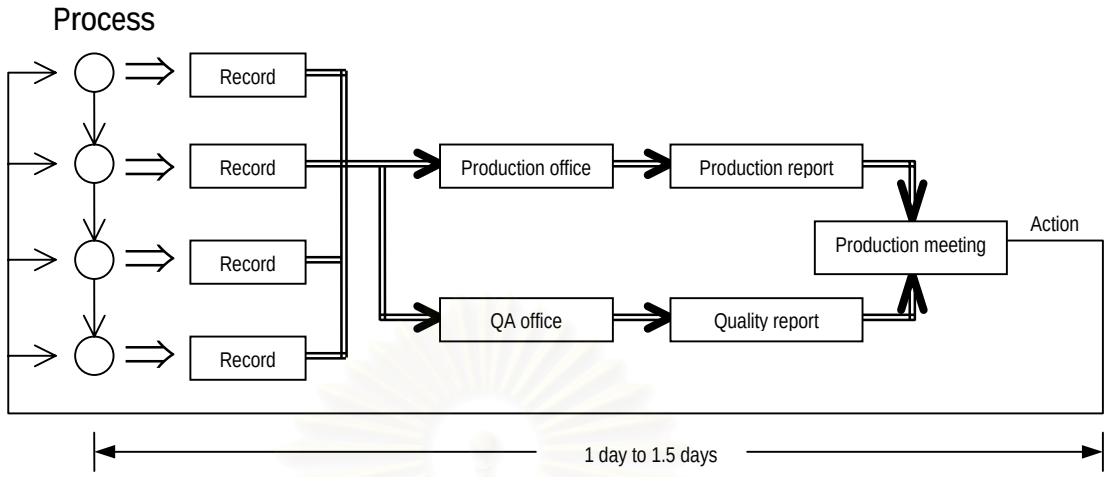


Figure 4.6 Review of traditional system

If we apply shop floor information system, we can use scanner to input information to central database server, and the information can be accessed and shared by all authorized users. The main structure can be shown as figure 4.7

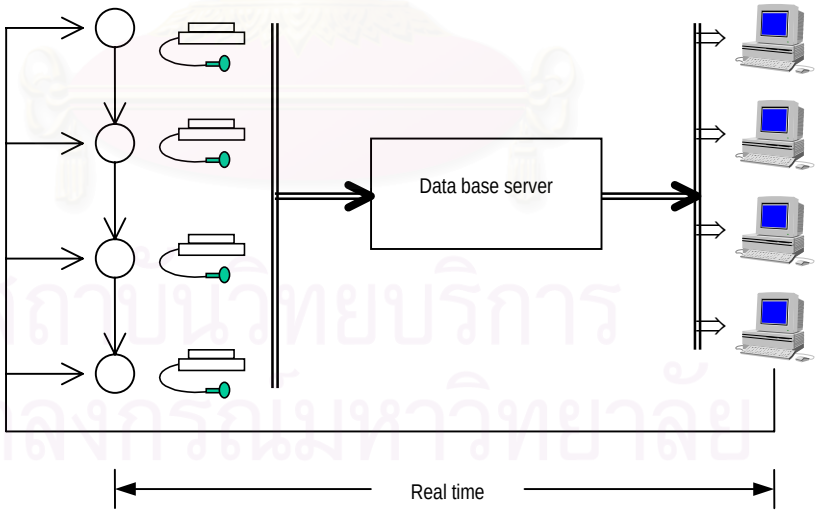


Figure 4.7 Main structure

If use this system, we can shorten the lead time from 1 - 1.5 days to real time (immediately).

The manufacturing information system can be expanded to include document control and shop floor information system.

MRP	C.R.P.	S.F.I.S.	On line Document Control
• Production planning • Inventory	• Industrial engineering	• Quality control	• Document control

In summary, the solution can be shown as below. Through Product Data Management (PDM), HQ R&D data can be transferred and accessed by overseas factories. Inside overseas factories, the shopfloor document control network and shopfloor information system can be integrated and the information loop is closed.

4.2 Development of the system

For above research, we selected an electronics manufacturing company in Thailand named TTL, to carry out this project.

TTL have employed 1800 persons (December 2000 figure). Main products are monitors and All-In-One (AIO, a combination of PC Base and monitor, it is a type of Internet PC). Total output in year 2000 is 2.6 million sets. Currently this company have 9 physical lines from Auto-insertion to PCB assembly then to final assembly lines. For AIO product, 2 additional lines will be set up late of year 2001. This company is an overseas company of a Taiwan leading manufacturing company.

Based on Curtis (2000), to design and construct a information systems, we need following steps,

1) Develop corporate policies and strategies.
2) Analyze business information requirements.
3) Design and construct system.
4) Implement the system.

These steps are shown as figure 4.8

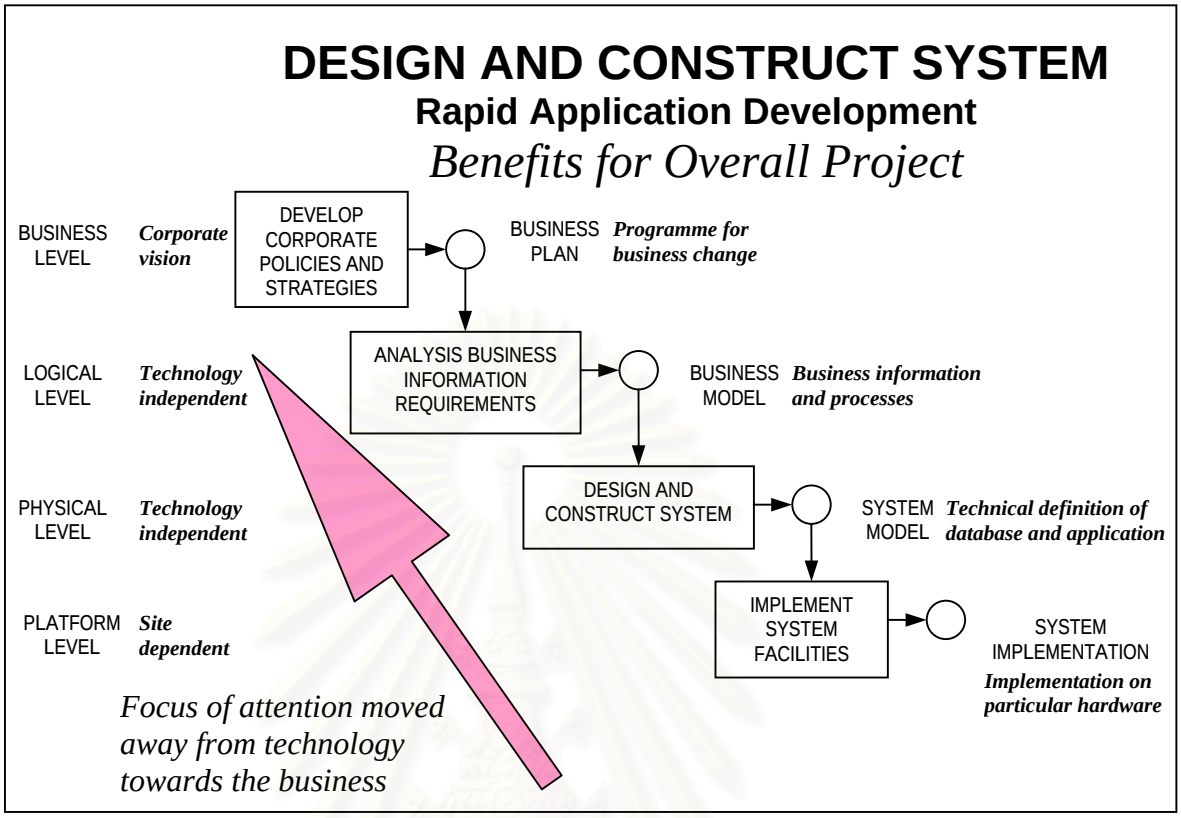


Figure 4.8 System construction

Above is for whole system level, however, we can apply the approach to develop the shopfloor document system and shopfloor information system.

After survey the current practice in the company, as well as survey the literature, I suggested that,

1) A task force needs to set up.
2) A client/server architecture can be considered.
3) New system must be capable to solve problem and must be put in trial before year March 2001. The system building is the key.

This is based

1) Currently TTL already have a Local Area Network (LAN) system. If we apply client/server concept, we can share existing facilities thus the time and cost can be saved.
2) Good existing practices in other companies. According to Marilyn M. Parker, many companies applied Local Area Network (LAN) and succeeded.

For SFIS, as other sister companies also have this similar requirement, we can co-operate on this project.

The task force for this project is as figure 4.9

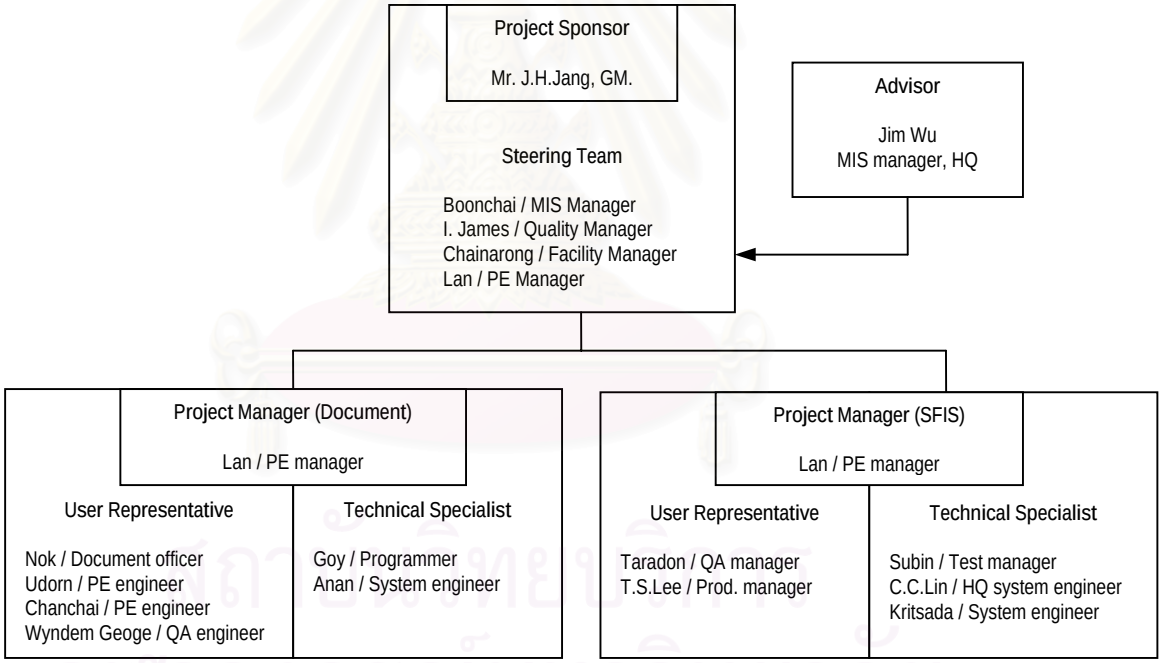


Figure 4.9 Task force structure

The task forces have two projects, one is document system, and the other is SFIS.

I am the project manager for both projects.

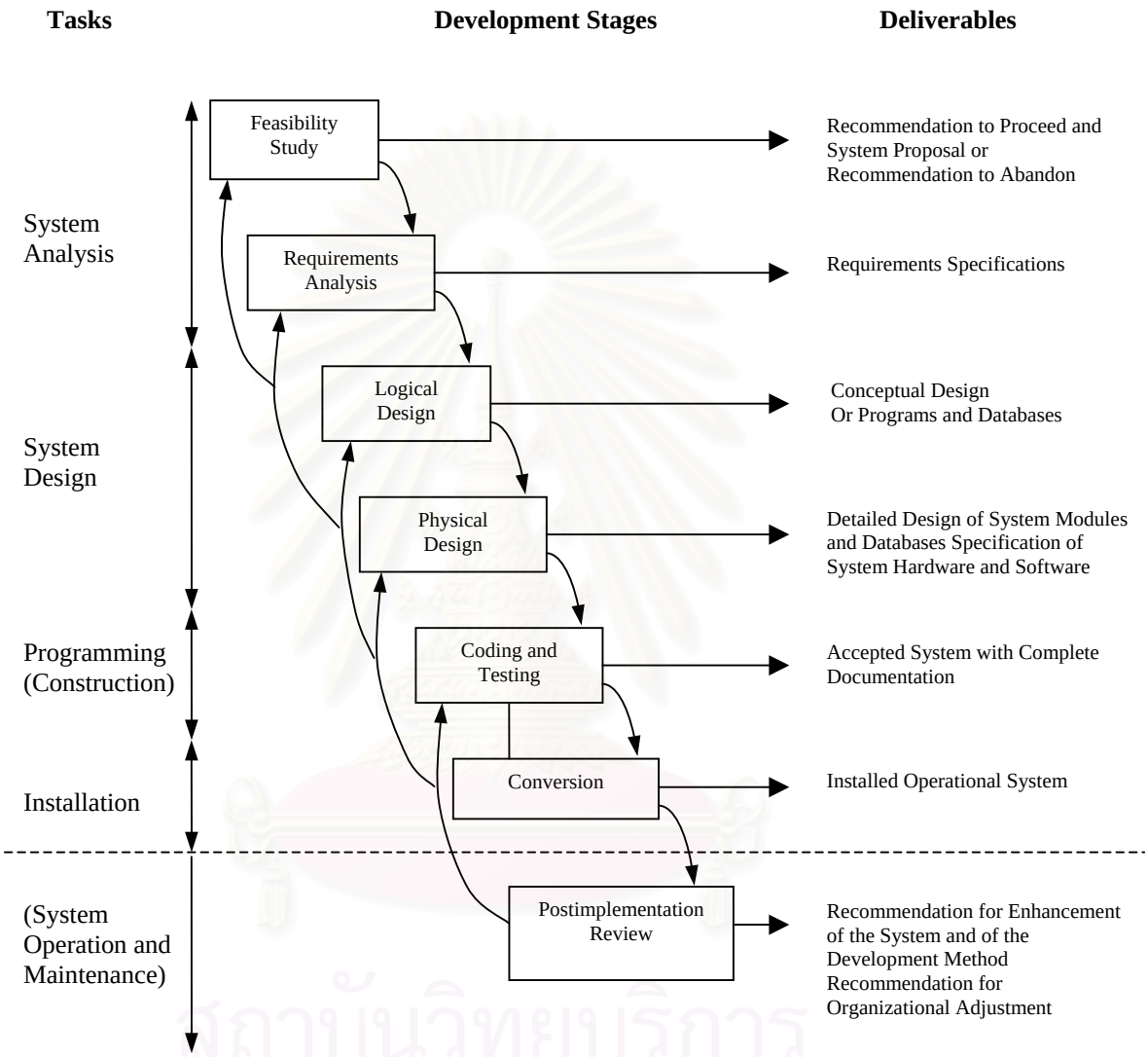
The project team's objectives as table 4.1

Table 4.1 Task force objectives

Role	Name	Objectives
Sponsor Steering team	J.H. Jang Boonchai I. James Lan Chainarong	• Support and authorize the projects. • Approve the project and commits the organization's resources. • Approve the project schedule, review the progress and take appropriate corrective actions. • Review the project, make decision for necessary modification.
Advisor	Jim Wu	
Project leader	Lan	• Advise & review on the system.
Project team (user representative)	Nok Udorn Chanchai Taradon T.S.Lee W. Geoge	• Lead the project team to raise and execute the project plan, co-ordinate among the team and report to steering team, set up training, report project progress. • Identify the user needs, implement new document control and train concerning department on application. • Also entry existing database into new system.
Project team (technical specialist)	Goy Anan Subin C.C.Lin Kritsada	• Based on the user needs, develop a programme and assist on the introduction and implementation. • Raise proposals on develop system by ourselves or buy in the system.

The budget for the project is 20 millions Baht.

System design can follow following procedure in figure 4.10



Source: Vladmir Zwass, "Foundations of Information Systems", MCGRAW HILL, International Edition, 1998.

Figure 4.10 System flow

As software development is critical in system design, the software quality should be secured. Software quality include effectiveness, usability, efficiency, reliability and maintainability as shown in figure 4.11

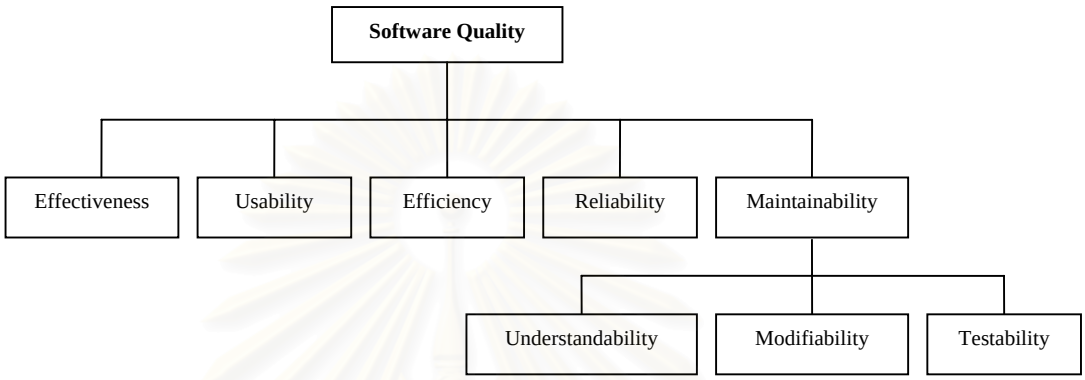


Figure 4.11 Software quality

In order to confirm the software quality, measure of information system should be established. It includes several items. Most importantly, user satisfaction is main objective. This can be shown in figure 4.12

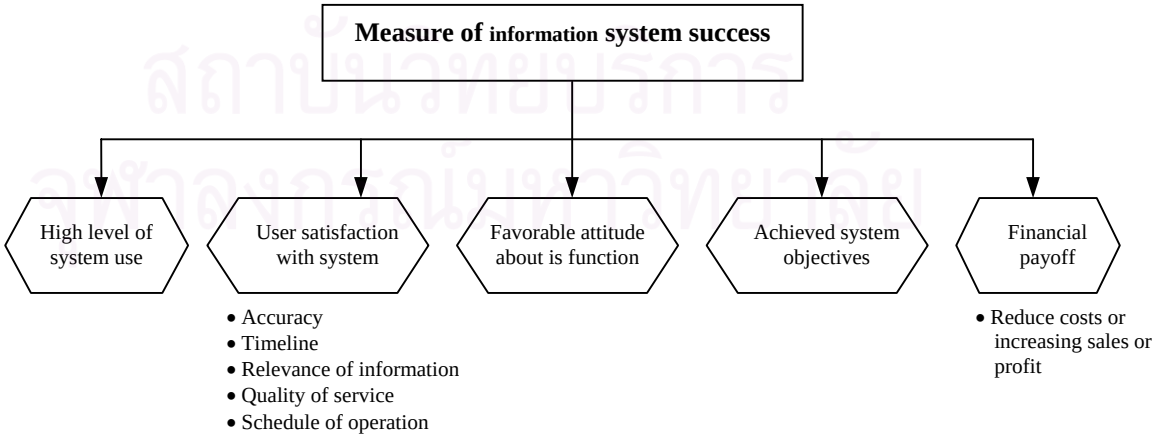


Figure 4.12 Measure of information system

Basically, the causes of implementing success and failure are as below.

1) The role of users in the implementation process.
2) The degree of management support for the implementation effort.
3) The level of complexity and risk of the implementation process.
4) The quality of management of the implementation process.

For these two projects, whatever way we develop the system (traditional systems life cycle, prototyping, applications software packages, end-user development and outsourcing), we use following approach to perform the system development and implement. See figure 4.13

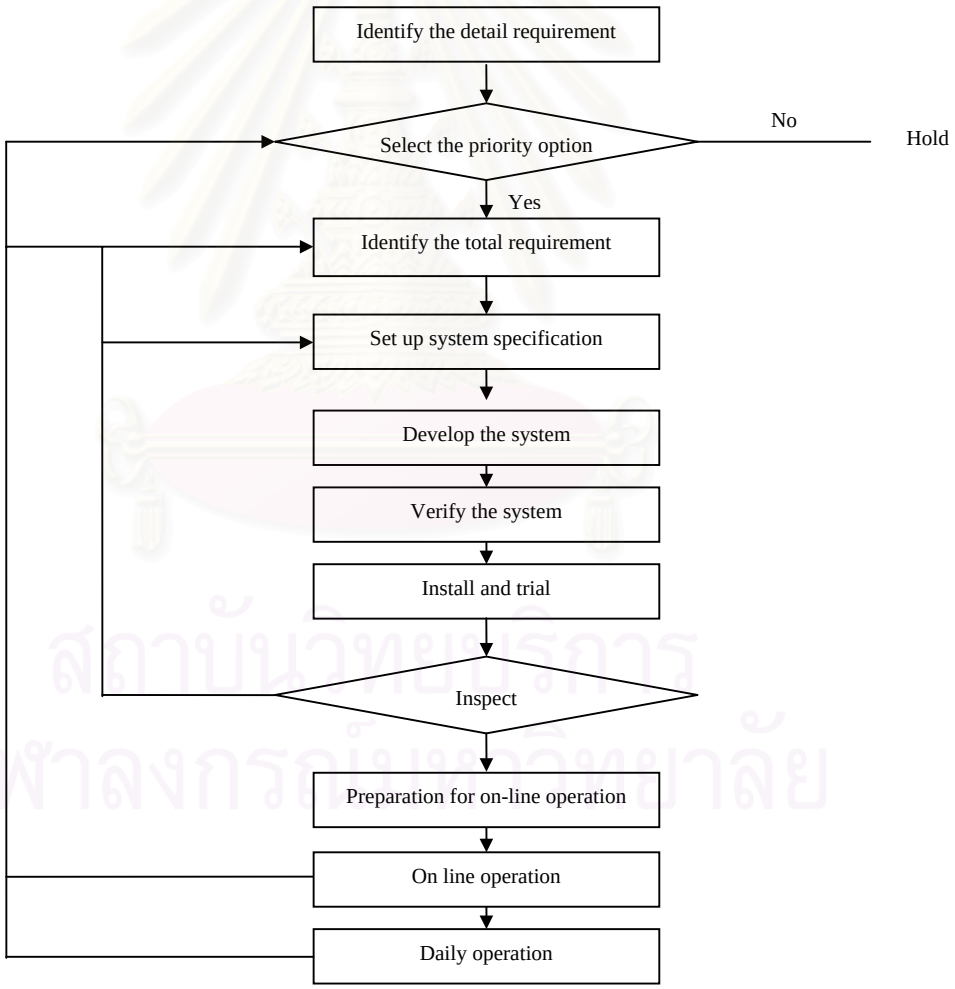


Figure 4.13 Flow of system development and implementation

The detail will be discussed in 4.3, 4.4 and 4.5.

4.3 Software selection

Software plays a crucial role in database management system. Currently in market, we can have “Access” from Microsoft, “FoxPro” from Microsoft, “Inter Base” from Borland, “Oracle” from Sun and “MS SQL server 2000” from Microsoft. Each of them have pros and cons, depending on application requirement. Generally we can summarize them as shown on table 4.2

Table 4.2 Database software comparison

Program	Vendor	Suitable Work	Conspicuous	Inferior	Development Tool	Suitable
Access	Microsoft	General database system	- Easy to use - Include in Microsoft Office - Compatible whit Microsoft Windows	- Not suitable for big database	- Visual Basic - Visual C++ - Itself	Office
Approach	Lotus/IBM	Same as Access	- Easy to use - Cheap	- Hard to find good manual - Some data can not export to Excel or Access	Itself	Office
FoxPro 6.0	Microsoft	General database system	- Flexible to develop - Support database on Internet (DNA) - Compatible whit Microsoft Windows - Cheap, can be complied to exe file	- Need developer skill	- Itself - Visual Basic - Visual C++	Database
Inter Base	Borland	General database system	Same as FoxPro	Old generation software		Database
Oracle	Sun	World wire network database system	- Standard network database system - Environment : WIN NT	- Developer and user need to train and support from vendor. - Expensive	Delphi Visual Basic Visual C++	Big system
MS SQL Server 2000	Microsoft	General Database System	- Compatible with Microsoft Windows - Environment : WIN NT	- Need developer skill such as SQL plus	- Itself - Visual Basic - Visual C++	Big system

4.4 Shopfloor document control system

4.4.1 Sutton (1996) developed a Enterprise Data Management System (EDMS) model as shown on figure 4.14

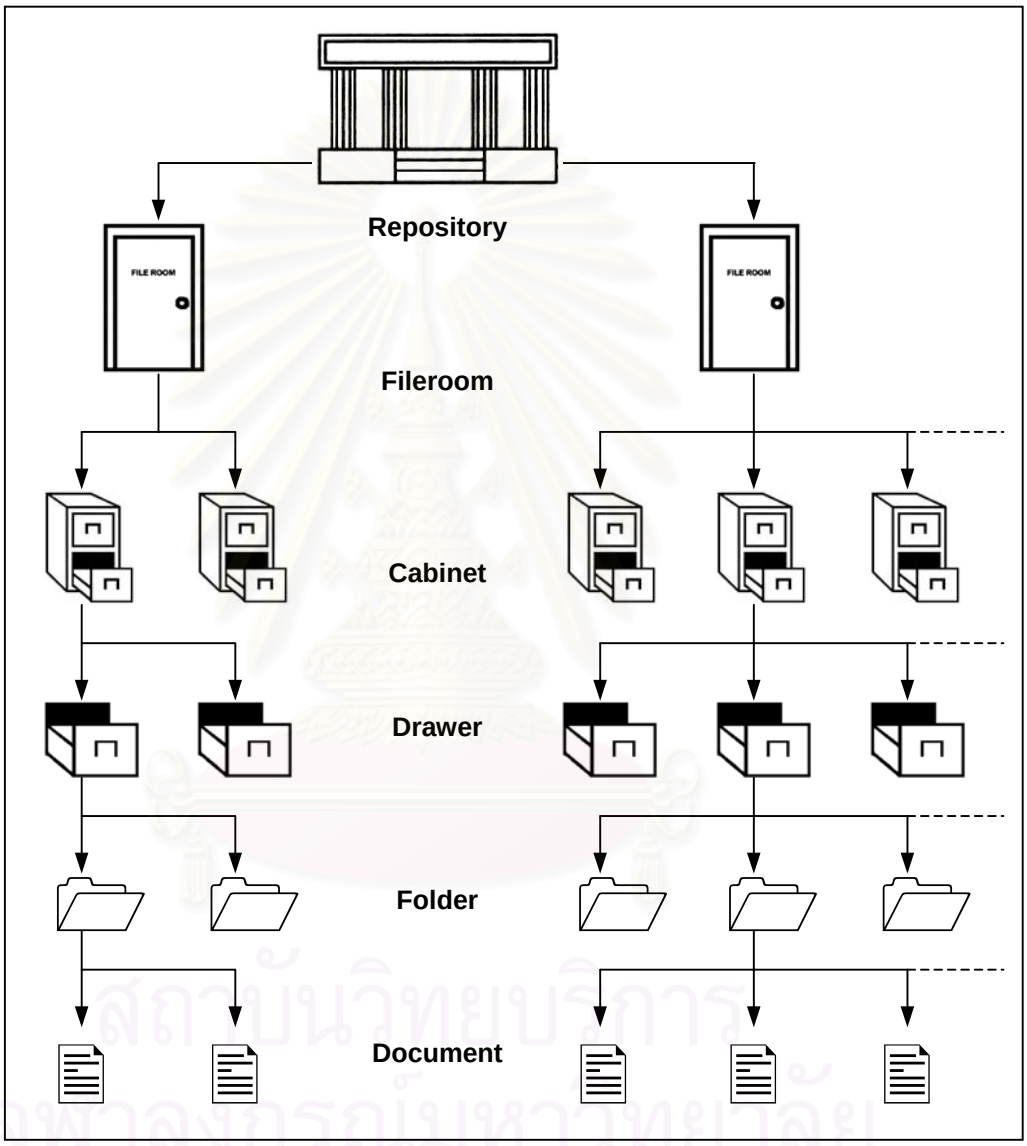


Figure 4.14 Architecture of EDMS

In this model, many kinds of enterprise document were discussed. However, in this report, we will only discuss on manufacturing document in shopfloor.

After several meeting in the task force, the server concept was approved. This is based on

1) System build can apply end user development. The system we build is small system with about 30 clients. Internally we have capability to develop the system if we select appropriate software. If we apply this approach, we can ensure the system is user-friendly and we can easily control the process.
2) Cost saving. As we have already had Local Area Network and Internet system, we can share this resource without much more investment.
3) Through the LAN, all documents can be electronically transferred and saved in the server. We will put the file under the document menu thus the end user can read the content on the their own screen.
4) The software, we can use dBase, Lotus or Access Windows. As we already have Access Windows and we have capability to develop it, we can use it to develop the system.
5) As “access” is easy to apply, the process time can be reduced. The development speed will be faster.
6) The hardware, as TTL already have client/server architecture, therefore, we can utilize current server plus some terminal which can be accessed by shopfloor personnel to check the availability and the lasted version of documents.

This approach originally come from “Vault” concept. That is all documents are kept in server while any authorized user can access the data via their terminals. This is quite suitable for design person or those who work in office.

In PC and monitor manufacturing companies, the process is labour incentive, one complete line require over 150 operators. It is impossible to put one terminal to each operator to check the document.

Alternatively, we can use server to keep document checklist and quality control people can access the data to check the correctness and completeness of document.

All control documents will be kept in server. In order to reduce the occupation of e-mails, all e-mails are kept in PC clients by adding personal files under exchange programme.

4.4.2 The budget for the new system in is as below,

4.4.2.1 Hardware

Hardware specification and other information are as table 4.3

Table 4.3 Hardware information

Item name	Spec.	Q'ty	Status	Cost (Baht)	New buy budget (Baht)
1. PC server	Compaq Proliant 800, Pentium Pro 200, 4 GB * 2 HDD, 64 MB * 2 RAM	1	Already existing	150,000	
2. Data record tape	24 GB recorder HP	1	"	40,000	
3. Local Area Network Hardware	Hub, Fiber cable, etc.…	1	"	4,000,000	
4. PC client	Pentium II 350, 9.1 GB HDD, 64 MB Ram, CR-R (write/read)	8	Need new buy		240,000
5. Cable + Card					10,000
				Total	**250,000**

4.2.2.2 Software

Windows (NT) is applied. MIS system engineer and programmer will use application software "Access" to develop the program. 50 working hours will be used to identify user need and another 100 hours will be used to develop the program. The installation, training and meeting etc.… will take place but are not considered in budget but treat them as routine job.

4.4.3 Document flow will directly affect the system development. Therefore, the flow is summarized in order for system development. The flow is shown as figure 4.15

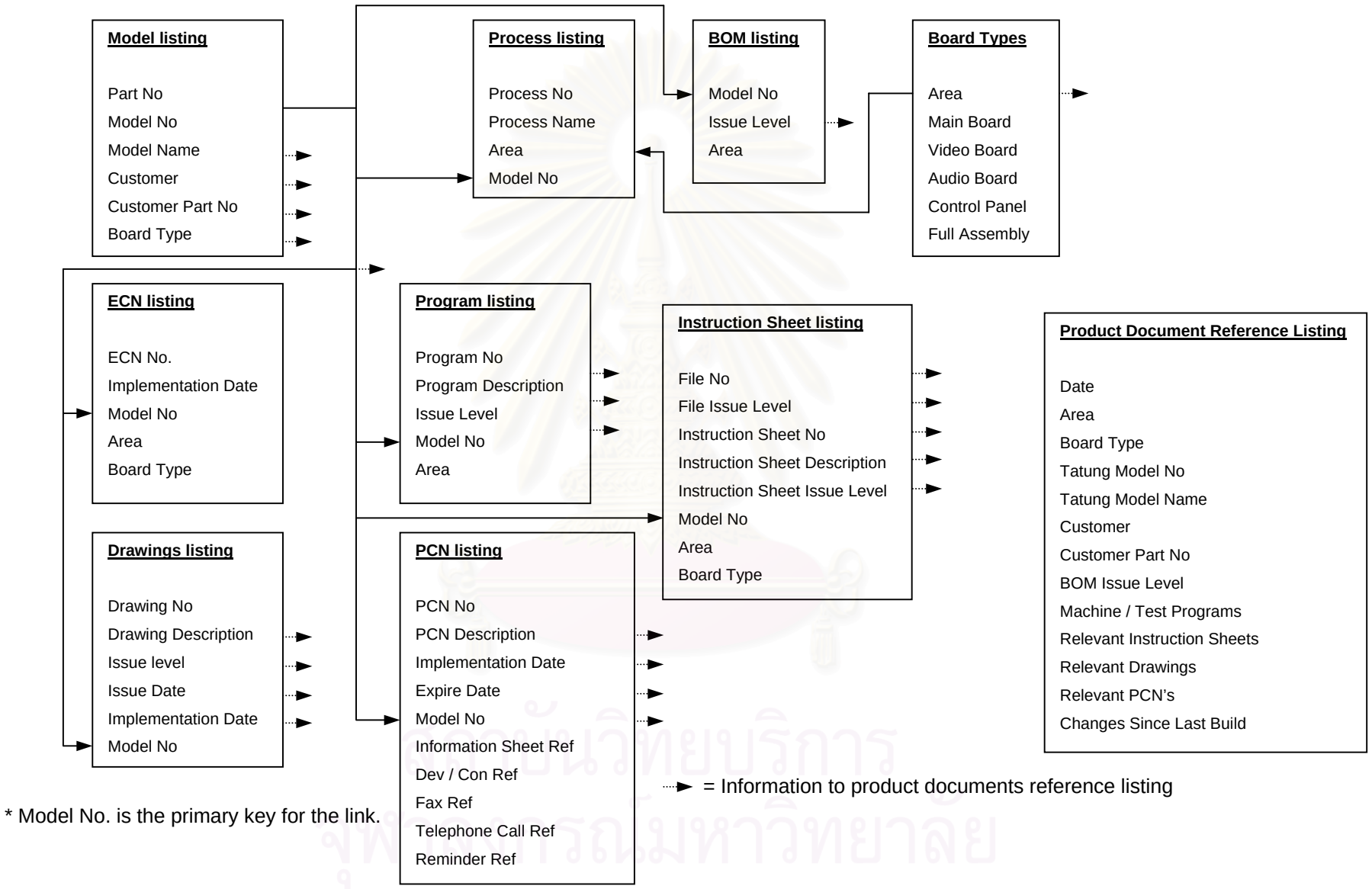


Figure 4.15 Document control system-document listing/cross reference system

After review document control system, we have following date flow information,

1) Source / Sinks

(1) Design authority from design authority, production engineer / quality engineer.

(2) End-users.

2) Process

(1) Sort out and confirm the completeness.

(2) Select file and put to server.

(3) Stamp and entry date.

(4) Copy and distribution.

(5) Return acknowledgment.

(6) Access data in the system.

3) Data stores

(1) Document attributes.

(2) Document contents.

(3) Distribution list.

(4) Display file.

4) Data flows

(1) Document.

(2) Document acknowledgment.

(3) Display document.

(4) Distribution information.

(5) Selected file.

All these information can be summarized to overall document control system as shown as figure 4.16

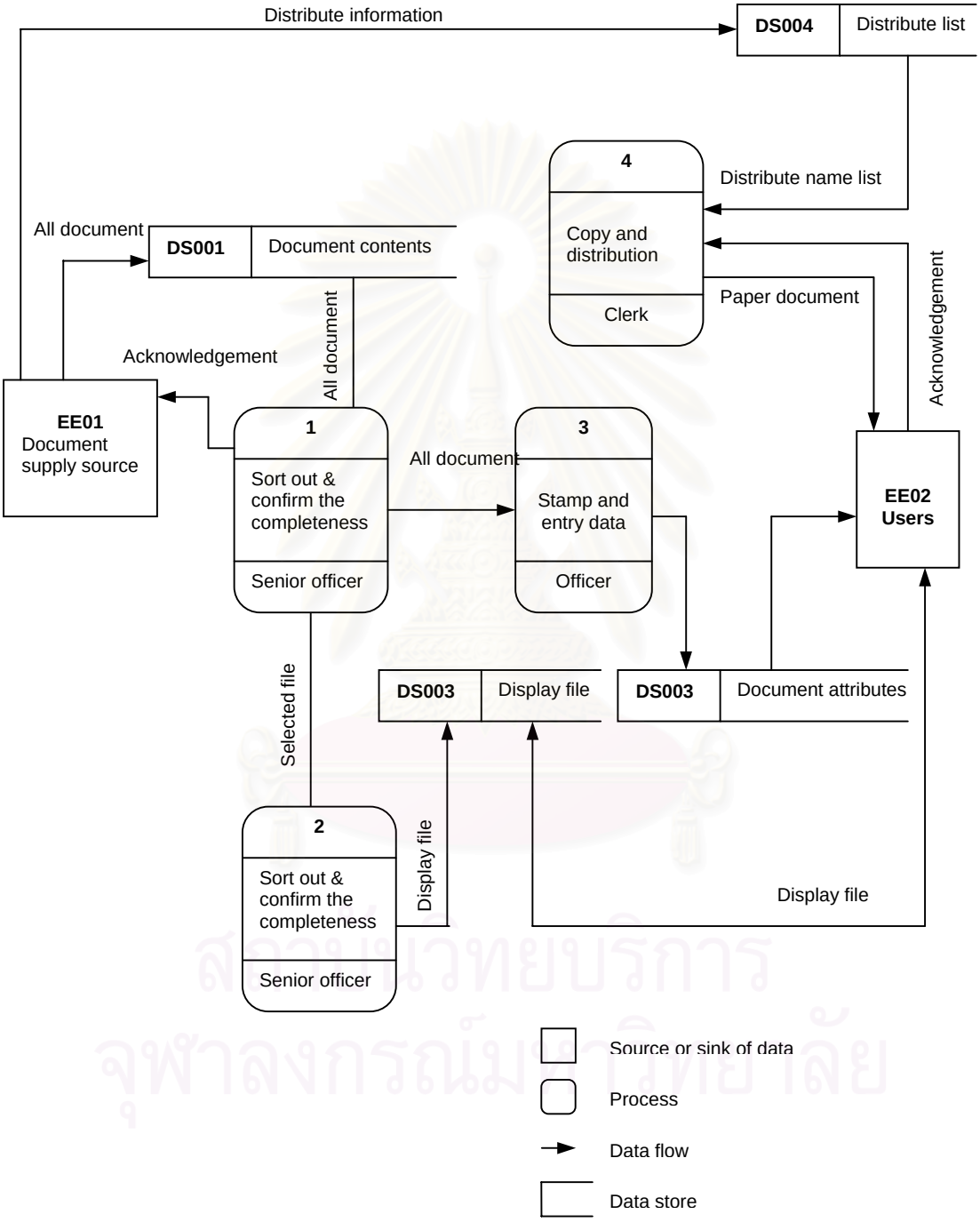


Figure 4.16 Overall document control system (level 1)

The data access is as shown as figure 4.17

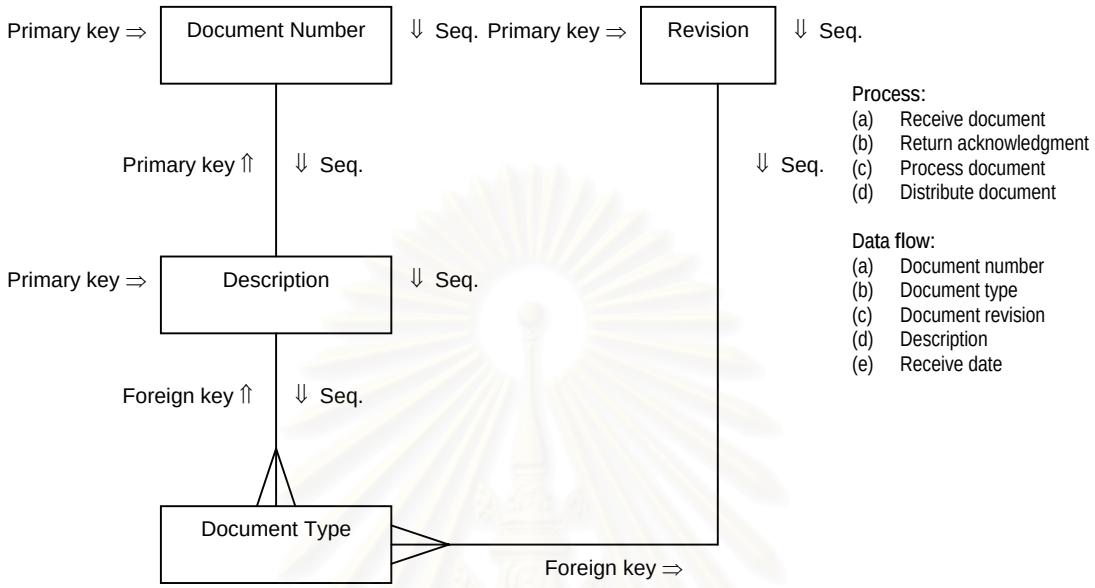


Figure 4.17 Data access flow

After this, data attribute can be identified. The Entity contents – Data attribute is as below,

Entity	Primary key	Attributes revision	Foreign key
Document	Document number	Description	Document type
		Receive date	Model name
		Revision	
		Remark	
		Display file	

In order to develop the system, the task force reviewed all controlled document inside the company and the menu they expected, total 30 items.

The structure block diagram can be as figure 4.18

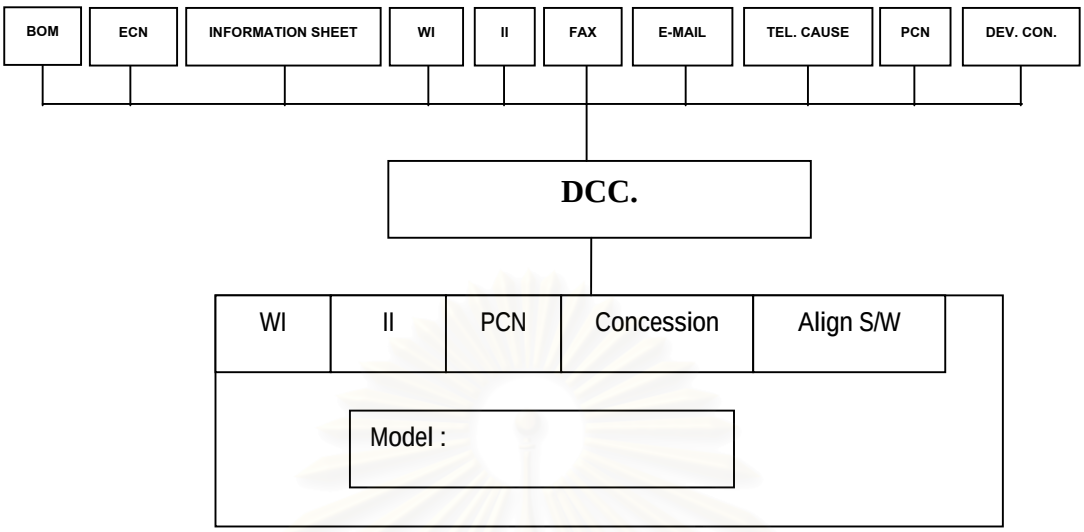


Figure 4.18 Block diagram of system

All documents will be filtered by production engineering and document control staff, then shop floor can access all necessary documents through the inquiry menu.

On the menu, we can check what the latest version of WI, II is, how many changes will affect this model (PCN), how many waivers (concession notes) applied on the product, how many alignment software and what the latest version is.

For WI/II/PCN/Concession/Alignment software, as they are models linked, the inquire menu should have a menu to key in model name, for other documents, the model number is not applied.

4.4.4 For security and data access consideration, log in and password are required in the system, i.e., only authorized person can use the system.

1) The highest access level is from document control centre. The centre can enter / modify / delete the data and also link electronic data file such as e-mails to the document menu.

2) The menu is generated via MIS staff. However, neither document centre staff nor MIS staff can modify it unless PE manager approve it.
3) The user can read and search the data, also can read the content on the screen display but can not modify the data.
4) When document centre delete data, or replace the file by latest version, document centre will back up the obsolete file in tape record.
5) Document centre will also print out all data in paper format for text files. For some special artworks, such as carton artwork, they will be saved in CD-R.

As BOM already put into mini-computer system called TAMIS, they are directly transferred among HQ and TTL; therefore, TTL document control centre will only record the document information without putting the content in server. Thus the big memory is saved.

For the hardware, all data can be put in the server, and all end users can access the data via their own client PC as figure 4.19

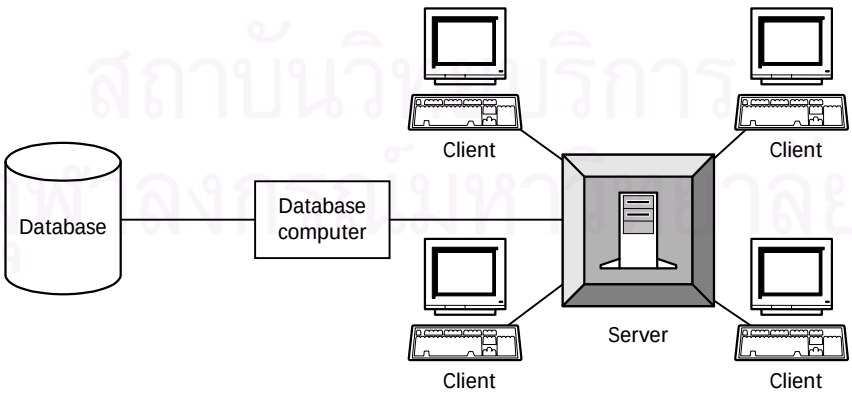


Figure 4.19 Document system hardware

Finally, MIS programmer use windows access, apply “Visual Basic” program tool to develop the database. The system design based on the system requirements developed by the project team.

After programming, a testing was performed and we found some point need to improve. Some of them is the requirement itself which is not clear enough or well considered. For example, we can not key in some field on the menu as we ignored the field on the actual document. Some is the program itself have deficiency. The programming is thus revised to overcome problems we found during testing.

Before implementation, a training was performed. The training was divided into two groups: End user group and Data entry group. End user group was trained on how to access the data. The data entry group was trained on how to entry the data appropriately.

After testing, training, debugging, database set up, the system finally can be implemented.

After test run and live run, a project review will be carried out to validate the system.

Especially risk management must be considered in this system. As all files will be kept in server and can be linked in the network, any broken server accident or virus affected issue will cause lost data.

To prevent this, all files will be backed up in CD-R and also will be printed out and kept in document control centre. In addition, the document menu was designed in such a way that all users can only read the file on screen but can not change the file.

The actual project complete in March 2001, which took total 5 months.

4.4.5 Operation of the system

The operation is that document clerk enter data (see figure 4.20), then PE engineer to verify the data (see figure 4.21). Finally shopfloor operator can access data via the system (see figure 4.22)

Figure 4.20 Document clerk entry the data

Figure 4.21 PE engineer to verify the data

Figure 4.22 Shopfloor to access the data

As shown in figure 4.23, all documents are displayed. If we check WI, then we can click WI font to enter WI menu (see figure 4.24) then can further check detailed information as shown on figure 4.25

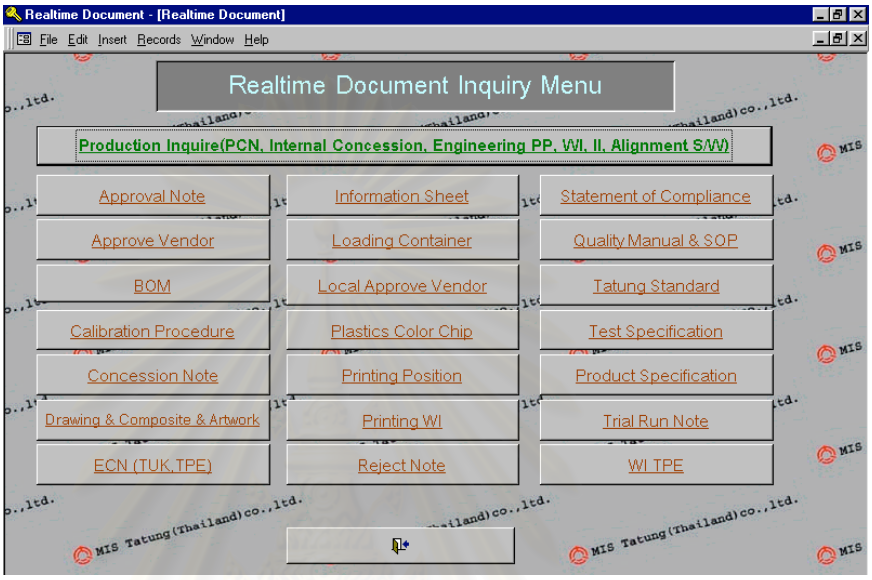


Figure 4.23 Main menu of inquiry

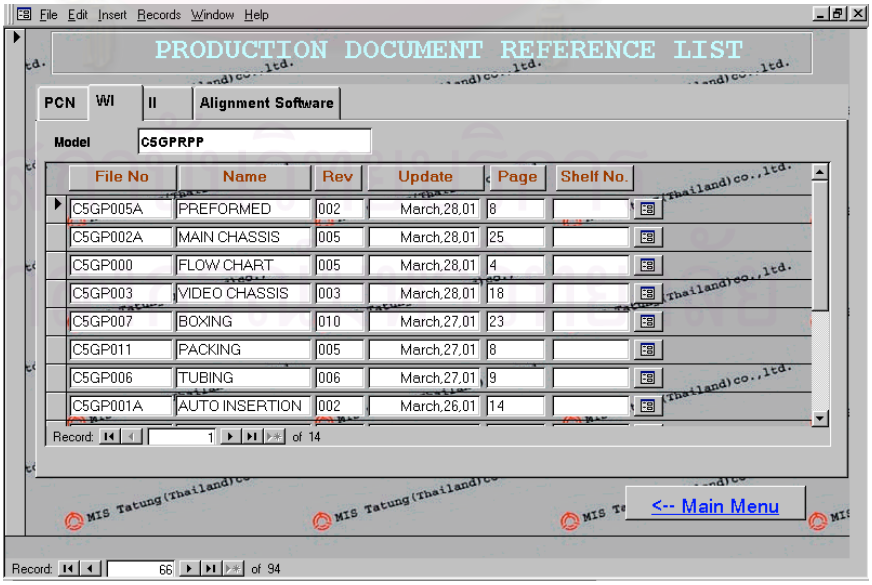


Figure 4.24 Menu of WI

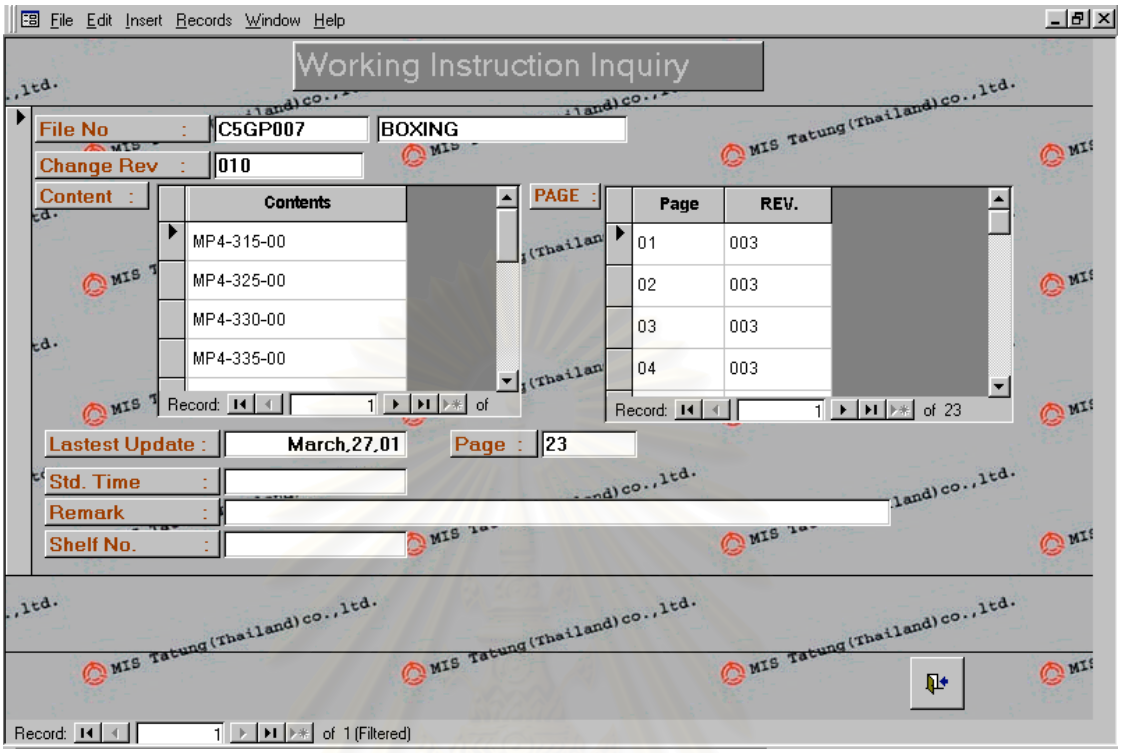


Figure 4.25 Details of WI

4.5 Shop floor information system (SFIS)

4.5.1 Review of current shop floor information flow

Currently, production do daily record, repair record and QA do the inspection report. Afterwards, the supervisor will summary production status based on production daily record and repair record. This plus OQA inspection report are developed by production section for production report while QA will develop quality report. Both of them will be reported on the second meeting. We can see the data process is slow. Our task is to develop a system to speed up the process.

Moreover, if we get field failure return, we can have tractability data about the failure product as to whether it was ever repaired, what the key parts are, etc.…

The manufacturing process is as figure 4.26

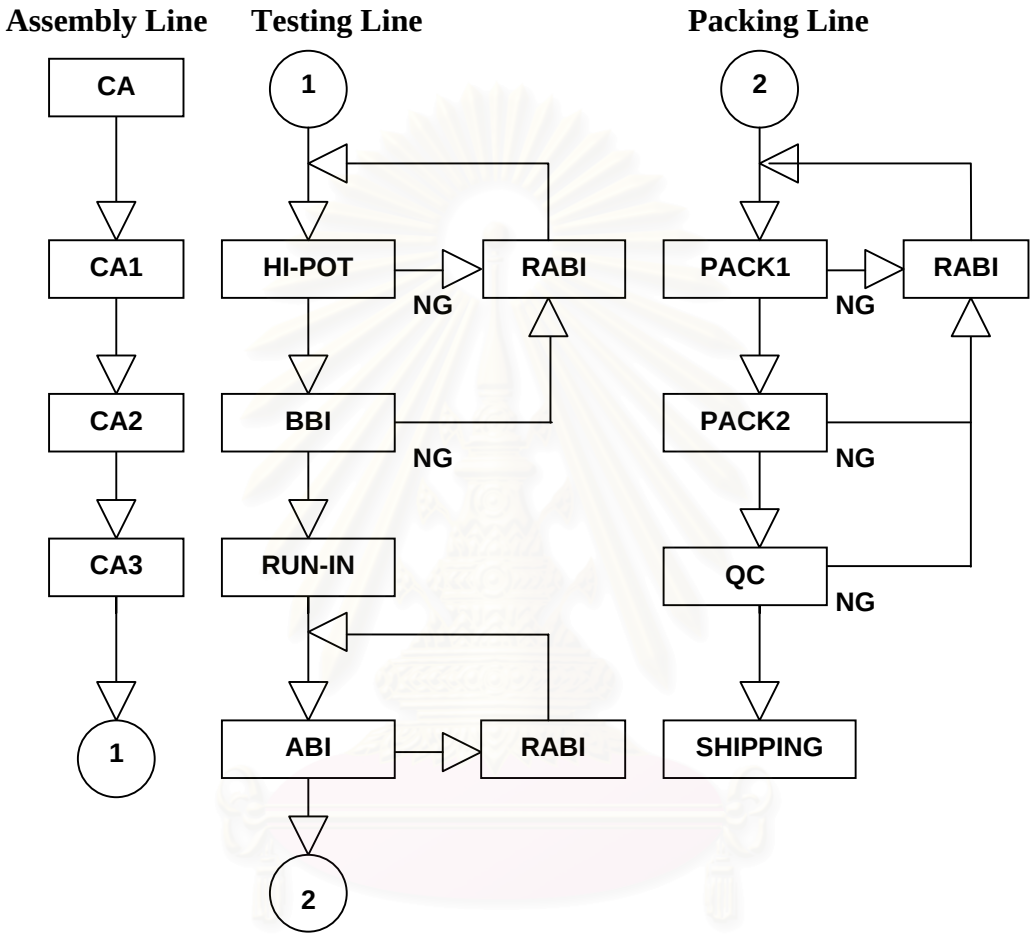


Figure 4.26 Manufacturing process

Initially, we tried to use line as primary key to develop the system. Later we found it is not feasible. Actually what we care most of individual product. Thus we use product serial number (S/N.) as the primary key. The SFIS flow is shown as figure 4.27

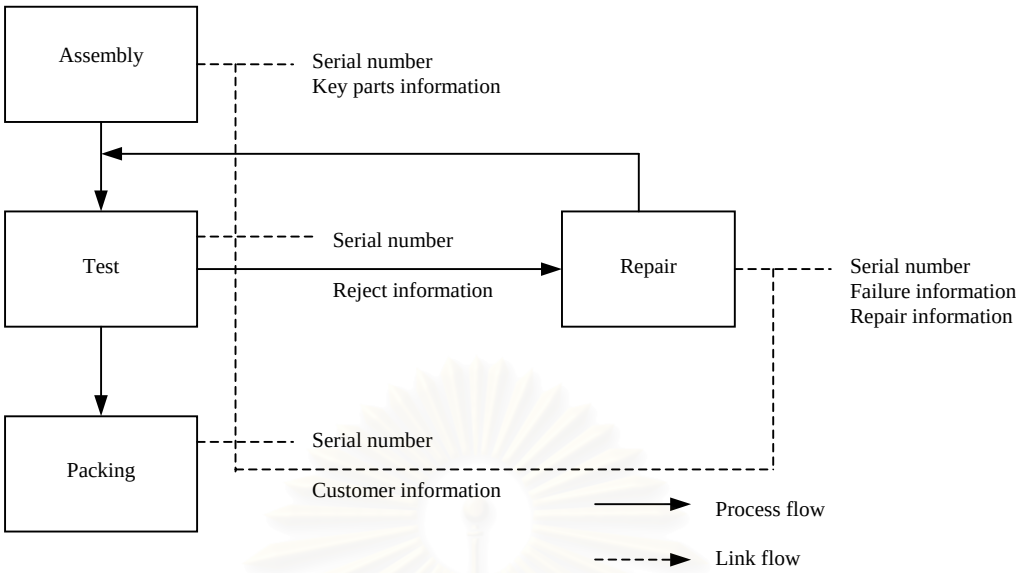


Figure 4.27 SFIS

The process and data flow can be summarized as figure 4.28

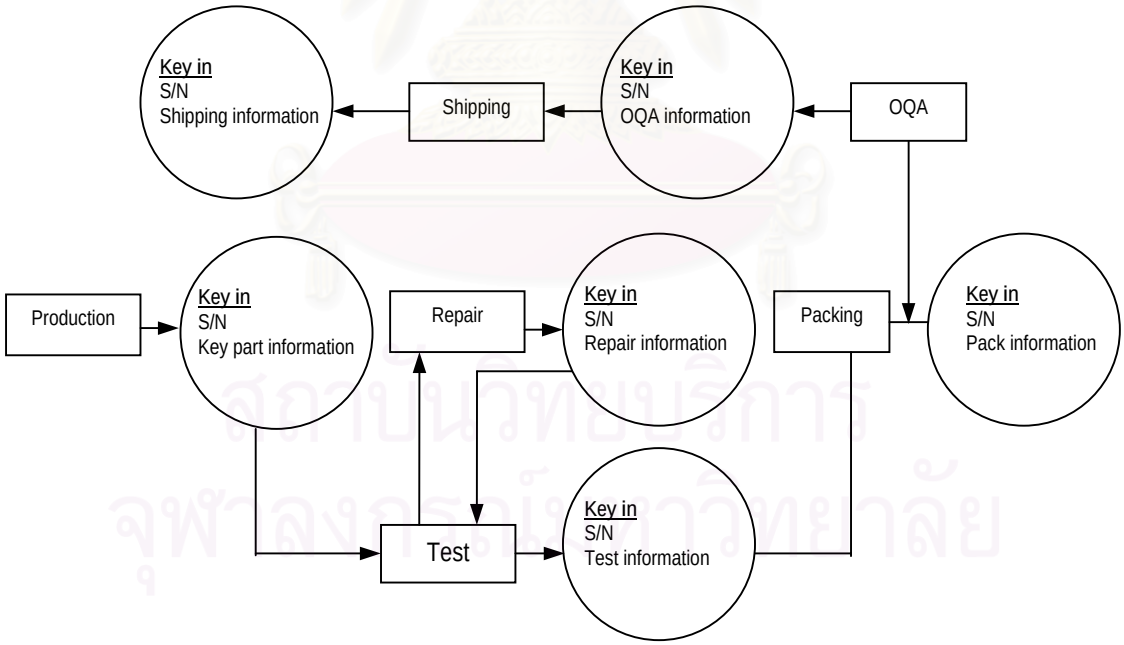


Figure 4.28 Process and flow

As the database should cover all products produced and on the whole process, the speed must be quickly enough for the real time. The company current window access can

not have this capability. The company programmers do not capability to build such a database. Furthermore, as our sister companies will also apply the system, therefore, we decide to sub-contract the project out (outsourcing).

This is based on

1) This system is medium size, with about 200 terminals. The process speed must be high and have capability to process medium to large size database. This requires specialized to develop. If we develop it ourselves, it will be more costly and will delay the schedule.
2) This company does not have capability to develop this database.
3) As sister companies will also apply the system, if we subcontract it out, we can share the cost.
4) As specialist companies have experts, sub-contract can achieve system economy.
5) As specialist companies have professional knowledge and experience, as long as we raise the correct requirement, the quality of the system can be secured.
6) If we sub-contract the system development out, we can free human resource on the development and we will have free the financial capital.

However, we realized that outsourcing also have disadvantage, if not handle well, the project may lose control and the project may excessively depend on the vendor. To overcome this, we assigned our technical representatives together with user representatives to develop the system together. And the ownership of the programme is our own.

After selecting partners, we select Windows NT as operating software, oracle as database software and apply Delphi as programming tool.

4.5.2 System selection

Before selection, following question must be reviewed,

1) Does the system capture essential business requirement?
2) Accuracy consistency?
3) In budget?
4) Does the system run well?

It is essential to establish benefits, even if they are intangible and difficult to qualify, such as improved service or enhance internal communication.

Then we come out following selection criteria (see table 4.4 and table 4.5).

Table 4.4 Selection criteria of the system

	Performance specification for the selection of a DataBase system	Desired demand	Min	Fixed
Name:	**Date:**			
1. System software Window NT				✓
2. DBMS ← 5,000 Baht per employee ; ↑ Programming of various			← ✓	↑ ✓
3. Multi-Access capability Need				✓
4. Hardware Connection of work station				✓
5. Interfaces LAN WAN				✓ ✓
6. Documentation Documentation in different language		✓		
7. Service Training Hot-line		✓ ✓		
8. Integration capabilities Graphics Spreadsheets		✓		 ✓
9. Database and recovery				✓
10. Security and privacy				✓

Table 4.5 Software selection criteria

Legend:
λ existing
- no existing

	Small Database	Big Database	Easy to Develop	Network Capability	Costing	Compatible with Microsoft	Number of installation	Operating System	Data editing or validation	Database capacity	Security	Data backup and recovery		Price (X USD)
Access	λ	λ	-	-	λ	-	<50	-	λ	Small	λ	Mediu m		599 USD Professional 339 USD MS Access 2000
Approach	λ	λ	-	λ	λ	λ	<50	λ	λ	Small	λ	Mediu m		114.46 USD Millennium edition
FoxPro 6.0	λ	λ	λ	λ	λ	-	<50	-	λ	Mediu m	λ	Mediu m		549 USD Full pack 279 USD for upgrade
Inter Base	λ	λ	λ	λ	λ	λ	<50	λ	λ	Mediu m	λ	Mediu m		149.99 USD
Oracle	λ	λ	λ	λ	λ	λ	>500	-	λ	High	λ	High		250 USD Enterprise edition 200 USD Standard edition
MS SQL	λ	λ	λ	λ	λ	λ	>500	λ	λ	High	λ	High		499 USD Develop edition

4.5.3 Data format

After review, following table was developed.

General information table

Time	Line	Model

Manufacturing information table

Pass	Fail	Output	Yield	Key parts	Statistical	Fail reason	Fail component	Responsible

Quality information table (outgoing quality assurance)

Pass	Fail	Reject reasons	Sampling No.	Reject No.

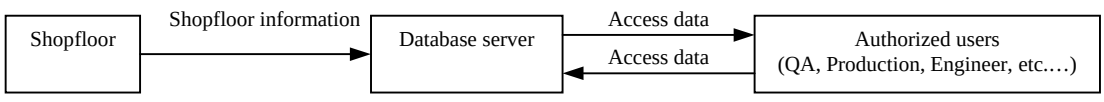
Shipping information

S/N.	Ship times	Container No.	P/O No.

Key parts information

S/N.	Part Code	Repair Reason	Repair person

In terms of flow, we develop the system as below,

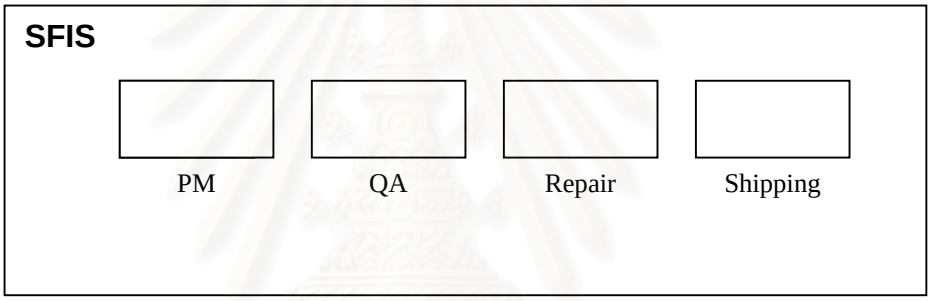


The information we require is

1) Production quantity and yield.
2) Repair report.
3) Quality report including In Process Quality Control (IPQC) and Outgoing Quality Assurance (OQA).
4) Shipping information.

As the process requires over 40 data input and over 10 terminals, the DBMS must be high efficiency.

The inquiry menu can be shown as figure 4.29



Key: PM: Production Management

QA: Quality Assurance

Figure 4.29 SFIS menu

Under each menu, we can also see sub menu, (see figure 4.30)

SFIS – QA

Model Line Period To

Station	Pass	Fail	Total	Rate
CAI	16835	0	16835	100
BBI	974	0	974	100
ABI	14428	32	11460	99.78
HIPOT	11615	2	11617	99.98
FI	11110	1	11111	99.99
PACK	10224	0	10224	100

Figure 4.30 Sub menu of the system

From this menu, we can see the output and yield. Further, we can check the fail then supporting engineers can perform onsite support.

4.5.4 Structure

The structure should cover all manufacturing activities. Also, supporting staff and related manager need in the structure (see figure 4.31)

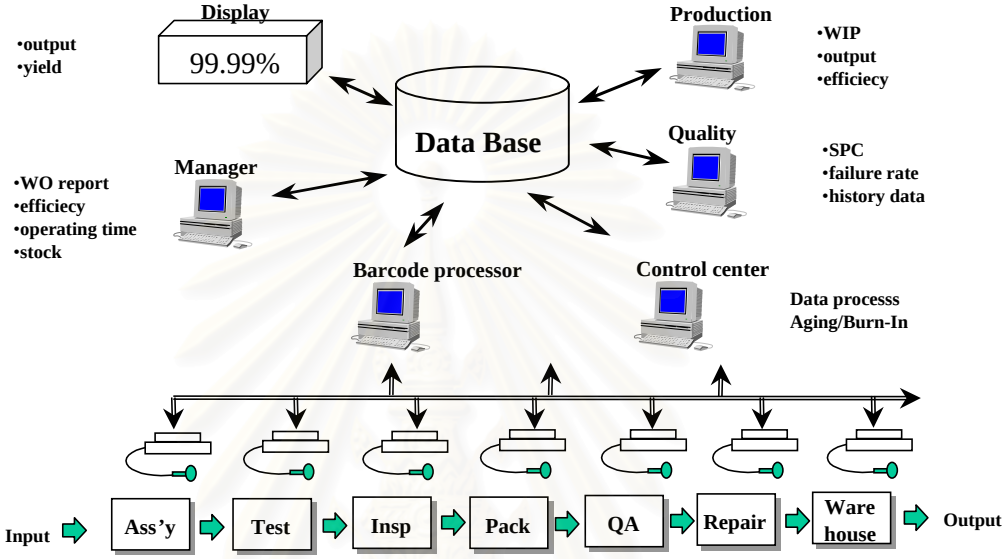


Figure 4.31 Structure of shop floor information system

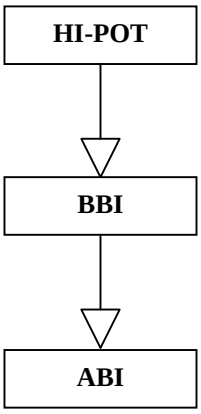
4.5.5 Flow and operation

In the shopfloor, in order to get information, barcode system is developed allow each lines (see figure 4.32, figure 4.33, figure 4.34)

Figure 4.32 Assembly line barcode system

Through this, we can record the pass / failed status, and also can record key component information.

Testing Line



1) OK: SERIAL_NUMBER
2) NG: ERROR_CODE + SERIAL_NUMBER

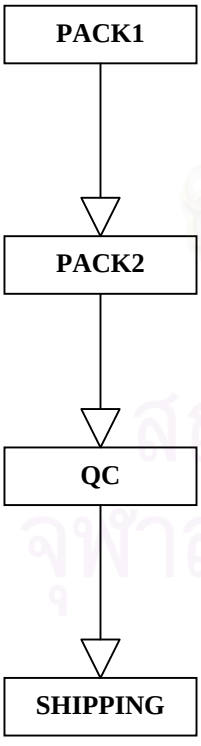
1) OK: SERIAL_NUMBER
2) NG: ERROR_CODE + SERIAL_NUMBER

1) OK: SERIAL_NUMBER
2) NG: ERROR_CODE + SERIAL_NUMBER

Figure 4.33 Testing line barcode system

Through this, we can record the test information as well error code.

Packing Line



1) Input SERIAL_NUMBER
2) KeyInKEYPARTS_CODE (K/B)
3) Check Specification.
4) Input CUSTOMER SERIAL_NUMBER
5) Print CARTON LABEL / CARTON SN

1) KeyInPALLET'S CAPACITY
2) Input CARTON SN
3) Go to step 2 until the count is full
4) Print PALLET LABEL / PALLET SN

1) KeyInSAMPLING SIZE (PALLET SN)
2) OK SHIPPING_NUMBER
3) NG ERROR_CODE + SHIPPING_NUMBER
4) Go to step 2 until finish
5) Input PASS or REJECT

1) Input PALLET_NUMBER / CARTON / CUSTOMER SN
2) Transfer data to PC from H/T
3) Print SHIPPING LABEL

Figure 4.34 Packing line barcode system

Through this, we can record packing information and ship information.

4.5.6 Implementation

4.5.6.1 After selected a vendor, we plan to use client/server architecture, use Window NT as system software and Oracle as the database software. For the development, we use Delphi as the tool. This is because

1) Client/server is cost saving comparing to mainframe or minicomputer.
2) The database is medium size and Oracle can meet this requirement.
3) Window NT is widely applied.

Hardware and software specification and database information is summarized as figure 4.35

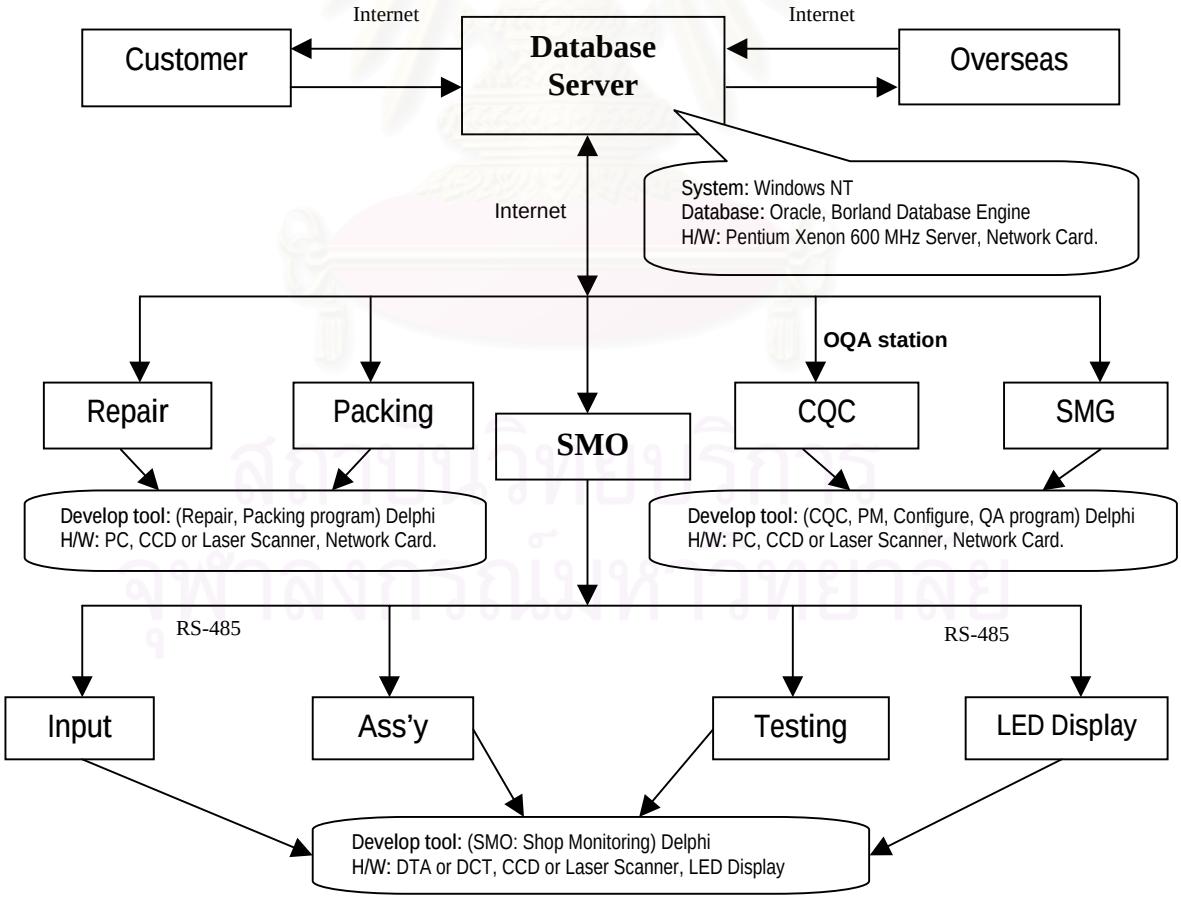


Figure 4.35 SFIS hardware, software and database

Cost is saved as we select appropriate method. Cost information is shown as table 4.6.

Table 4.6 Cost information

Standard Equipment for SFIS Installation (per line)				**Total price**
Equipment	**Specification**	**Q'ty**	**Unit price**	
1. Server & Disk array	Oracle workgroup_server 8.1	1	16,732	16,732
2. Computer	Pentium 1G RAM, 108G, CPU 486-100. 32 RAM	11	999	10,989
3. Hub	D-Link 908TX	2	496	892
4. DCT-201	Data Control Terminal	39	550	2,145
5. DIC-101	Data Interface Controller	2	20	40
6. Scanner		47	273	12,841
7. SFIS software		1	14,193	14,193
8. RS232/485 Converter	DIC 101	4	195	780
9. LCD display board	Shown Target, Actual Unit Passed	3	2,306	6,918
10. Windows NT	Ver. 4.0 Service Peak 4	1	500	500
11. Database S/W	Oracle Workgroup Server 8.1 Borland Database Engine (BDE).	1	10,713	10,713
12. Printer	Zebra S-400	3	1,170	3,510
13. Scanner	PTH	1	1,490	1,490
				101,048 USD

In order to realize the system we use bar code which contain the control information inside.

If use SFIS, only barcode is needed for entry the data. It is convenient and real time. Then the data will be automatically processed and convert to pre-set reporting format. Related supporting staff and manager can access the report which it always the latest.

Like other information systems, the security, training, trial run, project review were carried out. The process is quite similar with the shop floor document control system.

The system was implemented in factory middle of year 2000. It has very good effect.

4.5.6.2 System operation

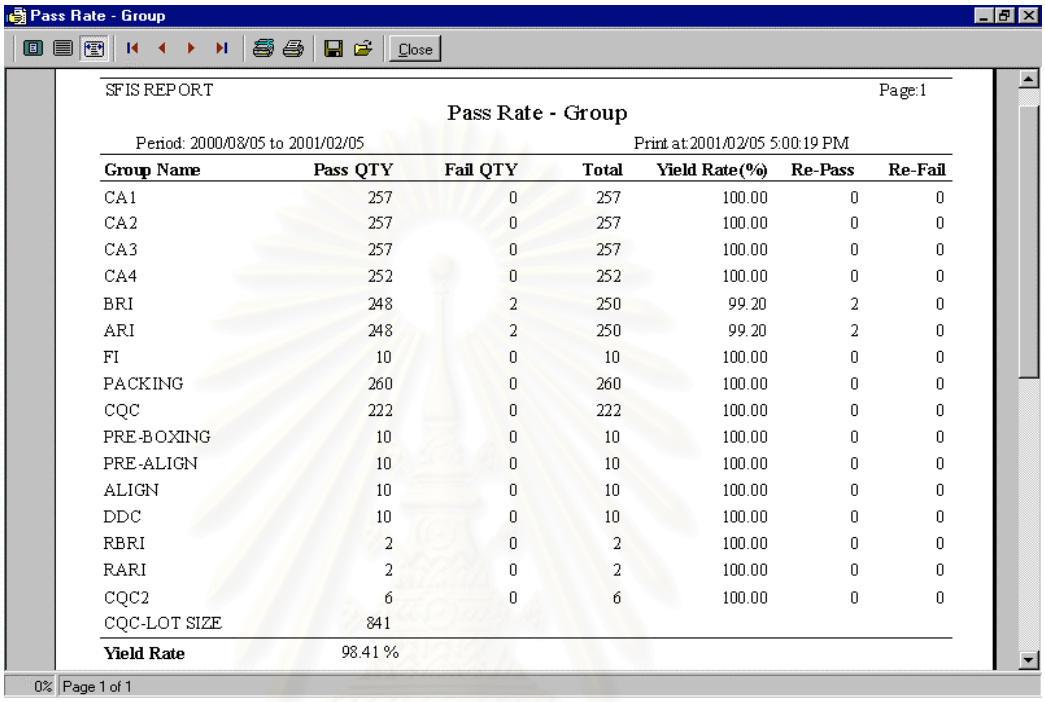
After implementing the system, the data can be entried in real time way and only one engineer is needed to maintain the system.

The operator scan barcode on arrange stage (see figure 4.36). Manager and supporting engineer can access data in the real time (see figure 4.37).

Figure 4.36 Scan barcode in shop floor

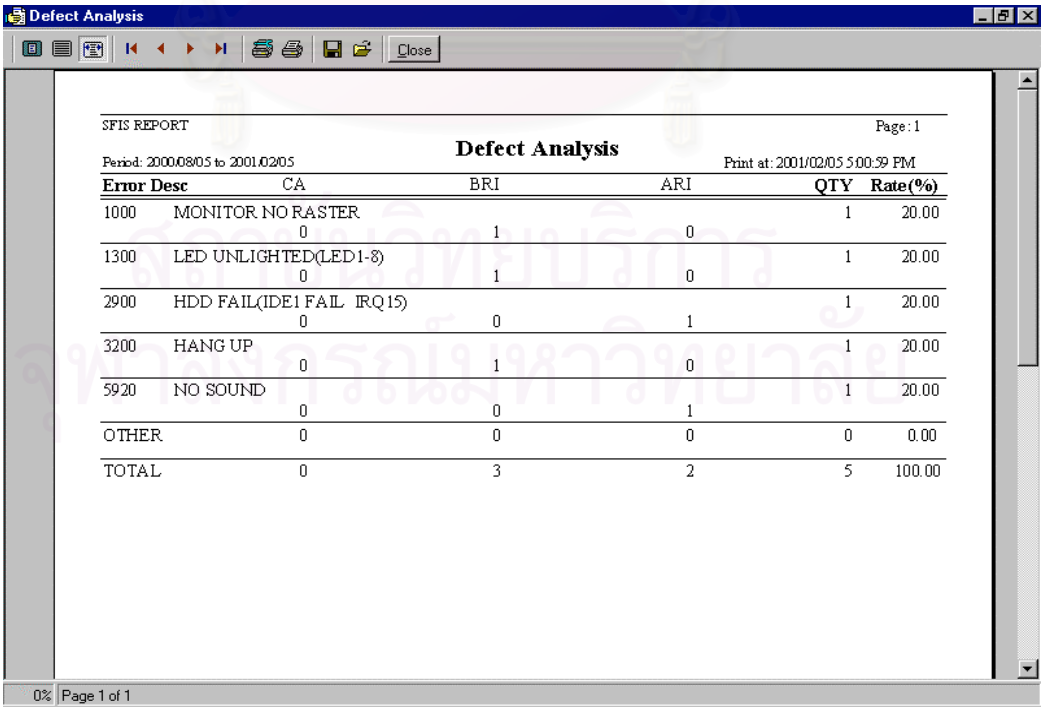
Figure 4.37 Engineer access data from SFIS

For example, if we need to check yield, we can enter the menu then have yield rate information (see figure 4.38). As there have failure, then we can enter defect analysis (see figure 4.39) and repair analysis (see figure 4.40). All these information is real time then immediate action can be taken.



Group Name	Pass QTY	Fail QTY	Total	Yield Rate(%)	Re-Pass	Re-Fail
CA1	257	0	257	100.00	0	0
CA2	257	0	257	100.00	0	0
CA3	257	0	257	100.00	0	0
CA4	252	0	252	100.00	0	0
BRI	248	2	250	99.20	2	0
ARI	248	2	250	99.20	2	0
FI	10	0	10	100.00	0	0
PACKING	260	0	260	100.00	0	0
CQC	222	0	222	100.00	0	0
PRE-BOXING	10	0	10	100.00	0	0
PRE-ALIGN	10	0	10	100.00	0	0
ALIGN	10	0	10	100.00	0	0
DDC	10	0	10	100.00	0	0
RBRI	2	0	2	100.00	0	0
RARI	2	0	2	100.00	0	0
CQC2	6	0	6	100.00	0	0
CQC-LOT SIZE	841					
Yield Rate	98.41 %					

Figure 4.38 SFIS report-yield rate (pass rate)



Error Desc	CA	BRI	ARI	QTY	Rate(%)
1000 MONITOR NO RASTER	0	1	0	1	20.00
1300 LED UNLIGHTED(LED1-8)	0	1	0	1	20.00
2900 HDD FAIL(IDE1 FAIL IRQ15)	0	0	1	1	20.00
3200 HANG UP	0	1	0	1	20.00
5920 NO SOUND	0	0	1	1	20.00
OTHER	0	0	0	0	0.00
TOTAL	0	3	2	5	100.00

Figure 4.39 SFIS report-defect analysis

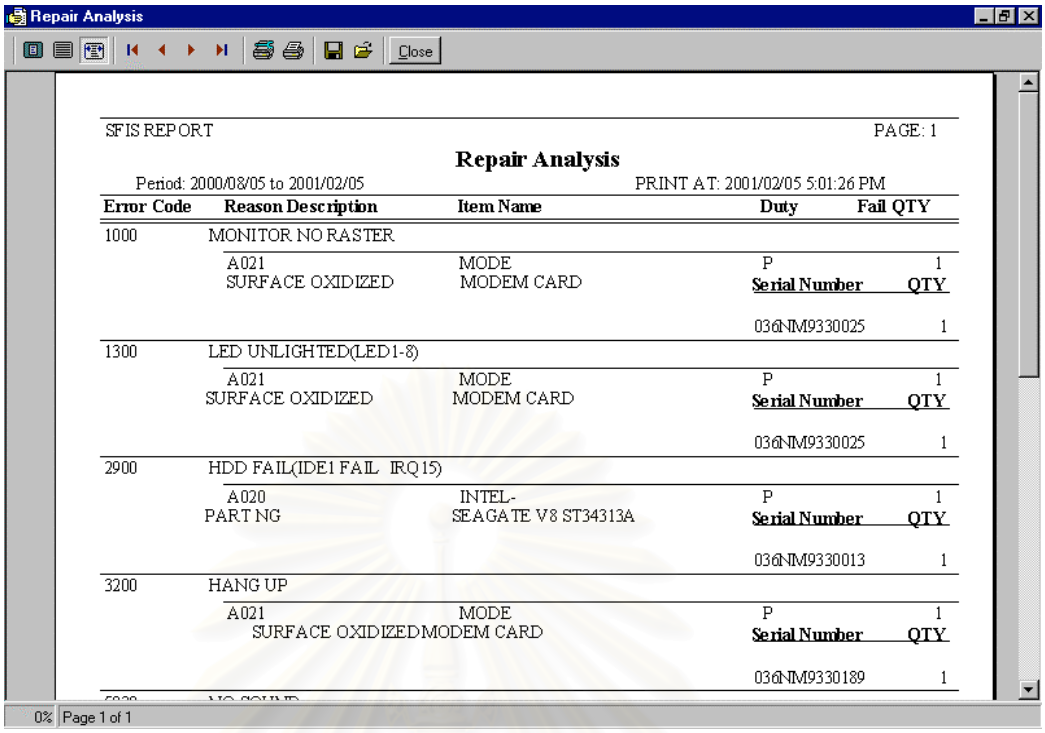


Figure 4.40 SFIS report-repair analysis

4.5.6.3 Review of the system

After we implemented SFIS, Total 12 people were saved,

1) Clerk total 9
2) Data engineer total 2
3) Chief technician total 1

Yearly saving is 1 million Baht.

The gains from the system also include quick action to shopfloor problem. Even it is difficult to identify, we compare the rework cost related to shopfloor information to the previous year, the cost is estimated 12 million Baht annually.

Very importantly, we have good tractability on the product quality. This gives customer more confidence on the business.

However, the problem on the system is that as long as the SFIS server is down, all production have to be stopped. Even worse, some shopfloor information were lost become we do not have weekly back up programme.

To solve this problem, we set up two servers and two disk array on the system. The budge was increased about 170,000 Baht.

The schedule is kept as we selected correct strategy-outsourcing. However, we only sub-contract the software development. For system maintain, we handle by ourselves. This can ensure we can control the system and do not depend on vendor. More important, as we build product to OEM customer, we can keep confidential data.

However, when we developed the system, we did not consider the system integration to current company information system (MPS, MRP, POS, etc…). they are currently running in parallel. If we need to process some function such as manufacturing order, we still use to download MPS from the central system then input data into SFIS. Integration issue must be considered before system development.

4.6 Road map on the system development and implementation

For above two systems, the actual road maps are shown as figure 4.41 and figure 4.42

Task name	Duration	Start	Finish	Year 2000						Year 2001			
				Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1. Vendor selection	30 days	01/07/00	31/07/00										
2. System development (vendor and TTL)	60 days	03/08/00	05/10/00										
3. Review and revise	30 days	07/10/00	07/11/00										
4. User training	14 days	09/11/00	23/11/00										
5. Review and modify the system where applicable	15 days	25/11/00	10/12/00										
6. Test & Parallel run	10 days	12/12/00	22/12/00										
7. Review and modify if applicable	15 days	07/01/01	20/01/01										
8. Live run (1)	15 days	22/01/01	10/02/01										
9. Start new system	-	20/02/01											

Figure 4.41 Road map on the system development and implement

Task name	Duration	Start	Finish	Year 2000		Year 2001							
				Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.
1. Hardware preparation													
- PC	15 days	08/11/00	23/11/00										
- Cable + Card	30 days	08/11/00	08/12/00										
- Installation	2 days	09/12/99	10/12/99										
2. Software preparation													
- Selection	5 days	08/11/00	13/11/00										
- Development	30 days	14/11/00	15/12/00										
3. Users training													
- Data entry menu	10 days	16/12/00	26/12/00										
- Application menu	5 days	4/01/01	09/01/01										
- Reporting													
4. Data preparation													
- Data entry	14 days	11/01/01	25/01/01										
- Check & Confirm figure	10 days	26/01/01	06/02/01										
5. Review and modify the system where applicable	15 days	08/02/01	23/02/01										
6. Test & Parallel run	10 days	25/02/01	05/03/01										
7. Review and modify if applicable	10 days	07/03/01	17/03/01										
8. Live run (1)	10 days	18/03/01	28/03/01										
9. Start new system	-	29/03/01											

Figure 4.42 Road map on the system development and implement

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

After implementation of these systems, the documentation mistake was greatly reduced. Also, as we set up SFIS, all concerned managers and staff can know shop floor information in a real time manner.

We also gained customer confidence that we can handle information well.

Still, during and after system implementation, several issues were raised will be discussed later.

5.1.1 Cost saving

Total investment on this project is total 5,250,000 Baht. This is less than the budget 20,000,000 Baht.

If compared loss in 1999 (total 22.2 million Baht), the project payback period is only 3 months.

The detail can shown as table 5.1

Table 5.1 Total investment

Unit: Baht

Hardware and software	Shopfloor document control	250,000
	SFIS	4,000,000
Man		500,000
Travel, training		500,000
	Total	5,250,000

It can be justified that the investment is worthwhile.

5.1.2 Error reduction.

The error documents used in shopfloor reduced from 30 times per months to 3 times per months.

5.1.3 Promote company image.

When customers audit this factory, they are well impressed on this system. They believe the concept is quite good and can help improve quality.

5.1.4 User friendly

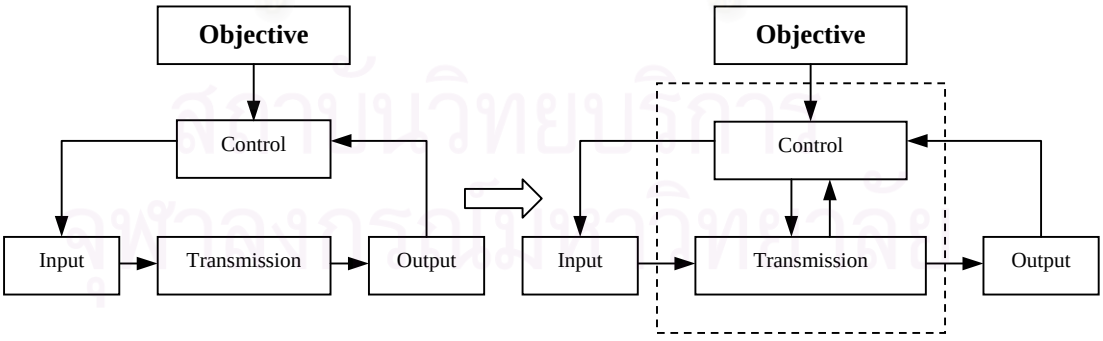
The system is very easy to use. User-friendly menu enable operator know how to use the system within 5 minutes.

5.2 Discussion

5.2.1 After the system was implemented, the documentation error times were significantly reduced. The action speed is becoming more quicker.

Even we set up the system, as workmanship still can make mistakes, therefore, the continuous training is required.

Real time system can improve control timing as below,



5.2.2 Through this project, following gains can be obtained.

1) Usually the management regards IT as money-consuming and hi-tech tools. Therefore, when talking IT, they always think that it requires big

money and difficult to implement, at least in TTL. In fact, IT does not always mean mainframe computer, mini-computer, network and software development, etc… which usually cost minimum several million Thai baht. It also means apply the existing technology to improve the current work practice. In this project, we only add some limited hardware and develop application software then can contribute to a good job.

2) Teamwork is important. User involvement's during this project can feedback many suggestions on improvement. Only working with end-user can technical persons identify the user needs and come out appropriate solution. The new system overcomes the disadvantage on old system. During the project meeting, many other new ideas were raised and some of them were considered in the new program.
3) Training must be well prepared. As end users and document control officers are used to existing system, they need time to adapt to the new system. Training is an effective process for this adaptation. During the training, the user may identify further improvement ideas to the project team that may consider them and take the appropriate action.
4) Usually IT department staff work separately with other departments. How can IT department co-operate with other department to break the communication barriers is important. Through the task force, we can break the barriers and come out a suitable solution.
5) The disadvantage of the new system is the speed. As many end users will share the PC server, the speed will become slow.
6) Inside the company, there have many areas can use this concept for work improvement. For example, some tester in shop floor can be linked through LAN then the test engineer can debug the test program in the central office without going to the shop floor.

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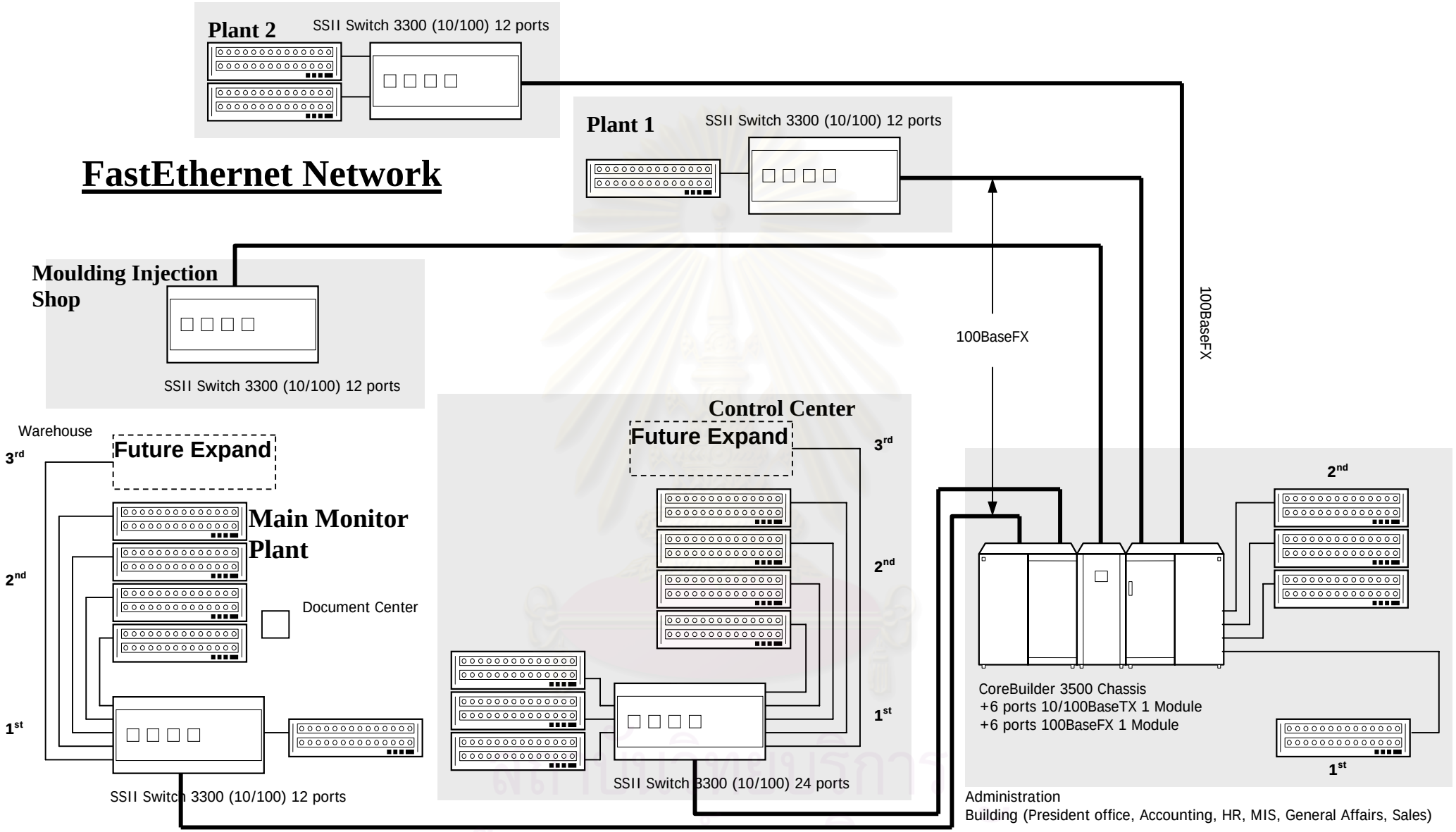
APPENDICES

Appendix A

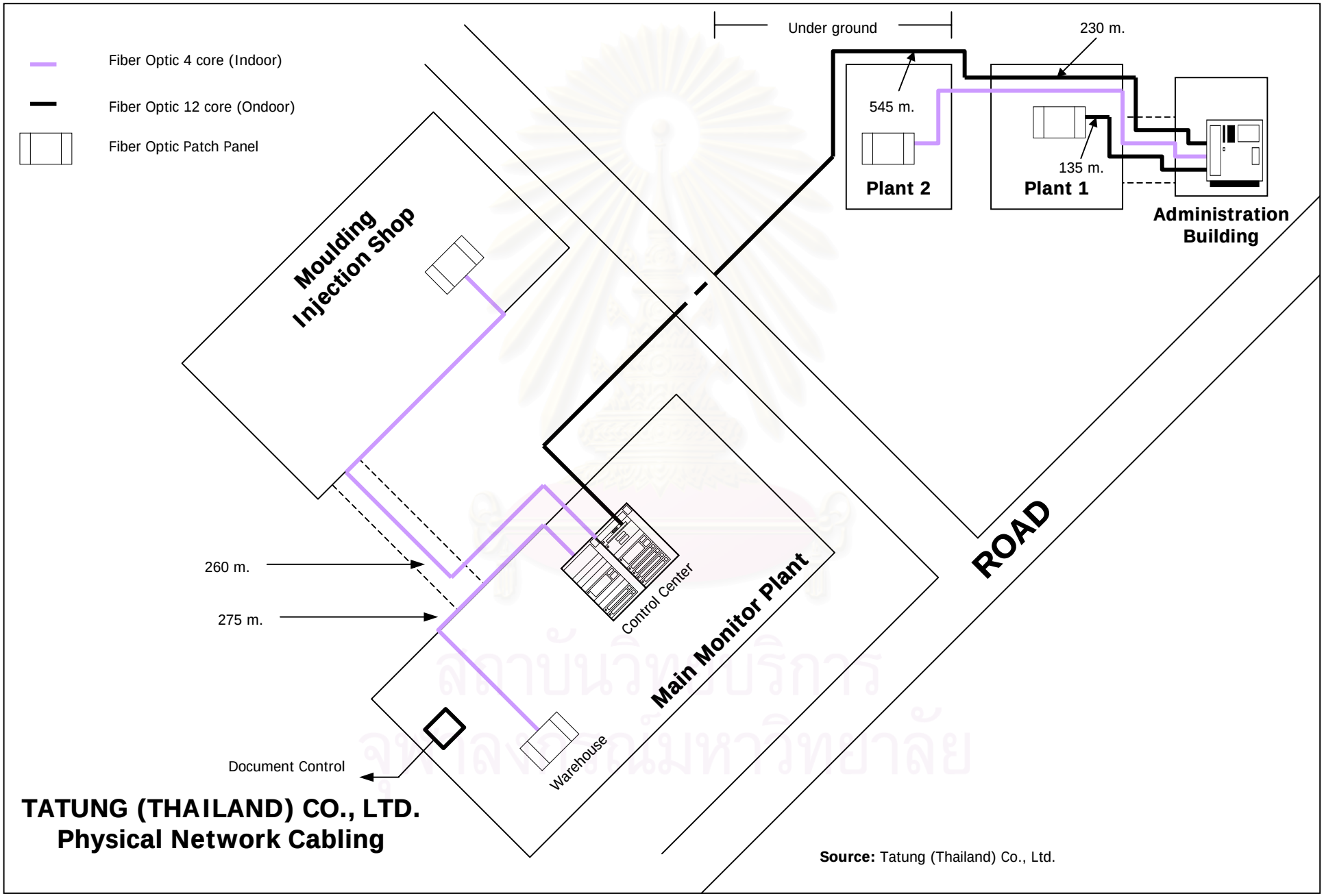
Network of Tatung (Thailand)



TATUNG (THAILAND) CO.; LTD.
Logical Network Configuration.

100BaseFX (Fiber optic)
100BaseTX (UTP)
SSII Dual Speed Hub 500
(10/100 Autosensing)

Source: Tatung (Thailand) Co., Ltd.


Fiber Optic 4 core (Indoor)
Fiber Optic 12 core (Ondoor)
Fiber Optic Patch Panel
Under ground
230 m.
545 m.
135 m.
Plant 2
Plant 1
Administration Building
Moulding Injection Shop
ROAD
260 m.
275 m.
Control Center
Main Monitor Plant
Warehouse
Document Control
TATUNG (THAILAND) CO., LTD.
Physical Network Cabling
Source: Tatung (Thailand) Co., Ltd.

Appendix B

SFIS Outline

SFIS Outline

1. Purpose

1.1 To reinforce manufacture control system for future small quantity but variety models manufacture type.

1.2 On line collect and feedback manufacture quality data.

1.3 Provide different control type for customer's require.

1.4 Provide on line WIP quantity information.

1.5 FIFO control of inventory and shipping.

2. Methods

2.1 To unify the coding of manufacture # and outing #.

2.2 To use Bar code to represent all the control number.

2.3 To unify the model label specification (contents and dimension) for on line label printing.

2.4 Route control to control manufacture process.

2.4.1 To fix the input station for repaired units.

2.4.2 NG sets in QA station must be fixed before lot accepted.

2.4.3 No unit can jump station during manufacture process.

2.5 To stick manufacture label in every key part for warranty check and type of key part will scan into system for configuration check if necessary.

2.6 FIFO for shipping control by line up pallet number and mark up with different color to show storage time.

3. Flow: control items as following

3.1 Manufacture number: Before input in manufacture line every products will have their unique manufacture number, all the manufacture information such as configuration, input data, repair status, inspection status, etc… all are included in manufacture number.

3.2 Control label: they are manufacture label, model label, carton label, pallet label, shipping label(to see the label specification and coding of computer plant for more detail).

3.2.1 Manufacture number label:

Contain manufacture number stick in key parts and process control card. One piece for M/B process, 5 pieces for NMB process, 10 pieces for set process, they are 12 digits in manufacture number and ahead with S for set, M for M/B, N for notebook, year code (1 digit)+month code (1 code)+lot code (5 digits)+continuous code (5 digits).

3.2.2 Model label:

Contain model number and outing number (with bar code), For HP project stick in input station, normally stick in packing station.

Now just print S/N bar code for model label but we are planning to print whole label on the line.

3.2.3 Carton label:

After pass all the inspection then printing in packing station, label contains

NMB: Carton #, quantity, model # and ID code.

M/B: Carton #, quantity, model # and ID code.

D/T and NB: Carton #, model #, configuration and ID code.

They are 12 digits in carton number.

For NMB and M/B: C (1 digit)+line code (2 digits)+data code (6 digits)+continuous code (3 digits)

For desk top and notebook: carton # as same as outgoing #.

3.2.4 Pallet label:

Pallet is the basic unit of QA sampling and shipping control which contains pallet number, model number and quantity (all with bar code), they 12 digits of pallet number which are P (1 digit)+line code (2 digits)+data code (6digits)+continuous code (3 digits).

For one line code the second line code is full with X.

3.2.5 Shipping label: for shipping control of very order or vehicle.

Ship over two times order: has different shipping # for each shipment.

Several orders in same shipment: each order has individual shipping label.

10 digits of shipping number: order (6 digits)+order attach code (2 digits)+continuous code (2 digits).

3.3 Outgoing number: Every product has individual unique outdoing number for warranty check, now is printing in model label and stick in out of product. The coding of outgoing number as follow year code (1 digit)+month code (1 digit)+line code (1 digit)+customer code (2 digits)+model code (2 digits)+continuous code (5 digits).

3.4 Process control: Key point as follow

3.4.1 Working order for each lot must key in configuration, S/N range, key part information, REV # for both H/W and S/W, quantity and necessary verified key part items.

3.4.2 Model label with outgoing number bar code will be printing in packing station after finishing all the inspection and configuration comparison.

3.4.3 Rework process must use pallet as base unit and not included in SFIS.

3.4.4 Sampling of reject lot must be using the same sampling number of rejected lot, reject pallet are identified with different color.

3.4.5 To input the sampling set of rejected lot is necessary for following judgment.

3.4.6 Can not printing shipping label with the pallet is not pass CQC station.

3.4.7 During shipping station can separate pallet if necessary and with new pallet number which ahead with S.

3.5 WIP function: provide real WIP quantity of model

For desk top and notebook: CA – ABI – CQC - SHIPPING

For M/B: SMT – MI – CQC – SHIPPING

3.6 Input key part's S/N when necessary.

3.7 Outgoing control:

- Line up the pallet number by finish time after input the outgoing model.
- Shipping department choose pallet in sequence for FIFO control.
- Scan pallet number for model check, shipping control and printing shipping label.

4. Report

4.1 Quality report Type:

- Daily, weekly and monthly report.
- Lot report.
- RMA report.

4.2 Quality report contains

- First and second yield rate by line or model.
- Top five defect.
- Repair status of top five defect or top five repair status.
- Line up defective parts.

4.3 WIP report: print distribution of chose model by defined station.

4.4 Outgoing report (shipping label): print all the pallet number and serial number for each shipping number.

Appendix C

SFIS Process Management Plan

SFIS Process Management Plan

Station	Work Contents	Equipment	User Software	Attention Item	Control
M/O Open Manufacture Order	1. Input Lot NO., Lot size. 2. Input Model name & input station. 3. Input Key parts No. (if necessary) 4. Input Route code. 5. Input S/N. 6. The original lot depend on demand can be deviled in to several lots. (If necessary). 7. Set target yields rate of model. 8. Input key part S/N set (if necessary)	**PC**	**PM Config**	1. Apply encode rule to make S/N. The S/N can't be repeating. 2. Lot NO., S/N & key parts. Operator will check the length of number. 3. Route name should be correct. 4. New added Model, Route & key parts can be key-in from "Config" program.	1. Every P/O is given by a lot No. to control. 2. Define a specific NO. of each product in order to check after shipping. 3. Key parts comparison. 4. Routing control of product.
Shop Monitor (SMO)	1. Set production target by line, station, and work time, Q'ty. 2. Set Kaban content. 3. Press the system "Start " button.	**PC** **LED Kanban** **DTA(RS-232)** **DCA Card**	**SMO**	1. Confirm Kanban number. 2. Every job of Kanban will continue to show for 1 minute. 3. You can set the Quality of any kind of job on the Kanban. 4. It should look into process when DTA show the red or yellow color. 5. DTA ID can't be modified arbitrary. 6. Pay attention to check the "Start" button be pressed or not, otherwise the system can't operate.	1. Showing the productivity target. 2. Monitor the system status any time Interrupt-broadcast function can show the message any time.
Input Assembly (CA)	1. Input the S/N.	**Laser Scanner** **DTA(K/B)**	**SMO**	1. Every number only can input for one time, it will show warning message from 2nd time. 2. Error code will check the length of number. 3. When input wrong number, you can input "UNDO" and try to input correct one. 4. Every station should input correctly, otherwise can't input in next station	1. Recording the build quality of lot. 2. Recording the incoming quality of lot. 3. Route control of production.

SFIS Process Management Plan (continue)

Station	Work Contents	Equipment	User Software	Attention Item	Control
Input Assembly (HI-POT)	1. Input the SN of good parts. 2. For the defective parts, input the error code first then input the S/N.	**Laser Scanner DTA(K/B)**	**SMO**	1. Every number only can input for one time, the DTA display will show warning message from 2nd time. 2. Error code will check the length of number. 3. When input wrong number, you can input "UNDO" and try to input correct one. 4. Every station should input correctly, otherwise can't input in next station.	1. Route control of production.
Testing	1. Input the S/N of good parts. 2. For the defective parts, input the Error code first then input the S/N	**Laser Scanner DTA(K/B)**	**SMO**	1. Every number only can input for one time, the DTA Display will show warning message from 2nd time. 2. Error code will check the length of number. 3. When input wrong number, you can input "UNDO" and try to input correct one. 4. Every station should input correctly, otherwise can't input in next station.	1. Route control of production. 2. Inspection statistics collection.
Repair	1. Input repair station No. and name of worker. 2. Input the SN of defective set. 3. The picture will show the explanation of inspection station, error code and defect phenomenon. 4. After repair, input the reason code, item code, duty type and responsibility. 5. Press the Finish.	**Laser Scanner PC**	**Repair Config**	1. If Reason code not enough for used, need for SFIS personnel setup. 2. Item code not enough used, need for SFIS personnel setup. 3. All Error repair ok, must to press the Finish is Ok. 4. Check for repair ok then input the station, route code to avoid is wrong.	1. Routing control of product. 2. 2.Repair statistics collection. 3. Product which un-finish repair can't be on line.

SFIS Process Management Plan (continue)

Station	Work Contents	Equipment	User Software	Attention Item	Control
Packing	1. Input test disk for packing PC. 2. Input S/N. 3. Print Carton Label. 4. Print Pallet Label.	**Laser Scanner** **Barcode Print**	**Packing**	1. Shipping number can be matched with the disk then pass. 2. Attention input place. 3. Checks print the Label again. 4. Different Model can't mix packing same pallet. 5. Carton, Pallet S/N is automatism to produce.	1. Model comparison automatically. 2. Auto distinguishes lot No. 3. On-line printing Label.
Quality Audit (QA)	1. Setup checks Lot. 2. Input shipment number, then display machines the pallet No. Model & stay check the same Model with pallet NO. 3. Input Shipment number with good. 4. Input Error code then input Shipment number with N/G. 5. Decide for Lot then presses the "Pass" or "Reject" button.	**PC** **Laser Scanner**	**CQC**	1. Check Lot number can't duplicate. 2. The Lot numbers for QA setup. 3. If input the code is wrong, you can input "UNDO" then input the coed is correct again. 4. Check the first then input number. 5. According Pallet for unit. 6. Reject then check again the Pallet NO. will show to yellow base and red word.	1. All pallets should be qualified during QA. 2. Pallet is the base of sampling.
Shipping	1. Input order number. 2. Input container number. 3. Input seal. 4. Input pallet NO. 5. Print Packing List.	**PC** **Laser Scanner** **Printer**	**Shipping**	1. Input pallet No., needs check if Pallet is first in then first out. 2. If you can't key in the pallet No. which not verify by QA. 3. Due to the demand need to divide the pallet, the system will generate new pallet NO. automatically.	1. First in, first out of product. 2. Only quality inventory can be shipping. 3. Stock consulting. 4. On-line printer label.

Appendix D

Production Record Form

MONITOR
DAILY RECORD SHEET
OUTPUT

LINE	
OPN.	
DATE	
MODEL	

MODEL	12:45 – 15:30	15:40 – 18:20	O.T.	8:00 – 10:00	10:10 – 12:00

PASS = _____

FAIL = _____

PASS

FIRST REWORK

1	2	3	4	5	6	7	8	9	10	31	32	33	34	35	36	37	38	39	40		
11	12	13	14	15	16	17	18	19	20	41	42	43	44	45	46	47	48	49	50		
21	22	23	24	25	26	27	28	29	30	51	52	53	54	55	56	57	58	59	60		

2nd REWORK

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		

FAIL

FIRST REWORK

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		

2nd REWORK

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		

	FAULT	FIRST TIME FAIL				2nd FAIL	REMARK
		12:45-15:30	15:40-18:20	08:00-10:00	10:10-12:00		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

MONITOR
DAILY RECORD SHEET
OUTPUT

LINE	
OPN.	
DATE	
MODEL	

MODEL	12:45 – 15:30	15:40 – 18:20	O.T.	8:00 – 10:00	10:10 – 12:00

PASS = _____

FAIL = _____

PASS

FIRST REWORK

1	2	3	4	5	6	7	8	9	10	31	32	33	34	35	36	37	38	39	40		
11	12	13	14	15	16	17	18	19	20	41	42	43	44	45	46	47	48	49	50		
21	22	23	24	25	26	27	28	29	30	51	52	53	54	55	56	57	58	59	60		

2nd REWORK

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		

FAIL

FIRST REWORK

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		

2nd REWORK

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10		

	FAULT	FIRST TIME FAIL				2nd FAIL	REMARK
		12:45-15:30	15:40-18:20	08:00-10:00	10:10-12:00		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

MONITOR

DAILY RECORD SHEET

LINE			
OPN.			
DATE			
MODEL			

PASS

1	11	21	31	41	51	61	71	81	91	1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92	2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93	3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94	4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95	5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96	6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97	7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98	8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99	9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100	10	20	30	40	50	60	70	80	90	100

1	11	21	31	41	51	61	71	81	91	1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92	2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93	3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94	4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95	5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96	6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97	7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98	8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99	9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100	10	20	30	40	50	60	70	80	90	100

1	11	21	31	41	51	61	71	81	91	1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92	2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93	3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94	4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95	5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96	6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97	7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98	8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99	9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100	10	20	30	40	50	60	70	80	90	100

FIRST REWORK

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

ถ้าพบปัญหาของเสียที่เหมือนกันในจำนวนมากกว่า 3 ตัวให้แจ้ง ซุปเปอร์ไวเซอร์ทันทีเพื่อแก้ไขปัญหา

PASS

FIRST REWORK

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60

2nd REWORK

1	2	3	4	5	6	7	8	9	10

1	2	3	4	5	6	7	8	9	10

FAIL

FIRST REWORK

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

2nd REWORK

1	2	3	4	5	6	7	8	9	10

REJECTION RECORD

	FAULT	FIRST TIME FAIL				O.T.	2nd FAIL	REMARK
		08:00-10:00	10:10-12:00	12:45-15:30	15:40-18:20			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

T/M INSP. DEP.

DATE : ______________

Q'TY INSP. : ______________ **MODEL :** ______________ **LINE :** ______________ **NAME :** ______________

ITEM	**POSITION**	**DEFECTIVE**													**REMARK**
		B/T	**C/T**	**D/I**	**DMG.**	**I/S**	**L/O**	**L/S**	**M/S**	**N/S**	**R/V**	**S/S**	**W/V**	**OTHER**	
TOTAL															

FAULT FINDER REPORT

MOD :

EL

LINE :

SECT. :

DATE :

TECH :

DEFECT CODE

No.	CODE	CCT.REF.	STAGE	S/N	: BROKEN TRACK / PAD LIFTED BRN	: BURNING / SMOKE C/O	: COMPONENT TILTED C/T	: DRY JOINT D/J	: DAMAGE / BROKEN DMG	: ETCHING OPEN E/G	: ETCHING SHORT E/S	: RESIDENTIAL FLUX F/S	: INSUFFICIENT / LESS SOLDER I/S	: LOOSE ASSEMBLY L/A	: LEG OUT / LIFTED L/O	: LEG SHORT / TOUCHING L/S	: MISSING M/S	: NO SOLDER N/S	: REVERSED R/V	: SOLDER OVER FLOW S/O	: SOLDER SHORT / BRIDGING S/S	: WRONG ASSEMBLY W/A	: WRONG VALUE W/V	: COMPONENT FAIL C/F	TOTAL
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									
	TOTAL																								

DAILY CHECKING LIST PCB.

ITEM	LINE: : ……..	MODEL รุ่น		PWB.No.		TIME เวลา		
Checking detail รายละเอียดการตรวจสอบ				Responsible ผู้รับผิดชอบ	Signature ลายเซ็น	OK.	NG	NG. Detail รายละเอียดของเสีย
H/I :								
1	Ensure production model ตรวจสอบยืนยันรุ่นที่ผลิต			Leader				
2	Latest update PCN of this model PCN. ล่าสุดของรุ่นนี้			Leader				
3	Point for retention of this model จุดที่ต้องระวังของรุ่นนี้			Leader				
4	Double check component specification and direction on each stage ตรวจสอบสเปกและทิศทางของอุปกรณ์ที่แต่ละ Stage			Leader				
5	Ensure if model sticker is correct ตรวจสอบสติกเกอร์แสดงรุ่นต่างๆ			Leader				
6	Check if the H/I component transfer from AI. Is correct ตรวจดูว่า Component ที่ Transfer จาก AI ถูกต้องหรือไม่			Leader				
Trimming :								
1	Are component on component side close PWB. ตรวจดูว่าอุปกรณ์ที่อยู่ด้านบน อุปกรณ์ติดกับ PWB			Leader				
2	Ensure track side re-solder point and FBT can not be stuffed solder ตรวจสอบจุดที่ต้องเติมตะกั่วและตัว FBT ต้องไม่ติดตะกั่ว			Leader				
3	Double check item 1, 2, 3 of H/I ตรวจเช็คราย การ 1, 2, 3 ของ H/I			Leader				
4	Gluing of component that solder on truck side ตรวจสอบสเปกตำแหน่ง ทิศทาง หยอดกาวของอุปกรณ์			Leader				
Testing :								
1	Ensure IC is programmed IC โปรแกรมหรือยัง			Leader				
2	Ensure if are program is correct โปรแกรม ATE ถูกต้องหรือไม่			Leader				
3	Check power source pattern of model under test is correct or not ตรวจแหล่งจ่ายไฟของรุ่นที่ทดสอบถูกต้องหรือไม่			Leader				
4	Check if equipment is correct (1. Electroscope, 2. PC, 3. DVM, 4. PC diskette) ตรวจเช็คความถูกต้องของอุปกรณ์ เครื่องมือ			Leader				
Corrective action								
Responsible	**Supervisor**		**Section Mgr.**			**Manager**		

Appendix E

Barcode

TATUNG (THAILAND) CO., LTD.

ERROR CODE FOR PC BASE

SYM	DEFECTS STATUS	BARCODE
1000	MONITOR NO RASTER	
1100	SPS FAIL	
1104	POWER MANAGEMENT (SLEEP, GREEN)	
1107	FAN NOISE	
1108	FAN NG	
1200	KEY BOARD FAIL	
1300	LED UNLIGHTED (LED 1-8)	
1500	RESET, REBOOT FAIL	
3903	SMART CARD FAIL	
1604	ROM DATE FAIL (WRONG VER)	
1605	DMI TEST FAIL	
1706	MEMORY FAIL	
1800	VGA FAIL	
1900	SPEED FAIL	
2400	SPK FAIL	
2401	MIC TEST FAIL	
2709	PHONE RING	
7003	INTERNET	

SYM	DEFECTS STATUS	BARCODE
2500	MOUSE TEST FAIL	
2600	PRINTER PORT FAIL	
2701	MODEM FAIL	
2702	COM1 FAIL	
2706	IR TEST FAIL	
2800	GAME PORT FAIL	
2801	BUTTON TEST FAIL	
2900	HDD FAIL	
2901	HDD BOOT FAILURE	
3005	CD-ROM FAIL	
3008	CD-ROM EJECT FAIL	
3106	USB FAIL	
3200	HANG UP	
3400	RTC FAIL	
3810	BURN-IN NG	
7002	D-LINK FAIL	
5920	AUDIO TEST	
9999	OTHER	

TATUNG (THAILAND) CO., LTD.

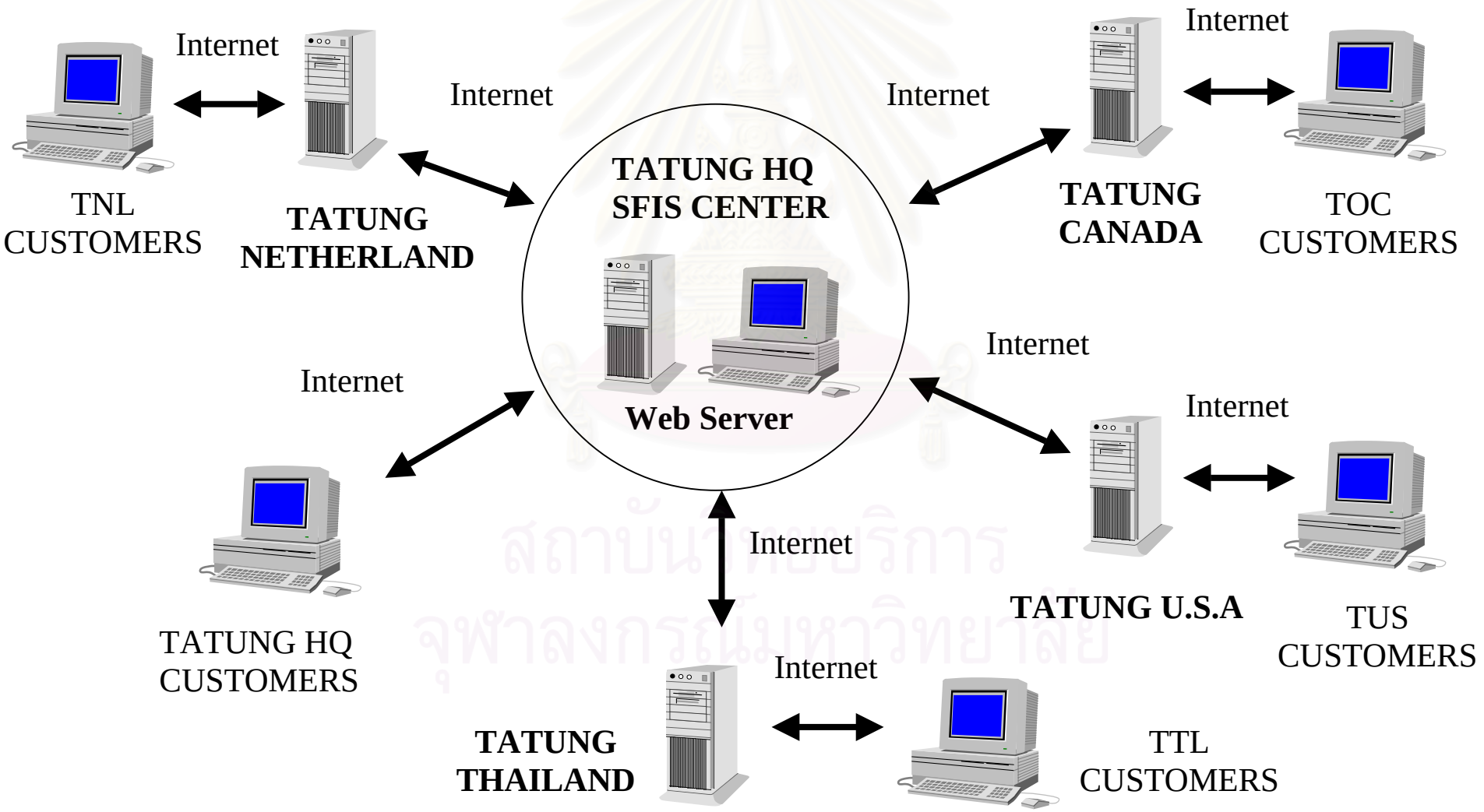
REASON CODE REJECT AIO

BARCODE	ERROR	REASON CODE_DESC	REASON CODE_DESC
	A021	SURFACE OXIDIZED	เกิดเป็น OXIDE ที่อุปกรณ์
	A022	NTF	อาการเสียชั่วขณะ
	A023	RE - INSERT	ใส่อุปกรณ์ใหม่
	A024	RE - ARRANGE	จัดอุปกรณ์ใหม่
	A001	SHORT	วงจรช็อต
	A002	OPEN	วงจรขาด
	A003	COMPONENT REVERSE	ใส่อุปกรณ์กลับขั้ว
	A004	COMPONENT MISSING	ไม่ได้ใส่อุปกรณ์
	A005	WRONG COMPONENT	ใส่อุปกรณ์ผิด
	A006	LEG CUT	ใส่ขาอุปกรณ์ไม่ลง
	A007	DISPLACEMENT	วางอุปกรณ์ไม่ตรง
	A008	LEG FOLDING	ขาอุปกรณ์พับ
	A009	POSITION REVERSE	ใส่อุปกรณ์ผิดตำแหน่ง
	A010	LEG OUT	ใส่อุปกรณ์ลอย
	A011	ELECTRONIC PERFORMANCE IS NOT GOOD	การประกอบไม่ดี
	A013	BURNING	อุปกรณ์มีรอยไหม้
	A014	LOOSE (MAN - MADE)	ใส่อุปกรณ์หลวม (คนใส่)
	A015	LOOSE (NATURAL)	ใส่อุปกรณ์หลวม (ทั่วไป)
	A016	SUBMERGED TIN	ตะกั่วท่วม

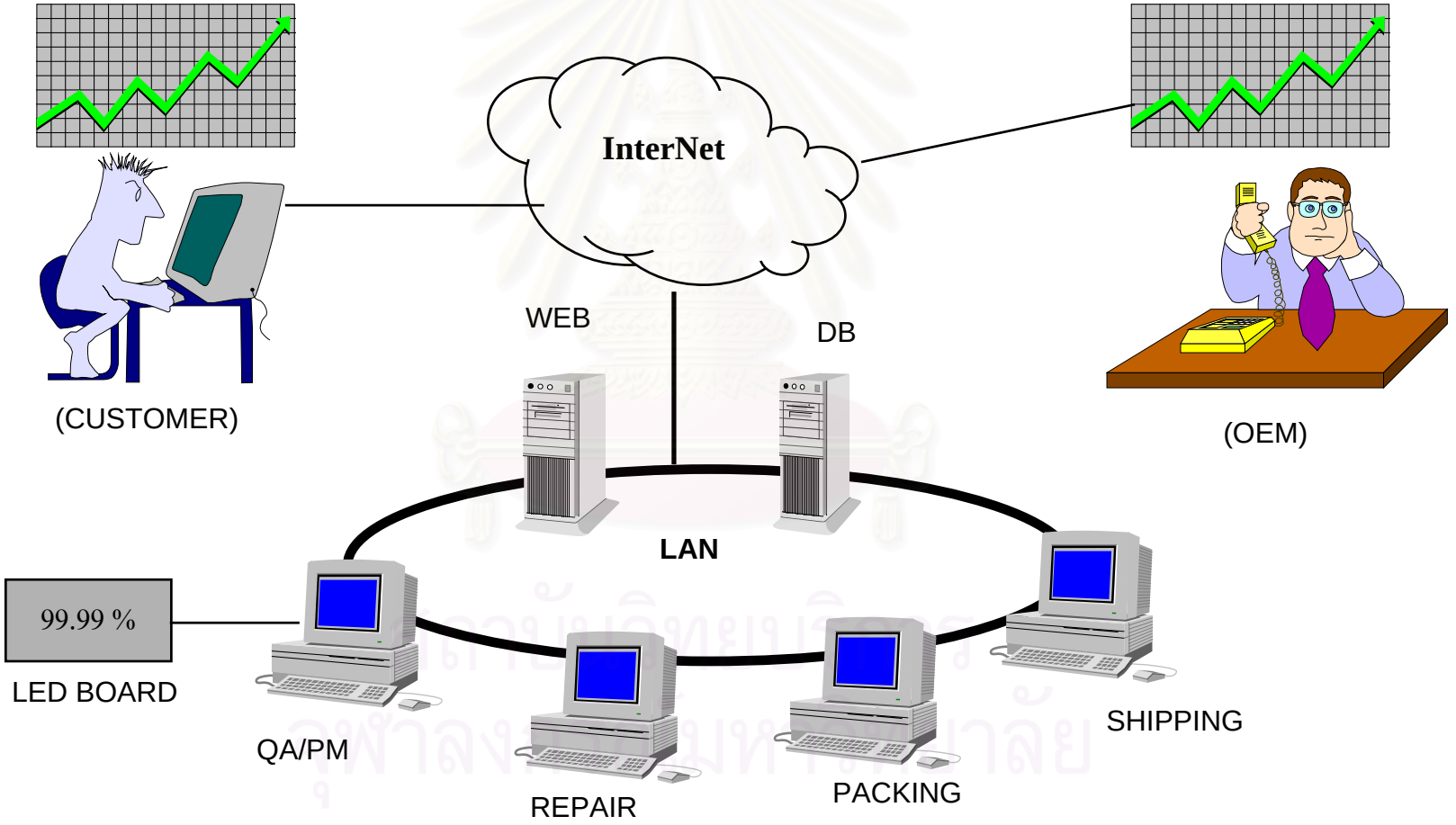
Appendix F

SFIS Demo

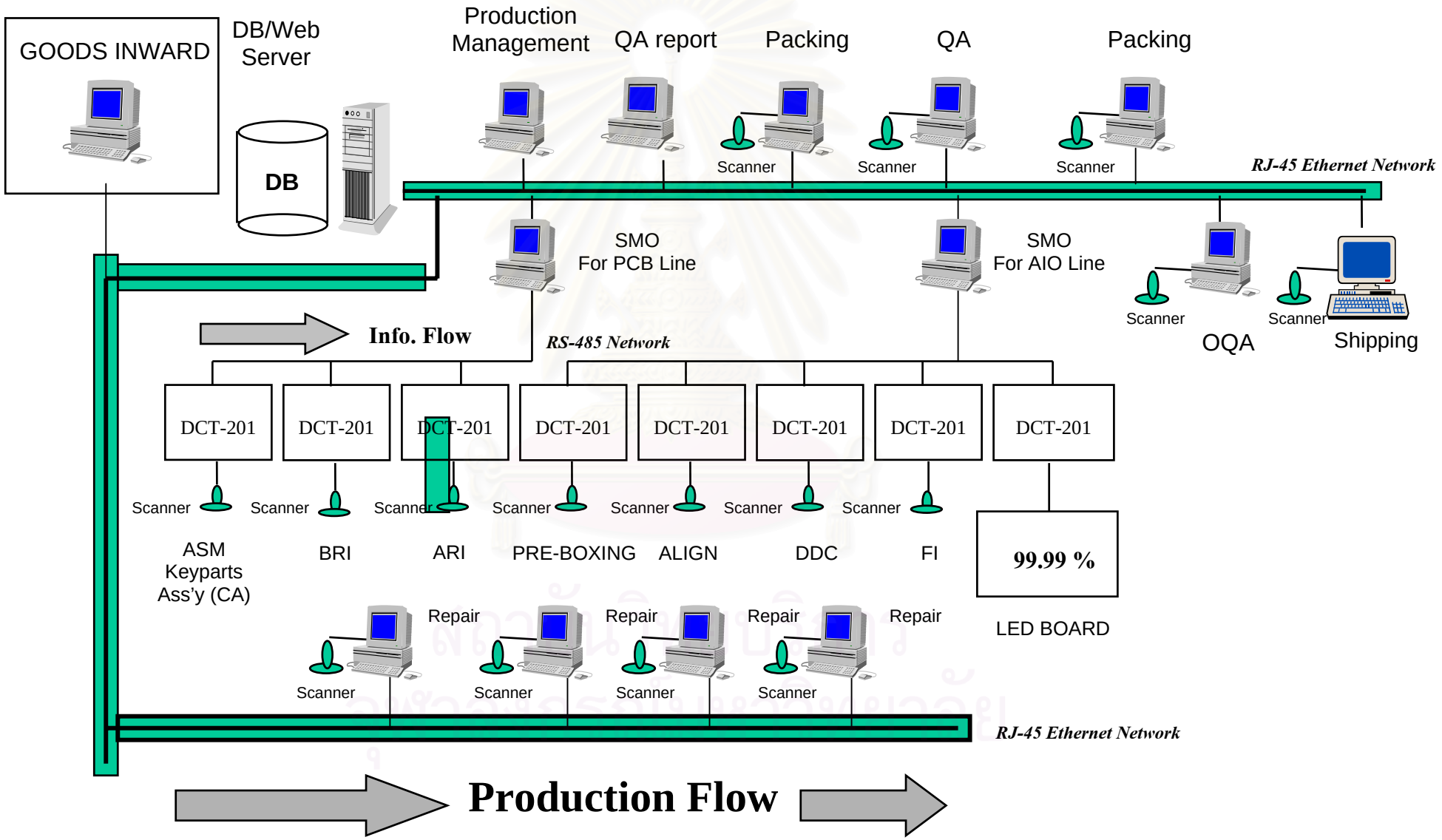
SFIS WORLD WIDE SYSTEM



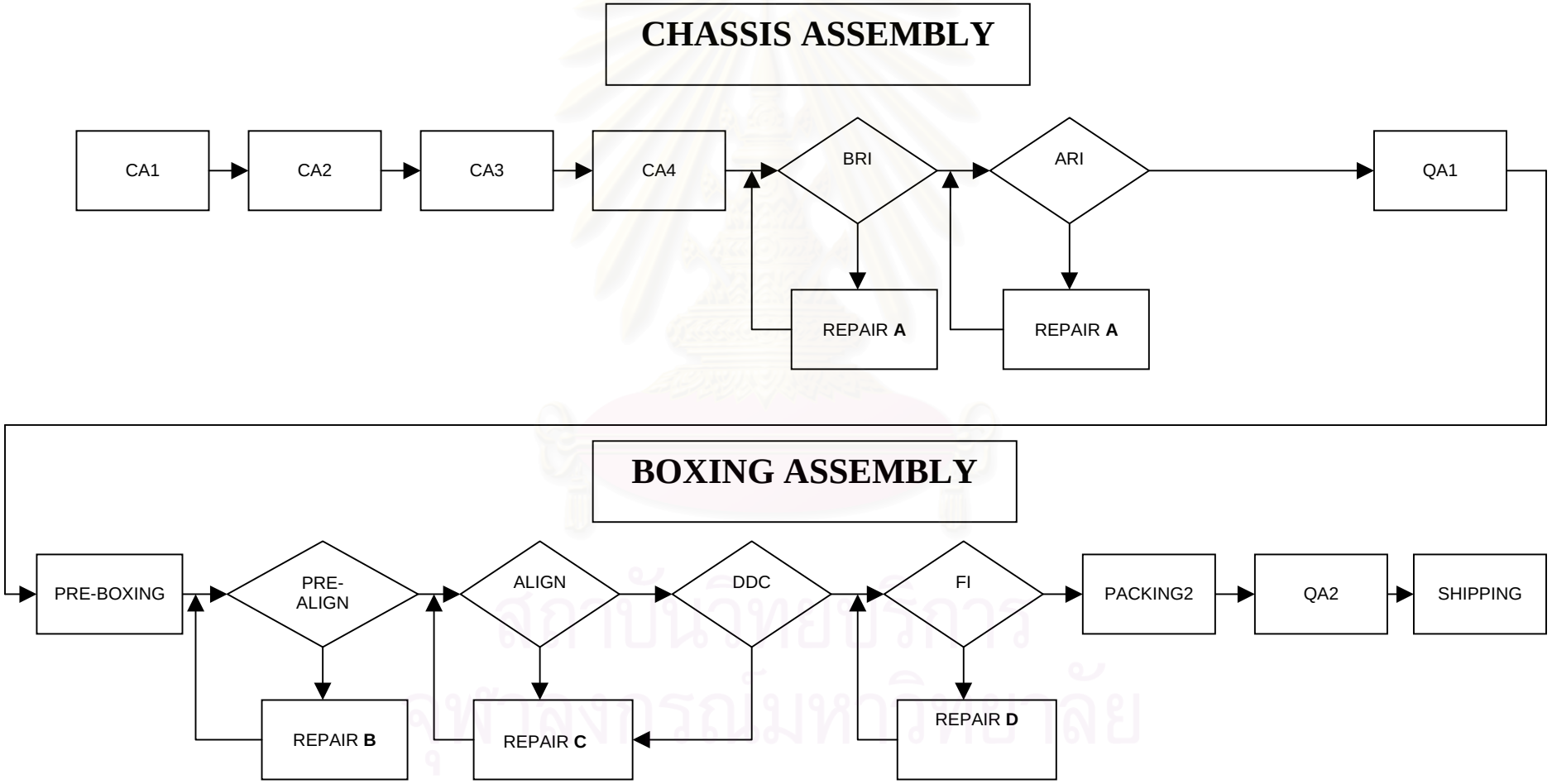
SFIS Web Connection



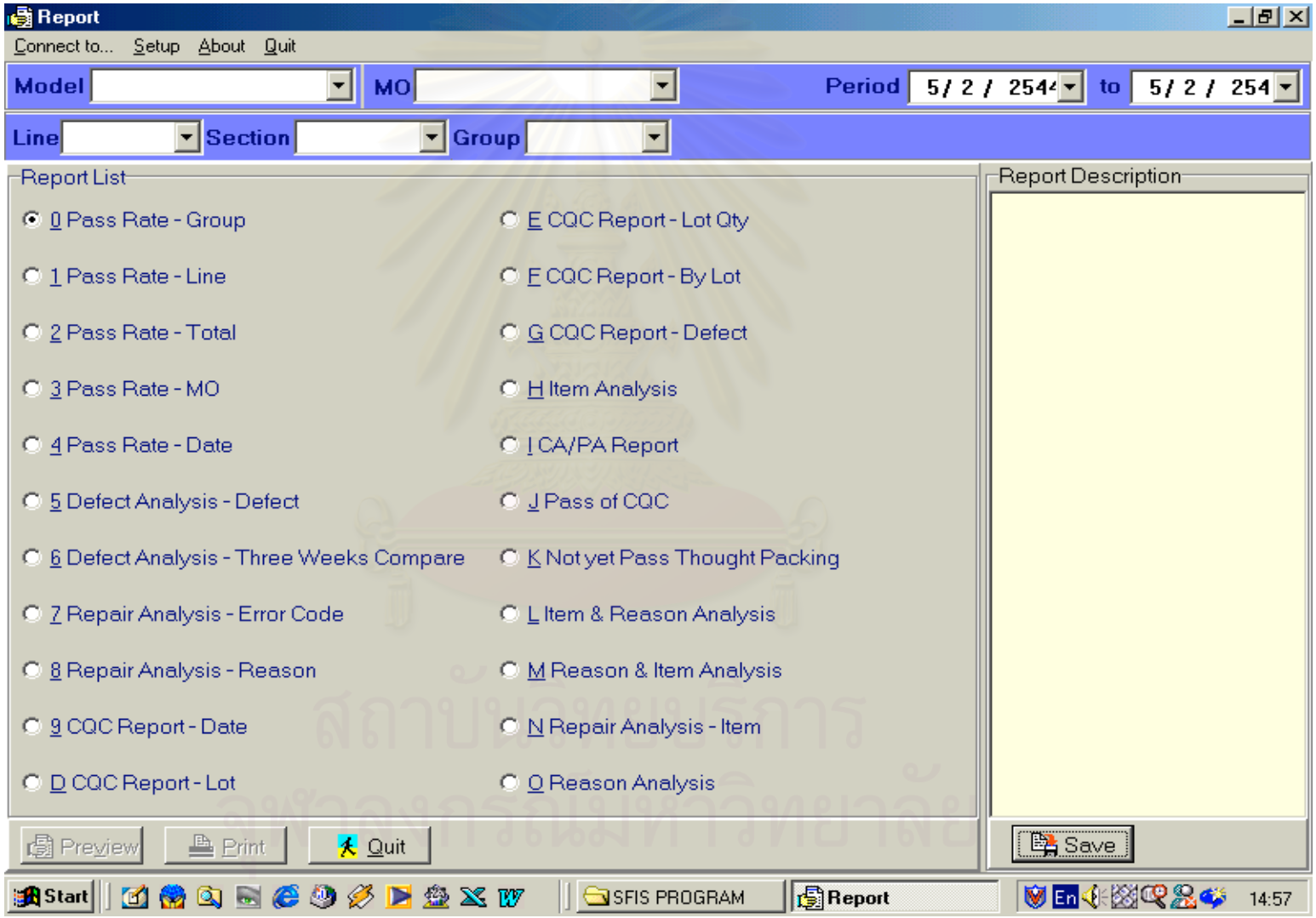
SFIS Production Flow (BLUE RIVER)



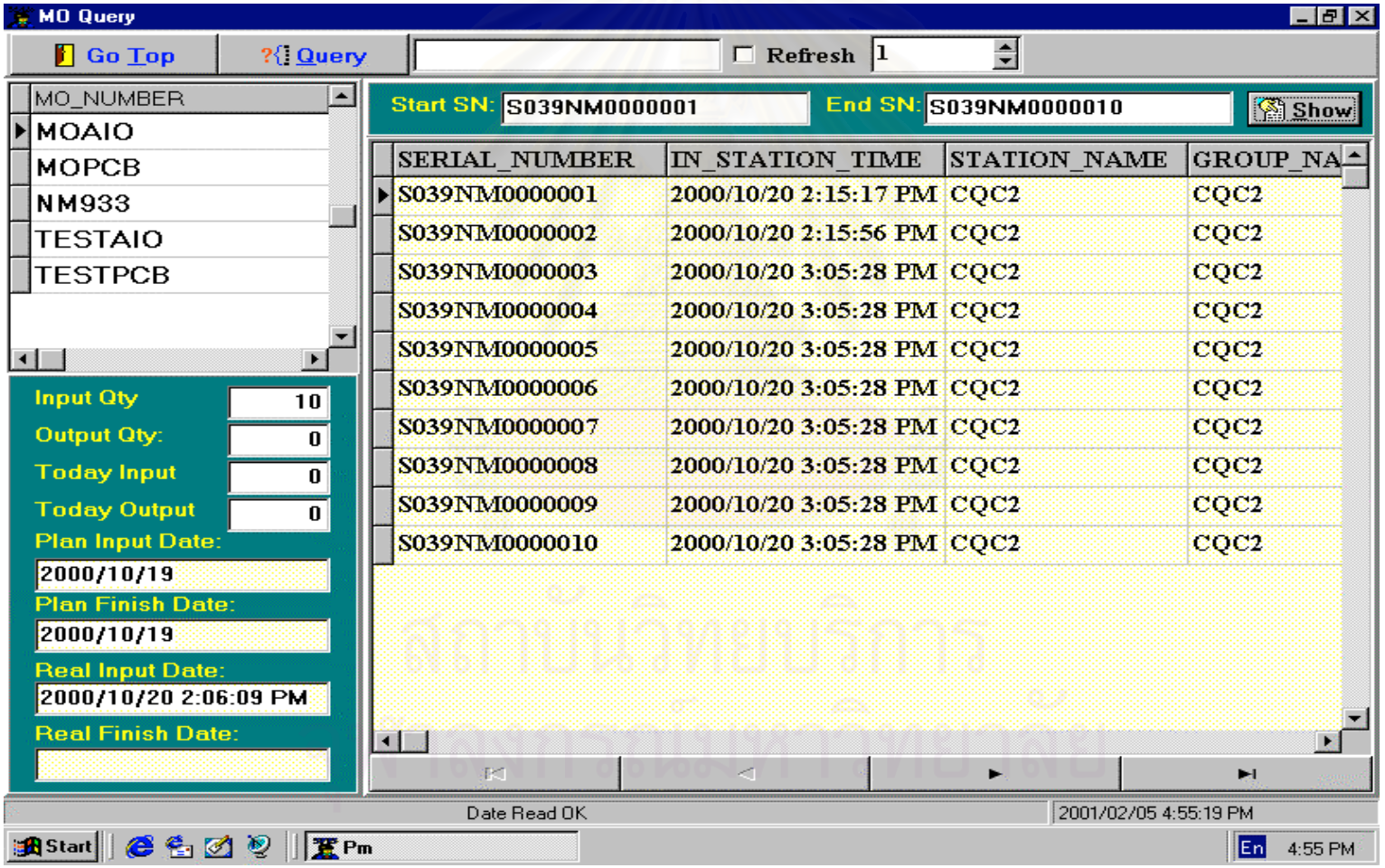
SFIS Route Control (BlueRiver)



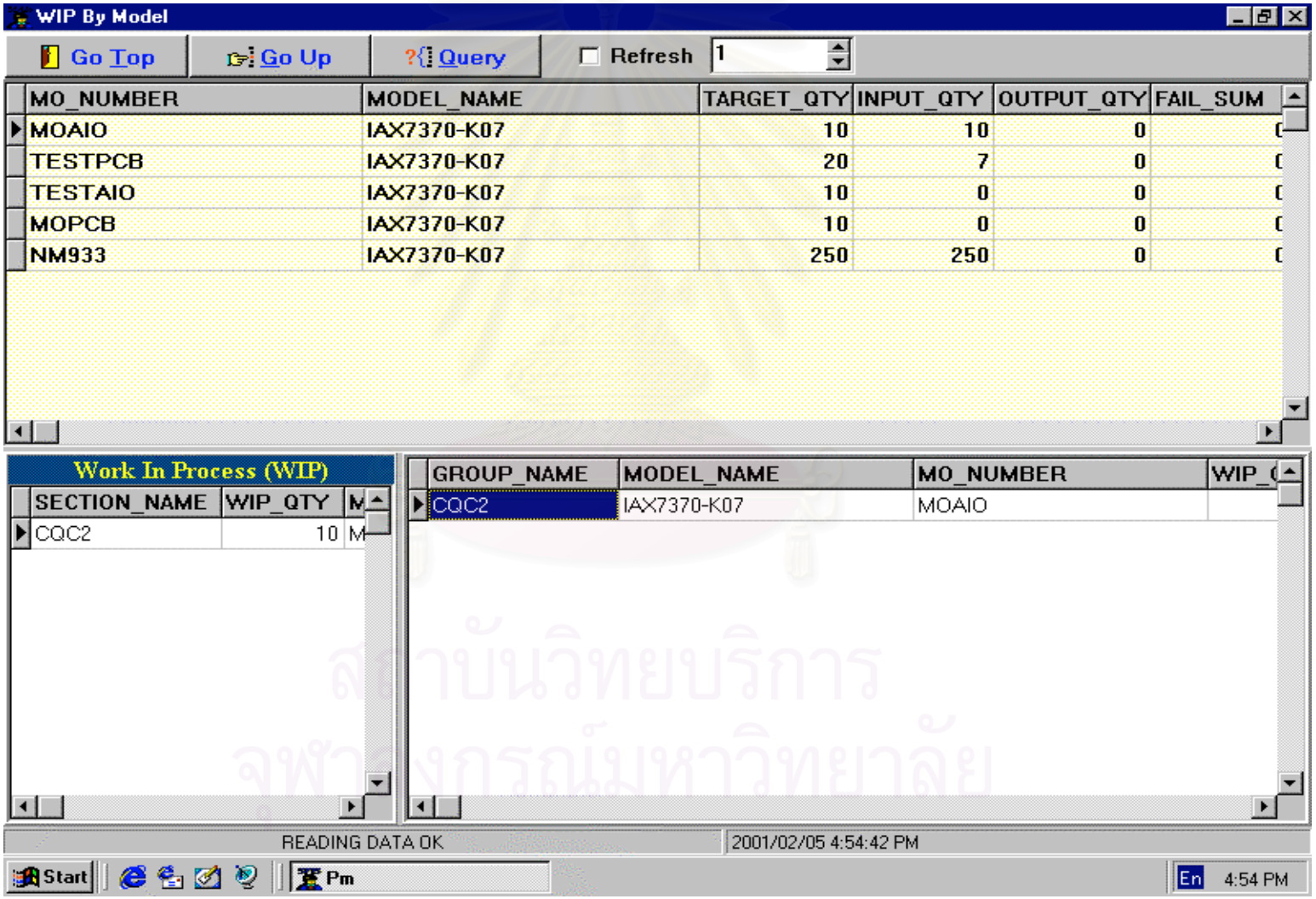
SFIS Report


Report
Connect to... Setup About Quit
Model
MO
Period 5/ 2 / 254
to 5/ 2 / 254
Line
Section
Group
Report List
0 Pass Rate - Group
1 Pass Rate - Line
2 Pass Rate - Total
3 Pass Rate - MO
4 Pass Rate - Date
5 Defect Analysis - Defect
6 Defect Analysis - Three Weeks Compare
7 Repair Analysis - Error Code
8 Repair Analysis - Reason
9 CQC Report - Date
D CQC Report - Lot
E CQC Report - Lot Qty
F CQC Report - By Lot
G CQC Report - Defect
H Item Analysis
I CA/PA Report
J Pass of CQC
K Not yet Pass Thought Packing
L Item & Reason Analysis
M Reason & Item Analysis
N Repair Analysis - Item
O Reason Analysis
Report Description
Preview
Print
Quit
Save
Start
SFIS PROGRAM
Report
14:57

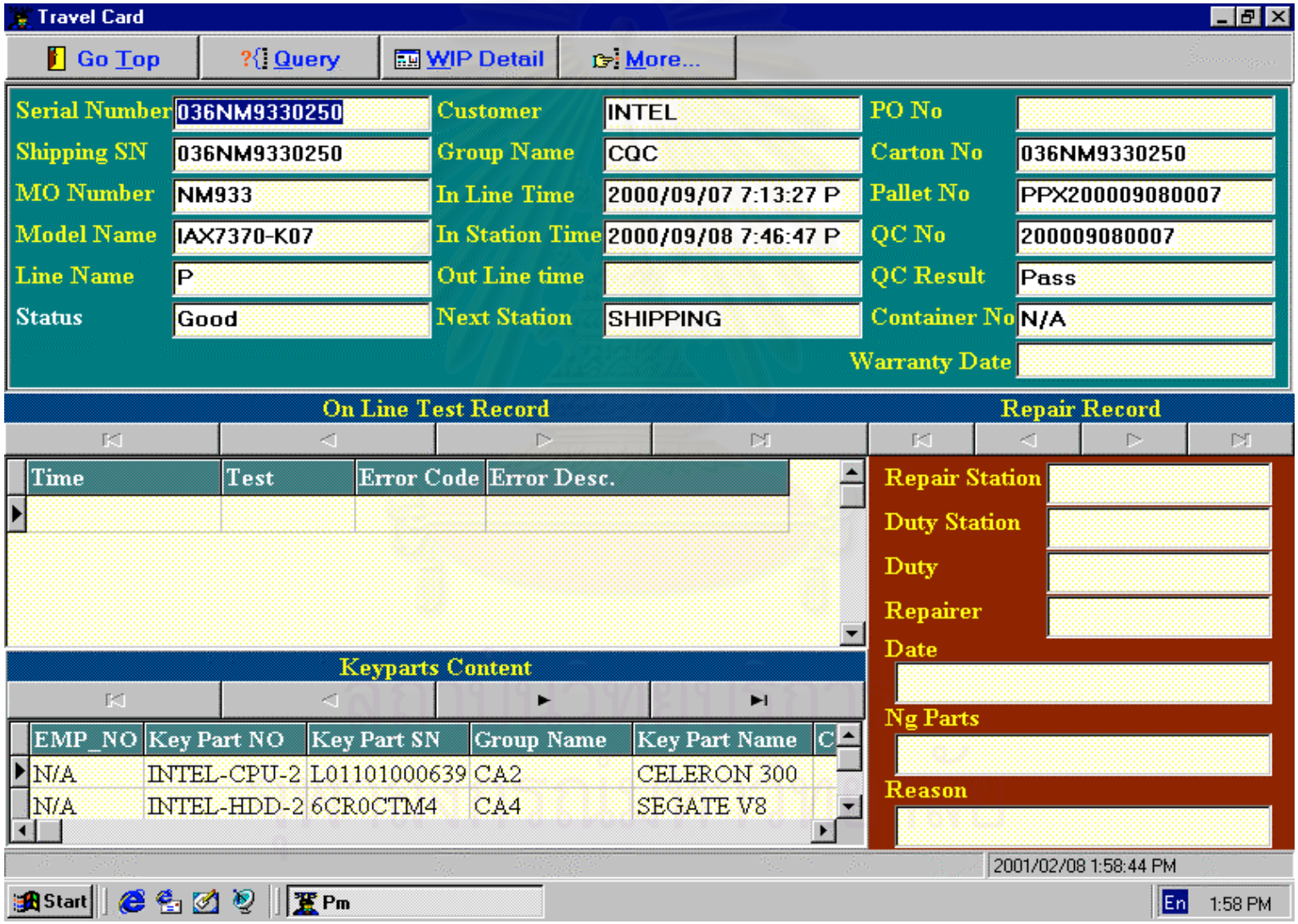
LOT(Model) MO Query - Real Time tractability



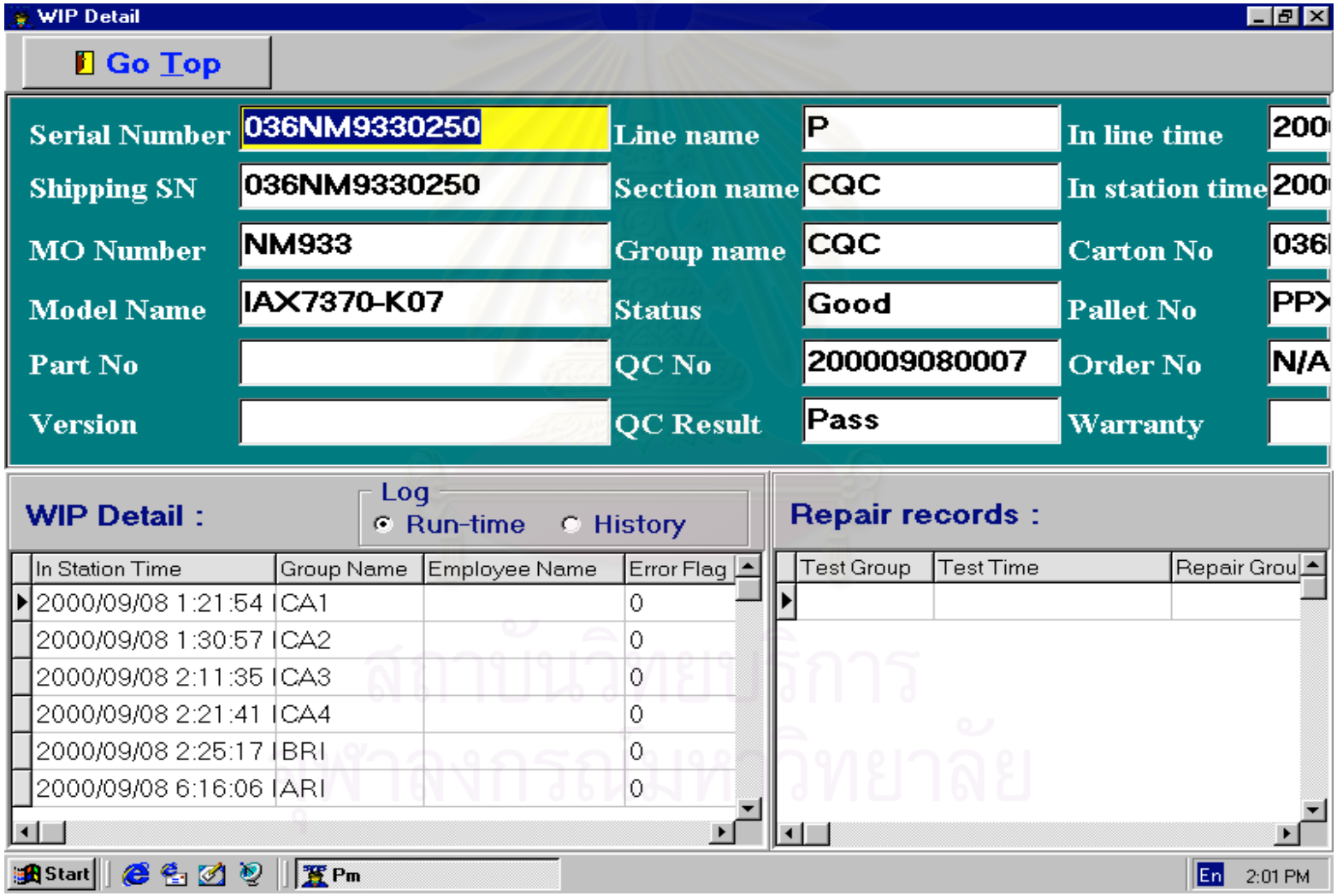
LOT(Model) - WIP by model



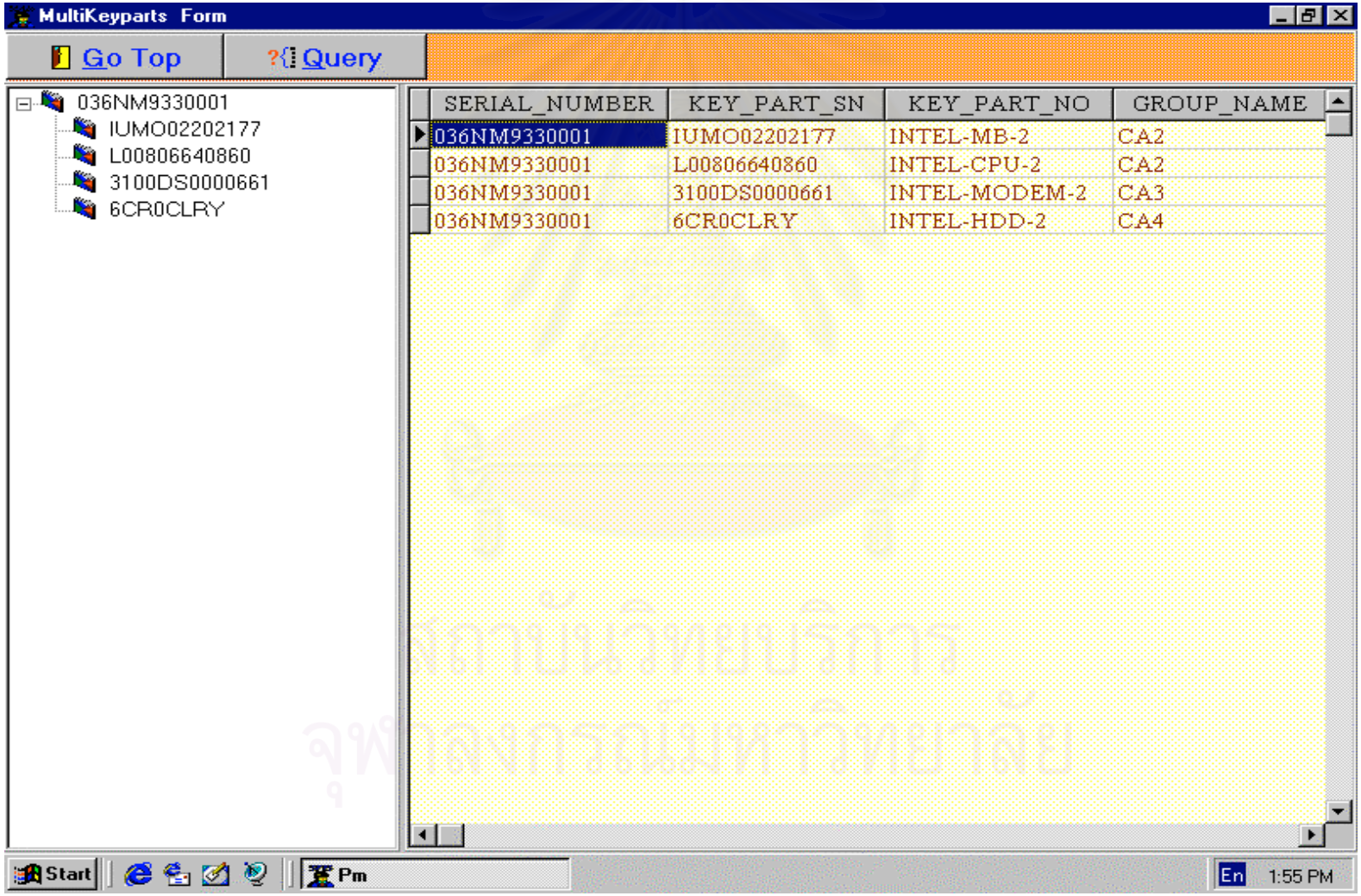
LOT(Model) - Historical information for a model



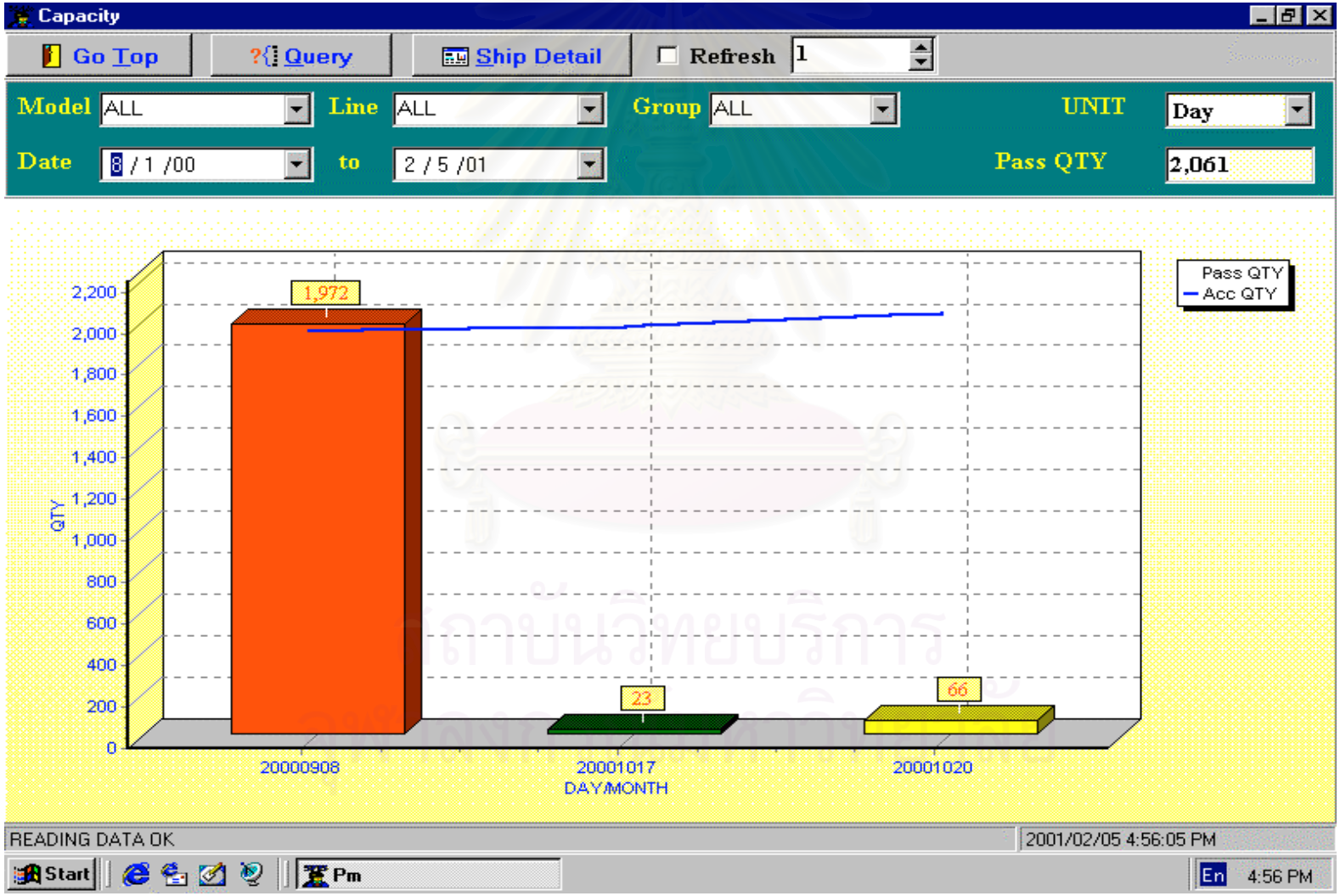
LOT(Model) - WIP Detail



LOT (Model) - Key parts in a model



LOT(Model) - Capacity



Appendix G

Database Key in / Maintain and Access

No.	Document type	Description	Key in & maintain	Double check
1	Approval Note	Component approve	Document clerk	Document clerk
2	Approval Vendor	Supplier approve	Document clerk	Document clerk
3	Alignment Software	Software type / Ver. / History	Document clerk	PE engineer
4	Calibration Procedure	Result of equipment calibration	Document clerk	Document clerk
5	Concession	Temporary use alternative part	Document clerk	PE engineer
6	Internal Concession	Result of internal concession	Document clerk	Document clerk
7	Drawing & Composite & Artwork	Status of Drawings / Composite and Artwork	Document clerk	Sr. officer doc.
8	ECN (TUK, TPE, TTL)	Detail of change part and affect model	Document clerk	Sr. officer doc.
9	Engineering PP	Result of PP	Document clerk	PE engineer
10	Information Sheet	- Details of change - Affect model	Document clerk	Sr. officer doc.
11	Inspection Instruction(II)	- Current revision of II - Quantities of pages	Document clerk	PE engineer
12	Loading Container	- Type of loading - Quantities of loading	Document clerk	PE engineer
13	Local Approve Vendor	Approve local supplier	Document clerk	PE engineer
14	Original Bill of Material(BOM)	Structure of BOM	Document clerk	PE engineer
15	Plastics Color Chip	Approval color of plastic for injection	Document clerk	Sr. officer doc.
16	Printing Position (Moulding)	Detail of printing	Document clerk	Sr. officer doc.
17	Printing WI (Moulding)	- Detail of printing	Document clerk	Sr. officer doc.
18	Process Change Notice (PCN)	- Detail of change - Affect model	Document clerk	PE engineer
19	Production Specification	Spec of produced	Document clerk	PE engineer

No.	Document type	Description	Key in & maintain	Double check
20	Test Specification	Status of test spec.	Document clerk	Sr. officer doc.
21	QM & SOP	Detail of quality manual	Document clerk	Sr. officer doc.
22	Reject Note	Report of reject parts	Document clerk	Sr. officer doc.
23	WI TPE	Status of WI from TPE	Document clerk	Sr. officer doc.
24	Working Instruction (WI)	- Current revision of WI - Quantities of pages	Document clerk	PE engineer
25	Statement of Compliance	Status of statement	Document clerk	Sr. officer doc.
26	Tatung Standard	Class of parts	Document clerk	Sr. officer doc.
27	Trial	Result of testing component	Document clerk	Sr. officer doc.
28	Standard Time	Standard time of each model	IE engineer	IE engineer
29	Bar code	Status of Bar code	Document clerk	Sr. officer doc.
30	Component Specification	Report of component spec.	Document clerk	Sr. officer doc.

Appendix H

Working Instruction of Document Manual

TATUNG (THAILAND) CO., LTD.		WORKING INSTRUCTION			
TITLE : REAL TIME DOCUMENT SYSTEM		**FILE No.** : **WI-000-999-00**			
MODEL : ALL MODELS		**PAGE** : **1** **OF** **9**			
REV.	**DESCRIPTION**	**DATE**	**ISSUER**	**CHECKER**	**APPROVED**
001	NEW RELEASE				

วัตถุประสงค์ (OBJECTIVE)

1. เพื่อให้สามารถรู้วิธีการทำงานของระบบ และสามารถใช้งานได้อย่างถูกต้อง

   FOR KNOWLEDGE OPERATING OF SYSTEM AND CAN APPLY ARE CORRECTLY.

2. เพื่อให้สามารถรู้วิธีการในการเข้าไปเชื่อมกับระบบ เพื่อเข้าไปใช้งานได้

   FOR KNOWLEDGE WITH LOG ON TO CONNECT THE SYSTEM AND CAN DO THE ENQUIRY.

3. เพื่อให้รู้วิธีการในการใช้คำสั่งต่างๆ

   FOR KNOWLEDGE WHICH METHOD AND COMMAND.

แนะนำระบบ (ABSTRACT)

1. REAL TIME SHOPFLOOR INFORMATION SYSTEM คือระบบข้อมูลเอกสารของการผลิต เมื่อใช้ระบบนี้แล้วจะทำให้ทราบว่าเอกสารในการผลิตที่นำไปใช้นั้นถูกต้องตามสถานะของการผลิตในปัจจุบันหรือไม่

   REAL TIME INFORMATION SYSTEM IS DATABASE INFORMATION DOCUMENT FOR MANUFACTURING AND THEN IMPLEMENT THIS SYSTEM WILL BE SOLVING WITH CORRECT INFORMATION.

2. โปรแกรมที่ใช้ คือ MICROSOFT “ACCESS” และใช้ระบบเครือข่ายในการเชื่อมโยง

   THE PROGRAMS SUPPORT IS MICROSOFT “ACCESS” AND LINK BY NETWORK.

3. โครงสร้างของโปรแกรมจะแบ่งออกเป็น 2 ส่วน คือ

   STRUCTURE OF PROGRAM CONSIST 2 PARTS

   3.1 การคีย์ข้อมูล (DATA KEY IN)

   3.2 การดูข้อมูล (INQUIRY DATA)

TATUNG (THAILAND) CO., LTD.		WORKING INSTRUCTION			
TITLE : REAL TIME DOCUMENT SYSTEM		**FILE No.** : **WI-000-999-00**			
MODEL : ALL MODELS		**PAGE** : **2** **OF** **9**			
REV.	**DESCRIPTION**	**DATE**	**ISSUER**	**CHECKER**	**APPROVED**
001	NEW RELEASE				

ข้อแนะนำเบื้องต้น (BASIC INTRODUCTION)

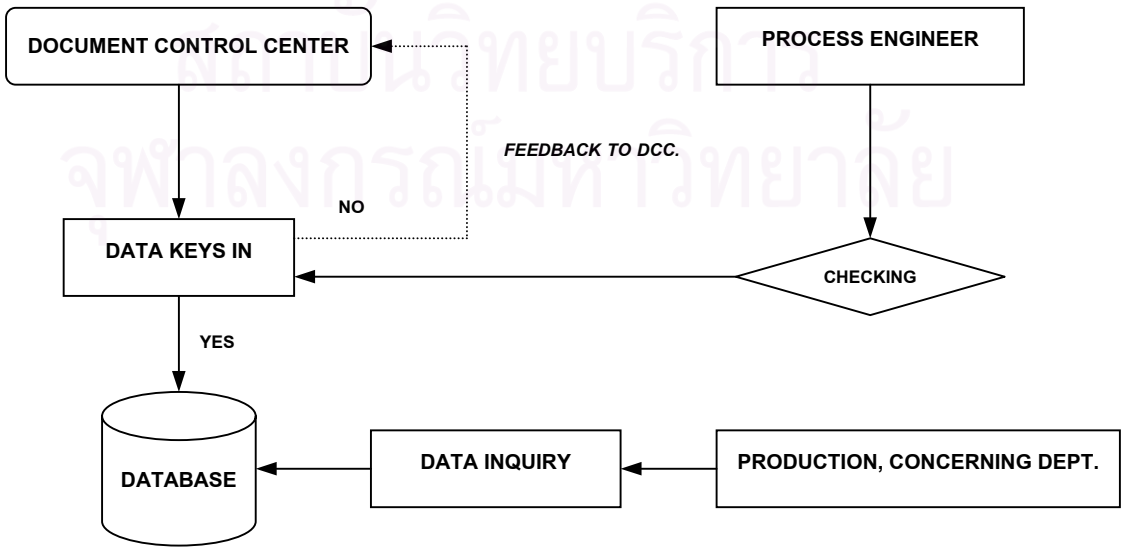
1. สำหรับพนักงาน ลีดเดอร์ หรือหัวหน้างาน ที่จะใช้งาน REAL TIME INFORMATION SYSTEM จะต้องได้รับการอบรมเกี่ยวกับคอมพิวเตอร์พื้นฐาน หรือมีความรู้เกี่ยวกับคอมพิวเตอร์มาก่อน

   FOR OPERATOR, LEADER OR SUPERVISOR WILL BE USED THIS SYSTEM SHOULD BE PASS TRAINING BASIC COMPUTER OR KNOWLEDGE WITH COMPUTER.

2. ไม่อนุญาตให้ผู้ที่ไม่มีส่วนเกี่ยวข้อง ทำการแก้ไขข้อมูล ยกเว้น DOCUMENT CONTROL CENTER และวิศวกรฝ่ายผลิตที่มีหน้าที่เกี่ยวข้องเท่านั้น

   DO NOT ALLOW PERSON NOT CONCERNING TO MODIFIED DATA. EXCEPT, DOCUMENT CONTROL CENTER AND PROCESS ENGINEERING SECTION.

3. โครงสร้างในการทำงาน DATA ENTRY และ DATA INQUIRY (USER) ดังรูป 1
   STRUCTURE OF DATA ENTRY AND INQUIRY (USER) SHOWN AS FIGURE 1.



รูปที่ (FIGURE) 1 แสดงแผนผังการควบคุมในการทำงาน (PROCEDURE OF FLOW CHART)

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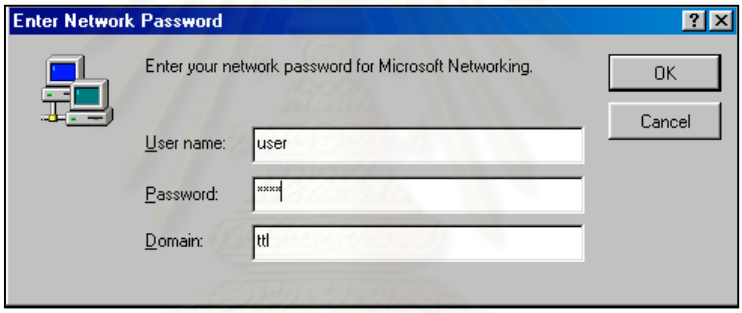
<u>วิธีการทำงาน (PROCEDURE)</u>

1. เปิดเครื่อง PC โดยการกดปุ่มสวิตช์ “ON” รอจนกว่าเครื่อง BOOT เสร็จ จนปรากฏหน้าจอ ดังรูป 2

   PRESS SWITCH POWER OF PC TO “ON” AND THEN WAITING UNTIL APPEAR MENU, SEE FIGURE 2.



รูปที่ (FIGURE) 2 แสดงการเข้าระบบ (LOG ON TO NETWORK)

2. ตรวจสอบที่ช่อง User name: จะต้องเป็น “ user “ ห้ามเปลี่ยนเป็นอย่างอื่นโดยเด็ดขาด
   CHECK USER NAME SHOULD BE USED “ user ”, DO NOT CHANGE TO ANOTHER.
3. ตรวจสอบที่ช่อง Domain จะต้องเป็น “ ttl ” ห้ามเปลี่ยนเป็นอย่างอื่นโดยเด็ดขาด
   CHECK DOMAIN SHOULD BE USED “ ttl ”, DO NOT CHANGE TO ANOTHER.
4. ที่ช่อง Password: ให้คีย์คำว่า user เข้าไป หลังจากนั้นให้กดปุ่ม ENTER บนคีย์บอร์ด หรือใช้เม้าส์คลิกที่ปุ่ม “OK”
   KEY WORD “user” IN PASSWORD AND THEN PRESS ENTER BUTTON ON KEY BOARD OR USE MOUSE CLICK “OK” MENU.

<u>หมายเหตุ</u> <u>(N.B.)</u>

- ในส่วนของ USER NAME และ PASSWORD จะแตกต่างกันไปในแต่ละแผนก ขึ้นอยู่กับการติดตั้งของทาง MIS และขั้นตอนการทำงานนี้จะครอบคลุมเฉพาะระบบที่ติดตั้งในฝ่ายผลิตเท่านั้น
  FOR THE USER NAME AND PASSWORD ARE DIFFERENT FOR EACH OF DEPARTMENT, AND DEPEND TO MIS SET UP. THERFORE, THIS METHOD ARE COVER ON PC INSTALL IN PRODUCTION ROOM ONLY.

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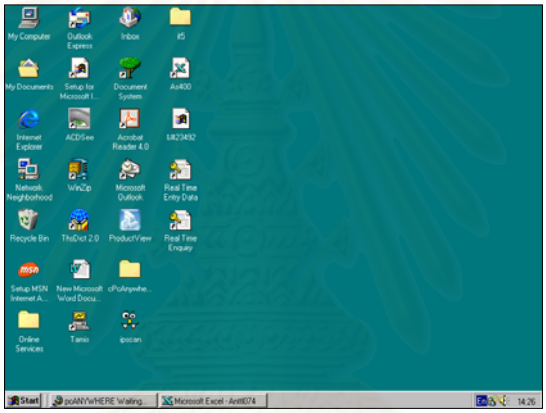
5. จากนั้นให้รอสักครู่ จนปรากฏหน้าจอขึ้นมา ดังรูป 3

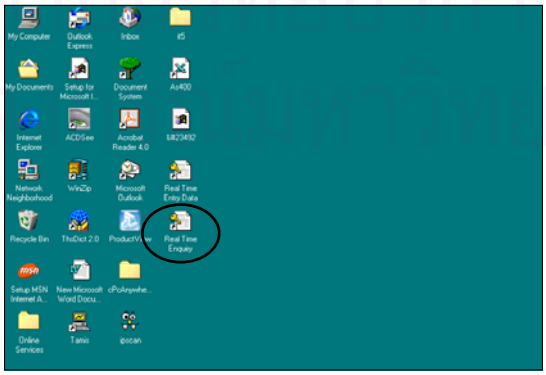
WAIT A MOMENT UNTIL APPEAR MENNU, SEE FIGURE 3.



รูปที่ (FIGURE) 3 แสดงหน้าจอก่อนเข้าโปรแกรม (SHOWN MENU SCREEN BEFORE FOR ENTER TO PROGRAM)

6. ใช้เม้าส์ดับเบิลคลิกที่โฟลเดอร์โปรแกรม REAL TIME ENQUIRY เพื่อเข้าสู่โปรแกรม ดังรูป 4

USE MOUSE DOUBLE CLICK FOLDER “REAL TIME ENQUIRY” FOR ENTER THE PROGRAMM, SEE FIGURE 4.



รูปที่ (FIGURE) 4 แสดงโฟลเดอร์ของโปรแกรม (SHOWN FOLDER OF PROGRAM)

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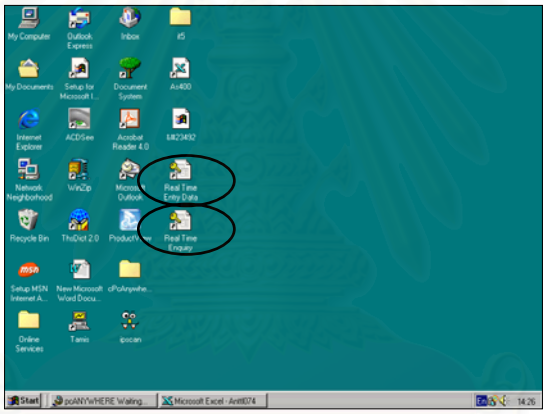
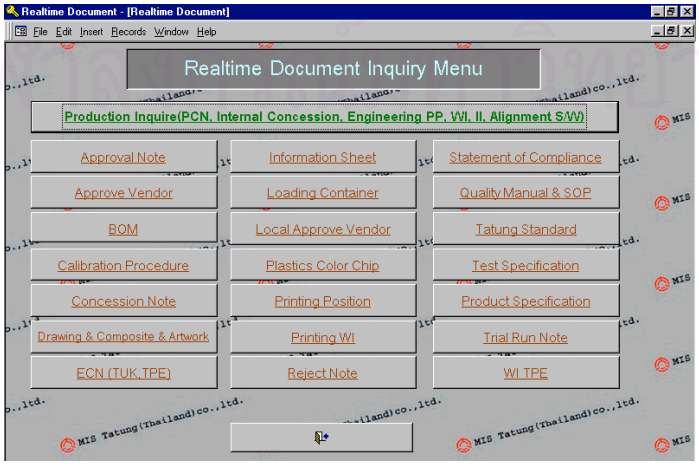
7. ในส่วนของ DOCUMENT CONTROL CENTER จะมีโฟลเดอร์ของ REAL TIME ENTRY DATA ด้วย สำหรับการคีย์ข้อมูลส่วนแผนกผลิตและแผนกอื่นๆ จะมีเฉพาะ ENQUIRY เท่านั้น ดังรูป 5
DOCUMENT CONTROL CENTER HAVE 2 FOLDER; 1) REAL TIME ENTRY DATA, 2) REAL TIME ENQUIRY, BUT PRODUCTION AND OTHERS HAVE 1 MENU ONLY (REAL TIME ENQUIRY), SEE FIGURE 5.



รูปที่ (FIGURE) 5 แสดงโฟลเดอร์ของโปรแกรม (SHOWN FOLDER OF PROGRAMM)

8. เมื่อเข้าโปรแกรมมาแล้ว จะแสดงเมนู ดังรูป 6 (ในขั้นตอนต่อไปนี้ จะบอกเฉพาะการ INQUIRY เท่านั้น)
ENTER TO PROGRAM SHOWN MAIN MENU AS FIGURE 6 (NEXT STEP ARE TELL AS INQUIRY DATA ONLY).



รูปที่ (FIGURE) 6 แสดงเมนูหลัก (SHOWN MAIN MENU)

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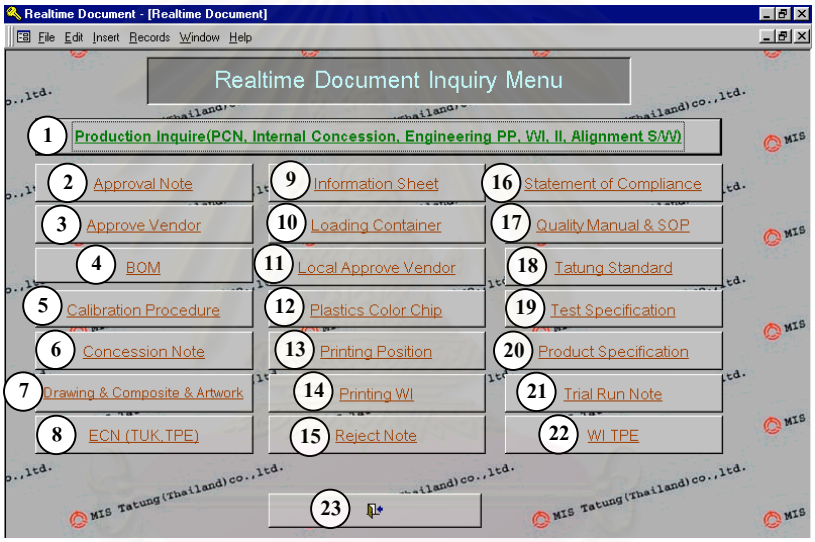
9. รายละเอียดของโปรแกรมมีดังนี้ ตามรูป 7

THE DETAIL OF PROGRAM ARE AS SHOWN ON FIGURE 7.



รูปที่ (FIGURE) 7 แสดงรายละเอียดของเมนู (SHOWN DETAIL OF MENU)

1. PRODUCTION INQUIRE (PCN, INTERNAL COSSESION, ENGINEERING PP, WI, II, ALIGNMENT S/W.
2. APPROVAL NOTE
3. APPROVAL VENDOR
4. BOM
5. CALIBRATION PROCEDURE
6. CONCESSION NOTE
7. DRAWING / COMPOSITE / ARTWORK
8. ECN (TUK, TPE)
9. INFORMATION SHEET
10. LOADING CONTAINER
11. LOCAL APPROVAL VENDOR
12. PLASTIC COLOR CHIP
13. PRINTING POSTION
14. PRINTING WI
15. REJECT NOTE
16. STATEMENT OF COMPLIANCE
17. QUALITY MANUAL & SOP
18. TATUNG STSNDARD
19. TEST SPECIFICATION
20. PRODUCT SPECIFICATION
21. TRIAL RUN NOTE
22. WI TPE
23. EXIT PROGRAM

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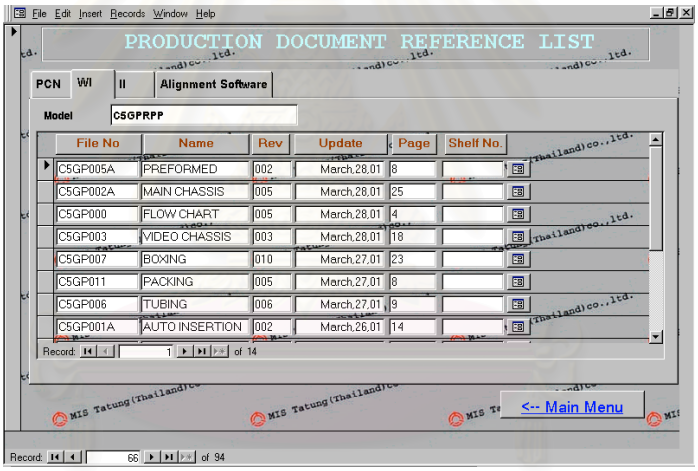
10. รายละเอียดของหัวข้อต่างๆ มีดังนี้

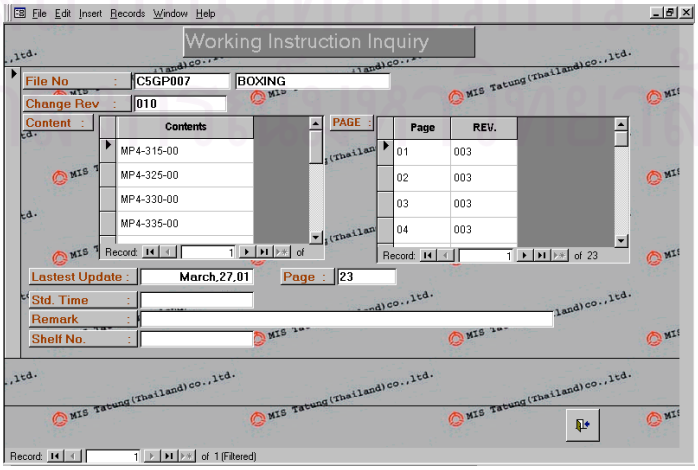
DETAIL OF EACH ITEM ARE AS BELOW.

10.1 PRODUCTION INQUIRE (PCN, INTERNAL COSSESION, ENGINEERING PP, WI, II, ALIGNMENT S/W.

เมื่อต้องการดูรายละเอียดของ PCN, INTERNAL CONCESSION, ENGINEERING PP, WI, II, ALIGNMENT SOFTWARE โดยจะต้องใส่โมเดลลงในช่องว่างก่อนแล้ว ถึงเลือกดูรายละเอียด



รูปที่ (FIGURE) 8 แสดงเมนูของ WI (SHOWN MENU OF WI)



รูปที่ (FIGURE) 9 แสดงรายละเอียดของ WI (SHOWN DETAL OF WI)

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10.2 APPROVAL NOTE

เมื่อต้องการดูรายละเอียดของการอนุมัติในการใช้อุปกรณ์

10.3 APPROVAL VENDOR

เมื่อต้องการดูรายละเอียดการอนุมัติของ VENDOR

10.4 BOM

เมื่อต้องการดูโครงสร้างของ BOM

10.5 CALIBRATION PROCEDURE

เมื่อต้องการดูการ CALIBRATION ของเครื่องมือที่ใช้อยู่

10.6 CONCESSION NOTE

เมื่อต้องการดูรายละเอียดของ CONCESSION

10.7 DRAWING & COMPOSITE & ARTWORK

เมื่อต้องการดูรายละเอียดของ DRAWING & COMPOSITE & ARTWORK

10.8 ECN (TUK, TPE)

เมื่อต้องการดูรายละเอียดของ ECN

10.9 INFORMATION SHEET

เมื่อต้องการดูรายละเอียดของ INFORMATION SHEET

10.10 LOADING CONTAINER

เมื่อต้องการดูรายละเอียดของการ LOADING CONTAINER

10.11 LOCAL APPROVAL VENDOR

เมื่อต้องการดูรายละเอียดของการอนุมัติสำหรับ VENDOR ภายในประเทศ

10.12 PLASTIC COLOR CHIP

เมื่อต้องการดูรายละเอียดสีของ PLASTIC

10.13 PRINTING POSITION

เมื่อต้องการดูรายละเอียดของการ PRINTING ปุ่มควบคุมต่างๆ บนหน้าจอ

10.14 PRINTING WI

เมื่อต้องการดูรายละเอียดของการ PRINTING หน้าจอ สีที่ใช้ และโลโก้

10.15 REJECT NOTE

เมื่อต้องการดูรายละเอียดของการ REJECT

10.16 STATEMENT OF COMPLIANCE

เมื่อต้องการดูรายละเอียดของ STATEMENT OF COMPLIANCE

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10.17 QUALITY MANUAL & SOP

เมื่อต้องการดูรายละเอียดของการ QUALITY MANUAL และ SOP

10.18 TATUNG STANDARD

เมื่อต้องการดูรายละเอียดของ TATUNG STANDARD

10.19 TEST SPECIFICATION

เมื่อต้องการดูรายละเอียดของ TEST SPECIFICATION

10.20 PRODUCT SPECIFICATION

เมื่อต้องการดูรายละเอียดของ PRODUCT SPECIFICATION

10.21 TRIAL RUN NOTE

เมื่อต้องการดูรายละเอียดของ TRIAL NOTE

10.22 WI TPE

เมื่อต้องการดูรายละเอียดของ WI TPE

10.23

เมื่อเลือกที่สัญลักษณ์นี้จะเป็นการออกจากโปรแกรม

BIOGRAPHY

Mr. Shiwei Lan was born in June 29, 1966 in Jilin, China. He graduated from Nankai University of China with a bachelor's degree in Micro-electronics Science, since 1989. He continued his education with a master's degree in Engineering Management at Chulalongkorn University in 1997.

He first was a design engineer in Greatwall Electronics company in Tianjin for four years and then became a process engineer and deputy production engineering manager in Tatung (Thailand) Co., Ltd. Today he is the production engineering department manager and component engineering department manager of Tatung (Thailand) Co., Ltd.