# Quality Control and Inventory System of Femina lace (Thailand) Co., Ltd.

by

Mr. Seethapathy Suresh

A Final Report of the Six-Credit Course
CS 6998 - CS 6999 System Development Project

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

March 2002

# Quality Control and Inventory System of Femina lace (Thailand) Co., Ltd.

by
Mr. Seethapathy Suresh

A Final Report for the Six-Credit Course
CS 6998 - CS 6999 System Development Project

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

March 2002

| | |
|---|---|
| Project Title | Quality Control and Inventory System of Femina lace (Thailand) Co., Ltd. |
| Name | Mr. Sethapathy Suresh |
| Project Advisor | Dr. Boonyarit Pokrud |
| Academic Year | March 17, 2002 |

---

The Graduate School of Assumption University has approved this final report of the six-credit course, CS 6998 – CS 6999 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

Approval Committee:

(Dr. Boonyarit Pokrud)
Advisor

(Prof.Dr. Srisakdi Charmonman)
Chairman

(Air Marshal Dr. Chulit Meesajjee)
Dean and Co-advisor

(Asst.Prof.Dr. Vichit Avatchanakorn)
Member

(Assoc.Prof. Somchai Thayarnyong)
MUA Representative

March 17, 2002

## ABSTRACT

Femina lace (Thailand) Co., Ltd. is one of the leading manufacturers and exporters of lace fabric. The company is developing at a fast pace and is trying to penetrate into highly competitive markets in Europe and America. In order to improve quality and efficiency and reduce cost the management has requested various departments to identify the problems and ways to improve the efficieny of the processes involved in their respective deparments. The primary concern of the management is the logistics and quality control.

This project has emerged as a result of that drive and concentrates on the system that involves inventory movement and quality control for the fabrics that is received from dyeing and finishing operation, inspected and monitored and sent to cutting at a later stage upon the request of the marketing department.

The existing system is a semi-computerised system in which the data is entered after the manual processes are completed. The entered data is printed out in the form of checklist for data entry verification. A limited amount of reports are generated which are not properly linked to other relevant information like sales and order processing. Apart from huge cost of high staff levels, untimely reports are deemed as useless in some cases.

The new system is designed to avoid the problems mentioned above and make the computerised system real time, controlled, time saving and cost effective.

## ACKNOWLEDGEMENTS

First of all, the writer would like to use this opportunity to thank the esteemed institution of Assumption University for providing all the necessary infrastructure and guidance to develop and complete this project successfully.

He would like to thank Dr. Boonyarit Pokrud, his project advisor, for his suggestions and advice given throughout the preparation of this project. He had been instrumental in imparting a sense of timeliness and professionalism in his approach.

He extends his sincere thanks to all the lecturers of MS (CIS) program who have imparted their knowledge to him, and to the Management of Femina Lace for their timely assistance and information provided to him while carrying out the data collection required for his project.

# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# I. INTRODUCTION

## 1.1 Background of the Project

Femina lace (Thailand) is one of the group of companies belonging to Hang Pho Chai Group specializing in manufacturing, dyeing and selling lace fabric in Thailand and the world. Due to this rapid growth and expansion of the business, the organization is found to be in need of efficient systems to be in place in all of its major operational areas. The manufacturing and finishing process involves accumulation and maintenance of stocks at various semi-finished stages. It is becoming increasingly difficult for the company to penetrate highly competitive overseas market due to high operational cost at various stages of manufacturing and finishing areas. After a preliminary survey, it has been found that certain departments are found to be not taking any initiative towards implementing latest advancement in technology to aid their operations thereby resulting in inefficiency and high cost. Alarmed by the survey, the management has ordered all departments to immediately come up with the potential problem areas and find ways to solve them to bring in overall efficiency for the organization. Such a drive has resulted in the launch of several projects through out the organization. These projects range from acquiring computerized manufacturing equipments, business process re-engineering, computerization of manual and semi-computerized process and an evaluation of the existing fully computerized systems as well.

One of the projects that resulted from the above drive is the Quality Control and Inventory System. The current system is a semi-computerized system by which the computer is merely used as a data entry and reporting tool rather than anything else. It is found to be incurring huge cost for data entry, verification and report generation. Even then the reports are found to be erroneous, untimely and isolated. After identifying the

underlying cause, it was proposed that a new computerized system is required to developed. The objective of the new system is to eliminate those causes by making the system real time. With the introduction of the new system, data will be collected and controlled at source to eliminate errors. It will also enable report generation instant and timely.

After gaining an approval of the project proposal from the management, the development team has prepared the project plan, as shown in Figure 1.1 at page 6, which composes three phases with their details as follows:

(a) **System Analysis Phase**, which is the survey and planning of the system and project, the study and analysis of the existing business and information system, and the definition of business requirements and priorities for a new improved system. The output of this phase is to model business requirement for a proposed system in the form of a logical diagram called ERD (Entity-Relationship Diagram), and DFD (Data Flow Diagram).

(b) **System Design Phase**, is the evaluation of alternative solutions and the specification of a detailed computer-based solution. This phase deals with the physical or implementation-dependent aspects of a system (the system's technical specifications) rather than logical emphasis in system analysis. The main activity is to design all system components including web interface, reports, database, network, and program.

(c) **System Implementation Phase**, which is the construction of the new system and delivery of the new system in day-to-day operations. Besides construction and delivery activities that are the typical phases of system

implementation, the user training and testing of a developed program before implementation should not be neglected.

The semi-finished stage taken for this project involves fabrics which are dyed and finished according to certain specifications. This fabric is inspected for its dyeing and finishing factors and further sent for the cutting process before it is inspected finally, packed and delivered to customer.

This project deals with developing the computerized system for monitoring the stock movement and recording the quality and other inspection details to control and produce several valuable information for the management to improve production quality and reduce costs apart from aiding the operational level personnel.

## 1.2 Objectives

Due to the rapid growth and expansion of the business, the organization is found to be in need of efficient systems to be in place in all of its major operational areas. One of the operational area of major concern has been the inventory handling department. The manufacturing process involves accumulation and maintenance of stocks at various semi-finished stages.

This project deals with developing the computerized system for one of those semi-finished stages.

(a) The new system should be a real-time system and should be able to interact with data from other existing systems to reduce redundancy.

(b) Information should be collected at source. Stock documents should be generated and printed from the system

(c) They new system should record stock by individual rolls and location should be recorded on every roll.

(d) The system should be open enough to share data with other existing applications.

(e) Quality control information should be recorded in the system and necessary reports have to be generated for sending to Q/C dept.

(f) Suitable changes have to be made to make the new system meet the requirements of the auditors.

(g) Barcode system should be incorporated to control itemcode and quantity errors.

## 1.3 Scope

It is important to specify the scope of the system in order to understand what the system will and will not do. This will help in determining the project timeline and effort required to complete the project.

The proposed system will do the following:

(a) Record and keep track of stock movement from dyeing process to cutting process

(b) Control and prevent errors in stock handling

(c) Provide stock location facility to the operational people

(d) To implement the barcode system to control the movement of stock.

(e) Rethink all business processes and procedures that are related and have an impact on departments concerning material management.

(f) Provide training courses in computer skills to the organization staff.

(g) The primary users of the new system would be the management and staff of the Inventory And Quality Control Division. The improved system will

affect or interface with the other systems like Dyeing and Finishing, Order processing, Production planning.

The proposed system will not do the following:

(a) The proposed system differs very much from conventional inventory system in that this portion of the system only deals with the semi-finished inventory and the department concerned is not responsible for procurement or maintaining stock level.

(b) The system does not interact with any external entities that are outside the company.

## 1.4 Deliverables

A fully functioning Quality control and Inventory system that would enable easy access to data and information as well as timely and accurate information on inventory movement and inspection results.

(a) Database and a Database Management system (purchased)

(b) A software package (built-in-house)

(c) Interface that would enable connectivity with other systems as well as user-friendly interfaces for end-users.

(d) Monthly and annual reports for management

(e) Daily reports for operational staff

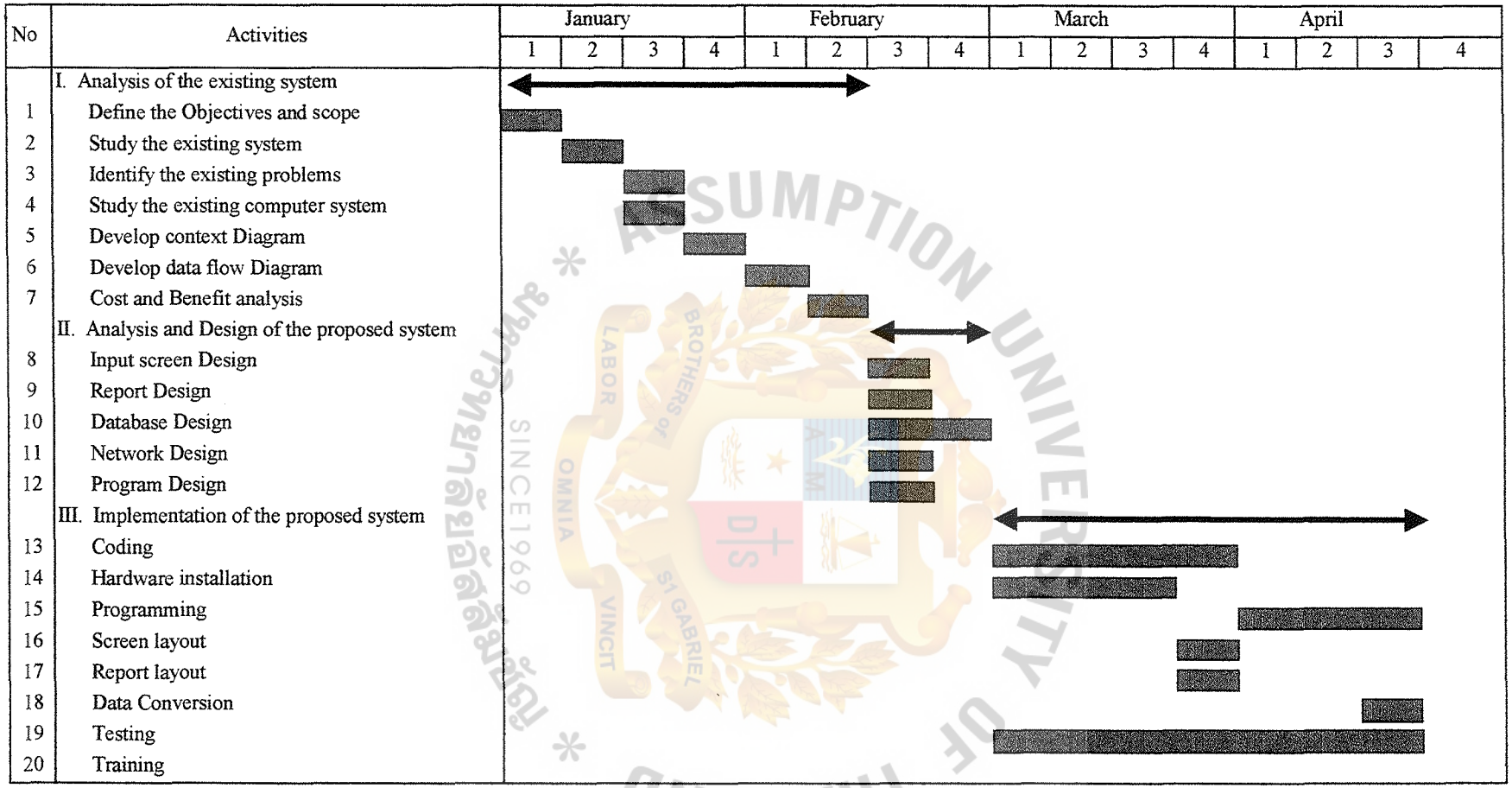



Figure 1.1. Project Plan for Quality Control and Inventory Management system.

# II. THE EXISTING SYSTEM

## 2.1 Background of the Organization

Femina Lace (Thailand) co. ltd. was established 40 years ago as a family business importing and selling printed fabrics on the domestic market. Today it is a vastly different business employing 600 people and operating over 140 machines though it is still a private business managed by the sons of the original founder Khun Amorn Kirtinarang and K.Montchai Kirtinarang.

Femina lace is an approved source of supply to all major brands of intimate apparel and also to the largest retailers worldwide.They now export globally and exports account for 50% of their total sales. Their success has been due to creating high quality products at affordable prices.

The company is one of the six companies belonging to Hang Pho Chai group. The companies that belong to the group are:

| | | | |
|---|---|---|---|
| (1) | Sky butterfly co. ltd | - | Manufacturing unit |
| (2) | Tronic lace co. ltd. | - | Manufacturing unit |
| (3) | Femina lace knitting co. ltd | - | Manufacturing and dyeing unit |
| (4) | Sardex Co. ltd | - | Lace Cutting factory |
| (5) | Femina lace international co. ltd. | - | Lace fabric exporting unit |
| (6) | Femina lace (Thailand) co. ltd | - | Lace fabric trading unit for local and export market |

The organization chart for Femina Lace (Thailand) Co., Ltd. is shown in Figure 2.1. in page 8. The organization is headed by a board of directors who are followed by Legal and Investment consultants. Also under the board are the Managing Directors for Marketing and Finance. The Materials Manager who is the head of the Material Dept.

reports to the Managing Director Marketing because the materials movement is by and large controlled by the intitiatives of the marketing. As we see, the current structure shows huge deployment of staffs to maintain the materials movement. The objective of the proposed system is to reduce the size of the material department to an optimum one. The marketing managers and their staffs interact with the proposed system by enquiring the balance stock for a specified design and making stock out request to be sent for cutting which is the next stage of the operation. The proposed system makes its data shareable and available to the marketing department as well as others so that any perceived report could be generated through their own systems. This data and system independence is seen as one of the major strengths of the proposed system.

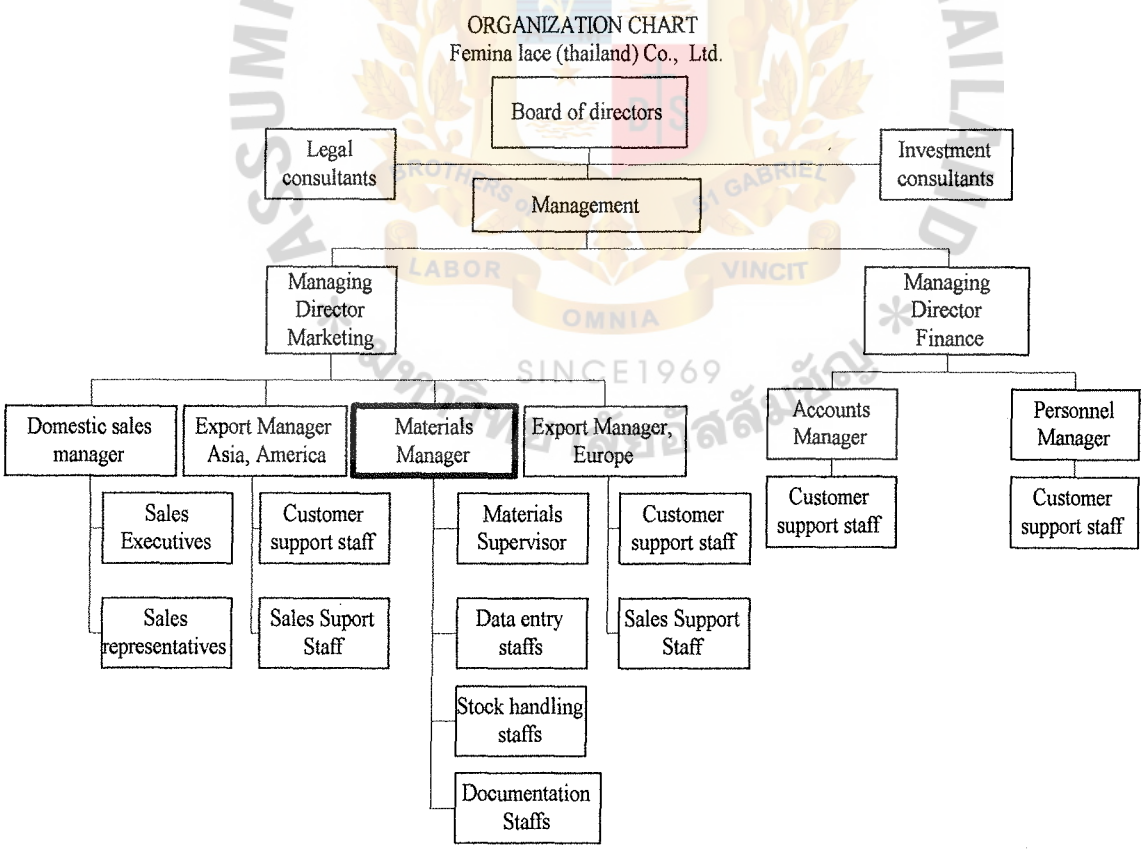



Figure 2.1. Organization chart of Femina lace (Thailand) Co., Ltd.

## 2.2 The Existing Problems and Areas of Improvement

The following are the major concerns that are related to the existing system. After spending considerable effort to study the proplems existing in the current system it has been found that the current system is dangerously incurring huge cost and inefficiency. Those are listed below:

(1) The stock reports do not reflect customer order related information

(2) Stock documents are written manually first and then entered into the computer.

  (a) Item codes and the quantity are wrongly written and/or entered into the computer.

  (b) Moreover, there is no proper control to check if all documents have been keyed-in into the computer.

  (c) Human cost is incurred for making writing and keying in the manual documents

  (d) Due to errors mentioned above, physical stock checking does not match with computer stock balance.

(3) The current computer system does not show stock location.

(4) Dyeing and finishing department can not trace stock pending at dyehouse

(5) Quality Control information is recorded manually. Q/c department only gets manually prepared stock specification sheet.

(6) The current computer system is not able to meet many of the requirements of the auditors

As is obvious from the above observation, the existing system has serious drawbacks which needs improvement to such an extent that a list of system improvement actually initiates a new system development effort.

The list of improvements over the existing system that should be part of the proposed system is listed as follows:

(1) The new system should be a real-time system and should be able to interact with data from other existing systems to reduce redundancy.

(2) Information should be collected at source.

(3) Stock documents should be generated and printed from the system

(4) The new system should record stock by individual rolls and location should be recorded on every roll.

(5) The system should be open enough to share data with other existing applications.

(6) Quality control information should be recorded in the system and necessary reports have to be generated for sending to Q/C dept.

(7) Suitable changes have to be made to make the new system meet the requirements of the auditors.

(8) Barcode system should be incorporated to control item code and quantity errors.

## 2.3 The Existing Computer System

In the current working environment, the materials department has two personal computers, one for keying the stock-in document and the other is for printing the stock-out document. There is a printer attached to one of the computers (which is shareable) is used for printing reports. The existing system was developed using Visual Foxpro and the data is stored using Visual Foxpro as well in the server. Although the Visual Foxpro database uses indexes efficiently to retrieve only the selected records, it is not a true client server system. Moreover the data is not secure and safe. The File server is located in the information technology department.

The existing computer hardware and software specifications of the materials department are 2 Intel Pentium III processors 500 MHz with 64 MB SDRAM and 6.4 GB Hard Drive, which run on Windows 98 with installed Office 97 as application program.

The context diagram for the existing system is shown in Figure 2.2. The Materials department prepare manual stock in and stock out documents and sends it to the data entry staffs to key-in the documents. The data entry staffs key-in the document and then print a checklist at the end of the day to verify data entry errors. Each document entered into the computer is stamped as entered and the final checklist after correction is signed by the staff and sent to the manager.

Design and Machine specification details arrive as manual sheets from the Production Planning department to the Materials Department which is used to prepare manual inspection details. A periodic manual report containing the inspection details is made and sent to the quality control department. A more detailed activities are indicated in the Level 0 DFD of the existing system in Figure 2.3.

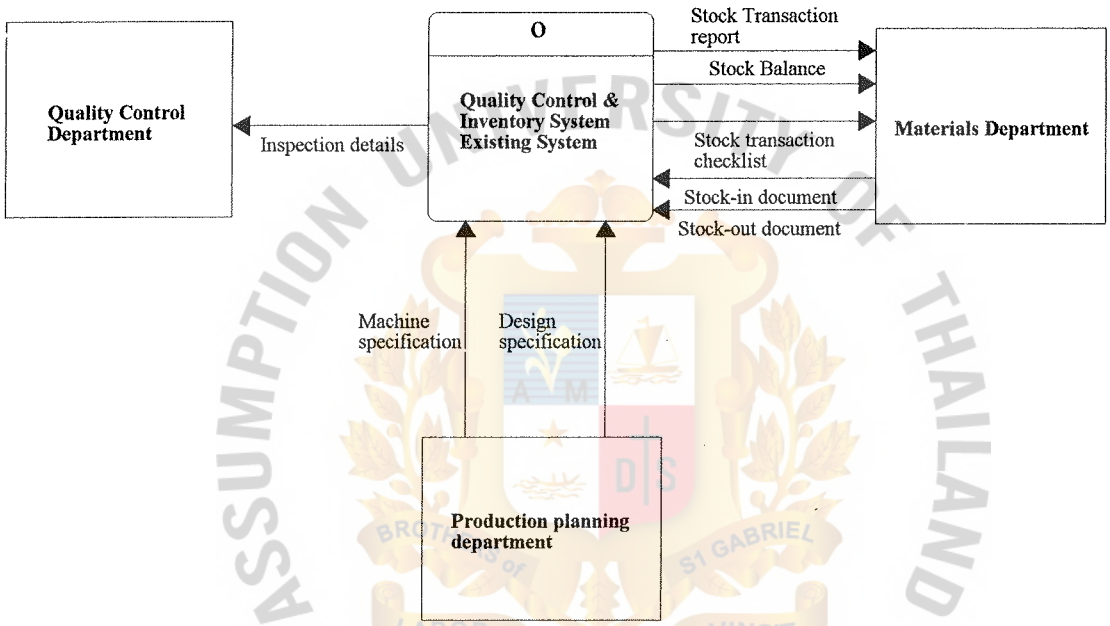



Figure 2.2. Context Diagram of the Existing System.

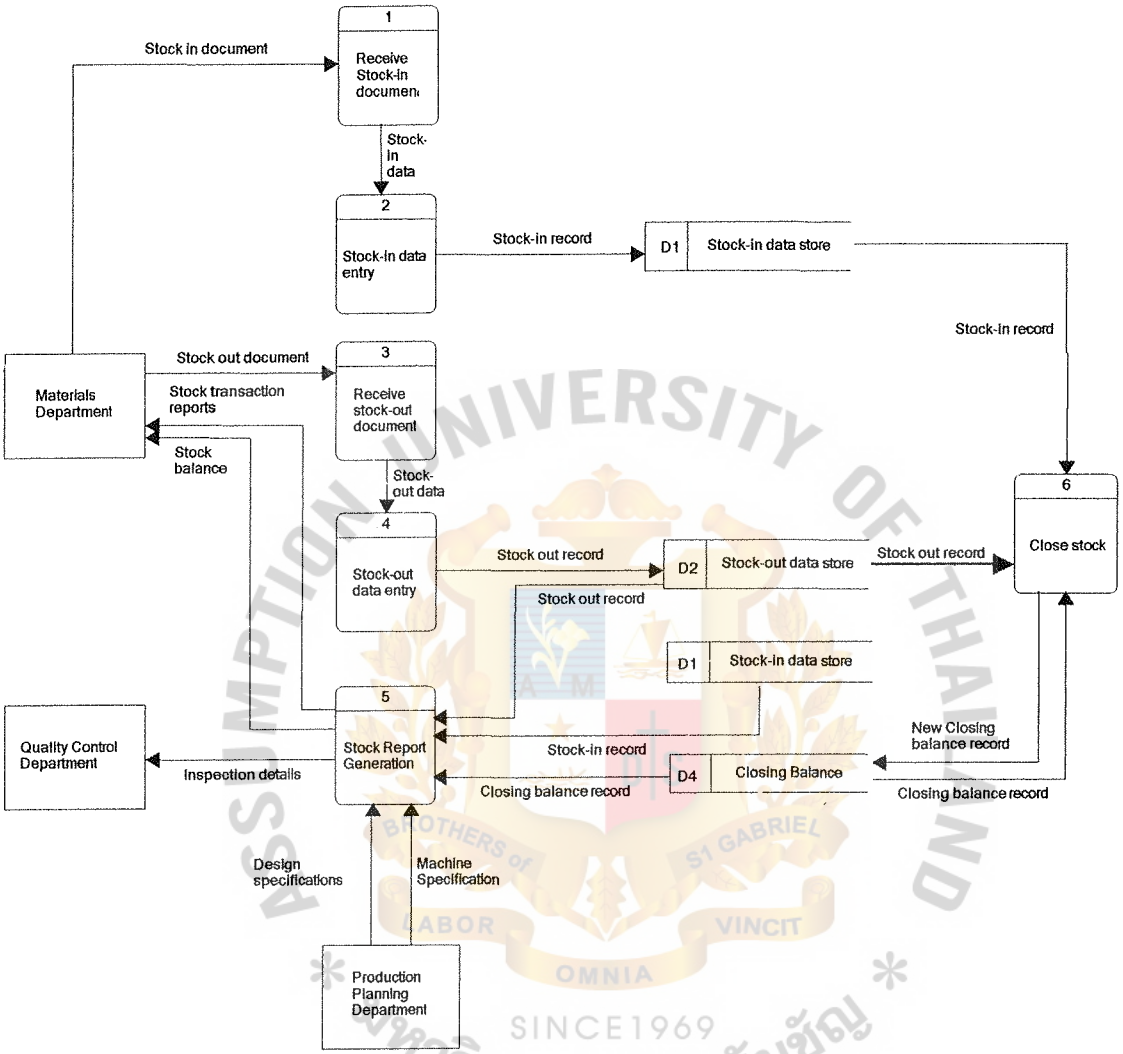



Figure 2.3. Level 0 DFD of the Existing Computerised System.

# III. THE PROPOSED SYSTEM

## 3.1 System Specifications

Based on the information in the previous chapter, the inventory system now requires an effective information system, which can accommodate the various processes of the stock flow and inspection system, and solve the problems occurring from the existing manual system with an ineffective partial computerized system.

To achieve the specified objectives, the proposed system should have the following components:

(1) Database server serving as a database server using the client/server model with the Visual Basic Front end.

(2) The existing database redesigned, developed and converted to the high performance database server, and make it shareable by other departments as well.

(3) Make effective querying and intuitive analysis of the quality information.

(4) Replace existing post-mortem static data entry screens to more manageable, easy to understand and in intuitive format.

## 3.2 Requirement Analysis

The study of the existing system reveals many problems, such as high operating cost and human errors, which cause the user to require a newly computerized system to handle their work more efficiently. After all problems are identified and evaluated, the business requirement for the new system can be summarized as follows:

(1) The proposed system should facilitate the user in searching the fabric rolls by using the location information stored in the database

(2) To keep stock situation up-to-date to enable viewing and selecting available stock rolls at any point of time

(3) The developed system should enhance the overall operational ease of the material department.

(4) The new system should be able to access data from other systems database

(5) Documents should be generated with computer generated numbers.

To gain a better understanding of the new system requirement, the logical model is drawn to depict the system independent of any technical implementation. In this project, data modeling and process modeling techniques are used to document business requirement, and serve as the logical design of the proposed system. The detail of each technique can be explained as follows:

Data Modeling

It is a technique for organizing and documenting a system's data. The complete data model is usually implemented as a database. Typically, the data model is called an entity relationship diagram (ERD). There are three levels of entity relationship diagram: context data model, key-based data model and fully attributed data model.

The context data model represents only the entity and relationship between each entity. The main entities that were discovered in the system: Stock-in, Stock-in roll, PreCutQcDetail, PostCustQcDetail, Stock-out roll. Each entity has the relationship, when combined with the entity name, in form of simple business sentences or assertions.

In key-based data model, the primary and foreign keys are added to each entity to exhibit the unique characteristic of each entity.

The final data model, fully attributed data model, shows all attributes of each entity. To identify all attributes, it requires the understanding of the data attributes for

the system. These facts can be discovered through the study of the existing reports and documents to be the naming standard for attribution.

The complete entity relationship diagram of the proposed system is shown in Appendix A.

Process Modeling

Compared with data modeling, process modeling is a technique for organizing and documenting the structure and flow of data through a system's process and/or the logic, policies, and procedures to be implemented by a system's process. To construct the process model, the context diagram is firstly drawn to establish the initial project scope, which defines how the developed system interacts with other systems and the business as a whole. Figure 3.1 in the next page illustrates the context diagram of the proposed system. Next, the functional decomposition diagram is created to show the top-down structure of a system. This diagram also serves as an outline for drawing the data flow diagram. The functional decomposition diagram of Proposed system is shown in Figure 3.2, which composes six main subsystems.

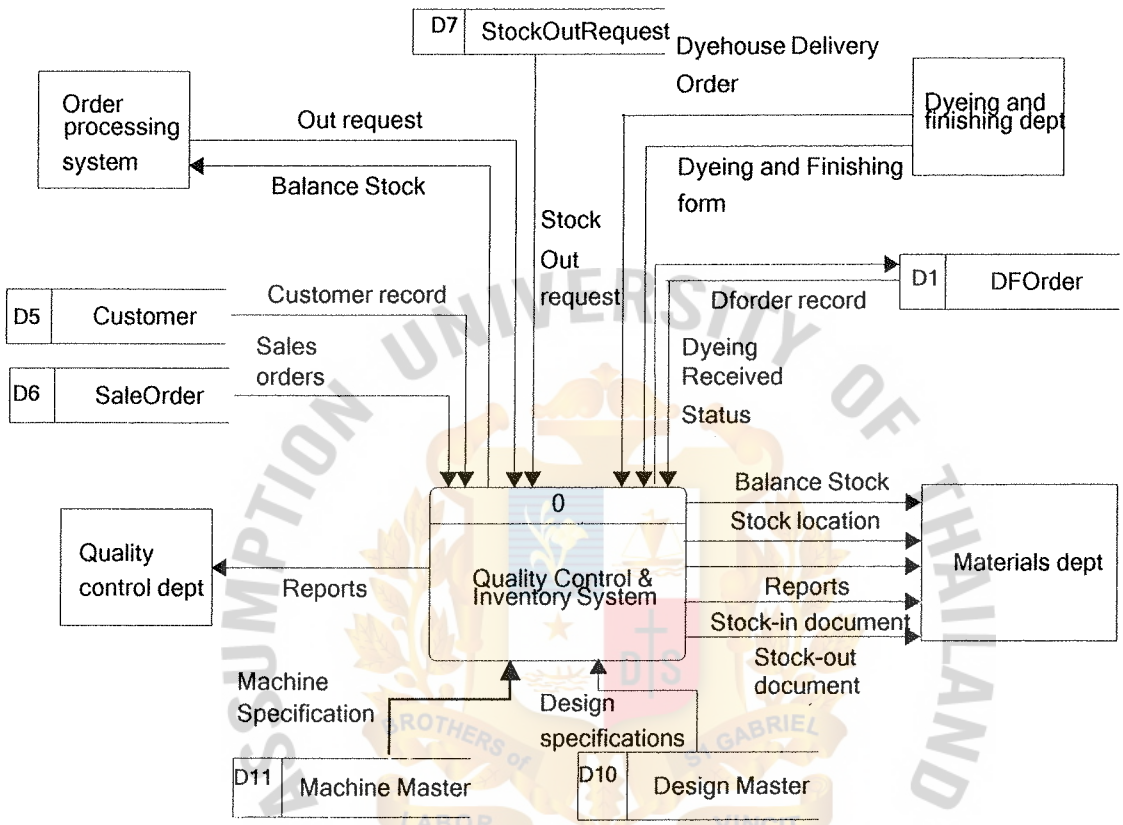



Figure 3.1. Context Diagram of the Proposed System.

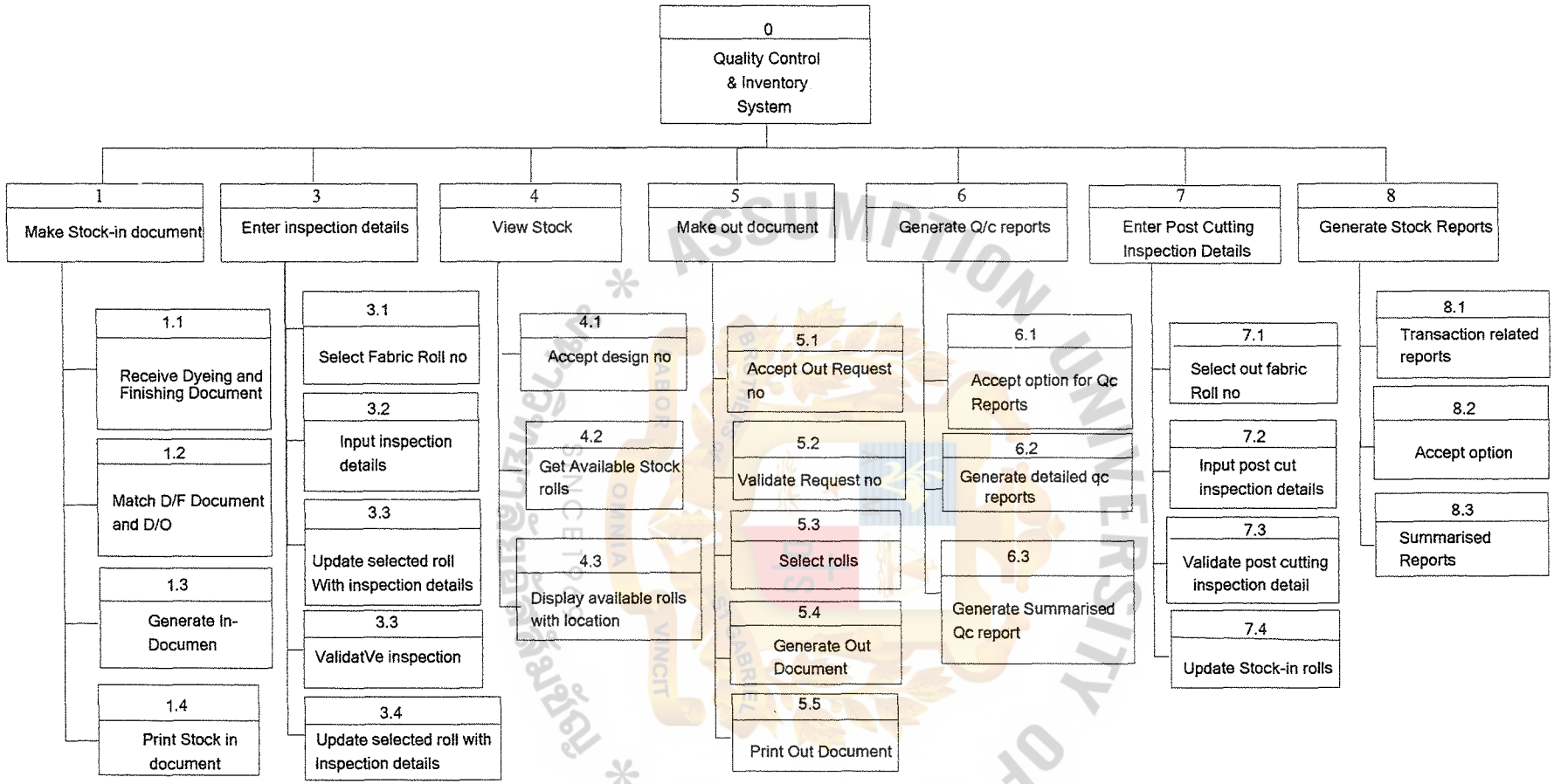



Figure 3.2 Functional Decomposition Diagram for the Proposed System

After finishing the previous two diagrams, a data flow diagram (DFD) can be drawn to depict the flow of data to, from, and within the system. A data flow diagram has many levels of details. The lower the level of data flow diagram, the more details of the processes within the system they have. The details of each main process can be explained as follows:

**(1) Make Stock-in document**

This is the first process for the proposed system. The system matches and validates the information from the dyeing and finishing form and the dyehouse delivery order from the dyeing and finishing department. Then it accepts information regarding individual rolls that came from the dye house. Upon user confirmation, the process will generate a unique document no and generates a stock-in record and stores into the stock-in database.

**(2) Enter inspection details**

Soon after the rolls are entered each roll is inspected against standard specification and the information is recorded and entered into the system. The roll no is called for and only the inspection details are entered into the system and saved.

**(3) View stock**

This process involves viewing of balance stock for a specific design no. Information from Rolls-in and Rolls-out database will be accessed to derive the available rolls information and will be shown on the screen with respective location information

**(4) Make Stock-out document**

This process is initiated once a computer generated request document from marketing department arrives at the material department. This request is generated by the marketing department by accessing the Rolls-in and Rolls-out database from the new system and the requested roll is updated into the RequestRoll database. This database is accessed in this process, the item code is scanned using the barcode reader and is matched with the requested roll database for validity and correctness. Finally after all the rolls requested are scanned the stock-out document is generated upon user confirmation with a computer generated no.

**(5) Enter post cutting qc details**

This process is initiated once the cutting process is completed and the relevant quality control information is recorded and sent back to the materials department. The Stock-out rolls database is accessed for getting a specified roll that was sent for cutting and the relevant quality information is recorded.

**(6) Generate Stock Reports**

This process is initiated periodically by the users of the materials department for generated various stock related reports. Some reports are more detailed and others are summarized. Accounts related reports like Stock Ledger is sent to accounts department and certain summarized reports are sent to marketing department as well.

(7) **Generate Qc Reports**

This process is initiated periodically by the users of the materials department for generating various quality related reports. Some reports are more detailed and others are summarized. Quality control department receives most of these reports with some reports going to marketing department as well occasionally.

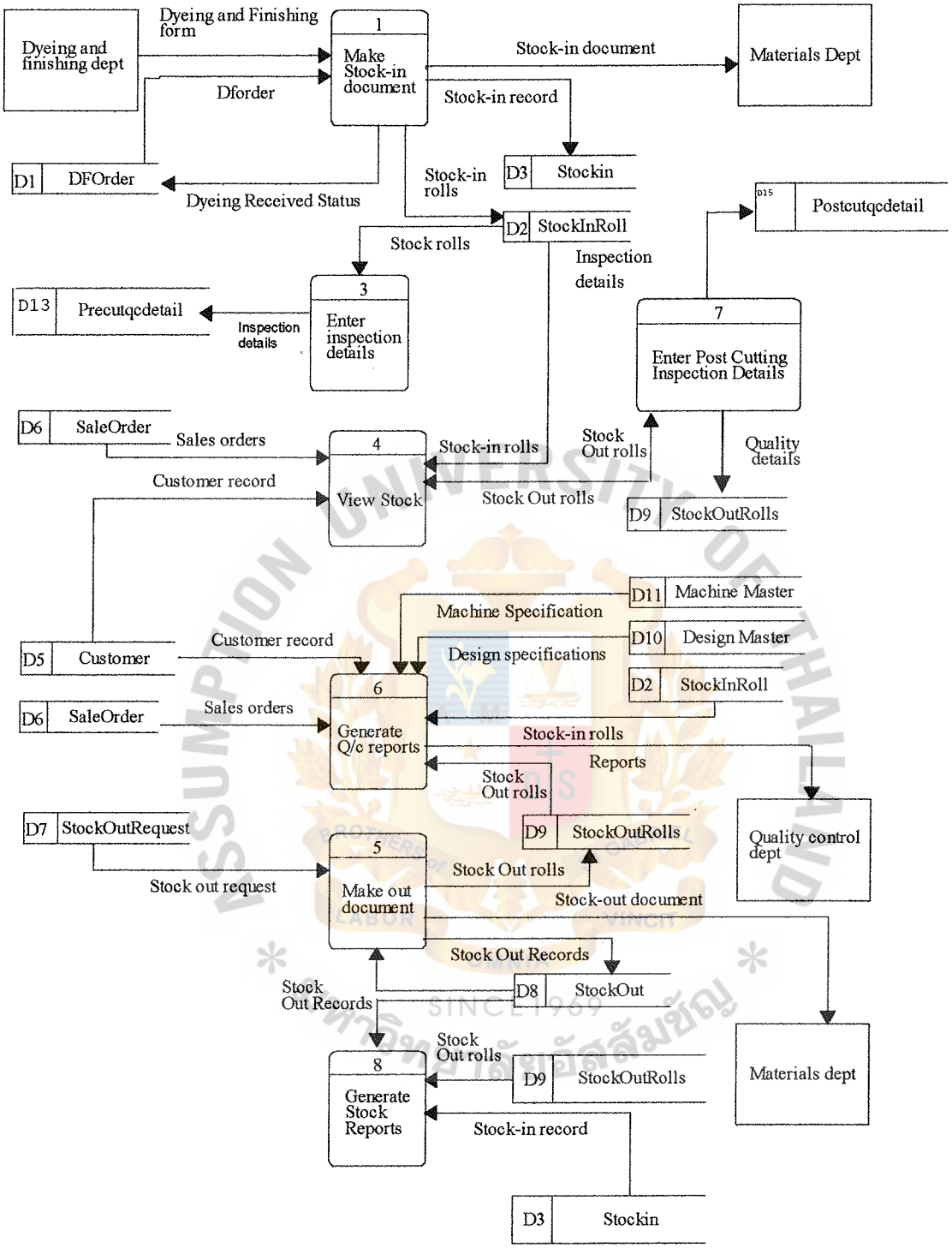



Figure 3.3. Level 0 DFD of the Proposed System.

## 3.3 System Design

The previous requirement analysis section primarily focuses on the logical aspects of a system, whereas system design deals with the physical implementation aspects of a system.

Various design techniques are applied to construct the system to accomplish the objectives of the project. The details of each design technique can be explained as follows:

**Candidate Solutions**

Given the business requirement established in the previous section, the alternative candidate solutions can be identified from the idea and opinion of the development team and user.

Along with reviewing the system specification, the three candidate solutions can be defined for the proposed system.

There are totally 3 candidates for the new system.

Candidate 1 is the existing system because it serves as our baseline for comparing alternatives.

Candidate 2 is the alternative of purchasing commercial off-the-shelf package software.

Candidate 3 is in-house custom solution.

**Candidate 1: Outsourcing the development of the new system**

This system was choosen as one of the candidates to avoid the time lag that we would incur due to the recruitment of trained people to do the system design and the development.

Various factors were weighed to determine if this candidate would serve the new system development goals.

The Candidate matrix for this candidate is presented as in Table 3.1 in page 25.

**Candidate 2: Purchasing the RAMCO ready made software**

This system was chosen as one of the candidates to avoid the time that would be taken to develop the system even if it is outsourced.

However there is a problem that is found with this system which is the huge re-engineering of the existing processes that would be required in order to efficiently use the RAMCO system.

Various other factors were also weighed to determine if the candidates would serve the new system development goals. The Candidate matrix for this candidate is presented as in Table 3.1 in page 25.

**Candidate 3: In-house development with the help of the development team of the organization**

This candidate has been finally chosen as the viable one due to the availability of Visual Basic Programmers in the market and the flexibility that is available with an in-house development team.

Various other factors were also weighed to determine if the candidates would serve the new system development goals. The Candidate matrix for this candidate is presented as in Table 3.1 in the next page.

Table 3.1. Candidate Systems Matrix.

| Characteristics | Candidate 1 | Candidate 2 | Candidate 3 |
|---|---|---|---|
| **Portion of System Computerized** | Entire portion of the proposed system | Same as Candidate 1 | Same as Candidate 1 |
| **Benefits** | Consultancy company with suitable extensive experience in the field Is expected to provide Industry standard system with best practices. | RAMCO Off-the-shelf system. Highly customizable and proven solution but needs highly trained professionals and extensive process re-engineering. | In-house development with Visual Basic Reduce manual works and data redundancy |
| **Servers and Workstations** | MS Windows 2000 Servers and workstation | Same as Candidate 1 | Same as Candidate 1 |
| **Software Tools Needed** | Reporting and analysing tools like Crystal Reports | Reporting and analysing tools like Crystal Reports and Visible Analyst 7.5 | VB 6.0<br>Visible Analyst 7.5<br>And Crystal reports. |
| **Application Software** | Custom solution | Package Solution | Custom Solution |
| **Method of Data Processing** | Client Server System | Same as Candidate 1 | Same as Candidate 1 |
| **Output Device & Implications** | Laser printer, Dotmatrix, barcode printers and display monitors | Same as Candidate 1 | Same as Candidate 1 |
| **Input Device & Implications** | Keyboard & mouse & barcode reader | Same as Candidate 1 | Same as Candidate 1 |
| **Storage Device & Implications** | Oracle 9i Relational Database Server with 40GB Storage capacity Harddisk | Same as Candidate 1 | Same as Candidate 1 |

After the candidate solutions are identified, the feasibility analysis can be done for each candidate. The following feasibility criteria should be taken into consideration when the development team wants to select the best solution to implement the production environment.

(1) Operational feasibility

It is a measure of how well the solution of problems or a specific solution will work in the organization. It is also a measure of how people feel about the system/project. All candidates are fully supporting the current business process but candidate 3 is the most feasible because it can be developed in-house and can be integrated easily and smoothly into other in-house developed systems in an incremental manner.

(2) Technical feasibility

It is a measure of the practicality of a specific technical solution and the availability of technical resources and expertise. Candidate 2 is the most advanced in technical excellence but not necessarily more feasible than Candidate 3 because it requires considerable business process reengineering and also that other in-house developed systems would also have to be replaced with this system or else the integration needs to be done which requires alterations to other existing systems. Candidate 1 is technically feasible but needs high dependence on the external consultants which might not be suitable for the organization's strategic goals.

(3) Economic feasibility

It is a measure of the cost-effectiveness of a project or solution. Candidate 2 is the most expensive solution because it requires across the board revamp of the existing system. The cost involves the purchase of the

software as well as the implementation and integration with other existing systems. It also requires sophisticated hardware and database systems.. In contrast, Candidate 1 and 3 require only a medium level hardware and a system analyst to implement and operate the developed system. Candidate 3 has the best economic feasibility because the system can be incrementally built.

(4) Schedule feasibility

It is a measure of how reasonable the project timetable is. Candidate 1 fairs better than other Candidate 3 because outsourcing does not consume time taken for recruitment of IT personnel. Candidate 3 spends slightly more time than Candidate 1 but it is also a quickly implemented solution. Conversely, Candidate 2 consumes the least time because it is a ready made solution and most of the time is consumed for implementation and training.

Up to this point, all four feasibility criteria assessments are provided for each candidate solutions. The score is then assigned to each feasibility criteria for each candidate, and multiplied by the weight, which is expressed in percentage, distributed from the total 100% to all four-feasibility criteria according to their degree of importance. The weight scores of each feasibility criteria are summed up for each candidate to rank the candidate solution of the proposed system.

The feasibility analysis result reveals that Candidate 3 has the highest scores in Operational, Technical and Economic Feasibility except in Schedule Feasibility, which is topped by Candidate 2. Thus, Candidate 3 has the highest total score, and ranks the best solution for the proposed system. Table 3.2 shows the completed feasibility analysis matrix for each candidate. In addition, the full details of cost-benefit calculations (Economic Feasibility) are shown in Appendix C, which are all Candidate

Cost tables, Payback table and graph, and Net Present Value (NPV) table.The feasibility criteria are weighed as shown in the Table 3.2. After assigning a score to each criterion, Candidate 3 of in-house custom solution has the highest score and is considered as the target system. The details of estimated costs for each candidate, net present value analysis and payback analysis are provided as references on the following pages.

Table 3.2. Feasibility Analysis Matrix.

| Feasibility Criteria | Wt. | Candidate 1 | Candidate 2 | Candidate 3 |
|---|---|---|---|---|
| Operational Feasibility | 30% | There is a risk of exposing company's business practices.<br><br>Score : 70 | It is too big software for our solution and requires major changes on the current business practice<br><br>Score : 60 | Custom solution and in- house development guarantees flexibility and continued user support.<br><br>Score : 80 |
| Technical Feasibility | 40% | Continued dependence on consultants poses technical and economical risks in maintaining the system in future.<br><br>Score : 60 | It is an extremely complex and more powerful software solution and requires lot of user training is required. Also it is difficult to find ERP consultants.<br><br>Score : 90 | The VB 6.0 product is a mature product and is very good product for Client/server data processing. It is easy to find VB 6.0 programmers. VB 6.0 is capable of interacting with any RDBMS product<br><br>Score :90 |
| Economic Feasibility<br>1. Cost to develop:<br><br>2. Payback period: (discounted)<br><br>3. Net present value: | 25% | Approximately Baht 2,537,300.00/-<br><br>Approximately 2 years 6 months<br><br>Approximately Baht B 1,577,069.00<br><br>Score : 60 | Approximately 3,283,300.00/-<br><br>Approximately 3 years 2 months<br><br>Approximately Baht B 788,534.00<br><br>Score : 40 | Approximately 1,629,300.00/-<br><br>Approximately 2 years.<br><br>Approximately Baht B 2,531,149.00<br><br>Score : 80 |
| Schedule Feasibility | 5% | 4 months<br><br>Score :70 | 5 months<br><br>Score :90 | 8 months<br><br>Score : 50 |
| Ranking | 100% | 63.5 | 68.5 | 82.5 |

**Structure Design**

To facilitate the development of the computerized system, structure design technique is used to break up the program into a hierarchy of modules that results in a program that is easier to implement and maintain.

Data Flow Diagram (DFD) from requirement analysis section is used as input of structure design.

The logical DFD, which depicts the business requirement of the proposed system, is converted to Program DFD, which illustrates the technical aspects of the proposed system.

The output of structure design is a partitioned data flow diagram and structure chart, which is illustrated in Appendix D.

**Process Specification**

The purpose of a process specification is to define what the system does to transform inputs into outputs.

It provides the details of system processes in table format, which is easier to look at all related input, output, and relevant process than in a diagram.

All specified tables, which are the process from the logical data flow diagram, are shown on Appendix E.

**Data Dictionary**

To support system design, data dictionary provides a list of terms and definitions for all data items and data stores within the developed system.

The data dictionary for both entity relationship diagram and data flow diagram is shown on Appendix F.

**Database Design**

The data model (ERD) in the previous section requires data analysis to convert the designed logical data model into implemented database. In data analysis, a normalization technique is used to transform all data in ERD into applicable database.

The result of database design is database structure in table format, which is shown on Appendix G.

**Input Design**

To design system input, it requires the information from data flow diagram.

These system inputs are represented as the data flows that connect external entities to process, and process to process. The selected attributes are reviewed to define the appropriate caption or label that clearly identifies these attributes appearing on the input screen. Input control is applied to ensure that the data input to the computer is accurate and that the system is protected against accidental and intentional errors and abuse, including fraud. The input screens that serve as information input to the system are the Stock-in, Stock-out document generation apart from ones that involve input of quality or inspection details. Other screens are used for querying and reporting only.

The input screens of the proposed system are in Appendix H.

**Output Design**

Like system input, output requirements also come from data flow diagram.

These system outputs are easily identified and examined through the data flows that are connected to external entities. More details of output design can be gathered from interviewing the system users about their output requirements.

The system generates various reports varying from simple stock transaction report to summarized quality or inspection report. The examples of report design are in Appendix I.

### 3.4 Hardware and Software Requirements

Based on the information in the previous chapter, the inventory system now requires an effective information system, which can accommodate the various processes of the stock flow and inspection system, and solve the problems occurring from the existing ineffective partial computerized system. To achieve the specified objectives, the proposed system should have the following components:

(1) Database server serving as a database server using the client/server model with the Visual Basic Front end.

(2) The existing database redesigned, developed and converted to the high performance database server, and make it shareable by other departments as well.

(3) Make effective querying and intuitive analysis of the quality information.

(4) Replace existing post-mortem static data entry screens to more maneagable, easy to understand and intuitive format.

Table 3.3. Database Server Specification.

| Device | Specification |
|---|---|
| Processor Type and Speed | INTEL Pentium III 800 MHz or higher |
| Cache Memory | 256 KB |
| Primary Memory | SDRAM 512 MB or higher |
| Hard Drive Capacity | 50 GB or higher |
| Fault tolerance | RAID 5 Controller |
| CD-ROM | Drive (X) 40X or higher |
| Floppy Drive | 3.5" 1.44 MB |
| Display Monitor | IBM SVGA 14" |
| UPS | UPS, 1000 VA APC |

Table 3.4. Server Software Specification.

| Software | Specification |
|---|---|
| Operating System | Microsoft Windows 2000 Server (SP2) |
| Relational Database Software | Oracle 9i |
| Application Development Software | Microsoft Visual Basic 6 & Crystal Reports |

Regarding the client machine the hardware should be capable of running windows based application smooth and stable. It is hence recommended to have atleast 64MB of RAM. As the data is going to stored in the database server, it is not necessary to have a high capacity harddisk.

Table 3.5. Client Machine Specification.

| Device | Specification |
|---|---|
| Processor Type and Speed | INTEL Pentium III 500 MHz or higher |
| Cache Memory | 256 KB |
| Primary Memory | SDRAM 64 MB or higher |
| Hard Drive Capacity | 6.40 GB or higher |
| Floppy Drive | 3.5" 1.44 MB |
| Display Monitor | PHILIPS SVGA 14" |
| Barcode scanner (1 client) | Quickscan 6000 plus Laser |

The client software installed will have the Microsoft Windows 98 Operating System along with the Microsoft Office Software Suite for out of the system presentation and analysis. The executable version of the Quality control and Inventory System will be installed on each client as well.

Table 3.6. Client Software Specification.

| Software | Specification |
|---|---|
| Operating System | Microsoft Windows 98 |
| Application Software | Microsoft Office 97 Professional Edition<br>Quality control and Inventory Executable |

In addition, the connection between Database server and client machine can be established through the existing LAN with some little configurations. Thus, there are no more investments in network peripheral. The network peripheral specification of the proposed system is shown below

Table 3.7. Network Peripheral Specification.

| Network Peripheral | Specification |
|---|---|
| Network topology | Star topology |
| Hub /Switch | 3com Switch |
| Card | Network interface card |
| Interconnection | 3 Com 12 10/100 Mbps |
| Wiring and cable | UTP 4 pair CAT 5 |

Client Server application can be easily developed with the widely used Visual Basic development tool. The network architecture of the proposed system is shown on Figure 3.4.

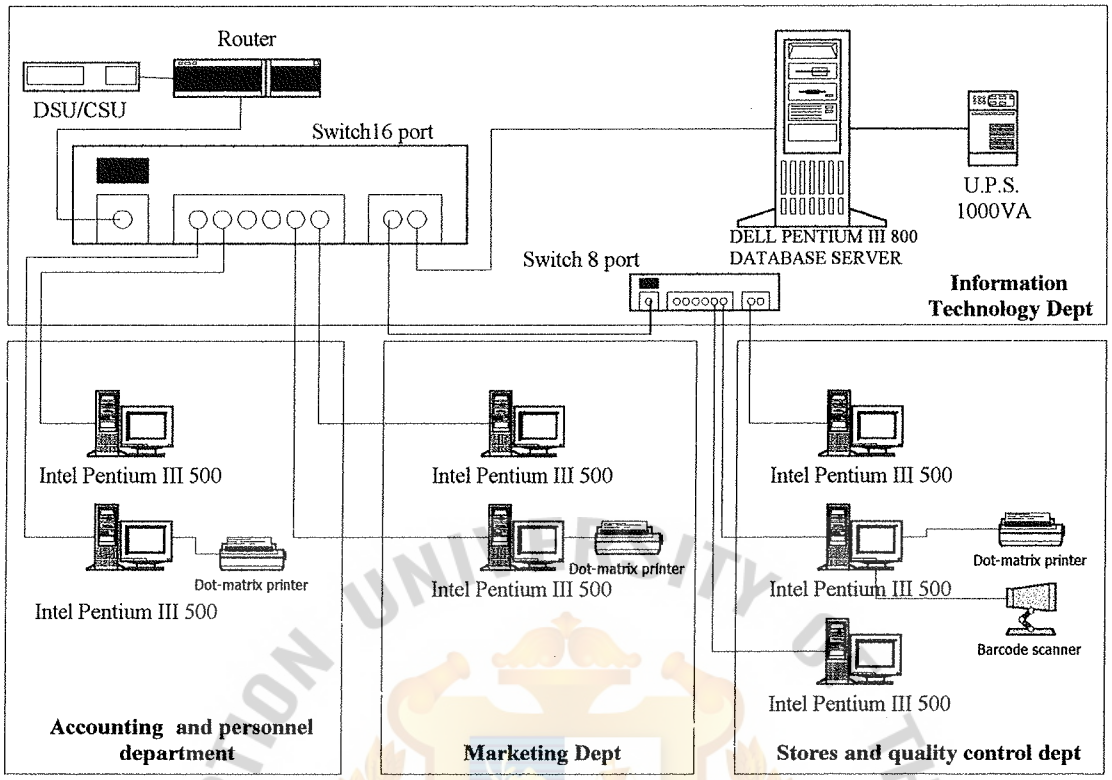



Figure 3.4. Network Configuration of the Proposed System.

## 3.5 Security and Control

The security and control for the system is divided into 3 categories:

(1) The security and control of the local area network which is the first protection to block the unauthorized users from accessing the system.

(2) The embedded protection in the program required password to enter the program, to read or to change the content of the record

(3) Protection from unauthorized access to data bypassing the application is taken care by the industry standard relational database system which has inbuilt security by which no user can access the physical data without proper username and password.

These include input and output control. Input control includes procedure to guarantee the correctness and integrity of data before it is stored in the database. Output

control ensures that all output reports and documents are produced efficiently and promptly. According to IT security policy of the company, the following minimum requirement of security standard must be applied to every computerized system to prevent unauthorized access and alteration to the system.

(1) Identification

The system must have the unique User ID and Administrative System ID. The procedure to control the creating of User ID must be set up to ensure the proper verification over the system users. The user responsibility to the system must be specified in advance before granting authorized level to each user. In each department, User ID must not be shared among officers and staffs.

(2) Authentication

The password system is required to authenticate the assigned User. The system/security parameter of password feature must be carefully configured to ensure the password is properly defined and monitored. The characteristics of good password feature are the specification of minimum range of password (normally 6 to 8 lengths), non-displaying password on system screen, forces user to change password automatically when the password expired in a specified duration, and locks User ID when entering incorrect password more than a specified time. The users must keep their password secret to prevent unauthorized persons using their password to enter the system and cause unauthorized alterations to the system.

(3) Authorization

The authorized level of each user must be carefully assigned to limit the area of accessing to the system information because of the sensitivity of

data and software. The user authorization should be updated when the users change their responsibility or are deleted from the system when the users resign. These user authorizations have to be reviewed every 6 months to ensure that the users have the appropriate authorization in the system.

(4) Auditing

The system must have audit trail to investigate the system in case of unauthorized access and alteration to the system. The audit trail may be in form of system log to monitor the changes to the system and the access violation. This log has to be reviewed by the assigned person on a consistent basis.

(5) Production Environment

The system must separate the development area and the production area when developing the new application program. This practice ensures the proper control over the unauthorized modification of the developed program in the production area because any new or modified program must be tested in the development area before migrating into the production area.

(6) Backup and Recovery

The backup and recovery procedures are required to ensure the availability of system information. Though the RAID technology at the server provides fault tolerance, it is still advised that the backup should be done on a daily basis. The recovery process must be cleared to ensure that all relevant persons know how to restore information from backup media into production.

### 3.6 Cost Benefit Analysis

When the proposed system is developed to replace the existing system, the details of both cost and benefit of the new system compared with the old system must be illustrated. Therefore, the tables and figures of cost information are constructed to provide a clear picture of the comparison of both systems costs.

Furthermore, the benefits of the new system are presented in both tangible and intangible terms. Finally, the analysis techniques, which are break-even analysis and payback period, are applied to show the benefits over the cost after the implementation of the proposed system.

(1) Cost of the existing system

The existing system is operated in a semi-computerized environment, and incurs both fixed cost and annual operating cost. For fixed cost, there is only office equipment cost, and, for annual operating cost, it includes salary cost and office supplies & miscellaneous expense.

The office equipment that the Materials Department uses in their operation is one dot matrix printer for printing the transaction and summarized report for stock information. To operate the existing system, the Materials department requires one materials manager to manage and control stock operation, six staffs for data entry, two for data verification and two for stock handling. Because the nature of existing system produces much paperwork, it causes the paper cost to be very high when compared with the computerized system. The details of the existing system cost are summarized on Table 3.8.

Table 3.8. Cost of Existing System, Baht.

| | Cost Items | Years | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| | Operating Cost | | | | | |
| | Accessories | | | | | |
| | Preprinted forms | 20,000.00 | 20400.00 | 20808.00 | 21224.16 | 21,648.64 |
| | Ribbon and Toner for Printer | 8,000.00 | 8160.00 | 8323.20 | 8489.66 | 8,659.46 |
| | Barcode Label & Toner | 1,000.00 | 1020.00 | 1040.40 | 1061.21 | 1,082.43 |
| | CDs | 300.00 | 306.00 | 312.12 | 318.36 | 324.73 |
| | Total Accessories cost | 29,300.00 | 29,886.00 | 30,483.72 | 31,093.39 | 31,715.26 |
| | Human resources | | | | | |
| 1 | Programmer Analyst (bht10,000/month) | 12,000.00 | 13,200.00 | 14,520.00 | 15,972.00 | 17,569.20 |
| 6 | Data entry staffs (bht 6,000/- per month) | 432,000.00 | 475,200.00 | 522,720.00 | 574,992.00 | 632,491.20 |
| 2 | Data verification clerks (bht 6,000/- per month) | 144,000.00 | 158,400.00 | 174,240.00 | 191,664.00 | 210,830.40 |
| 2 | Report Generation Staffs ( bht 6,000/- per month) | 144,000.00 | 158,400.00 | 174,240.00 | 191,664.00 | 210,830.40 |
| 4 | Stock handling staffs (bht 5,000/- per month) | 240,000.00 | 264,000.00 | 290,400.00 | 319,440.00 | 351,384.00 |
| | Total Accessories cost | 972,000.00 | 1,069,200.00 | 1,176,120.00 | 1,293,732.00 | 1,423,105.20 |
| | Total cost of running existing system | 1,001,300.00 | 1,099,086.00 | 1,206,603.72 | 1,324,825.39 | 1,454,820.46 |
| | Five Years Accumulated Existing System Cost | 1,001,300.00 | 2,100,386.00 | 3,306,989.72 | 4,631,815.11 | 6,086,635.58 |

(2) Cost of the Proposed System

The proposed system cost is also classified into fixed cost and annual operating cost. Fixed cost includes hardware cost, software cost, people cost (only the salary cost of specialized persons who are involved in developing the new system), maintenance cost (both hardware and software), and implementation cost, whereas annual operating cost has the same cost category as incurred in the existing system cost.

With the newly computerized system, there is no office equipment cost but it requires some investment in computer hardware and software.

The additional salary cost is paid to the people who are involved in the system development process.

Before implementing the proposed system, the training and implementation costs are spent according to the project budget.

The new system reduces the number of staffs and officers in the materials department. Only one materials manager, one supervisor, and two staffs can operate the system without any workloads.

The IT specialists are hired to develop and maintain the computerized system. They are system analysts who act as the consultants for the system user in case of any problem about system functions, and network administrators who are responsible for maintaining the network connection of the developed system.

The details of the proposed system cost are summarized on Table 3.9. at the next page.

Table 3.9. Estimated Cost of the Proposed System, Baht.

| | Cost Items | Years | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| | Development Costs | | | | | |
| | Hardware | | | | | |
| 1 | File Server | 180,000.00 | – | – | – | – |
| 1 | UPS | 10,000.00 | – | – | – | – |
| 1 | Laser Printer ( 15,000 baht x 2) | 15,000.00 | – | – | – | – |
| 3 | Dot Matrix Printer (@20,000/- per piece) | 60,000.00 | – | 20,000.00 | – | 20,000.00 |
| 1 | Barcode Scanner | 40,000.00 | – | – | – | – |
| 1 | Barcode Printer | 40,000.00 | – | – | – | – |
| 10 | Client Computers | 250,000.00 | 50,000.00 | 50,000.00 | 50,000.00 | 50,000.00 |
| 1 | CD Writer for backup | 15,000.00 | – | – | – | – |
| | Software : | | | | | |
| 1 | Visual Basic | 15,000.00 | – | – | – | – |
| 1 | Crystal Reports | 15,000.00 | – | – | – | – |
| 10 | Oracle 9i Database Standard Edition (B 8,000/- per license) | 80,000.00 | – | – | – | – |
| | Personnel : | | – | – | – | – |
| 1 | Systems Analyst (40,000 baht/month x 6 months) | 240,000.00 | – | – | – | – |
| 1 | Networking Specialist (15,000 baht /month x 4 months) | 60,000.00 | – | – | – | – |
| 3 | Programmer Analyst (20,000 baht /month x 6 months) | 360,000.00 | – | – | – | – |
| | Implementation & Training | | | | | |
| 1 | Training Cost | 30,000.00 | – | – | – | – |
| 1 | Installation Cost | 20,000.00 | – | – | – | – |
| | Total development cost | 1,430,000.00 | 50,000.00 | 70,000.00 | 50,000.00 | 70,000.00 |
| | Projected Annual Operating Costs | | | | | |
| | System Support | | | | | |
| 1 | Programmer Analyst (20,000 baht/mor | 240,000.00 | 264,000.00 | 290,400.00 | 319,440.00 | 351,384.00 |
| 1 | Data entry staff (6,000 baht/month) | 72,000.00 | 79,200.00 | 87,120.00 | 95,832.00 | 105,415.20 |
| 1 | Stock handling staff (6,000 baht/month | 72,000.00 | 79,200.00 | 87,120.00 | 95,832.00 | 105,415.20 |
| | Maintenance Cost | | | | | |
| 1 | Barcode printer | 10,000.00 | 10,000.00 | 10,000.00 | 10,000.00 | 10,000.00 |
| | Accessories | | | | | |
| | Preprinted forms | 20,000.00 | 20,600.00 | 21,218.00 | 21,854.54 | 22,510.18 |
| | Ribbon and Toner for Printer | 8,000.00 | 8,240.00 | 8,487.20 | 8,741.82 | 9,004.07 |
| | Barcode Label & Toner | 1,000.00 | 1,030.00 | 1,060.90 | 1,092.73 | 1,125.51 |
| | CDs | 300.00 | 309.00 | 318.27 | 327.82 | 337.65 |
| | Total Projected Operational Costs | 423,300.00 | 462,579.00 | 505,724.37 | 553,120.90 | 605,191.81 |
| | TOTAL PROJECTED COST | 1,853,300.00 | 512,579.00 | 575,724.37 | 603,120.90 | 675,191.81 |
| | Total Accumulated Yearly Cost | 1,853,300.00 | 2,365,879.00 | 2,941,603.37 | 3,544,724.27 | 4,219,916.08 |

(3) Comparison of system cost

After both the existing system cost and proposed system cost are identified, the comparison table is constructed to reveal the cost saving after implementing the proposed system.

The figures of the comparison of the system cost are summarized in Table 3.10.

Table 3.10. Comparison of the Accumulated Existing System Cost and the Accumulated Proposed System Cost, Baht.

| Year | Accumulated Manual Cost | Accumulated Proposed Cost |
|---|---|---|
| 1 | 1,001,300.00 | 1,853,300.00 |
| 2 | 2,100,386.00 | 2,365,879.00 |
| 3 | 3,306,989.72 | 2,941,603.37 |
| 4 | 4,631,815.11 | 3,544,724.27 |
| 5 | 6,086,635.58 | 4,219,916.08 |

(4) Benefit Analysis

The benefits of the proposed system can be classified into tangible and intangible benefits.

The tangible benefit can be expressed in monetary value, whereas the intangible benefit is qualitative, and difficult to measure.

The details of these benefits can be summarized as follows:

**Tangible Benefits**

The tangible benefit right from the first year of implementation of the new system is shown on Table 3.11, in page 45 and grouped into three main categories as follows:

(a) Cost Saving

The proposed system introduces the new way in handling stock. Fewer staffs and officers are required to operate the system.

The demand for paper and stationary are reduced because information is recorded at source rather than post mortem.

Documents that are generated and printed from the system serve as the verification for data entered.

Also the employment of barcode reader further eliminates the errors during data input.

This eliminates the need for data verification clerks.

Thus, the proposed system saves the operating cost, which are salary cost, office supplies expense.

(b) Operation Time Improvement

From the comparison of the total operation time between existing system and proposed system, it can be concluded that the new system can improve the operation time from 6 hours and 30 minutes to just 30 minutes.

This operation time improvement relieves the staffs and officers to perform other tasks.

The full details of operation time comparison are presented in chapter 5.

(c) Elimination of the possible long run cost

The proposed system provides a proper framework for scalability in that it can aid and enable the existing staffs to

comfortably and efficiently handle an increase in volume of stock over the next few years due to the ability to know the precise stock location that is requested from the marketing department.

**Intangible Benefits**

The intangible benefits are as follows:

(1) Reduced response time from the materials department

(2) Increased co-ordination among materials staffs and

(3) Increased morale of the materials staffs.

Table 3.11. Tangible Benefits of the Proposed System, Baht.

| | Tangible Benefit of Proposed System, Baht | Price |
|---|---|---|
| 5 | Data entry staffs (6,000/- baht per month) | 360,000.00 |
| 2 | Data verification clerks (6,000/- baht per month) | 144,000.00 |
| 2 | Report Generation Staffs (6,000/- baht per month) | 144,000.00 |
| 3 | Stock handling staffs (6,000/- baht per month) | 216,000.00 |
| | Total Tangible Benefit | 864,000.00 |

(5) Break-even Analysis

Break-even Analysis shows the point where the cumulative cost of the existing system is equal to the cumulative cost of the proposed system. At the beginning, the cost of the proposed system is higher than the cost of the proposed system. This difference comes from the development cost incurred at the first year of the new system implementation. But, for the long term, the proposed system can reduce the annual operating cost, especially salary cost and office supplies cost.

The break-even point of the proposed system is depicted on Figure 3.5. The proposed system cost is less than the existing system cost when the time passes in the second year. Thus, it can be concluded that the break-even point will occur approximately 1 year after the system has been operated. This result is satisfactory for investing and implementing the proposed system because it will incur less operating cost than the existing system in the long run operation.

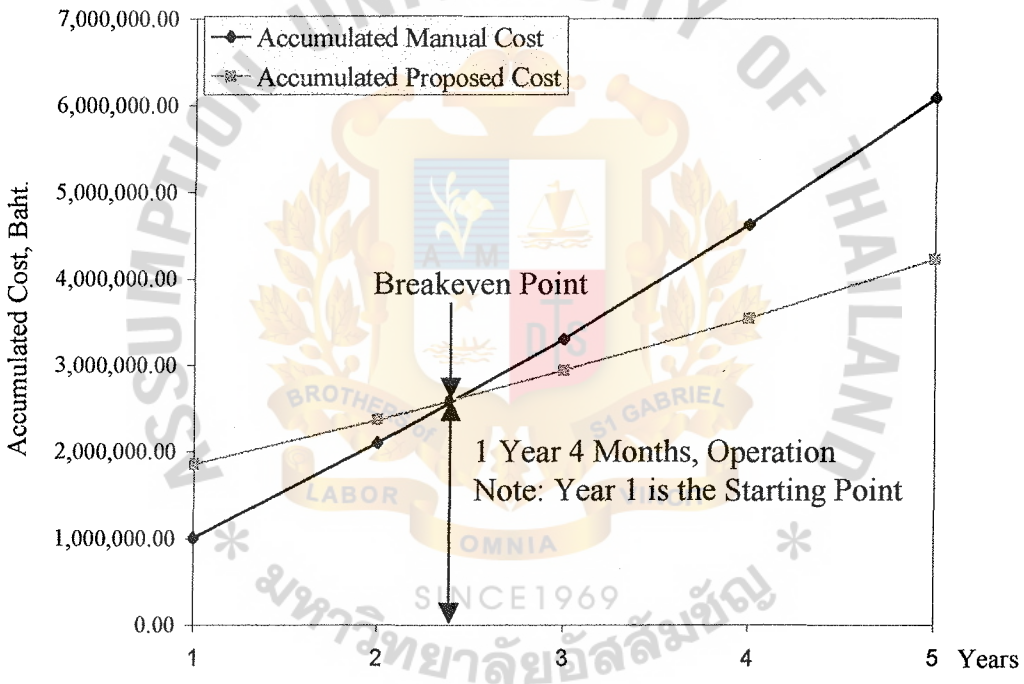



Figure 3.5. Breakeven analysis.

**(6) Payback Period**

Payback period is the commonly used technique to assess the value of investment.

Generally, payback period is the period that cash inflow can recover the initial investment within a specified period.

To reflect the real value of money, the time value of money concept also applies in this analysis.

The discount rate is required to calculate the discount value of all costs and benefits after the first year back to present value at the present year.

If the payback period is performed without time adjusting the costs and benefits (time value of money), non-time-adjusted paybacks tend to be over-optimistic and misleading.

After the lifetime cost and benefit are discounted, payback period can be computed.

The acceptance of the project occurs only when the project's payback period is less than or equal to the predefined payback period guideline, generally 3 years.

Figure 3.6 shows the payback period of the proposed system that has already been calculated to evaluate the candidate solution (See the full details of payback calculation in Table C.6. on Appendix C).

The lifetime costs are gradually increasing over the five-year period because operating costs are being incurred. But it also can be noticed that the lifetime benefits are occurring at a much faster pace.

The result of payback period is 2.7 year, which is less than the predefined maximum desired payback period (3 years).

Thus, this project is acceptable to implement with the return on investment to recover the initial investment within two years.

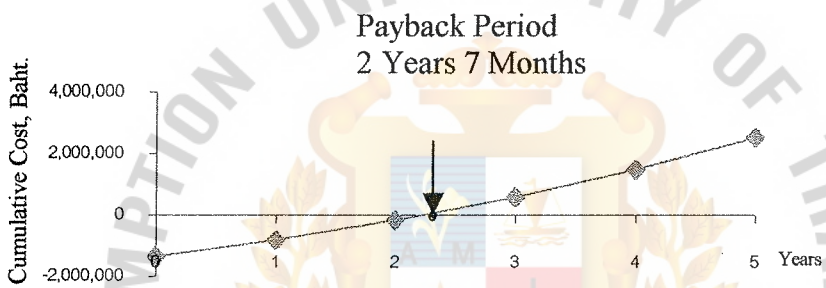



Figure 3.6. Payback Period Analysis of the Proposed System.

# IV. PROJECT IMPLEMENTATION

## 4.1 Overview of Project Implementation

Based on the work performed on the previous chapter, the proposed system is ready to be implemented in the current operation. The typical processes of system implementation are presented in brief details as follows:

(1) Hardware and Software Acquisition and Installation

The proposed system is expected to generate a high volume of data owing to the real-time processing and collection of data at source. Hence there is a need for a reliable database server with built in tolerance for failure. To achieve this objective a Dell Server with RAID 5 hard disk controller configuration would be required to be purchased.

(2) Personnel Training

Training is provided to both end-user and system administrator. The benefits of training are to give more understanding of the new system to all relevant users, and to enable the system administrator configure the system and to control adding, updating, and deleting User ID and password of all system users. Besides training on the basic use of the system, the users should also be trained on best practices to be applied under exceptional scenarios.

(3) Site and Data Preparation

The IT Department is responsible for preparing the site to implement the new system. LAN connection and other facilities should be ready before the developed system is implemented. The materials department, that is the system owner, will prepare data to input into the proposed system.

(4) System Testing

Testing is conducted to ensure that the proposed system is working properly. Unit Testing, System Testing, and Integration Testing are done to fulfill this objective. Data sampling is done from the actual data for testing to ensure that all possible combination is evaluated and tested on the new system.

(5) Conversion Plan

Before converting the old system to new system, the conversion plan must be prepared to serve as a guideline for the entire conversion process. The conversion method would be an abrupt cut off backed by sound testing.

## 4.2 Stage of Project Implementation

To simplify the implementation process, the overall processes can be categorized into two main stages, the details of which are as follows:

(1) Construction Stage

The purpose of the conversion stage is to build and test a functional system to ensure that the new system meets the business and design requirements. It also constructs the interfaces between the new system and existing production system. In summary, this stage includes the processes of installation and acquisition of the new hardware and software, preparation of data and site for the new system, and conducts the various types of testing to ensure there are no errors or problems in the new system.

(2) Delivery Stage

In the delivery stage, the conversion plan is prepared to provide a smooth transition to the new system. Database is installed, and network is configured for the new system. The training and documentation is provided to individuals who use the new system. Finally, the old system is converted to the new system with a predefined procedure to ensure the transition is smooth. After the new system is operated, the system evaluation is conducted to measure the new system performance, and to discover any troubles that may occur in the developed system.

## 4.3 Training and Documentation

Before the new system is fully implemented, the training and documentation must be prepared for the system users. In addition, the document that may prove useful in developing the new system must be collected. The user manual must cover all system functions. The training needs of system users must be reviewed, and the training session should be in-group to encourage group learning possibilities.

## 4.4 Conversion

This project selects the abrupt cut off method to convert the old system to the new system. The new system will be tested vigorously with heavy sampling of data from the existing system involving the users of the respective department with a simulated actual scenario.

Although this method will be backed by sound testing, there is bound to be some difficulties in the first one week during which the IT department personnel will be fully deployed for support.

## 4.5 System Maintenance

When the proposed system has been placed into operation, the on-going maintenance of the system needs to be done. Typically, this activity includes program maintenance and system improvement.

The purpose of program maintenance is to fix any possible program errors that occur after the system is implemented. The System analyst and programmer must coordinate to solve the program bugs and, sometimes, advise the users to fix the system troubles by themselves.

After the proposed system operates during some periods of time, it is necessary to evaluate its performance against a standard measurement of system capacity. The evaluation result will serve as the criteria in deciding to improve the system or not. This system evaluation and improvement may be done quarterly to guarantee that the system is still working in the current situation.

# V. CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Conclusions

The project study indicates that the proposed system introduces the very efficient ways of handling the inventory and the quality. In the existing system, most of the stock handling and quality control are done manually.

The results are human-error, slow response time to user, and high operating cost, especially salary cost. To improve the current operation this project is proposed to solve the mentioned problems, and improve its normal operation.

For the new system, the information technology is utilized to simplify the processes involving inventory handling. The proposed system improves the current operation in terms of both cost and time. It saves cost for the management which expects reducing department operating cost, and time for users in accessing and analyzing the required information. The benefit of saving cost and time can be proved by the work performed in the previous section: Cost and Benefit Analysis.

Referring to cost and benefit analysis section, the table and figure reveal the fact that the proposed system incurs less operating cost than the existing system.

Some cost items that are incurred in existing system can be eliminated and reduced, such as Salary Cost, Office Supplies Expense, etc. In the cost comparison table, the cost of the existing system is less than the cost of the proposed system during the first two years because the proposed system incurs some development cost in the first year of its implementation. But the benefit will be explored and become clear after Break-even point in the second year. The proposed system also spends less time to operate than the existing system.

This fact is illustrated in the following additional table.

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

| Process | Existing System | Proposed System |
|---|---|---|
| Stock-in document (one document) | 30 Minutes | 5 Minutes |
| Enter inspection details (for 10 rolls) | 1 Hour | 5 Minutes |
| View Stock Balance and location | 30 Minutes | 2 Minutes |
| Stock-out document (one document) | 30 min | 5 Minutes |
| Enter post qc inspection details | 1 Hour | 5 Minutes |
| Stock Report Generation | 1 Hour | 30 Minutes |
| Quality Control Report | 2 Hours | 15 Minutes |

The details of this operation time improvement can be summarized as follows:

(1) Stock-in document: The existing system spends 30 minutes because sufficient amount of time is spent on analyzing supporting documents, then preparing the stock-in document manually and later key in into the system. In contrast, information from the supporting documents are directly entered into the proposed system and all the validation and subsequent document generation and printing is done by the system itself.

(2) Enter inspection details: The existing system consumes 1 hours for this process. This is due to the recording of information manually first and keying into the MS Excel later. All information regarding each roll is entered. With the new system, the information is entered directly into the system and only the design, roll no and inspection details are entered and the rest of the information for any report generation is derived from the existing data in the systems.

(3) View Stock Balance and Location: In the existing system, there is no location information so it takes 30 minutes to locate a particular item in the stock whereas in the proposed system the location information for each roll is precisely recorded and hence this process takes just 5 minutes.

(4) Stock-out document: The existing system spends 30 minutes because sufficient amount of time is spent on analyzing supporting documents, then preparing the stock-out document manually and later keying into the system. In contrast, information from the supporting documents are directly entered into the proposed system and all the validation and subsequent document generation and printing is done by the system itself.

(5) Stock report generation: This process takes 1 hour every day in order to generate basic stock reports because some of the reports could not be generated from the existing system whereas the proposed system generates more reports in a shorter time due to the integrated nature of the system.

(6) Quality control report: The existing system takes 2 hours to generate quality report due to the fact that these reports are generated manually using MS Excel. In contrast, the existing system, takes incredibly less time due to the integrated nature of the system.

## 5.2 Recommendations

This project demonstrates how the application of information technology has become more and more important in order to support the diversification and the rapid growth of this organization.

Apart from the controls employed in the new computerized system to reduce intentional and unintentional errors, physical controls also need to be established. Here it is to be mentioned that there is no inbuilt physical security for goods moving out and coming in to the system. Similarly controls are also needed on barcode generation. Users should be accountable for the number of barcode labels generated per day, how many of them were used or destroyed. This is required to prevent duplicate barcodes which might be illegally used to tamper the system.

It is recommended that the system be evaluated every 6 months to measure the efficiency and worthiness so as to increase the life cycle of the system. This will ensure the expected return on investment as was shown earlier in the report. It is also recommended to issue questionnaires to users to know the satisfaction levels of the users in order to improve the operation efficiency and ease of use of the new system for maximum utilization and wide acceptance. High acceptance level will result in less resistance during introduction of any future systems and hence this aspect should be properly taken care of.

# APPENDIX A

## ENTITY RELATIONSHIP DIAGRAM

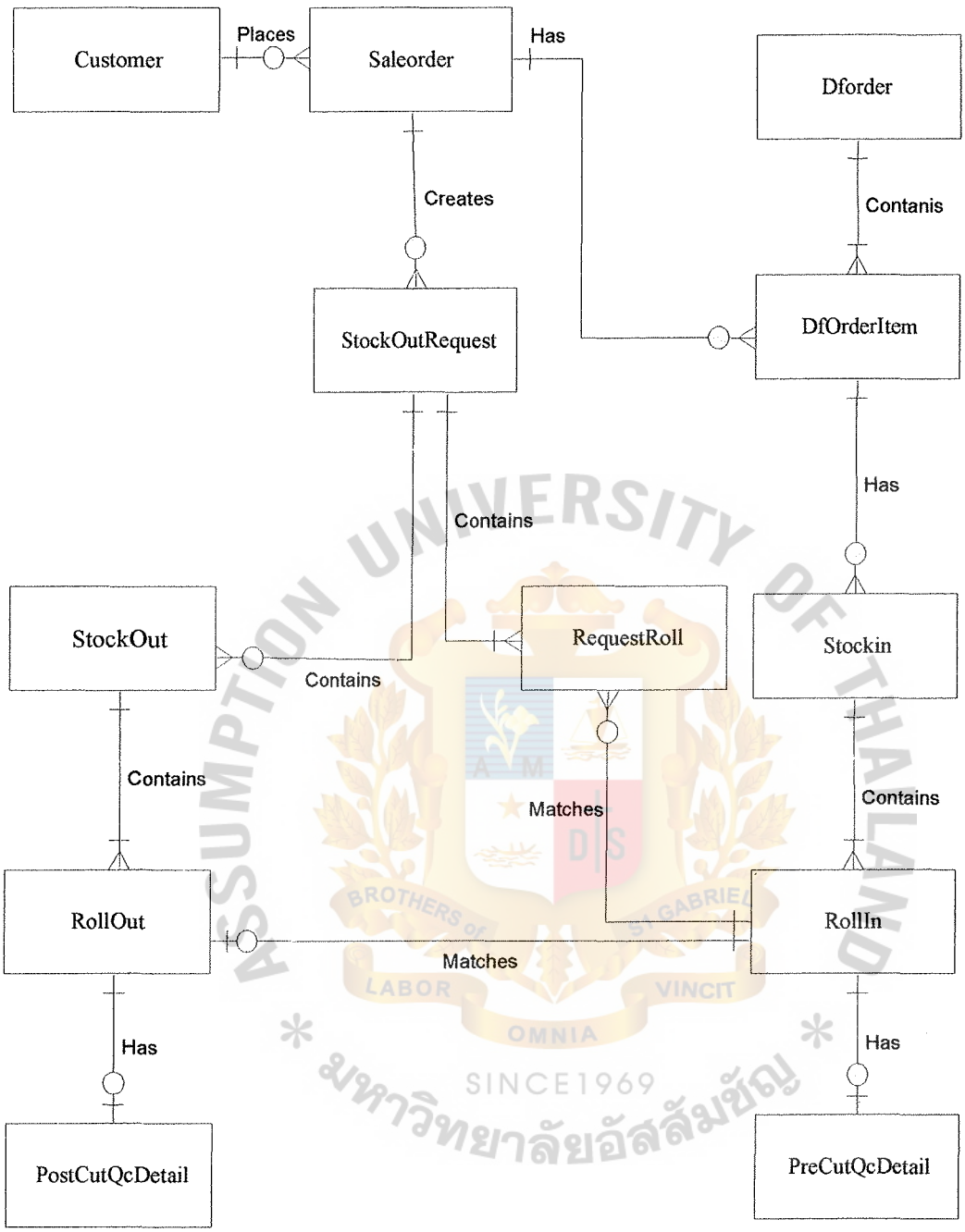



Figure A.1. Context Data Model of the Proposed System

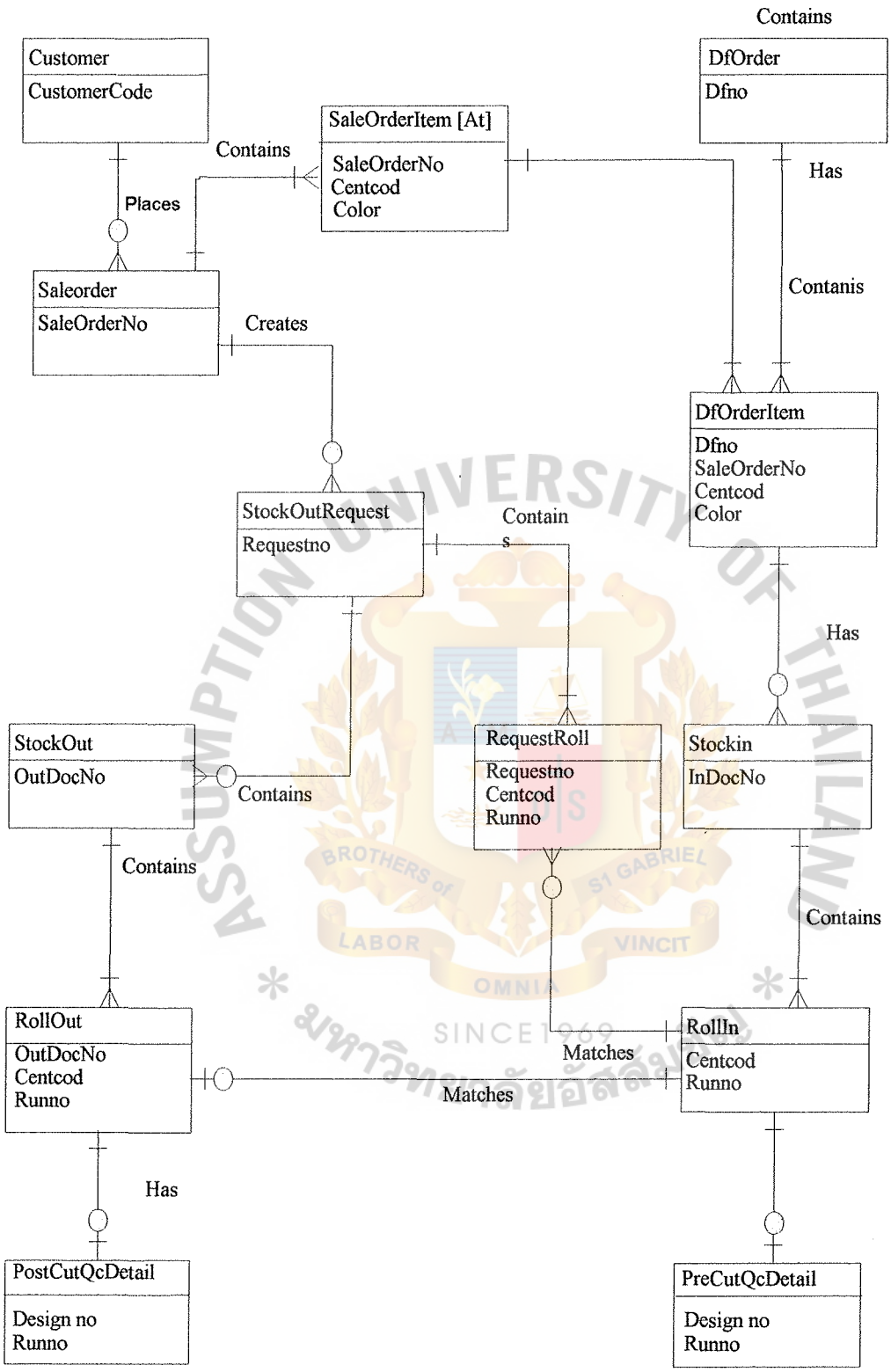



Figure A.2. Key-Based Data Model of the Proposed System

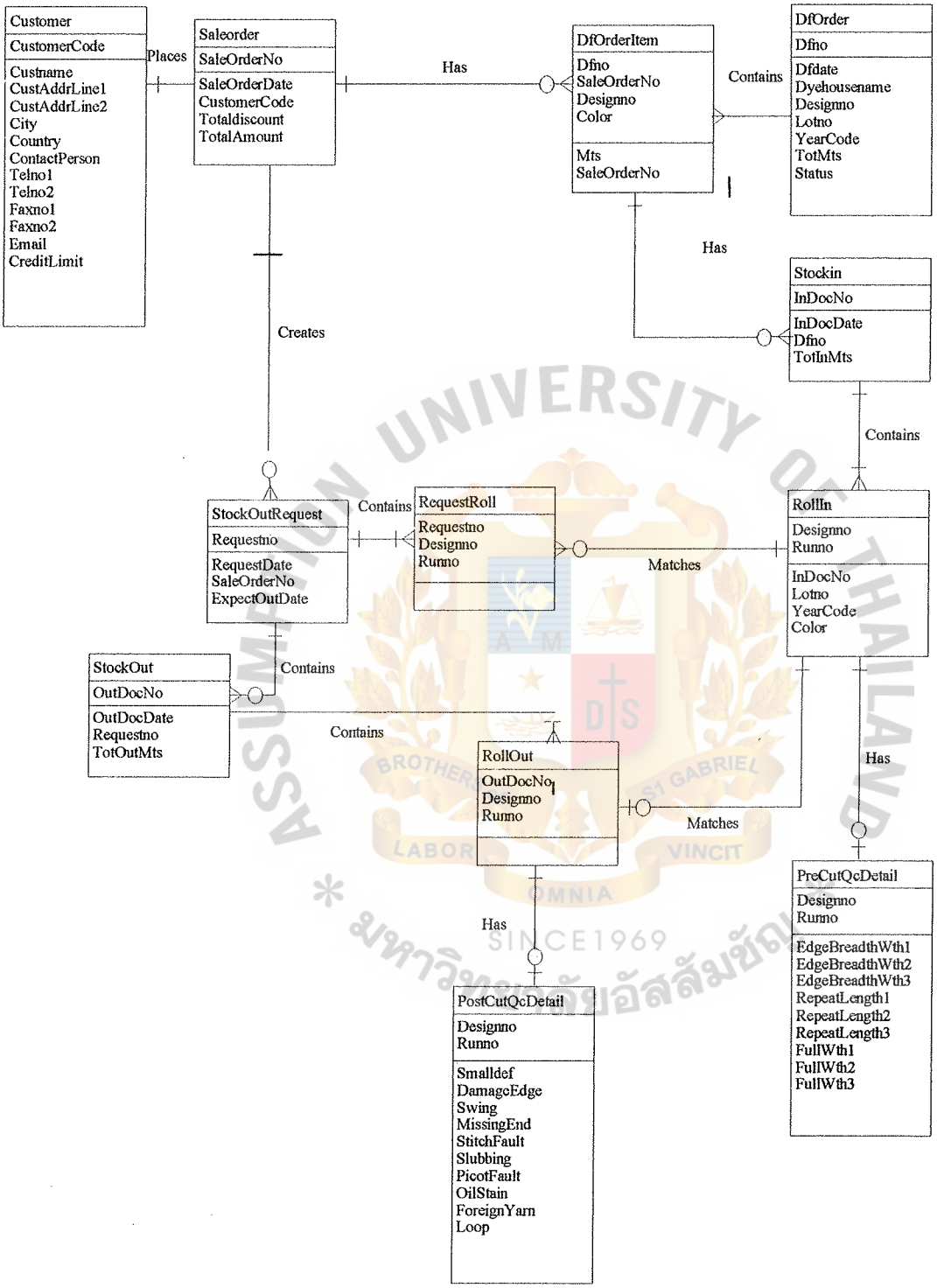



FIGURE A.3. KEY-BASED ERD DIAGRAM

# APPENDIX B

# DATA FLOW DIAGRAM

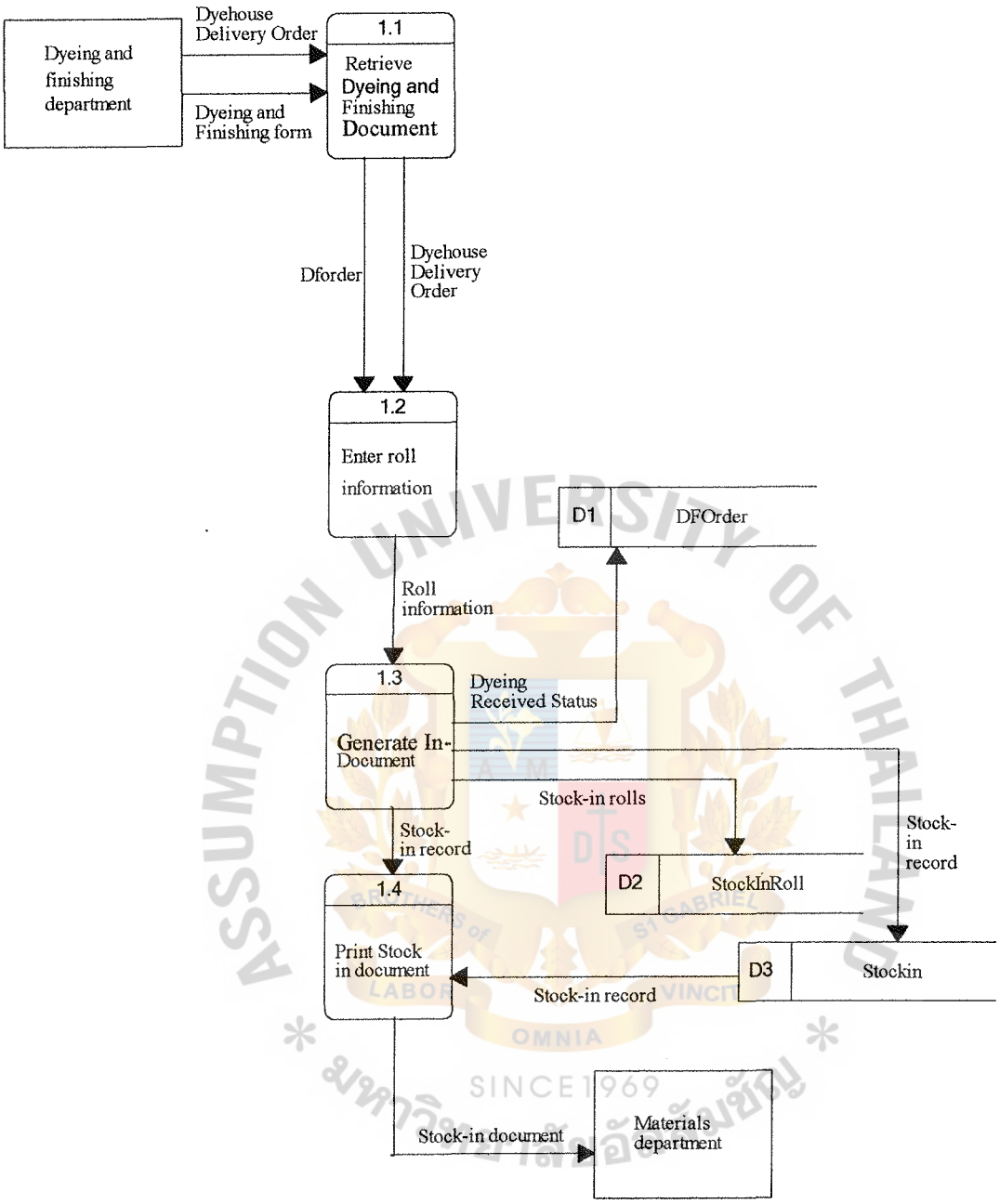



FIGURE B.1. Data Flow Diagram of Take Stock-In Document.

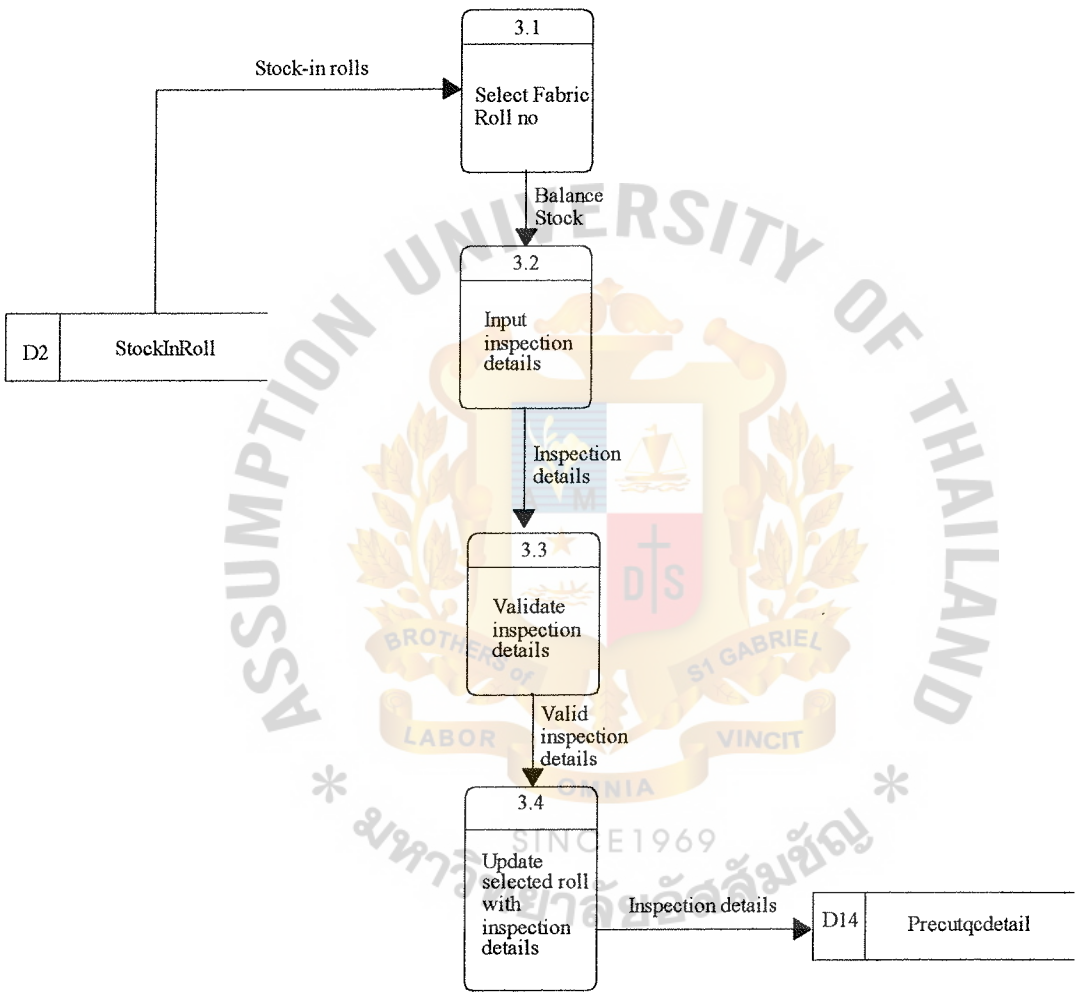



FIGURE B.2. Data Flow Diagram of Enter Inspection Details.

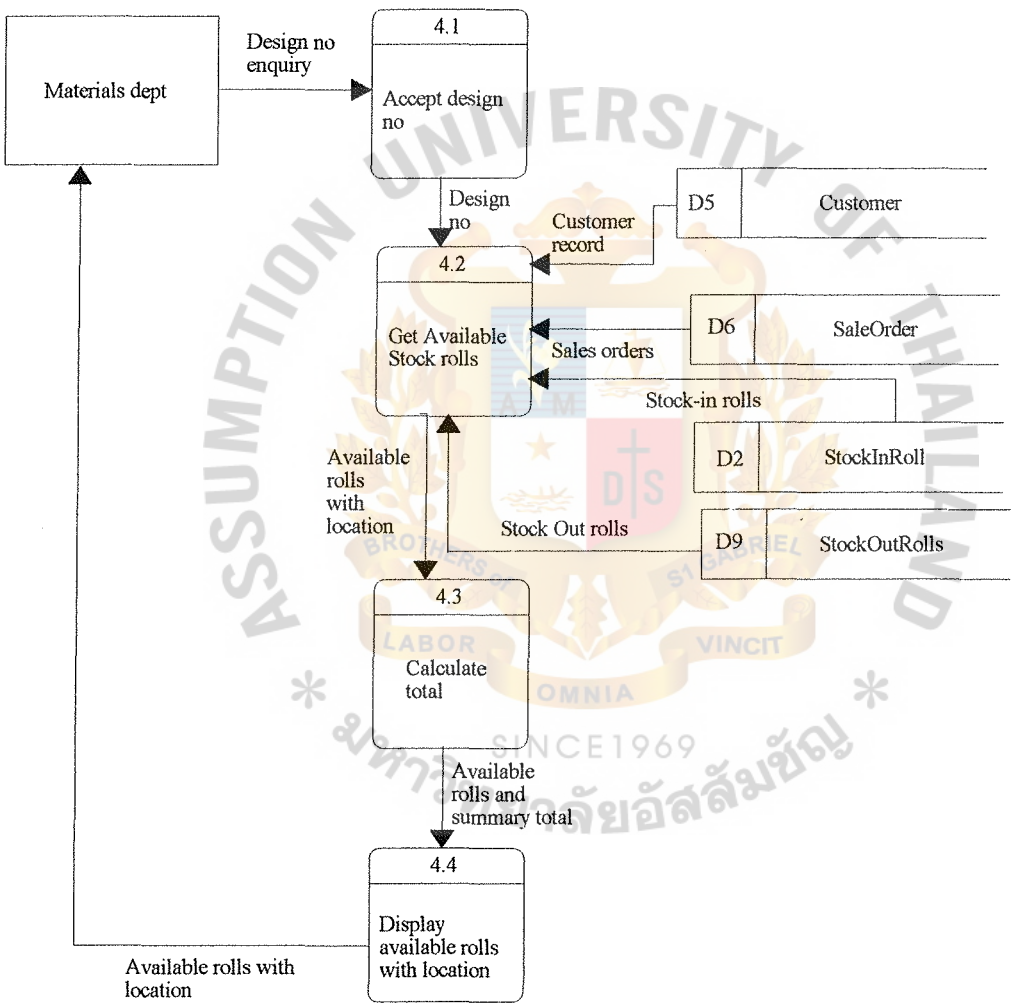



FIGURE B.3. Data Flow Diagram of View Stock.

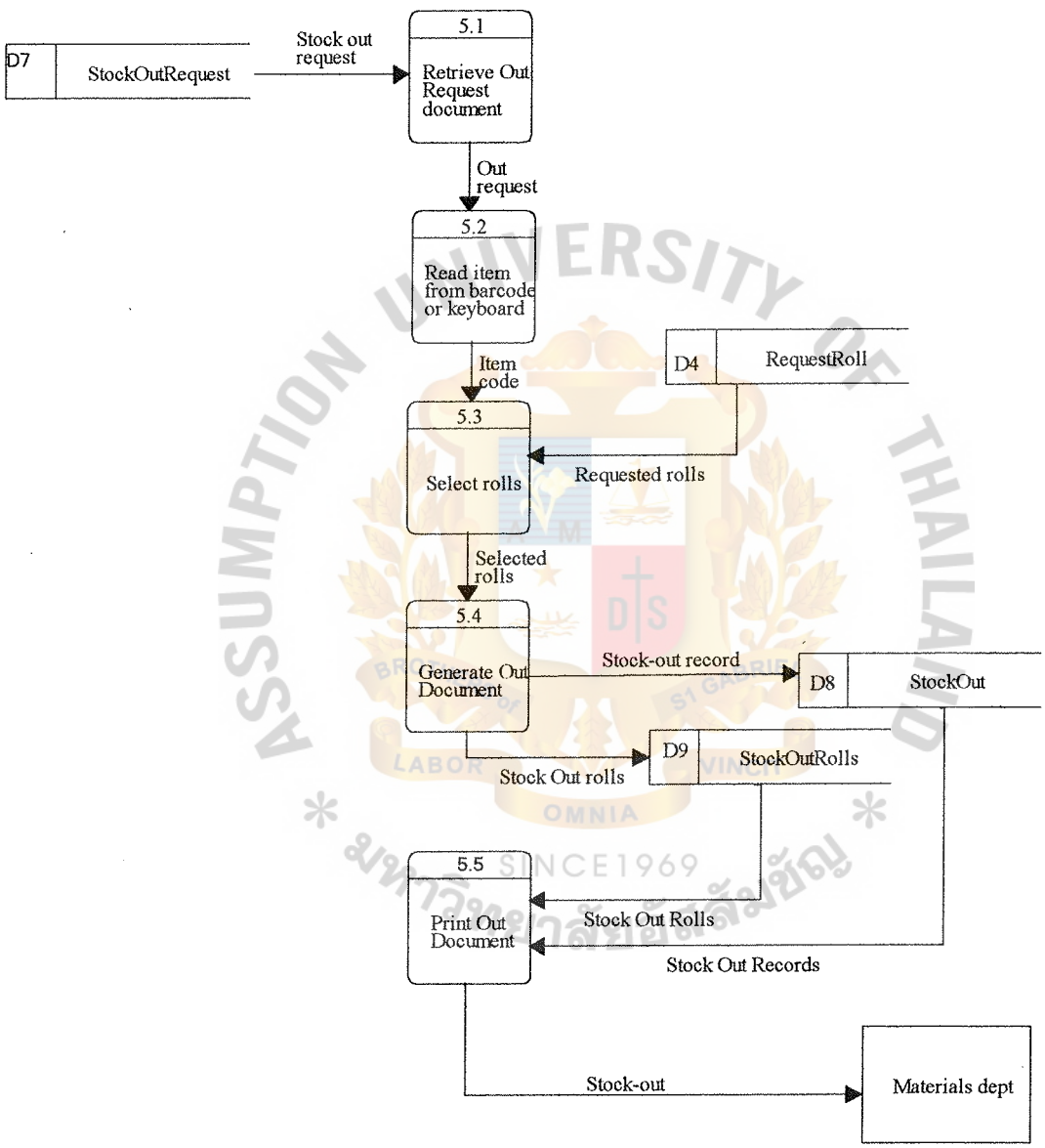



FIGURE B.4. Data Flow Diagram of Make Stock-out document.

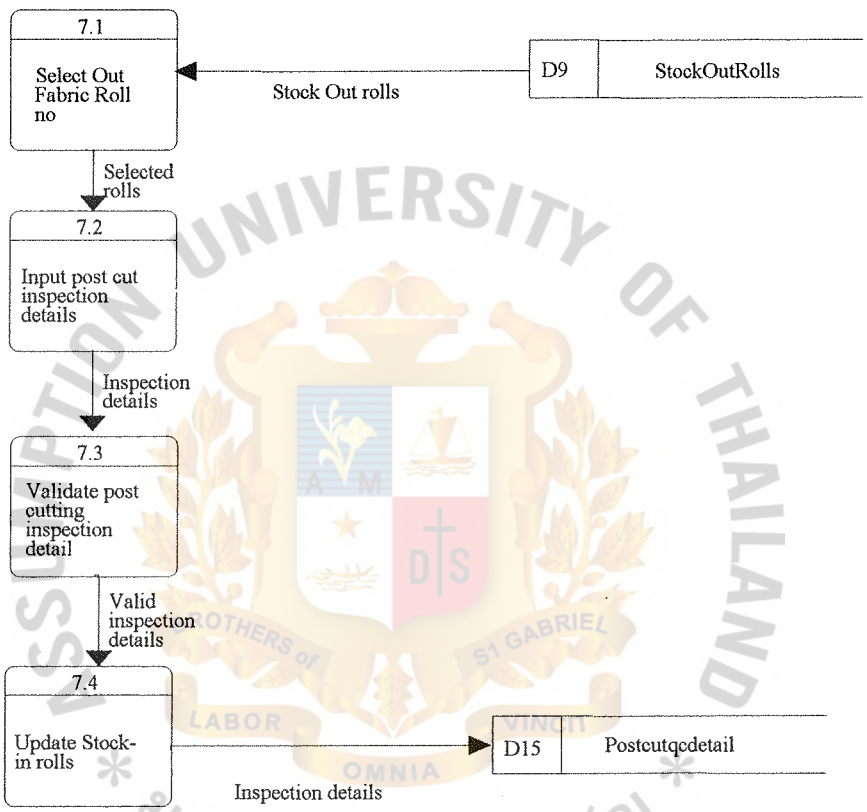



FIGURE B.5. Data Flow Diagram of Enter Post Cutting Inspection Details.

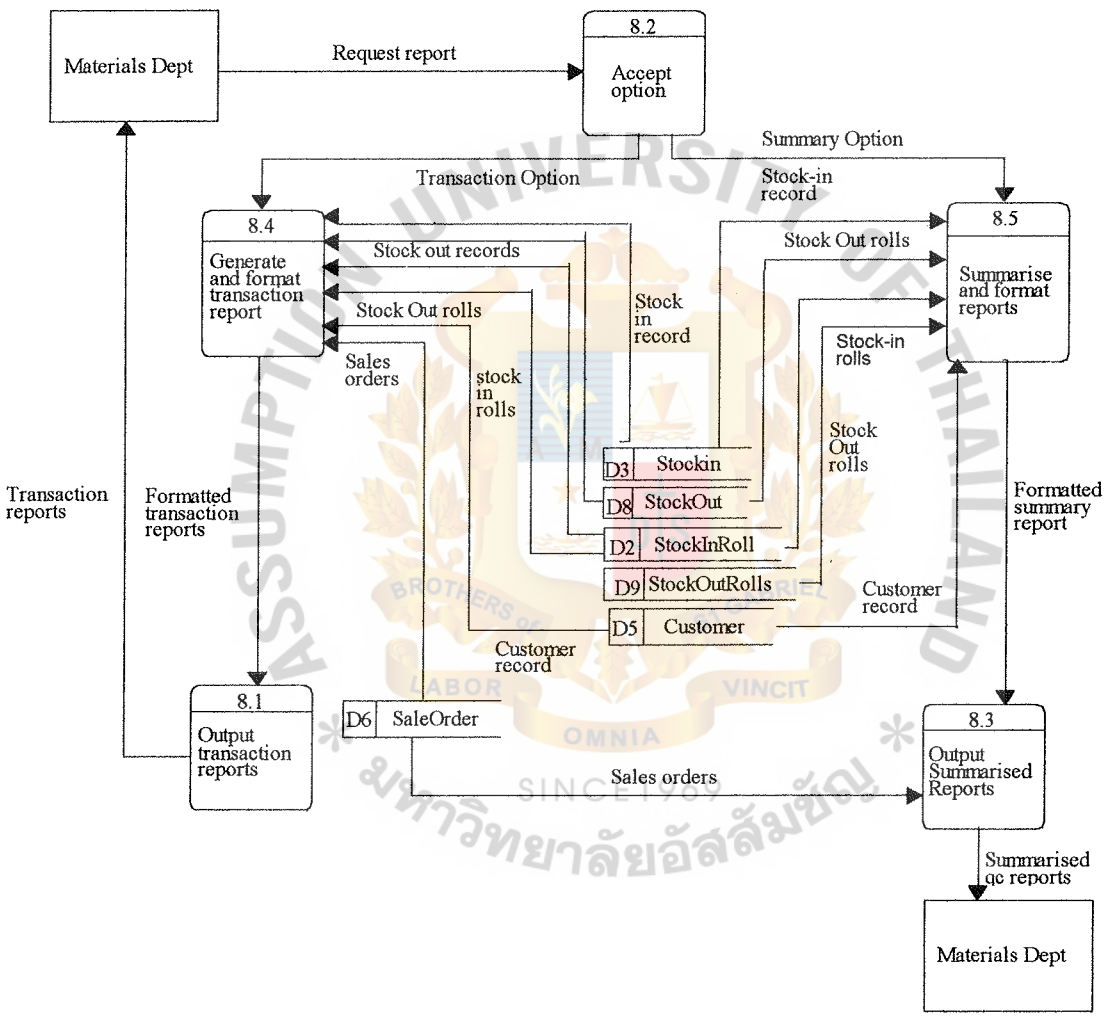



FIGURE B.6. Data Flow Diagram of Generate Stock Reports.

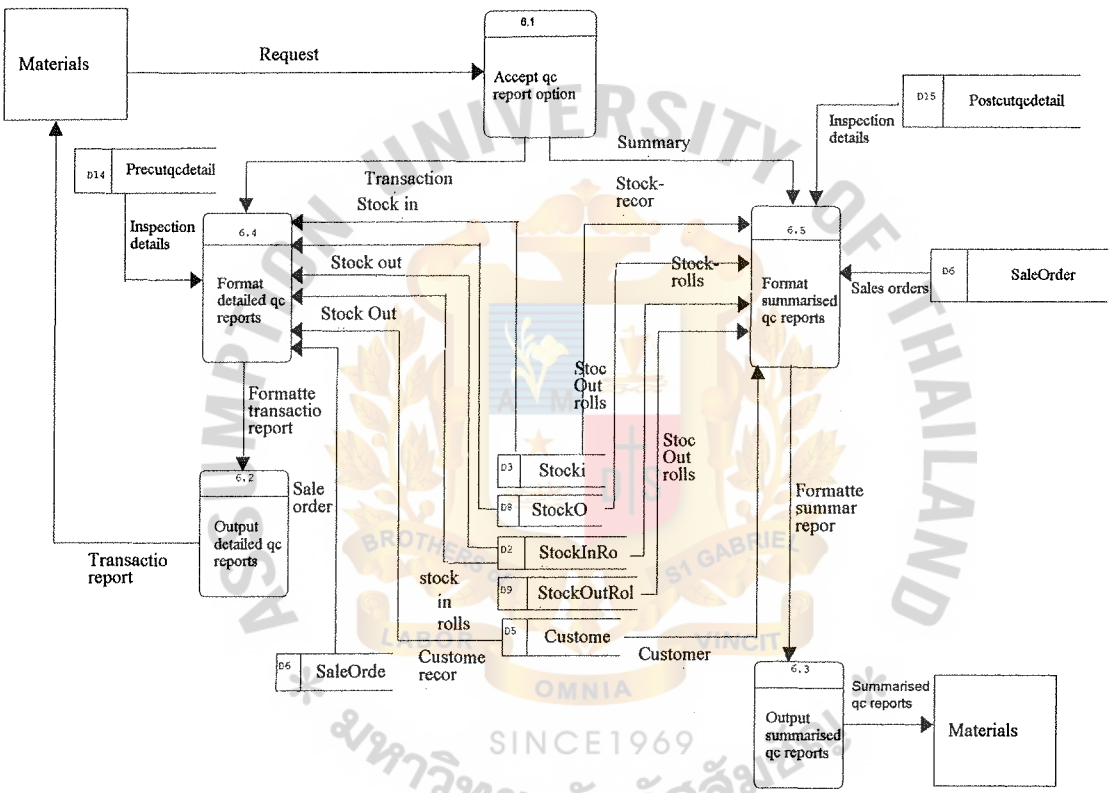



FIGURE B.7. Data flow diagram of Generate Qc Reports.

# APPENDIX C

# FEASIBILITY ANALYSIS

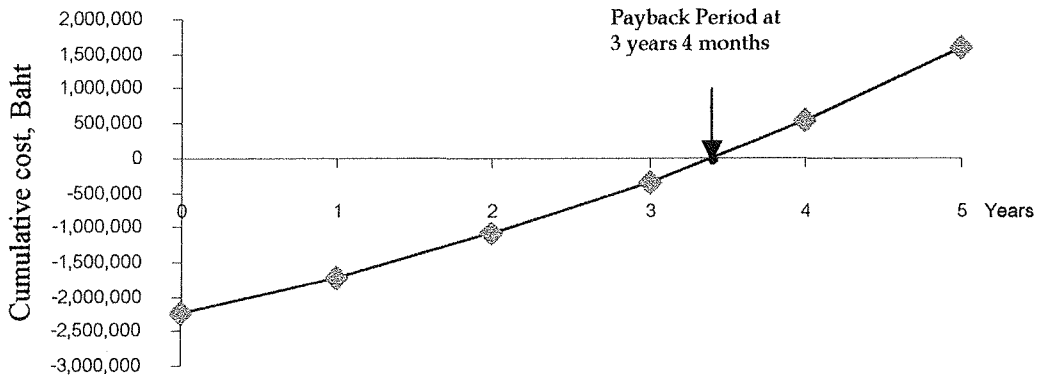



Figure C.1. Payback Period for Candidate 1.

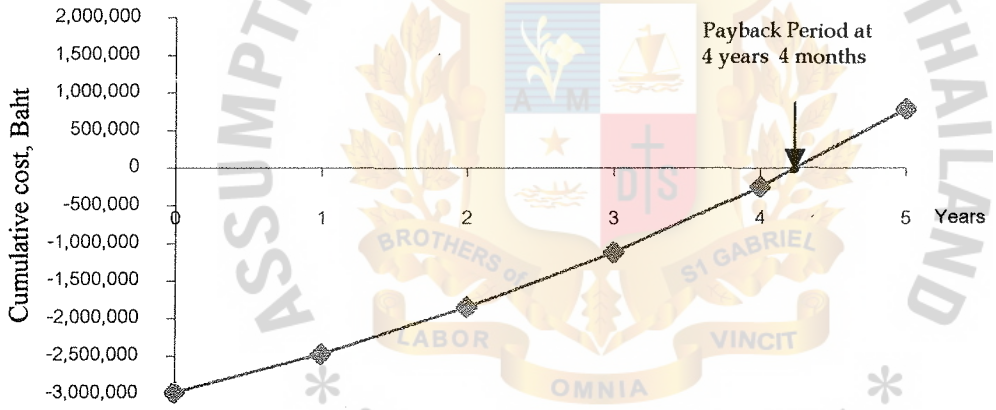



Figure C.2. Payback Period for Candidate 2.

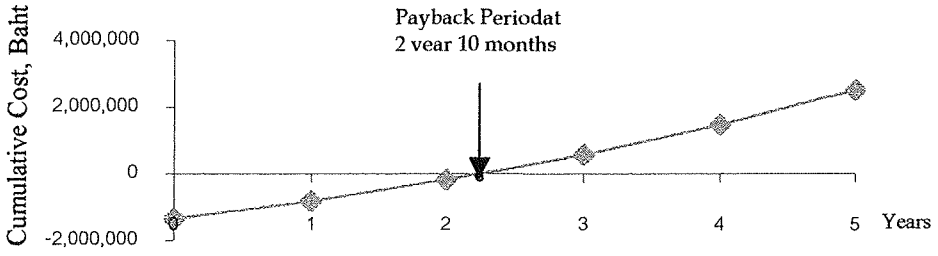



Figure C.3. Payback Period for Candidate 3.

Table C.6. Payback Analysis for Candidate 3 (Number's rounded to nearest 1 baht).

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Development Costs | -1,350,000 | | | | | |
| Operation & Maintenance Costs 1.1 | | -279,300 | -307,230 | -337,953 | -371,748 | -408,923 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Costs (adjusted to present value) | -1,350,000 | -253,884 | -253,772 | -253,803 | -253,904 | -253,941 |
| Cumulative Time Adjusted Costs over Lifetime | -1,350,000 | -1,603,884 | -1,857,656 | -2,111,458 | -2,365,362 | -2,619,304 |
| Benefits Derived from Operation of New System | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 |
| Cumulative Time Adjusted Benefits over Lifetime | 0 | 786,240 | 1,682,640 | 2,695,140 | 3,842,640 | 5,150,453 |
| Cumulative Lifetime Adjusted Costs + Benefits | -1,350,000 | -817,644 | -175,016 | 583,682 | 1,477,278 | 2,531,149 |

Table C.5. Payback Analysis for Candidate 2 (Number's rounded to nearest 1 baht).

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Development Costs | -2,979,000 | | | | | |
| Operation & Maintenance Costs | | -304,300 | -334,730 | -368,203 | -405,023 | -445,526 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Costs (adjusted to present value | -2,979,000 | -276,609 | -276,487 | -276,520 | -276,631 | -276,671 |
| Cumulative Time Adjusted Costs over Lifetime | -2,979,000 | -3,255,609 | -3,532,096 | -3,808,616 | -4,085,247 | -4,361,918 |
| Benefits Derived from Operation of New System | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 |
| Cumulative Time Adjusted Benefits over Lifetime | 0 | 786,240 | 1,682,640 | 2,695,140 | 3,842,640 | 5,150,453 |
| Cumulative Lifetime Adjusted Costs + Benefits | -2,979,000 | -2,469,369 | -1,849,456 | -1,113,476 | -242,607 | 788,534 |

Table C.6. Payback Analysis for Candidate 3 (Number's rounded to nearest 1 baht).

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Development Costs | -1,350,000 | | | | | |
| Operation & Maintenance Costs 1.1 | | -279,300 | -307,230 | -337,953 | -371,748 | -408,923 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Costs (adjusted to present value) | -1,350,000 | -253,884 | -253,772 | -253,803 | -253,904 | -253,941 |
| Cumulative Time Adjusted Costs over Lifetime | -1,350,000 | -1,603,884 | -1,857,656 | -2,111,458 | -2,365,362 | -2,619,304 |
| Benefits Derived from Operation of New System | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Time Adjusted Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 |
| Cumulative Time Adjusted Benefits over Lifetime | 0 | 786,240 | 1,682,640 | 2,695,140 | 3,842,640 | 5,150,453 |
| Cumulative Lifetime Adjusted Costs + Benefits | -1,350,000 | -817,644 | -175,016 | 583,682 | 1,477,278 | 2,531,149 |

Table C.7. Net Present Value for Candidate 1, Baht

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|
| Development Costs | -2,245,000 | | | | | |
| Operation & Maintenance Costs | | -292,300 | -321,530 | -353,683 | -389,051 | -427,956 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Present Value of Annual Costs | -2,245,000 | -265,701 | -265,584 | -265,616 | -265,722 | -265,761 |
| Total Present Value of Lifetime Costs | | | | | | |
| Benefits Derived from Operation of New System | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 |
| Discount Factors for 10% | 1 | 1 | 1 | 1 | 1 | 1 |
| Present Value of Annual Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 |
| Total Present Value of Lifetime Benefits | | | | | | |
| Net Present Value | | | | | | |

Table C.8. Net Present Value for Candidate 2, Baht

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|
| Development Costs | -2,979,000 | | | | | | |
| Operation & Maintenance Costs | | -304,300 | -334,730 | -368,203 | -405,023 | -445,526 | |
| Discount Factors for 10% | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 | |
| Present Value of Annual Costs | -2,979,000 | -276,609 | -276,487 | -276,520 | -276,631 | -276,671 | |
| Total Present Value of Lifetime Costs | | | | | | | -4,361,918 |
| Benefits Derived from Operation of New System | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 | |
| Discount Factors for 10% | 1 | 0.91 | 0.83 | 0.75 | 0.68 | 0.62 | |
| Present Value of Annual Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 | |
| Total Present Value of Lifetime Benefits | | | | | | | 5,150,453 |
| Net Present Value | | | | | | | 788,534 |

Table C.9. Net Present Value for Candidate 3, Baht

| Cash Flow Description | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|
| Development Costs | -1,350,000 | | | | | | |
| Operation & Maintenance Costs 1.1 | | -279,300 | -307,230 | -337,953 | -371,748 | -408,923 | |
| Discount Factors for 10% | 1 | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 | |
| Present Value of Annual Costs | -1,350,000 | -253,884 | -253,772 | -253,803 | -253,904 | -253,941 | |
| Total Present Value of Lifetime Costs | | | | | | | -2,619,304 |
| Benefits Derived from Operation of New System 1.25 | 0 | 864,000 | 1,080,000 | 1,350,000 | 1,687,500 | 2,109,375 | |
| Discount Factors for 10% | 1 | 0.91 | 0.83 | 0.75 | 0.68 | 0.62 | |
| Present Value of Annual Benefits | 0 | 786,240 | 896,400 | 1,012,500 | 1,147,500 | 1,307,813 | |
| Total Present Value of Lifetime Benefits | | | | | | | 5,150,453 |
| Net Present Value | | | | | | | 2,531,149 |

# APPENDIX D

STRUCTURE DESIGN

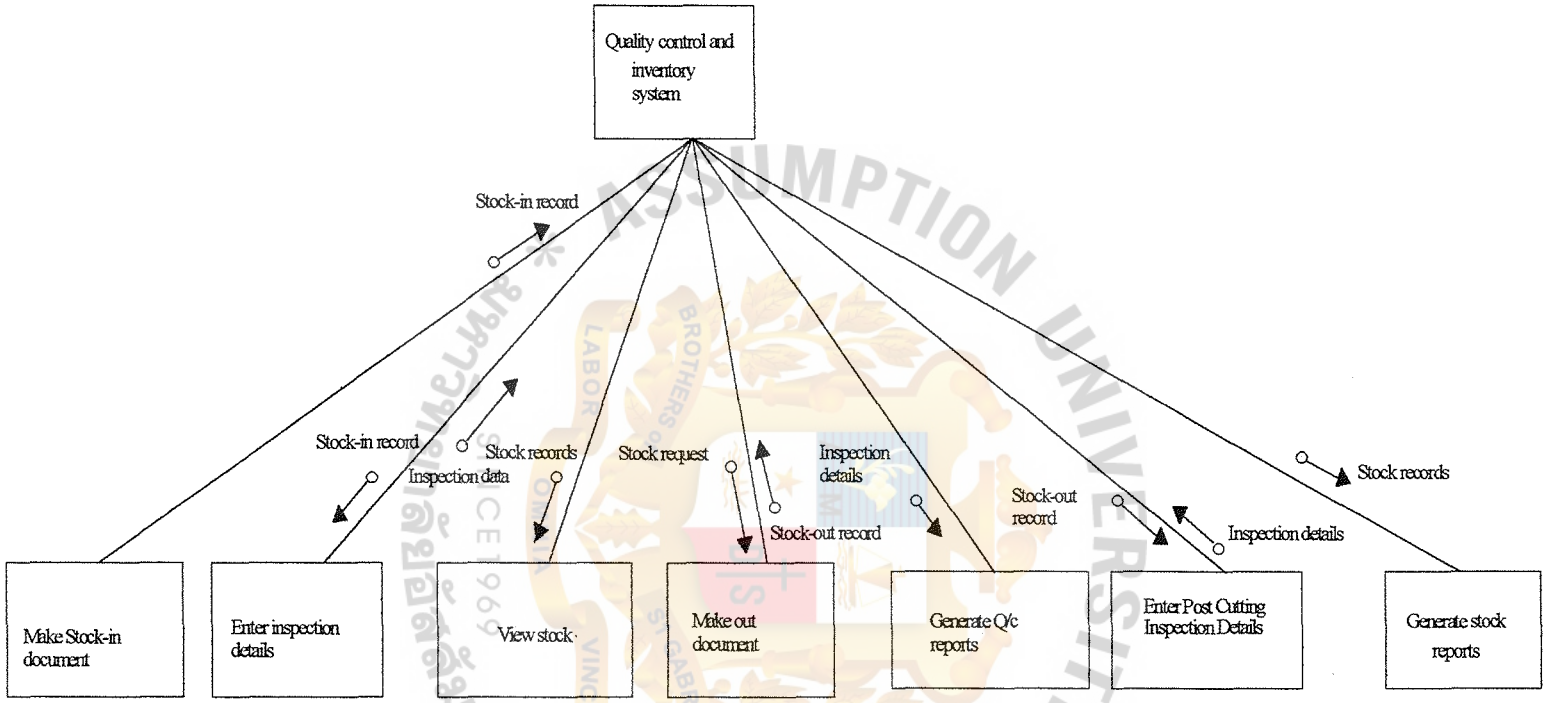



Figure D.1. Structure chart Quality control and inventory system

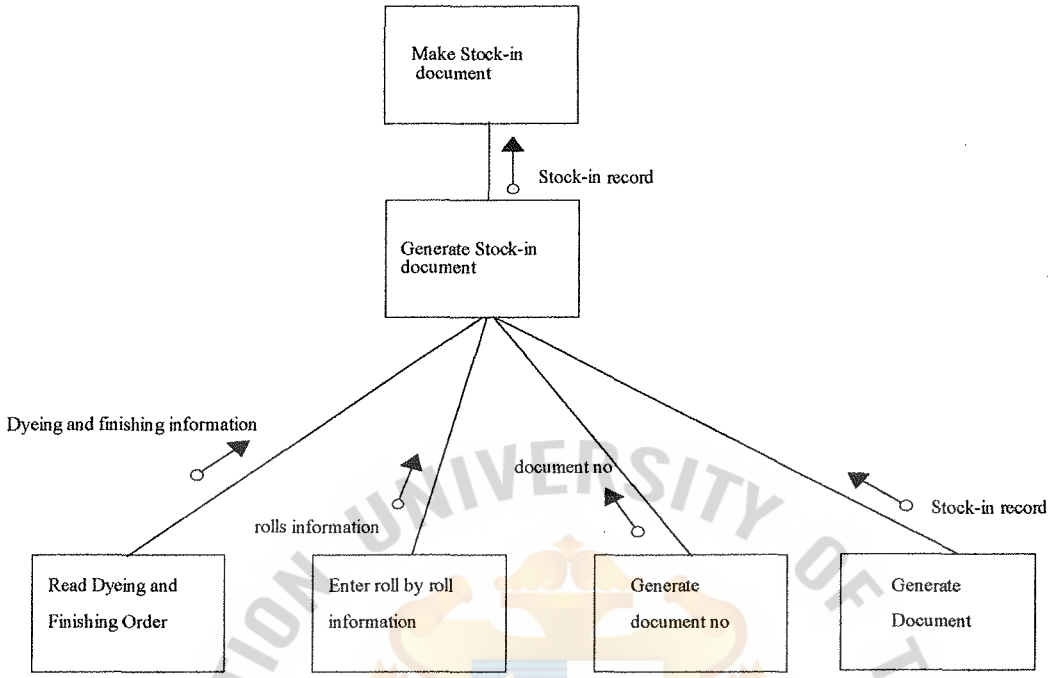



Figure D.2. Structure Chart of the Make Stock-in document.

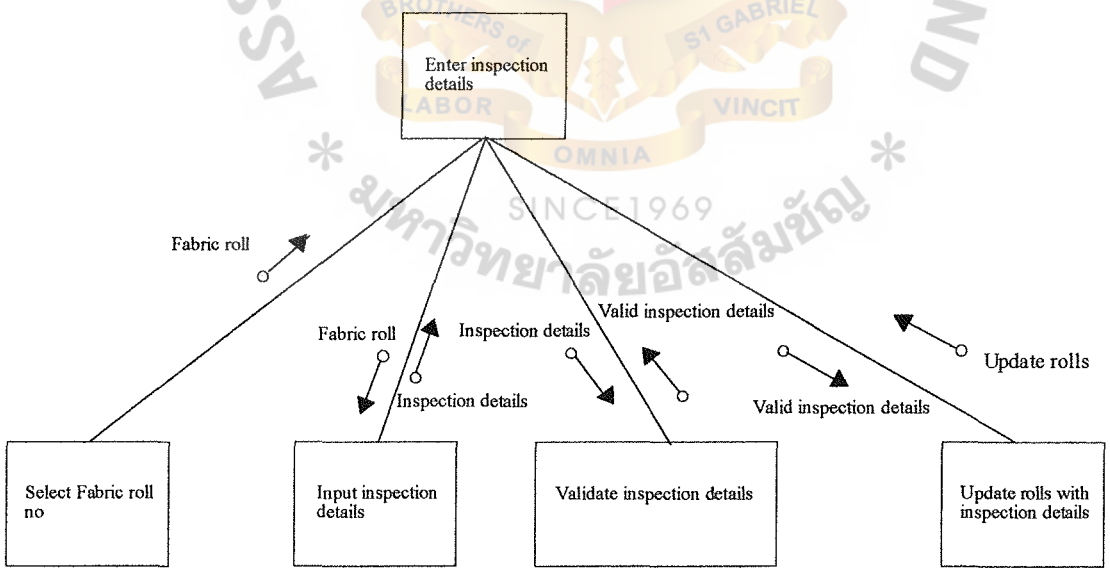



Figure D.3. Structure Chart of the Enter Inspection Details.

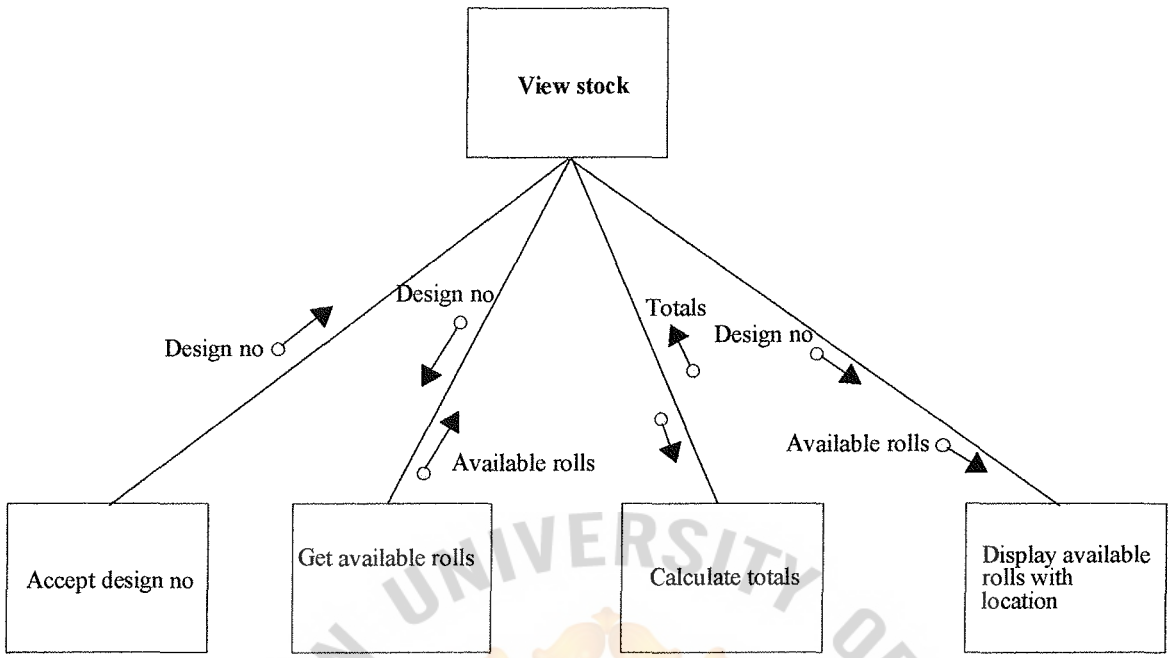



Figure D.4. Structure Chart of the View Stock.

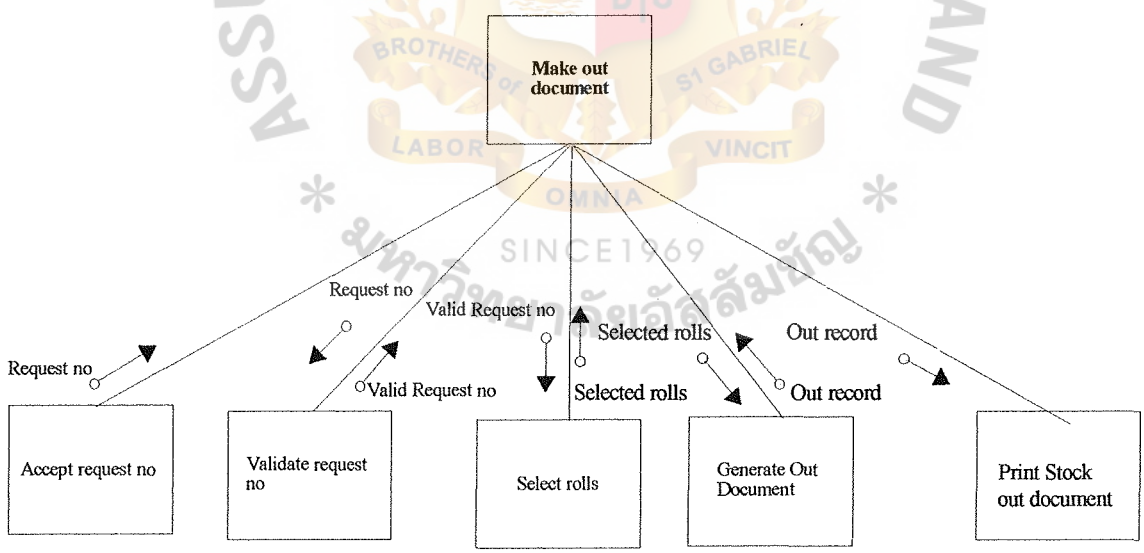



Figure D.5. Structure Chart of the Make Stock-Out document.

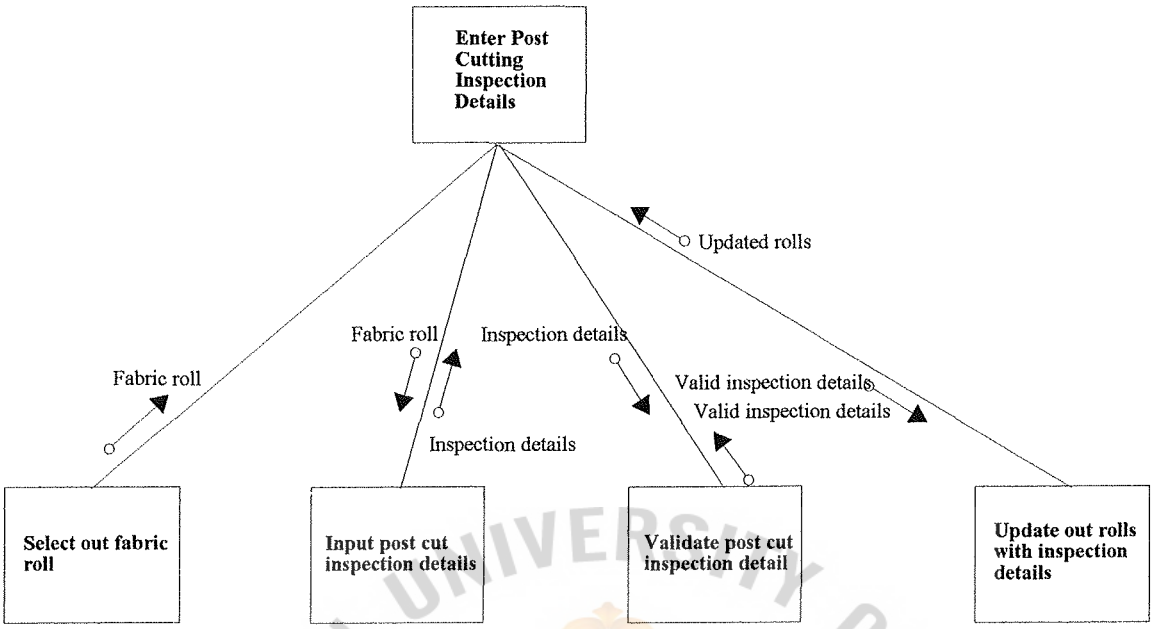



Figure D.6. Structure chart of Enter Post cutting qc details.

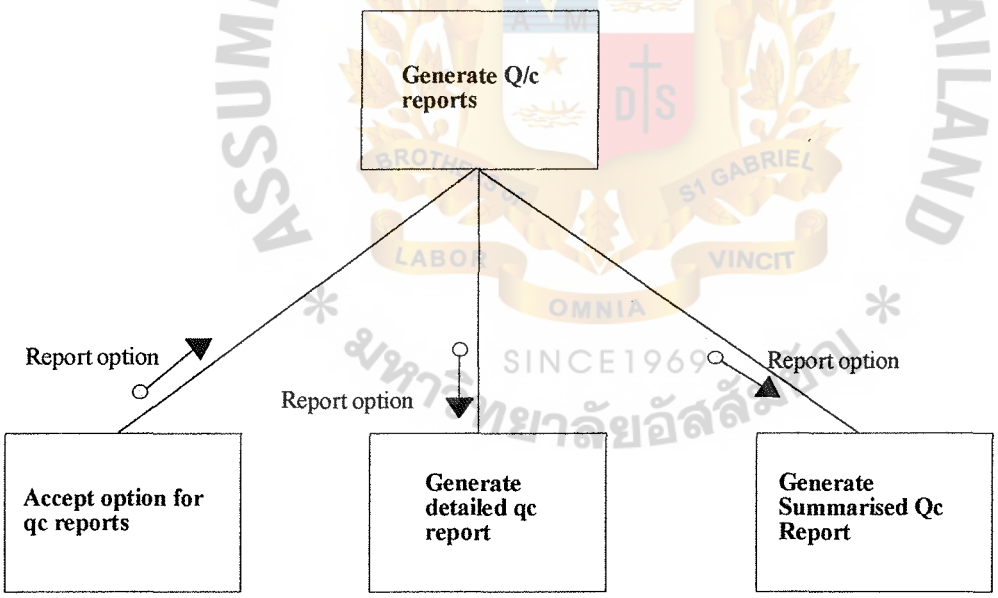



Figure D-7. Structure chart of Process Generate Qc Reports.

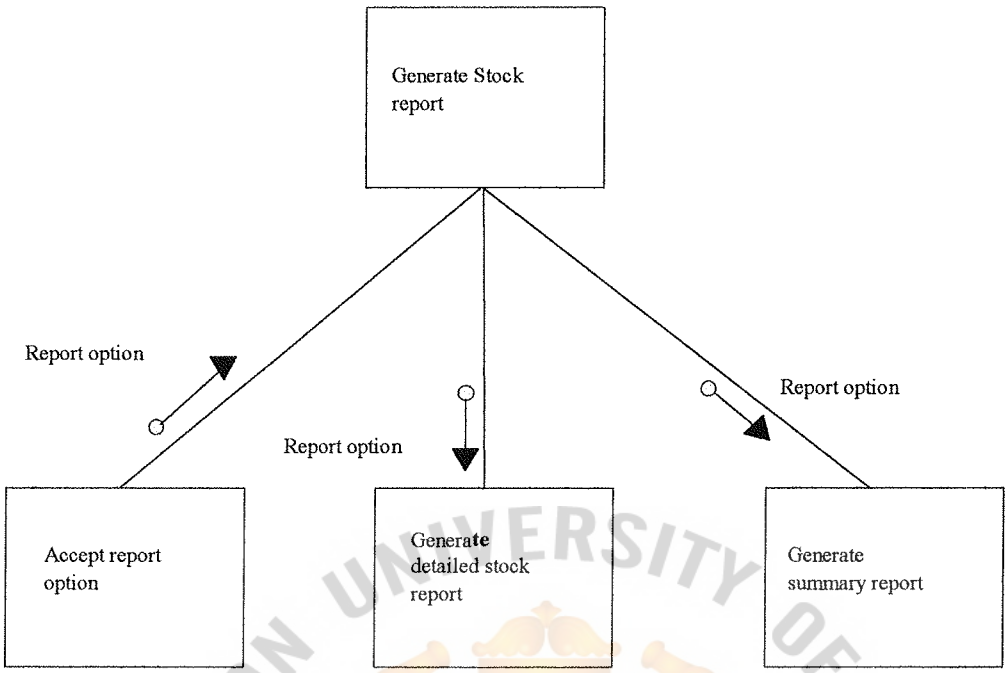



Figure D.8. Structure chart of Process Generate Stock Reports

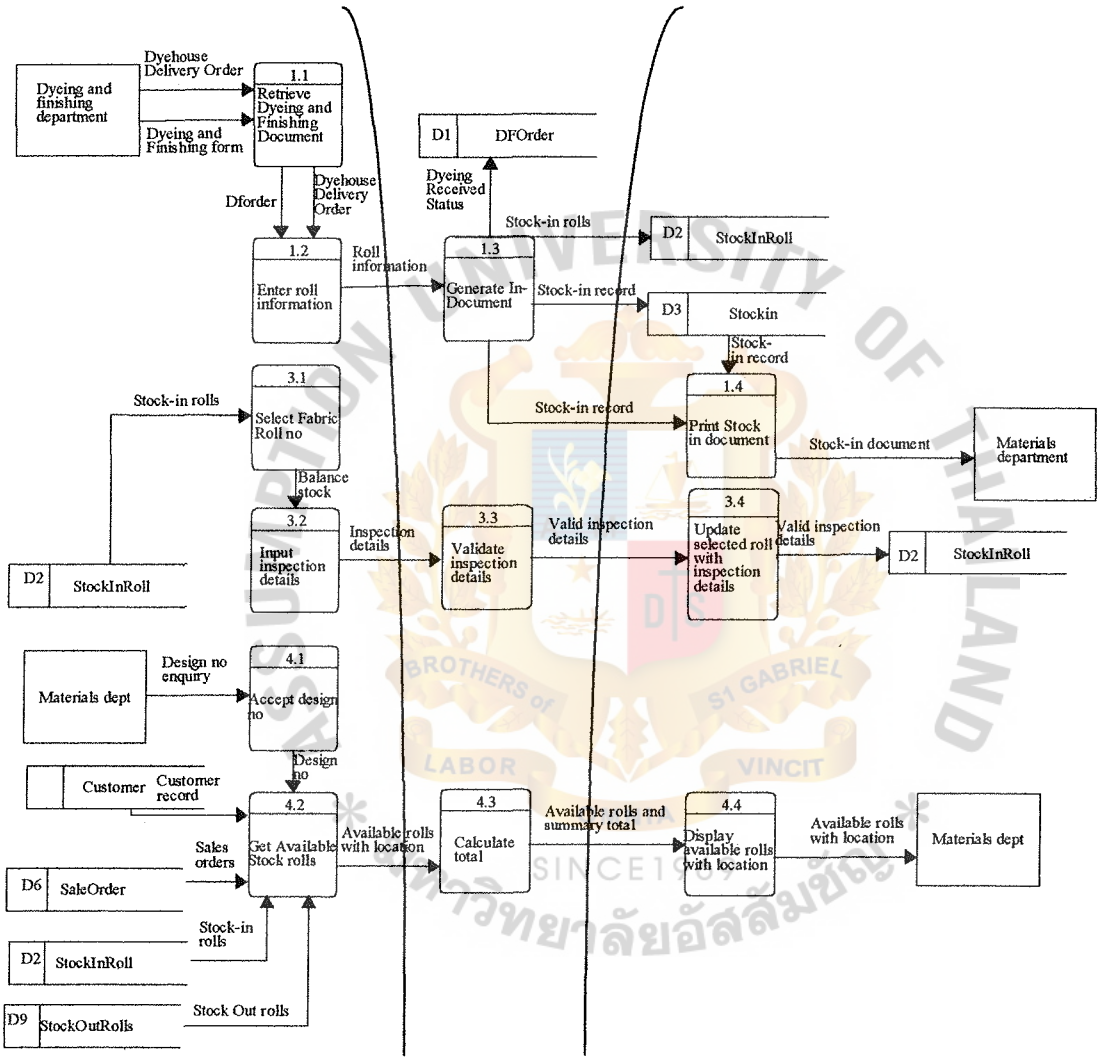



Figure D.9. Partitioned DFD for Make Stock in Document, Enter Inspection Details and View Stock.

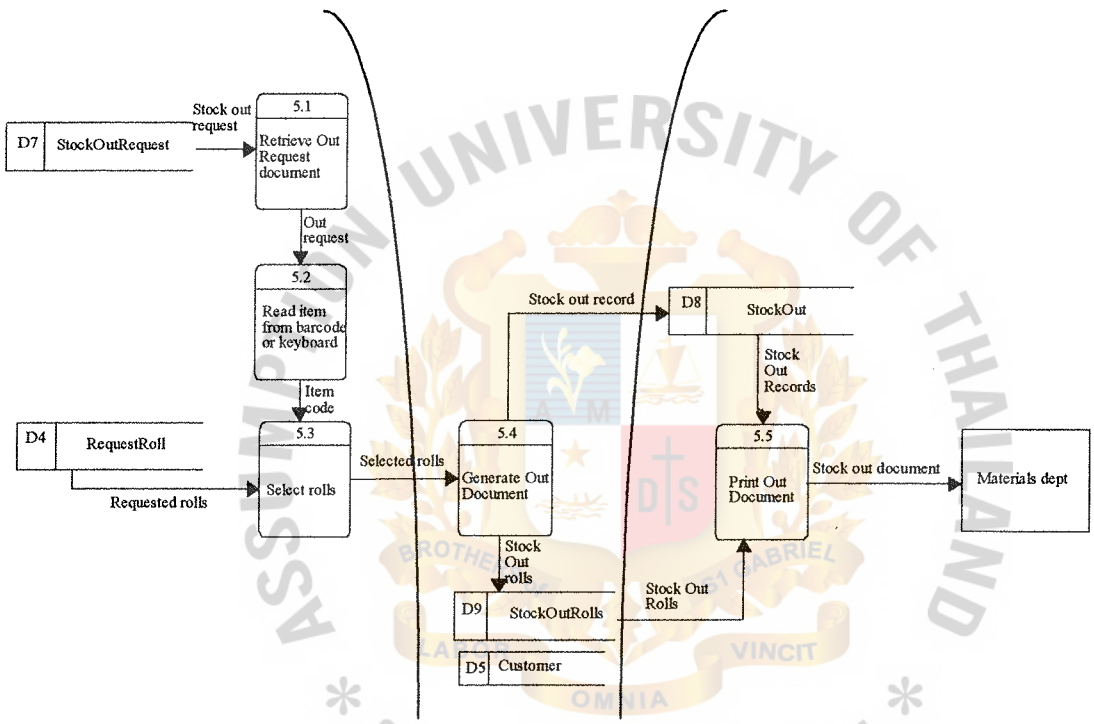



Figure D.10. Partitioned DFD for Make Stock Out Document.

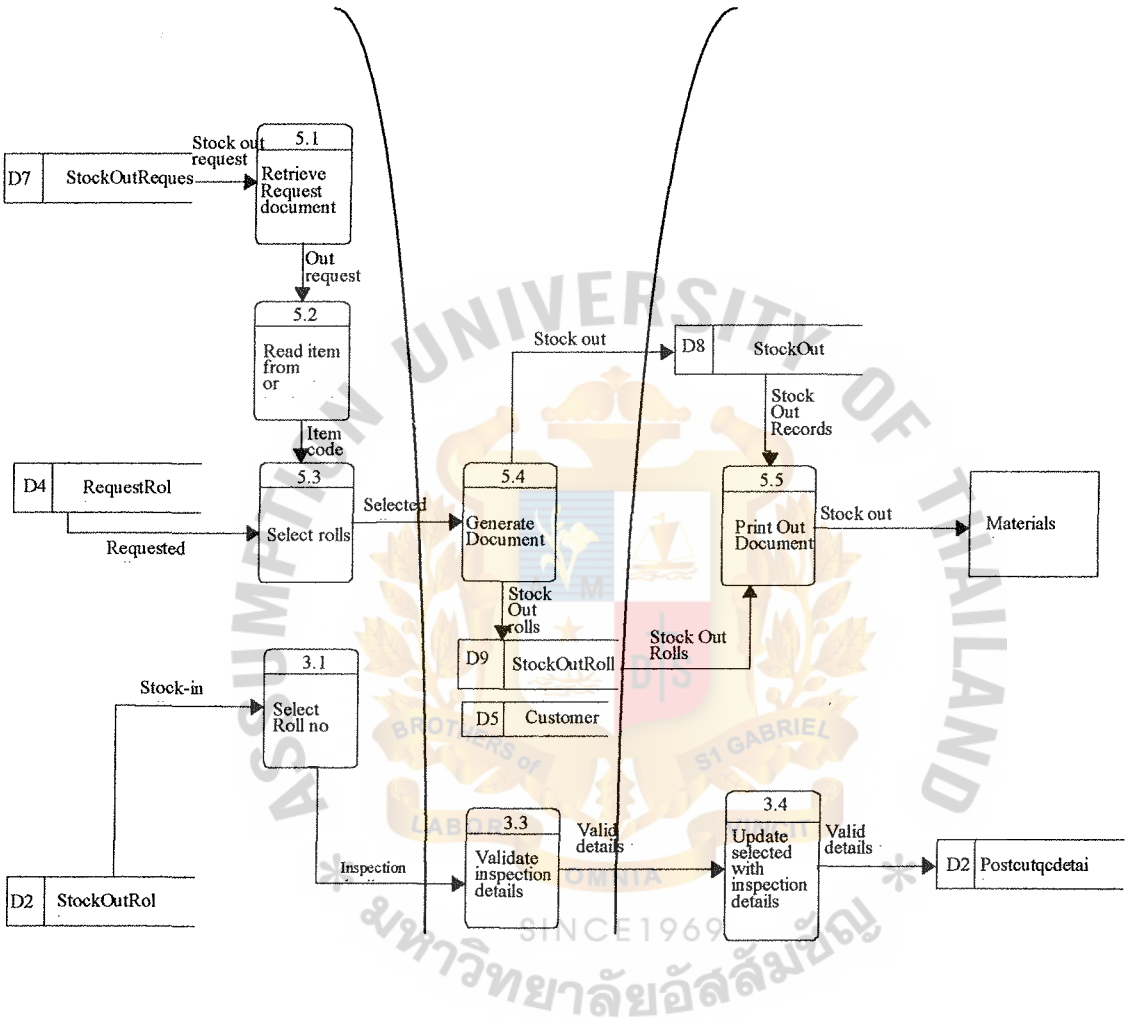



Figure. D.11. Partitioned DFD for Make stock out document, Enter post cut qc details

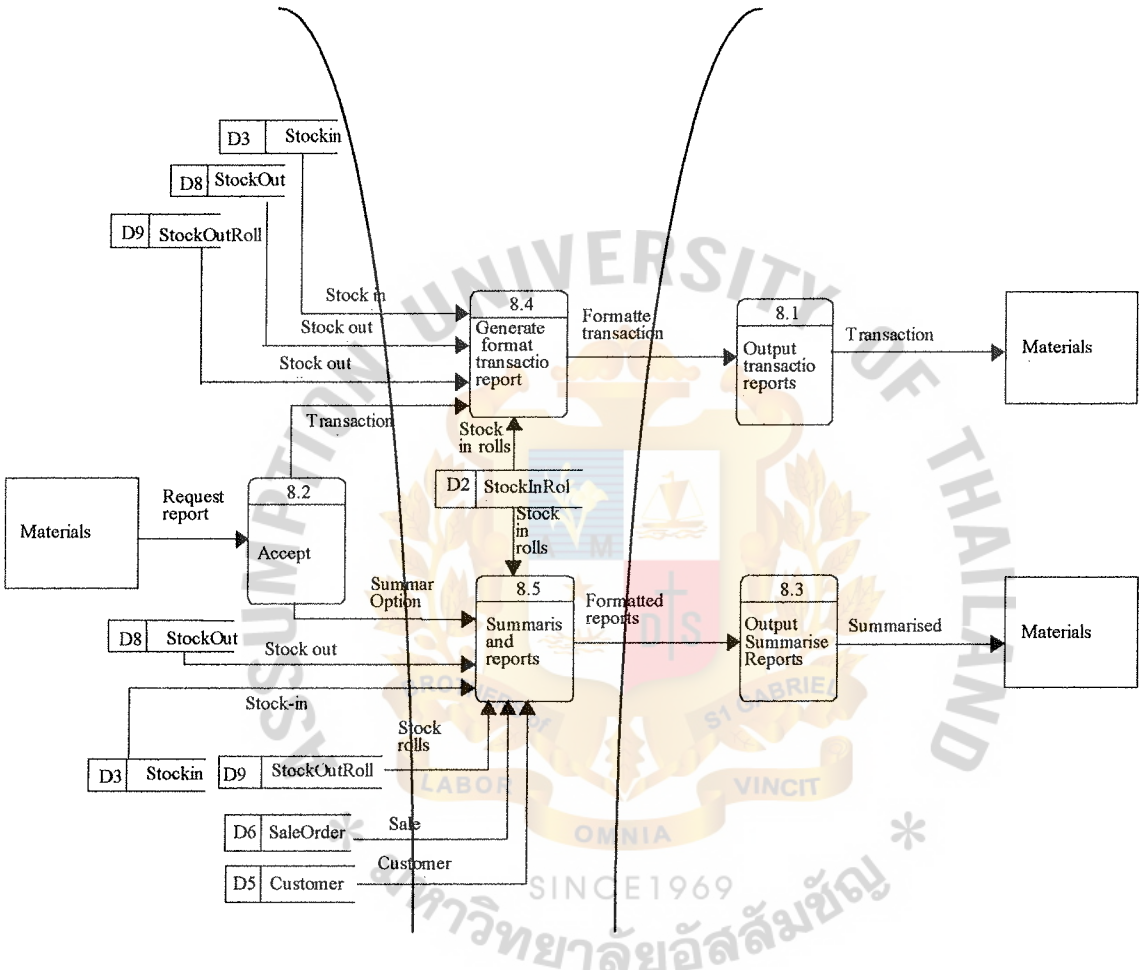



Figure D.12. Partitioned DFD for Generate Stock Reports.

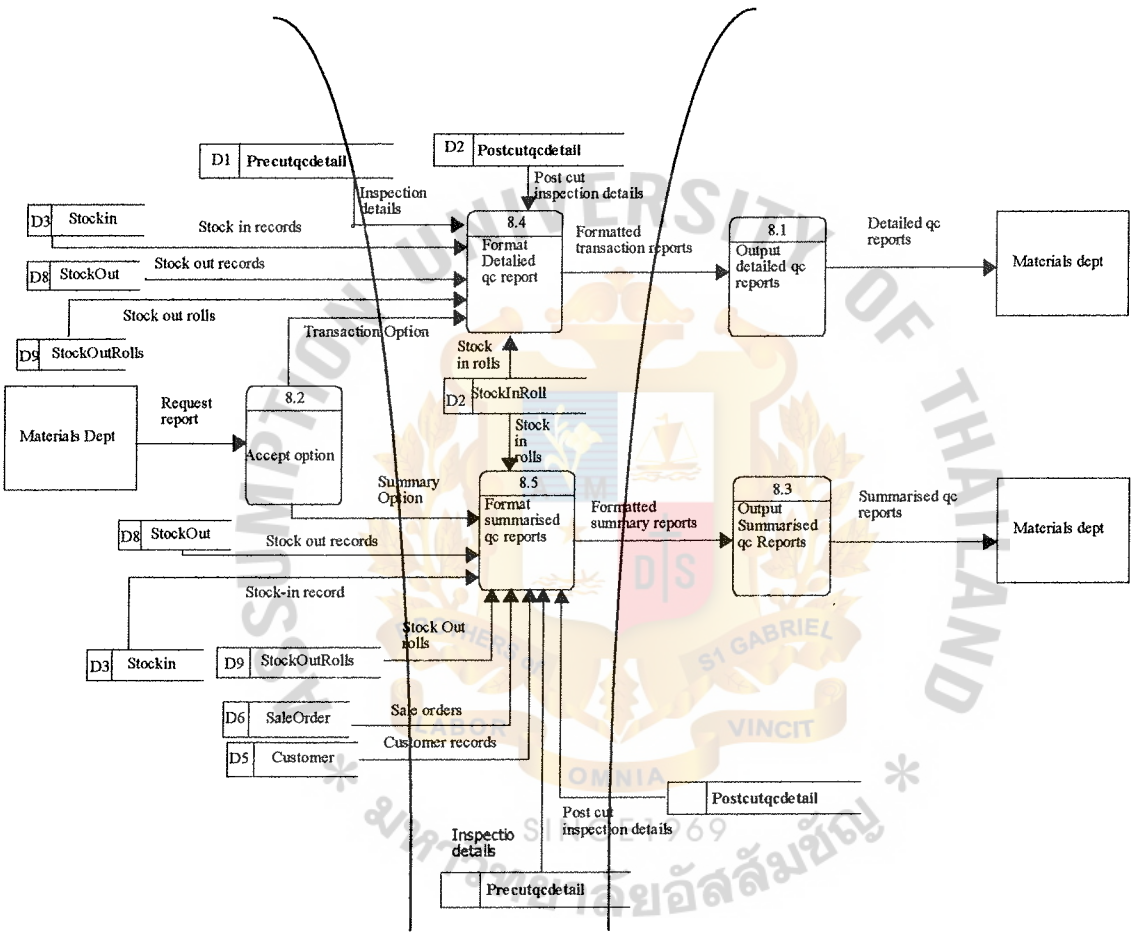



Figure D.13. Partitioned DFD for Generate Qc reports.

# APPENDIX E

PROCESS SPECIFICATION

Table E.1. Retrieve Dyeing and Finishing Document.

| Items | Description |
|---|---|
| Process name | Retrieve Dyeing and Finishing Document |
| Data-in | Dyeing and finishing record<br>Dyehouse Delivery order |
| Process | (1) Receive the documents from the traffic<br>(2) Access the dyeing and finishing database |
| Data-out | (1) Dyeing and finishing details<br>(2) Delivery order details |
| Attachment | (1) Dye house delivery order<br>(2) Dyeing and finishing database |

Table E.2. Enter rolls information.

| Items | Description |
|---|---|
| Process name | Enter rolls information |
| Data-in | Dyeing and finishing record<br>Dyehouse Delivery order |
| Process | (1) Accept d/f order no.<br>(2) Access the dyeing and finishing database<br>(3) Accept individual roll details |
| Data-out | (1) Rolls information and location |
| Attachment | (1) Stock-in document<br>(2) Dyeing and finishing database |

Table E.3. Generate in document.

| Items | Description |
|---|---|
| Process name | Generate in document |
| Data-in | Dyeing and finishing record<br>Dyehouse Delivery order<br>Rolls information |
| Process | (1) Generate totals<br>(2) Generate document no<br>(3) Update stock records |
| Data-out | (1) Stock-in record |
| Attachment | (1) Dyeing and finishing database<br>(2) Stock-in database<br>(3) Stock-in rolls database |

Table E.4. Print in document.

| Items | Description |
|---|---|
| Process name | Print in document |
| Data-in | Stock-in record |
| Process | (1) Generate totals<br>(2) Generate document no<br>(3) Update stock records |
| Data-out | (1) Stock-in record |
| Attachment | (1) Dyeing and finishing database<br>(2) Stock-in database<br>(3) Stock-in rolls database |

Table E.5. Select Fabric roll no.

| Items | Description |
|---|---|
| Process name | Select fabric roll no |
| Data-in | Inspection details |
| Process | (1) Generate totals<br>(2) Generate document no<br>(3) Update stock records |
| Data-out | (1) Roll no |
| Attachment | (1) Stock-in document<br>(2) Dyeing and finishing database<br>(3) Stock-in database<br>(4) Stock-in rolls database |

Table E.6. Enter inspection details.

| Items | Description |
|---|---|
| Process name | Enter inspection details |
| Data-in | Inspection details |
| Process | (1) Generate totals<br>(2) Generate document no<br>(3) Update stock records |
| Data-out | (1) Inspection details |
| Attachment | (2) Stock-in rolls database |

Table E.7. Validate inspection details.

| Items | Description |
|---|---|
| Process name | Validate inspection details |
| Data-in | Inspection details |
| Process | (1) Validate inspection details<br>(2) Show error messages |
| Data-out | (1) Valid Inspection details |
| Attachment | (1) Stock-in rolls database |

Table E.8. Update selected roll with inspection details.

| Items | Description |
|---|---|
| Process name | Update selected roll with inspection details |
| Data-in | Valid Inspection details |
| Process | (1) Update the individual rolls with inspection details in the database |
| Data-out | (1) Rolls and inspection details |
| Attachment | (1) Stock-in rolls database<br>(2) Precutqcdetail |

Table E.9. Accept design no.

| Items | Description |
|---|---|
| Process name | Accept design no |
| Data-in | Design no |
| Process | (1) Accept the design no |
| Data-out | (1) Design no |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database |

Table E.10. Get available stock rolls.

| Items | Description |
|---|---|
| Process name | Get available stock rolls |
| Data-in | Design no |
| Process | (1) Access and search database for rolls that were never out. |
| Data-out | (1) Design no |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database |

Table E.11. Calculate totals.

| Items | Description |
|---|---|
| Process name | Calculate totals |
| Data-in | Available stock rolls |
| Process | (1) Summarise and calculate totals qty of rolls |
| Data-out | (1) Total qty |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database |

Table E.12. Display available stock rolls with location

| Items | Description |
|---|---|
| Process name | Display available stock rolls with location |
| Data-in | Available stock rolls with location |
| Process | (1) Access and search database for rolls that were never out. |
| Data-out | (1) Design no |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database |

Table E.13. Retrieve out request document.

| Items | Description |
|---|---|
| Process name | Retrieve out request document |
| Data-in | Request information |
| Process | (1) Accept request no and fetch request record from out request database |
| Data-out | (1) Request information |
| Attachment | (1) Stock out request database |

Table E.14. Read item from barcode or reader.

| Items | Description |
|---|---|
| Process name | Read item from barcode or reader |
| Data-in | Item code |
| Process | (1) Accept item code entered from keyboard or scanned thru scaner |
| Data-out | Item code |

Table E.15. Select rolls.

| Items | Description |
|---|---|
| Process name | Select rolls |
| Data-in | Item code |
| Process | (1) Search for the item ie., the roll using roll no extracted from itemcode in the request roll database and retrieve them |
| Data-out | Requested rolls |
| Attachment | Requestroll database |

Table E.16. Generate out document.

| Items | Description |
|---|---|
| Process name | Generate out document |
| Data-in | Request information<br>Requested Rolls information |
| Process | (1) Generate totals<br>(2) Generate document no<br>(3) Update stock records |
| Data-out | (1) Stock-out record<br>(2) Stock out rolls |
| Attachment | (1) Stock out database<br>(2) Stock-out rolls database |

Table E.17. Print out document.

| Items | Description |
|---|---|
| Process name | Print out document |
| Data-in | Out record<br>Totals |
| Process | (1) Format document<br>(2) Print to printer |
| Data-out | (1) Stock-out record<br>(2) Stock out rolls |
| Attachment | (1) Stock out database<br>(2) Stock-out rolls database |

Table E.18. Select Out Fabric roll no.

| Items | Description |
|---|---|
| Process name | Select out fabric roll no |
| Data-in | Inspection details |
| Process | (1) Select the roll no for which the inspection is to be entered<br>(2) Retrieve the roll from stock-in rolls database and show it |
| Data-out | (1) Inspection details |
| Attachment | (1) Stock-in document<br>(2) Dyeing and finishing database<br>(3) Stock-in database<br>(4) Stock-in rolls database |

Table E.19. Input post cut inspection details.

| Items | Description |
|---|---|
| Process name | Input post cut inspection details |
| Data-in | Inspection details |
| Process | (1) Accept the inspection details for each roll |
| Data-out | (1) Inspection details |
| Attachment | (1) Stock-in rolls database |

Table E.20. Validate inspection detail.s

| Items | Description |
|---|---|
| Process name | Validate inspection details |
| Data-in | Inspection details |
| Process | (1) Validate inspection details<br>(2) Show error messages |
| Data-out | (1) Valid Inspection details |
| Attachment | (1) Stock-in rolls database |

Table E.21. Update Post qc rolls.

| Items | Description |
|---|---|
| Process name | Update post qc rolls |
| Data-in | Inspection details |
| Process | (1) Update the individual rolls with inspection details in the database |
| Data-out | (1) Rolls and inspection details |
| Attachment | (1) Stock-in rolls database<br>(2) Postcutqcdetail |

Table E.22. Accept option.

| Items | Description |
|---|---|
| Process name | Accept option |
| Data-in | Report request from user |
| Process | (1) Present option for various detailed or summary reports |
| Data-out | (1) Report option |
| Attachment | |

Table E.23. Format Transaction reports.

| Items | Description |
|---|---|
| Process name | Format transaction reports |
| Data-in | Report request from user |
| Process | (1) Access and retrieve stock records<br>(2) Format and filter data based on option |
| Data-out | Formatted data |
| Attachment | |

Table E.24. Output Transaction related reports.

| Items | Description |
|---|---|
| Process name | Output Transaction related reports |
| Data-in | Report option and parameters |
| Process | (1) Access and retrieve stock transactions and generate reports for the required option |
| Data-out | (1) Transaction reports |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Stock-in database<br>(4) Stock-out database<br>(5) Customer database<br>(6) Sale order database |

Table E.25. Format Summarised reports.

| Items | Description |
|---|---|
| Process name | Format transaction reports |
| Data-in | Report request from user |
| Process | (1) Access and retrieve stock records<br>(2) Format and Summarise data based on option |
| Data-out | (1) Formatted data |
| Attachment | |

Table E.26. Output Summarized reports.

| Items | Description |
|---|---|
| Process name | Output Summarized stock reports |
| Data-in | Report option and parameters |
| Process | (1) Access and retrieve stock records<br>Summarise and generate reports<br>for the required option |
| Data-out | (1) Summarised reports |
| Attachment | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Stock-in database<br>(4) Stock-out database<br>(5) Customer database<br>(6) Sale order database |

Table E.27. Accept option for qc reports.

| Items | Description |
|---|---|
| Process name | Accept option |
| Data-in | Report request |
| Process | (1) Present option for various<br>detailed or summary reports |
| Data-out | Report option |

Table E.28. Format Detailed Qc reports.

| Items | Description |
|---|---|
| Process name | Format detailed Qc reports |
| Data-in | Report option and parameters |
| Process | (1) Access and retrieve Qc information from<br>stock transactions and generate reports |
| Data-out | (1) Formatted Detailed qc data |
| | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Customer database<br>(4) Sale order database |

Table E.29. Output Detailed Qc reports.

| Items | Description |
|---|---|
| Process name | Output detailed Qc reports |
| Data-in | Formatted Report |
| Process | (1) Print formatted report on the desired output device |
| Data-out | (1) Detailed qc reports |
| | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Customer database<br>(4) Sale order database |

Table E.30. Format summarised Qc reports.

| Items | Description |
|---|---|
| Process name | Format Summarised Qc reports |
| Data-in | Report option and parameters |
| Process | (1) Access and retrieve qc information from stock records<br>(2) Summarise and generate reports for the required option |
| Data-out | (1) Summarized qc reports |
| | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Customer database<br>(4) Sale order database |

Table E.31. Output Summarised Qc reports.

| Items | Description |
|---|---|
| Process name | Output Summarised Qc reports |
| Data-in | Formatted Report |
| Process | (1) Print formatted report on the desired output device |
| Data-out | (1) Summarized qc reports |
| | (1) Stock-in rolls database<br>(2) Stock-out rolls database<br>(3) Customer database<br>(4) Sale order database |

# APPENDIX F

DATA DICTIONARY

Table F.1. Data Dictionary.

| Field name | Description |
|---|---|
| CustomerCode | Customer Code assigned to the customer |
| CustAddrLine1 | First line of customer address |
| CustAddrLine2 | Second line of customer address |
| City | Customer's City |
| Country | Customer's Country |
| ContactPerson | Name of the person to contact |
| Telno1 | Telephone no 1 |
| Telno2 | Telephone no 2 |
| Faxno1 | Fax no1 |
| Faxno2 | Fax no2 |
| Email | Email address of the customer |
| CreditLimit | Customer's credit limit |
| SaleOrderno | Sale order no generated when order is placed by the customer |
| Totaldiscount | The total discount amount that would be deducted for this order |
| TotalAmount | This is the total order amount |
| Dfno | Dyeing and finishing order document no |
| Centcod | Central code for the design no |
| Color | Color code for the color of the fabric |
| Mts | Quantity in meters |
| DfDate | Dyeing and finishing form date |
| Dyehousename | Name of the dyeing and finishing house |
| Designno | Complete design no for the fabric |
| Lotno | Lot no. assigned for a particular dyeing lot |
| YearCode | The year code stored the year the lot is dyed |
| TotMts | Total meters of fabric dyed |
| Status | The status of the dyeing and finishnig order |

Table F.1. Data dictionary (Continued).

| Field name | Description |
|---|---|
| FullWth3 | Third measurement of full width of the fabric |
| Design no | Pattern no. |
| FabricWidth | Width of the fabric before dyeing |
| Finished Width | Width of the fabric after dyeing |
| Meterperkg | Length in meters per kilo gram of fabric |
| Composition | Yarn composition of the fabric |
| Bars | Number of bars |
| Fines | Number of fines |
| Machineno | Machine no |
| Width | Width of the machine |
| Bars | Number of bars |
| Fines | Number of fines |
| Type | Type of the machine (Supertronic, Jacquard etc) |
| Category | Category of the machine (Computer, chain link etc.) |
| ProductionRate | Rate of production in terms of meters per hour |

# APPENDIX G

DATABASE DESIGN

Table G.1. Structure of Customer Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Customercode | Varchar(5) | No | - | - | Primary |
| Custname | Varchar(40) | No | - | - | Attribute |
| CustAddrLine1 | Varchar(40) | No | - | - | Attribute |
| CustAddrLine2 | Varchar(40) | No | - | - | Attribute |
| City | Varchar(40) | No | - | - | Attribute |
| Country | Varchar(40) | No | - | - | Attribute |
| ContactPerson | Varchar(40) | No | - | - | Attribute |
| Telno1 | Varchar(15) | No | - | - | Attribute |
| Telno2 | Varchar(15) | No | - | - | Attribute |
| Faxno1 | Varchar(15) | No | - | - | Attribute |
| Faxno2 | Varchar(15) | No | - | - | Attribute |
| Email | Varchar(20) | No | - | - | Attribute |
| CreditLimit | Number(10,2) | No | - | - | Attribute |

Table G.2. Structure of Saleorder Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| SaleOrderNo | Varchar(7) | No | - | - | Primary |
| SaleOrderDate | Date | No | - | - | Attribute |
| CustomerCode | Varchar(5) | No | - | - | Attribute |
| TotalDiscount | Number(10,2) | No | - | - | Attribute |
| TotalAmount | Number(10,2) | No | - | - | Attribute |

Table G.3. Structure of Dforder Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Dfno | Varchar(10) | No | - | - | Primary |
| Dfdate | Date | No | - | - | Attribute |
| Dyehousename | Varchar(40) | No | - | - | Attribute |
| Designno | Varchar(15) | No | - | - | Attribute |
| Lotno | Varchar(5) | No | - | - | Attribute |
| YearCode | Varchar(1) | No | - | - | Attribute |
| TotMts | Number(10,2) | No | - | - | Attribute |
| Status | Varchar(1) | No | - | - | Attribute |

Table G.4. Structure of Dforderitem Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Dfno | Varchar(10) | No | - | - | Primary |
| SaleOrderno | Date | No | - | - | Attribute |
| Color | Varchar(5) | No | - | - | Attribute |
| Mts | Number(10,2) | No | - | - | Attribute |

Table G.5. Structure of Stockin Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| InDocno | Varchar(10) | No | - | - | Primary |
| InDocDate | Date | No | - | - | Attribute |
| Dfno | Varchar(10) | No | - | - | Attribute |
| Totinmts | Number(10,2) | No | - | - | Attribute |

Table G.6. Structure of Rollin Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| InDocno | Varchar(10) | No | - | - | Primary |
| Designno | Varchar(15) | No | - | - | Attribute |
| Runno | Number(5) | No | - | - | Attribute |
| Lotno | Varchar(5) | No | - | - | Attribute |
| YearCode | Varchar(1) | No | - | - | Attribute |
| Color | Varchar(5) | No | - | - | Attribute |

Table G.7. Structure of Stockoutrequest Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Requestno | Varchar(10) | No | - | - | Primary |
| Requestdate | Date | No | - | - | Attribute |
| Saleorderno | Varchar(7) | No | - | - | Attribute |
| ExpectOutDate | Date | No | - | - | Attribute |

Table G.8. Structure of Requestroll Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Requestno | Varchar(10) | No | - | - | Primary |
| Designno | Date | No | - | - | Attribute |
| Runno | Number(5) | No | - | - | Attribute |

Table G.9. Structure of Stockout Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| OutDocno | Varchar(10) | No | - | - | Primary |
| OutDocDate | Date | No | - | - | Attribute |
| Requestno | Varchar(10) | No | - | - | Attribute |
| Totoutmts | Number(10,2) | No | - | - | Attribute |

Table G.10. Structure of Rollout Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| OutDocno | Varchar(10) | No | - | - | Primary |
| Designno | Date | No | - | - | Attribute |
| Runno | Number(5) | No | - | - | Attribute |

Table G.11. Structure of PreCutQcTable Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Designno | Date | No | - | - | Primary |
| Runno | Number(5) | No | - | - | Primary |
| EdgeBreadthWth1 | Varchar(3) | No | - | - | Attribute |
| EdgeBreadthWth2 | Varchar(3) | No | - | - | Attribute |
| EdgeBreadthWth3 | Varchar(3) | No | - | - | Attribute |
| RepeatWidth1 | Varchar(3) | No | - | - | Attribute |
| RepeatWidth2 | Varchar(3) | No | - | - | Attribute |
| RepeatWidth3 | Varchar(3) | No | - | - | Attribute |
| RepeatLength | Varchar(3) | No | - | - | Attribute |
| RepeatWidth | Varchar(3) | No | - | - | Attribute |
| FullWidth | Varchar(3) | No | - | - | Attribute |

Table G.12. Structure of PostCutQcTable Table.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Designno | Date | No | - | - | Primary |
| Runno | Number(5) | No | - | - | Primary |
| Smalldef | Number(3) | No | - | - | Attribute |
| DamageEdge | Number(3) | No | - | - | Attribute |
| Swing | Number(3) | No | - | - | Attribute |
| Missingend | Number(3) | No | - | - | Attribute |
| Stitchfault | Number(3) | No | - | - | Attribute |
| Slubbing | Number(3) | No | - | - | Attribute |
| Picotfault | Number(3) | No | - | - | Attribute |
| OilStain | Number(3) | No | - | - | Attribute |
| Foreignyarn | Number(3) | No | - | - | Attribute |
| Loop | Number(3) | No | - | - | Attribute |

Table G.13. Structure of Design Master.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Designno | Date | No | - | - | Primary |
| FabricWidth | Number(5) | No | - | - | Attribute |
| FinishedWidth | Number(3) | No | - | - | Attribute |
| Metersperkg | Number(3) | No | - | - | Attribute |
| Bars | Number(3) | No | - | - | Attribute |
| Fine | Number(3) | No | - | - | Attribute |
| Composition | Varchar(40) | No | - | - | Attribute |
| Noofbands | Number(3) | No | - | - | Attribute |

Table G.14. Structure of Machine Master.

| Name | Type | Null | Foreign Key to table | Check | Key Type |
|---|---|---|---|---|---|
| Machinno | Date | No | - | - | Primary |
| Width | Number(5) | No | - | - | Attribute |
| Bars | Number(3) | No | - | - | Attribute |
| Fine | Number(3) | No | - | - | Attribute |
| Type | Varchar(1) | No | - | - | Attribute |
| Category | Varchar(1) | No | - | - | Attribute |
| Productionrate | Number(3) | No | - | - | Attribute |

# APPENDIX H

INTERFACE DESIGN

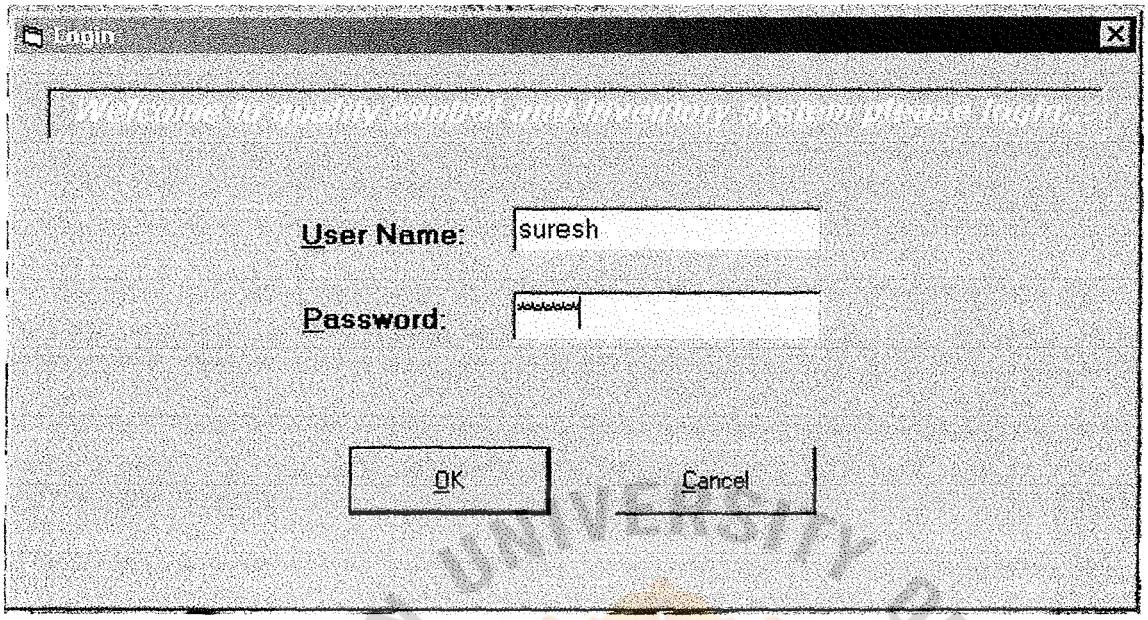



Figure H.1. Application Login Screen.

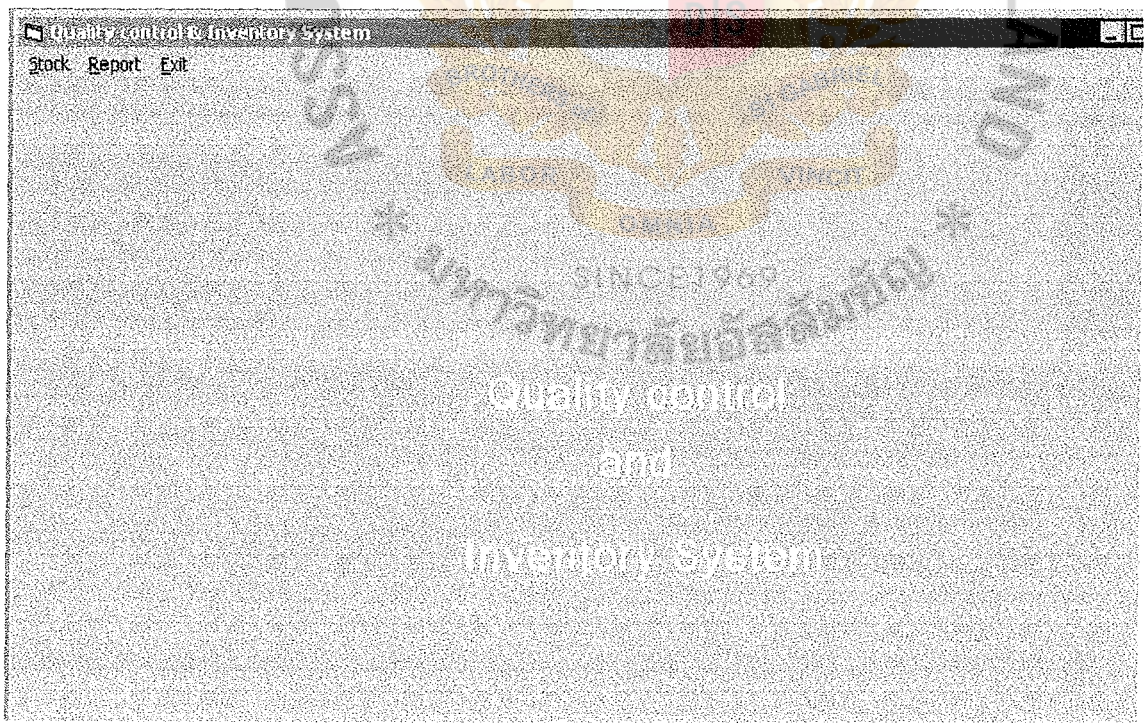



Figure H.2. Application Main Form.

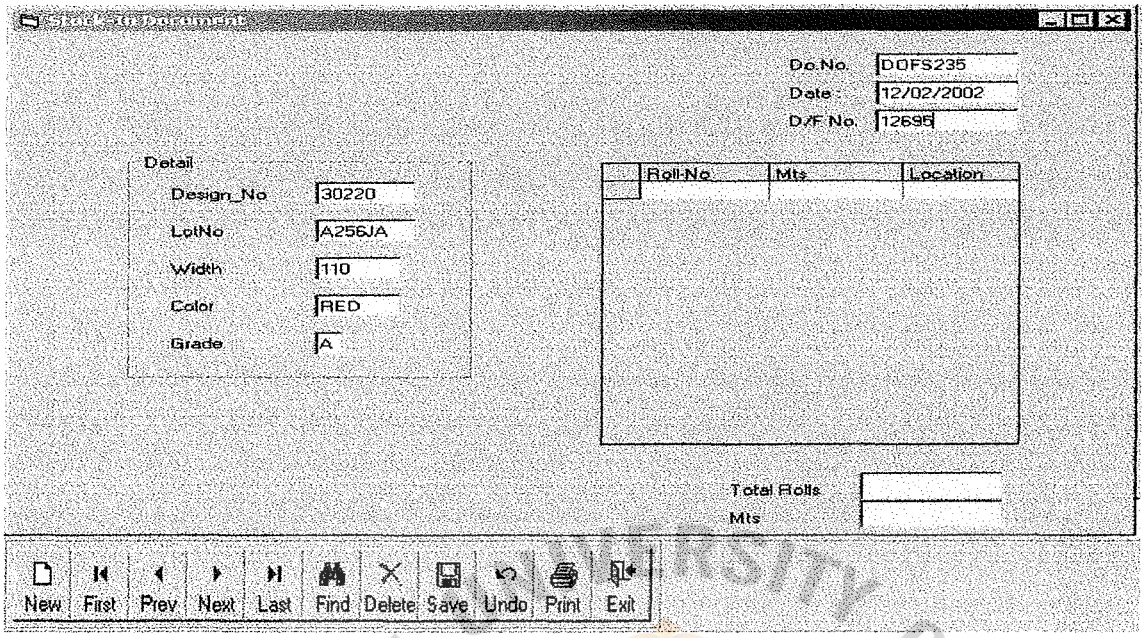



Figure H.3. Stock-in Document Form.

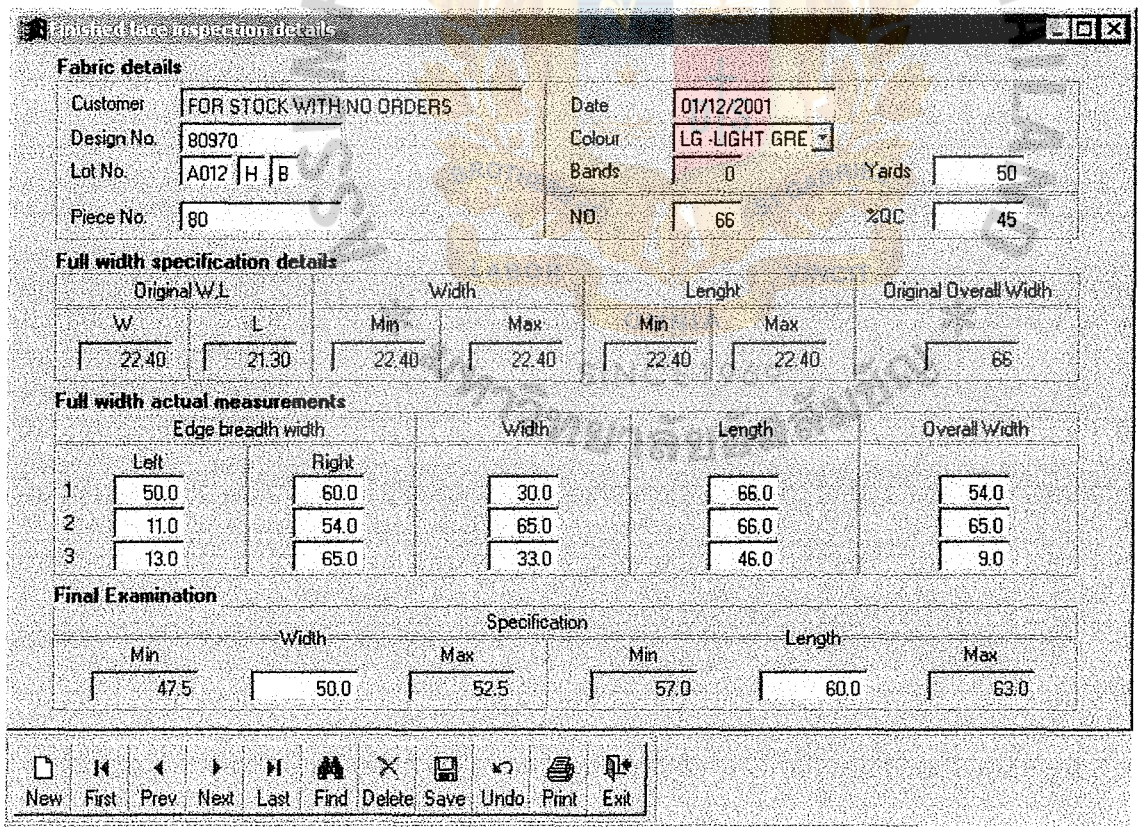



Figure H.4. Enter Inspection Details.

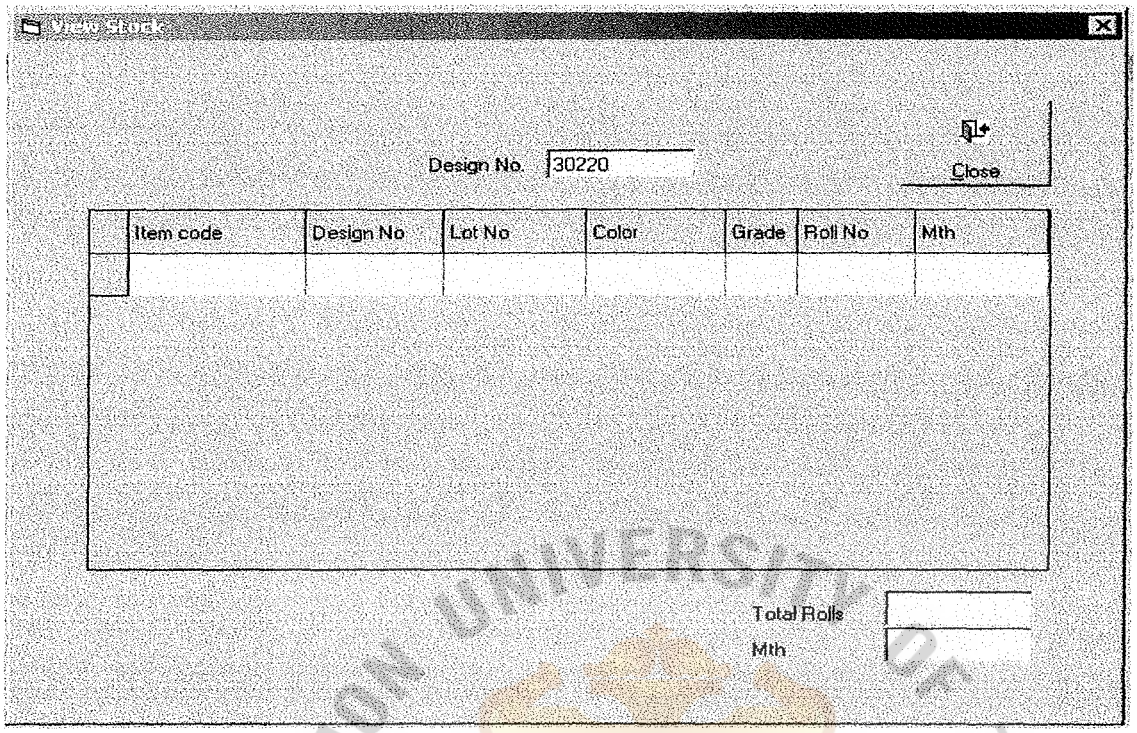



Figure H.5. View Stock.

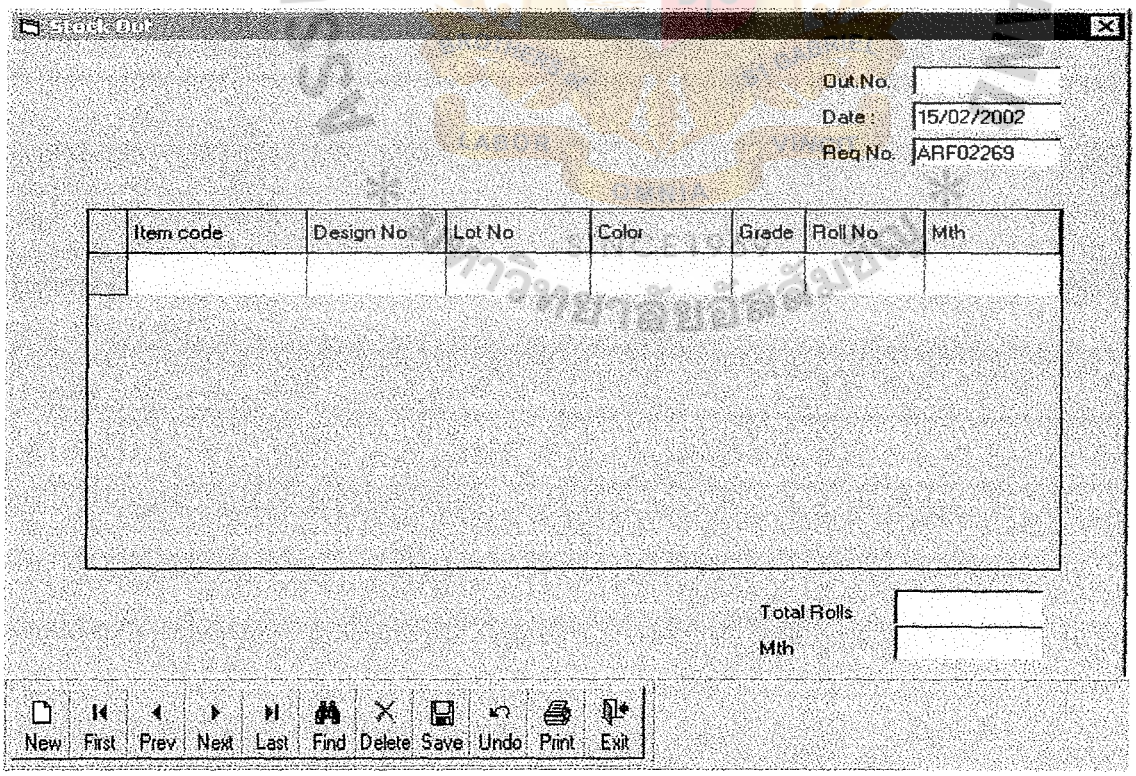



Figure H.6. Make Stock-out Document.

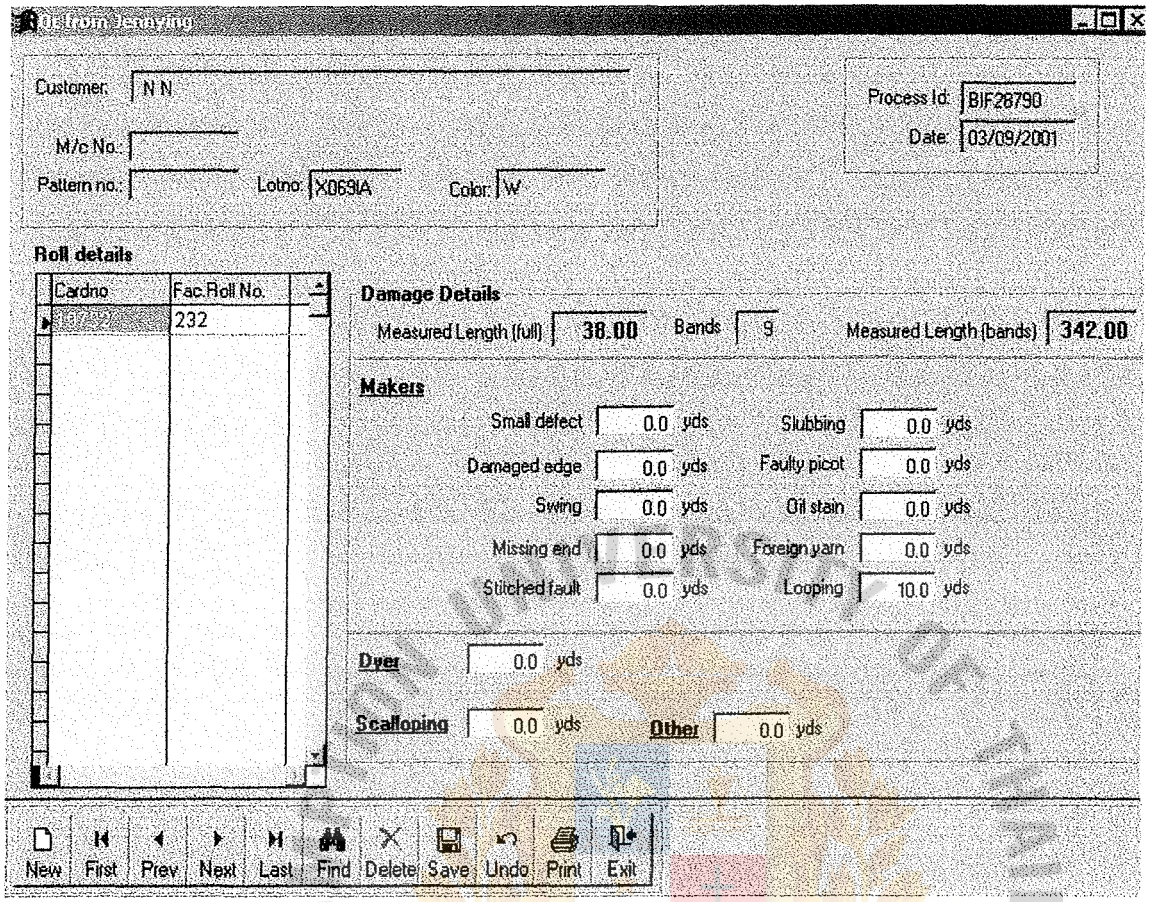



Figure H.7. Enter post Q/c Inspection Details.

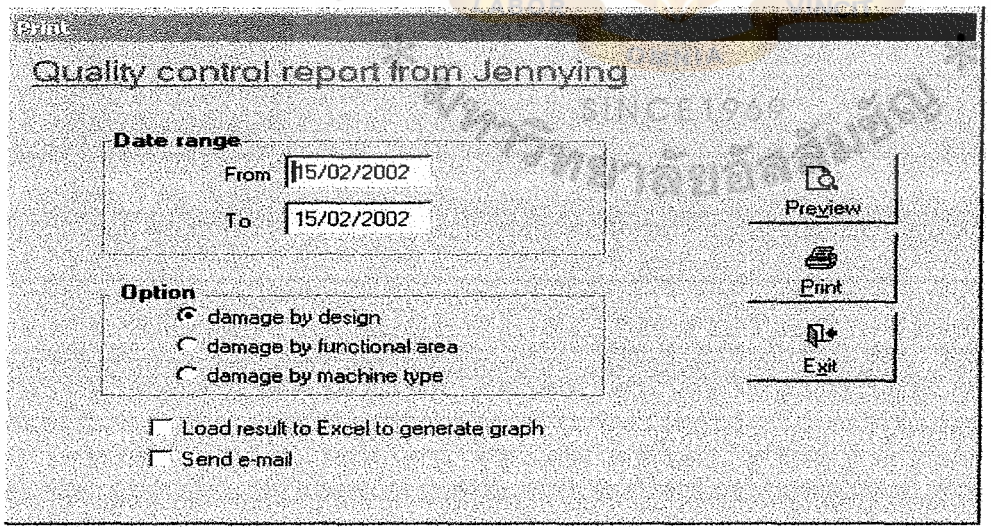



Figure H.8. Quality control report printing form.

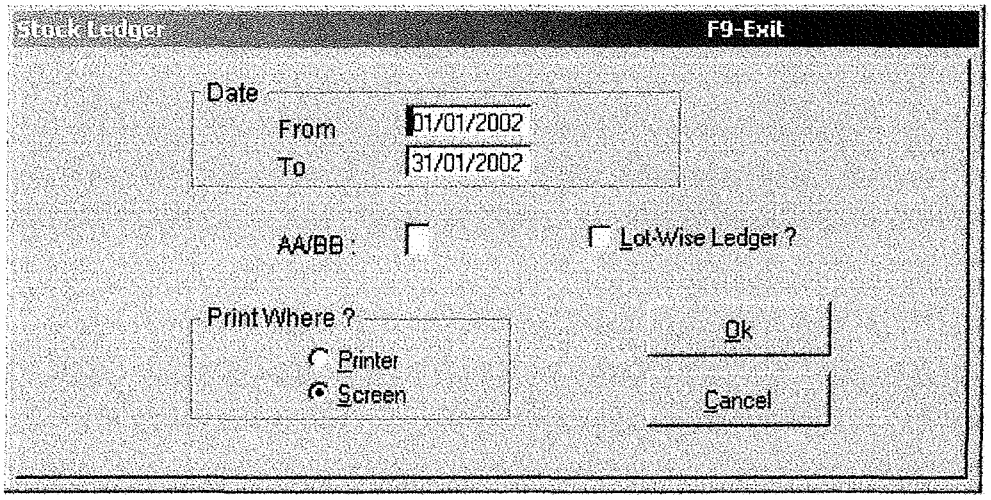



Figure H.9. Stock Ledger Report Printing Form.

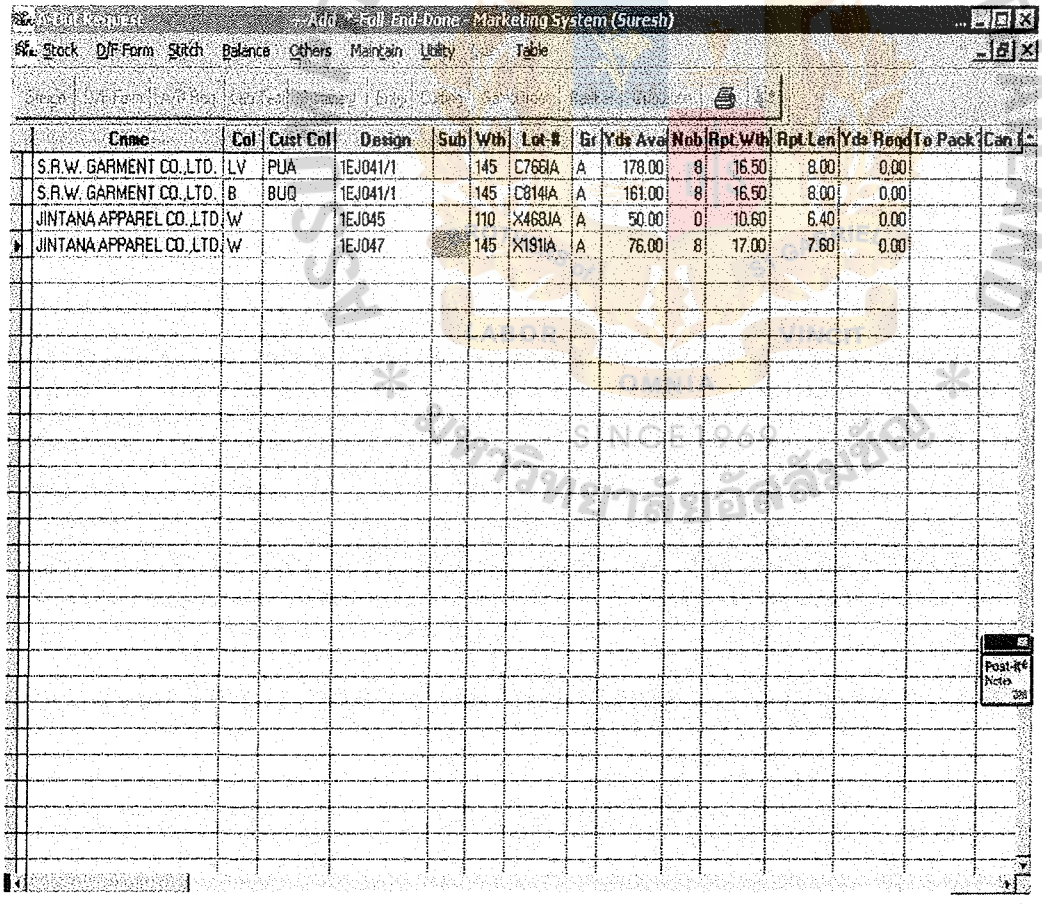



Figure H.10. Stock Request/View Screen at Marketing Dept.

# APPENDIX I

REPORTS DESIGN

Femina lace (Thailand) co. ltd.

## STOCK-IN

No: AID01231 II
Date : 16/03/02
D/F No.: 23156

D.House DO# : DH892386 / 16/03/02

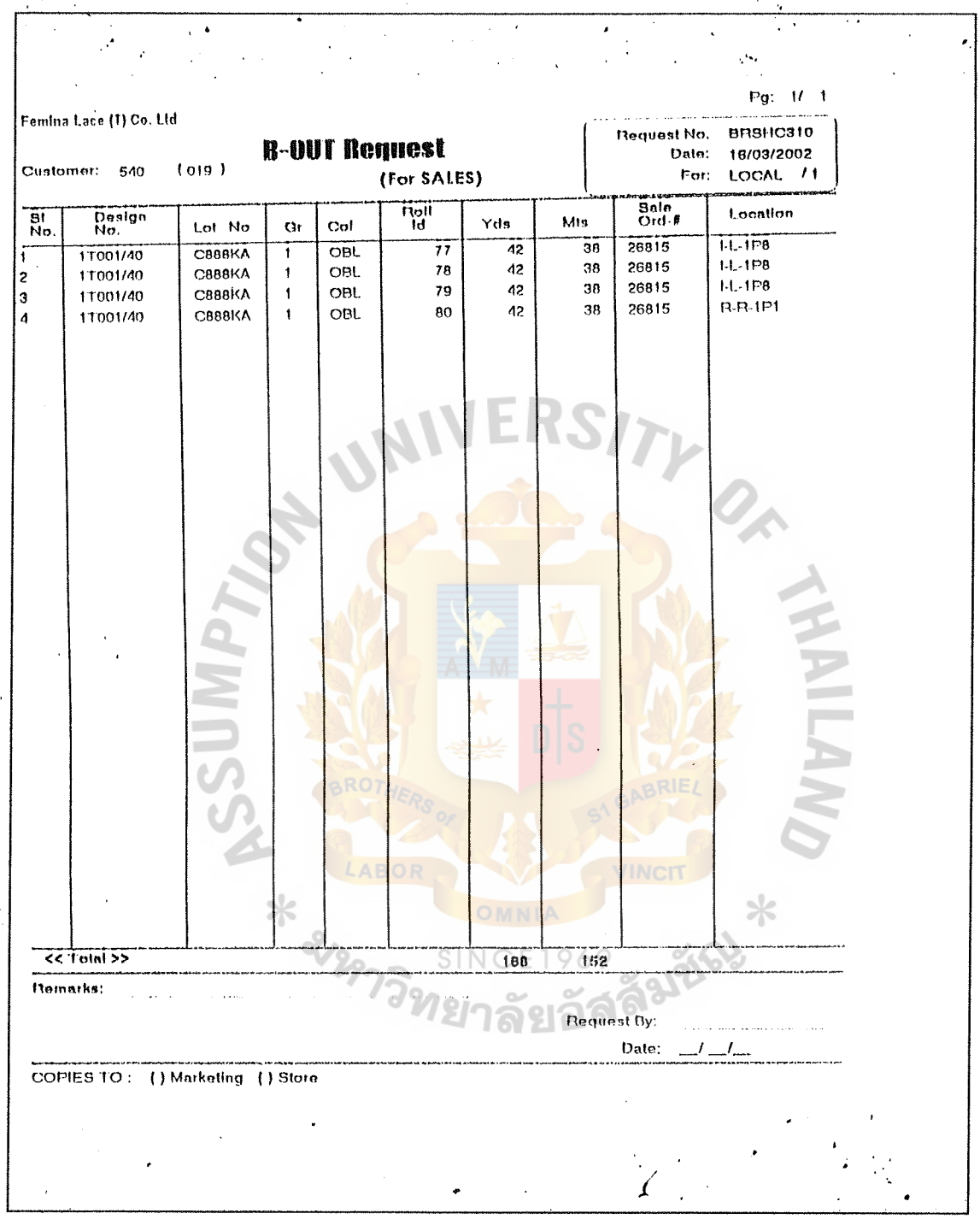
| Sale order No. | Design No. | Lot No. | Color | Gr | Roll No. | Mts |
|---|---|---|---|---|---|---|
| 10853 | 01392 | B391K | OW | A | K1565 | 45 |
| 10853 | 01392 | B391K | OW | A | K1566 | 62 |
| 10853 | 01392 | B391K | OW | A | K1567 | 71 |
| 10853 | 01392 | B391K | OW | A | K1568 | 58 |
| 10853 | 01392 | B391K | OW | A | K1569 | 64 |
| 10853 | 01392 | B391K | OW | A | K1570 | 55 |
| TOTAL | | | | | Rolls | 355 |

Received By : .....  Prepared by .....

Date : .....  Date: .....



FIGURE I.1. Report format – Stock-in document.



Pg: 1/ 1

Femina Lace (T) Co. Ltd

**B-OUT Request**

(For SALES)

Request No. BRSHC310
Date: 16/03/2002
For: LOCAL / 1

Customer: 540 ( 019 )

| Sl No. | Design No. | Lot No | Gr | Col | Roll Id | Yds | Mts | Sale Ord-# | Location |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1T001/40 | C888KA | 1 | OBL | 77 | 42 | 38 | 26815 | I-L-1P8 |
| 2 | 1T001/40 | C888KA | 1 | OBL | 78 | 42 | 38 | 26815 | I-L-1P8 |
| 3 | 1T001/40 | C888KA | 1 | OBL | 79 | 42 | 38 | 26815 | I-L-1P8 |
| 4 | 1T001/40 | C888KA | 1 | OBL | 80 | 42 | 38 | 26815 | R-R-1P1 |
| << Total >> | | | | | | 168 | 152 | | |

Remarks:

Request By:

Date: __/__/__

COPIES TO : ( ) Marketing ( ) Store

FIGURE I.2. Report format – Stock-out Request Document.

Femina lace (Thailand) co. ltd.

STOCK-OUT

No: AOS01258 fl
Date : 16/03/02
Marketing Request ARSKG024

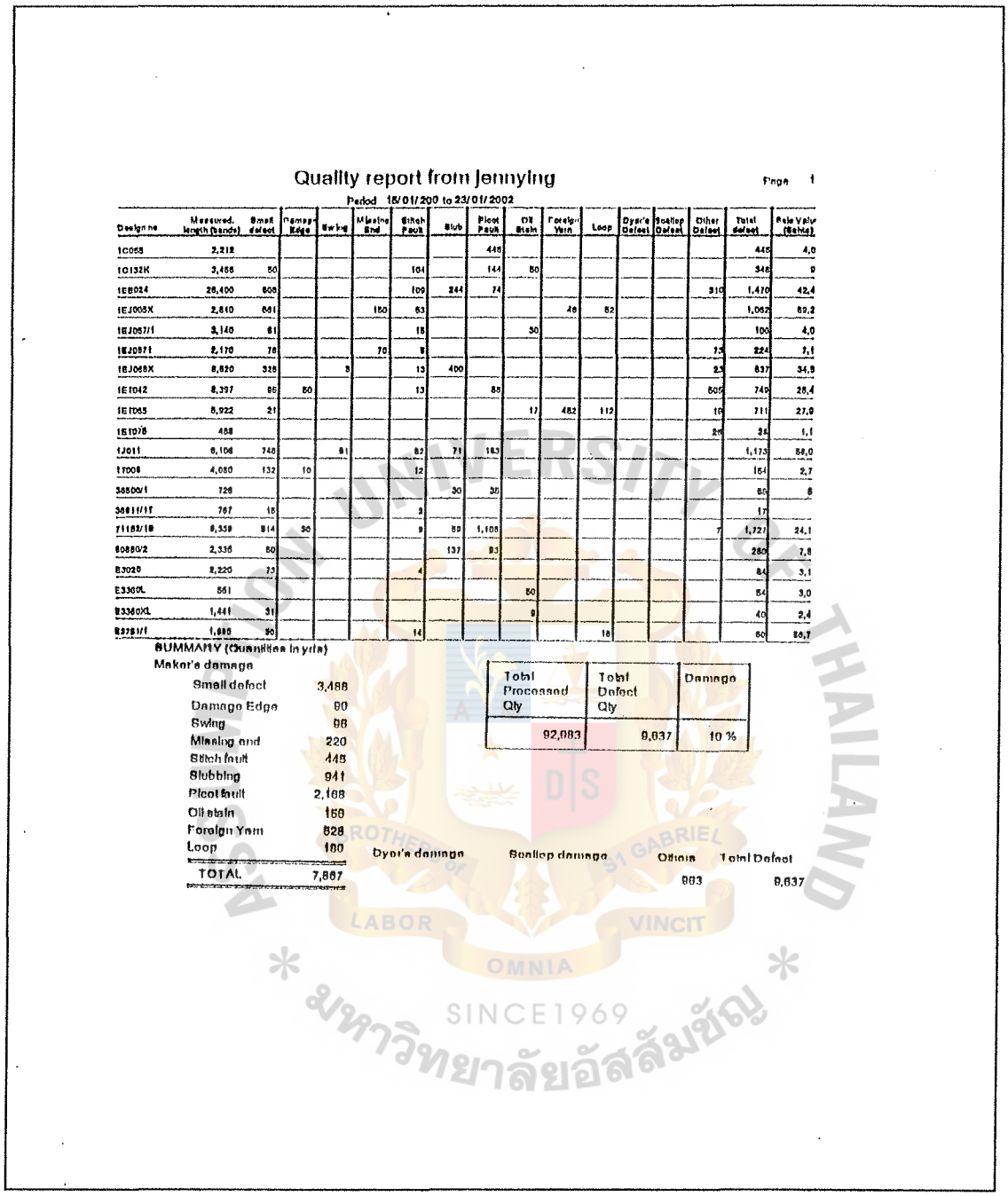
| Sale order No. | Design No. | Lot No. | Color | Gr | Roll No. | Mts |
|---|---|---|---|---|---|---|
| 10853 | 01392 | B391K | OW | A | K1565 | 46 |
| 10853 | 01392 | B391K | OW | A | K1566 | 62 |
| 10853 | 01392 | B391K | OW | A | K1567 | 71 |
| 10853 | 01392 | B391K | OW | A | K1568 | 58 |
| 10853 | 01392 | B391K | OW | A | K1569 | 64 |
| 10853 | 01392 | B391K | OW | A | K1570 | 55 |
| TOTAL | | | | | Rolls | 355 |

Received By : .....  Prepared by .....

Date : .....  Date: .....



FIGURE I.3. Report format – Stock-out Document.



Quality report from Jennying

Page 1

Period 16/01/200 to 23/01/2002

| Design no | Measured length (yards) | Small defect | Damage Edge | Swing | Missing End | Stitch Fault | Slub | Picot Fault | Oil Stain | Foreign Yarn | Loop | Dyer's Defect | Scallop Defect | Other Defect | Total defect | Rate Value (Baht) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1C058 | 2,212 | | | | | | | 445 | | | | | | | 445 | 4,0 |
| 1C132K | 3,466 | 50 | | | | 104 | | 144 | 50 | | | | | | 348 | 9 |
| 1EB024 | 26,400 | 608 | | | | 109 | 244 | 74 | | | | | | 310 | 1,470 | 42,4 |
| 1EJ065X | 2,510 | 661 | | | 150 | 63 | | | | 46 | 52 | | | | 1,052 | 89,2 |
| 1EJ067/1 | 3,140 | 61 | | | | 15 | | | 30 | | | | | | 106 | 4,0 |
| 1EJ067T | 2,170 | 76 | | | 70 | 8 | | | | | | | | 73 | 224 | 7,1 |
| 1EJ068X | 8,820 | 328 | | 9 | | 13 | 400 | | | | | | | 25 | 837 | 34,9 |
| 1ET042 | 8,397 | 95 | 50 | | | 13 | | 85 | | | | | | 505 | 749 | 26,4 |
| 1ET065 | 5,922 | 21 | | | | | | | 17 | 482 | 112 | | | 10 | 711 | 27,0 |
| 1ET078 | 488 | | | | | | | | | | | | | 26 | 26 | 1,1 |
| 1J011 | 8,106 | 748 | | 81 | | 82 | 71 | 183 | | | | | | | 1,173 | 58,0 |
| 1T008 | 4,080 | 132 | 10 | | | 12 | | | | | | | | | 164 | 2,7 |
| 35800/1 | 726 | | | | | | 30 | 30 | | | | | | | 60 | 6 |
| 3681T/1T | 767 | 16 | | | | 1 | | | | | | | | | 17 | |
| 71182/1B | 8,359 | 814 | 30 | | | 9 | 89 | 1,105 | | | | | | 7 | 1,727 | 24,1 |
| 80880/2 | 2,336 | 80 | | | | | 137 | 93 | | | | | | | 280 | 7,8 |
| B3026 | 2,220 | 73 | | | | 4 | | | | | | | | | 84 | 3,1 |
| E3360L | 561 | | | | | | | | 50 | | | | | | 54 | 3,0 |
| E3360XL | 1,441 | 31 | | | | | | | 9 | | | | | | 40 | 2,4 |
| E3781/1 | 1,888 | 96 | | | | 14 | | | | | 18 | | | | 80 | 26,7 |

SUMMARY (Quantities in yds)

Maker's damage

| | |
|---|---|
| Small defect | 3,488 |
| Damage Edge | 80 |
| Swing | 98 |
| Missing end | 220 |
| Stitch fault | 445 |
| Slubbing | 941 |
| Picot fault | 2,166 |
| Oil stain | 159 |
| Foreign Yarn | 828 |
| Loop | 180 |
| TOTAL | 7,867 |

| Total Processed Qty | Total Defect Qty | Damage |
|---|---|---|
| 92,883 | 9,037 | 10 % |

Dyer's damage | Scallop damage | Others | Total Defect

983 | 9,637

FIGURE I.4. Report Format – Quality Report from Jennying.

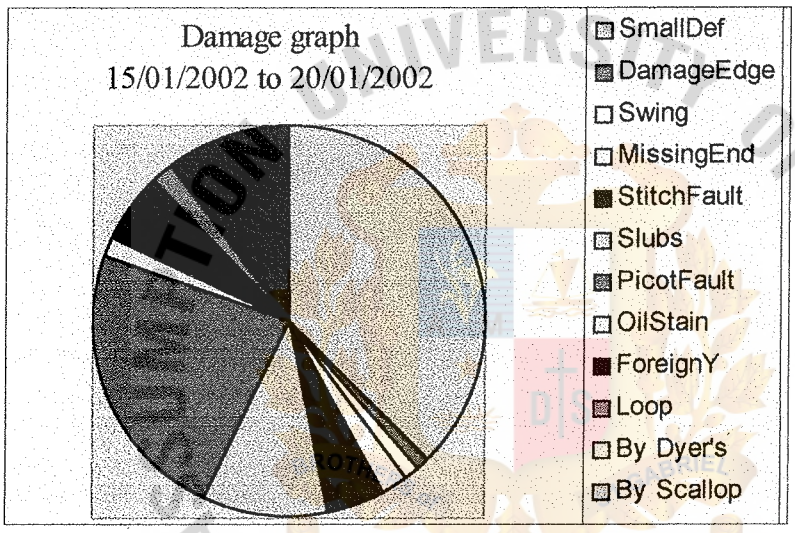



Figure I.5. Report Format: Damage Graph for a Given Period

## BIBLIOGRAPHY


1. Date, C. J. An Introduction to Database System Volume I, Sixth Edition. Reading,MA: Addison Wesley, 1996.

2. Forouzan, B. A. Introduction to Data Communication and Networking. MA: McGraw-Hill International, 1998.

3. Goldman, J. E. Client/Server Information System: A Business Oriented Approach. NY: John Wiley & Sons, Inc., 1999.

4. Greer, Tyson. Understanding Intranets. Redmond, WA: Mmicrosoft Press, 1998.

5. Kosiur, David. Understanding Electronic Commerce. WA: Microsoft Press, 1997.

6. Laudon, Kenneth and Jane P. Laudon. Management Information System. NJ:Prentice Hall International Company, 2000.

7. Micorsoft Corporation. The Windows Interface Guidelines for Software Design.USA: Microsoft Press, 1996.

8. Schewalbe, Kathy. Information Technology Project Management. MA: Course Technology, 1999.

9. Trepper, Charles. E-Commerce Strategies. USA: Microsoft Press, 2000.

10. Whitten, Jeffrey L. and Lonnie D. Bentley. System Analysis and Design Methods, Fourth Edition. Boston: Irwin McGraw Hill International, 1998.