CHAPTER IV

SYSTEM DESIGN AND IMPLEMENTATION

4.1 Introduction

In 1996, the case study implemented the Business Process Reform project which was consulted by a Japanese consultant team. There were several business processes which were suggested to reform. One of those is store operations and the Point of Sales (POS) system. The consultant described a lot of advantages in implementing the new system. The firm is now trying to study the impact of the POS system to its business by testing the system on a few pilot stores before a large scale implementation.

4.2 Plan for System Design and Implementation

After considering the potential advantages of the POS system on retail store operations from the consultant, the case study introduced the POS system to the store operations. The whole project which began from basic design to implementing the first store took at least two years. Furthermore, it required very high investment. In order to reduce the risk of implementing the system throughout the organization, the firm decided to have a pilot test project for the POS system. The system implementation can be classified into two alternatives : the construction of the new system and the development of application package before delivery to operation.

In order to shorten the testing period, the development of application package was selected. Steps of application package development were set up as follows:

1) Identify the User's Requirements

POS is the new system for the case study. The selected package will not fit to the firm's requirements. The users should identify a list of current and future requirements. This may be done by the real users themselves or by the members of the project team who may be able to suggest to the users which points they should consider. For this case study, a member of the project team was assigned to assimilate and document the users' requirements.

2) Collect Data

In order to have references for evaluating the system, the data of store operations' performances were collected at two periods: the current system and the proposed system. The type and procedure of data collection will be reported in Chapter 5 (Evaluation of the POS System on Retail Store Operations).

3) System Design

After collecting the users' requirements, the system is designed to support those requirements. However, before designing the system, objectives and scopes of the system should be clarified as guidelines for the project team.

4) Programming, Testing, and Conversion

These technical processes need a good cooperation between the programmer and the tester. Creating a complete system, requires a difficult and hard to control testing period. Next is the conversion of any pre-existing data to the required form, and to verify that they are correct before implementation.

5) System Implementation

This step includes many tasks (selection, preparation, training, installation, etc.), and is a critical step in measuring the success or failure of the project. Poor implementation may kill the good system.

6) System Maintenance

The task of system implementation does not end at the implementation step. The project team should consider the procedure of system maintenance concerning problems correction and system upgrading or enhancement.

7) System Evaluation

The direction of the project depends on the result of the proposed system evaluation. At this step, the project may go on or be terminated.

The system design and implementation activities concern many departments, tasks and details. In order to manage this kind of task, the project team is committed to follow the schedule as shown in Appendix E.

4.3 Users' Requirements

The major user of this system is operation. However, other concerned departments such as accounting, marketing, etc. can not be ignored. All users' requirements are collected and some will be the criteria for evaluating this proposed system. The evaluation factors will be mention in **5.2.1**. In order to have the suitable application for every system's user, important requirements of each department as stated below are surveyed:

4.3.1 Requirements of Operation

The most important requirement which will be the major direction for developing this system is operation's requirements. The requirements of operation are collected by studying the current practice system, interviewing key persons and field staff in the operation. They can be summarized as follows:

1) Service Quality

One of the critical successful factors of retail store operations is friendly service or service quality. Service quality of the store depends on many factors as described in chapter 2. Following are the requirements that the new system should support :

- Service Level

Stores with high service level have a variety of products available at all times which create sales opportunity. In order to have high service level, the staff tries to avoid goods shortages. Service level is measured by the proportion of time the item is available in the store. It will be concluded that the new system is able to support this requirement if the goods shortages at pilot stores are reduced. The new system which is able to capture itemized sales information is expected to generate better sales analysis in order to improve service level.

- Service Speed

Service speed for this case is identified by the operating time per transaction. The POS (Point of Sales) system which will replace the ECR (Electronic Cash Register) system should provide a better service speed. This will create higher customer satisfaction due to the decrease in customers' waiting time.

- Service Accuracy

The service accuracy for this case is measured by the percentage of the mistake billing such as incorrect price, incorrect quantity of each SKU (Stock Keeping Unit), incorrect quantity of each transaction, and incorrect type of product. Better service speed is insufficient if the service is inaccurate. Price calculation for this new system should have more accuracy.

2) User Friendliness

Normally, the staff are not highly educated and are not familiar with computer equipment. Therefore, the new system should be easy enough to apply. This should not be justified by the programmer but by the user's standpoint. User friendliness may hard to evaluate by the quantitative method. However, the ease of use and the time of training will be observed and used for evaluating the proposed system.

Training the staff to fully understand the package system is crucial. The training courses should be conducted in laymen's terms for easy comprehension. The turn-over rate of staff in the case study is high. The prospective users of this system will be trained on site at every branch either by a trainer or a senior staff.

3) Durability

The durability of the hardware is required because retail stores are located at many areas, operated by people with various backgrounds 24 hours a day. This means the hardware will be working the whole time. Furthermore, the location for installing the POS of the store is usually located close to the door which is opened frequently. The dust or contamination outside the store may have an impact on the computer hardware. However, this criteria will be used for selecting hardware but will not directly used for evaluating the proposed system in this study.

4) Daily Report

Currently, daily reports are prepared manually. The use of the POS system which is linked to the store controller at the back of the office should automatically generate daily reports. This requirement should be served but it will not be the evaluation criteria.

5) Sales Analysis Report

In order to improve service quality and store's performances, the itemized information from the POS should be reported as a format which is easy to analyze called 'Sales Analysis Report'. Operation's staff will use this kind of report to improve store performances. This analysis skill depends on the operators so the system evaluation will not use this requirement as the evaluation criteria.

4.3.2 Requirements of Accounting

1) Financial Report

The major requirement of accounting is the financial report which is used for measuring the financial performance of the store. The accuracy and promptness of this report are very important.

2) Inventory Control

Inventory level of each store impacts the benefit and cash flow of the company. With the current practice, the company controls the inventory level by physical counting and calculating the total value of inventory from retail price. Since it is impossible to know which and how many items remain in the store, inventory control by items is required from the accounting department and by the government (Revenue Department) in the future.

4.3.3 Requirements of Information System Support

1) Compatible with Existing Environment

The most economical and easy way to implement the new system is the compatibility with the existing operating environment (computer model, operating system, database management system, and etc.). The kind of required database or file structure should be compatible or can be converted to the current base.

2) Flexibility

The flexibility of the package is required because there is not any package that can be directly fitted to the firm's requirements. The ease of package modification is preferred with the package including the customized features. Furthermore, the vendor should be willing to modify the software for the client.

3) Maintenance

Nowadays computer system or information technology changes rapidly. The vendor should supply updates or enhancements to the system easily. The system needs a small number of ongoing maintenance and support (application programmers, analysts, database specialists). Finally, the source code should be clear, structured, and easy to maintain.

4.3.4 Requirements of Marketing

1) Sales Analysis Report

The previous sales analysis report which is generated at the store level is used to manage in-store operations. This sales analysis report is however, used for marketing purpose. It is the summary of many stores sales result and is used as a direction or guideline for product management at Headquarters level. An example usage of this report is that it will be used for product deletion process, new product analysis and promotional campaign.

2) Customer Analysis Report

This report is required in order to know the customers' requirement. It reports which product is required by which type of customer. Then the firm may be able to customize the customers' demand.

4.3.5 Requirements of Pilot Project

All requirements are important and considered from the conditions of the pilot project such as time-constraint, budget, etc. The system for the first phase of the project will not be able to support all of them. The project team decides to suspend these requirements for the first phase as shown below. However, these requirements will be considered in the next phase.

1) Inventory Control

The reason for suspending this requirement is the incomplete itemized information of the products, especially for product receiving. If the firm implements incomplete inventory control system, the government (Revenue Department) may calculate tax or audit the firm by using incomplete information as a reference. Furthermore this requirement needs a period of time to code program and convert data.

2) Sales Analysis Report for Marketing

This sales analysis report is used for marketing purpose which is used as a direction or guideline for product management at the Headquarters. This kind of report needs the information from a number of stores in order to represent the market. Using information from a few numbers of stores may mislead the firm.

3) Customer Analysis Report for Marketing

This report is required in order to know the customers' requirement. The reason for suspension of the requirement is similar to the suspension of sales analysis report for marketing.

4.4 System Design

4.4.1 Objectives of the proposed system

The system for the POS pilot project which is designed in order to achieve the firm's objectives are:

• To study the potential problems which may occur from the POS system implementation.

• To prepare the case study environment for supporting the total system implementation in the future.

• To evaluate the performance of the POS system when applied to the case study.

4.4.2 Scope of the Proposed System

• The proposed system will be implemented by using ten sets of POS.

• The system will support only the requirements of the pilot project.

4.4.3 Functions of the Proposed System

The functions of the proposed system can be classified into three parts. First is the functions for registering the business transaction and generating reports which are performed by Point of Sales (POS). Second is the functions for controlling and generating reports at store level which are performed by the Store Controller (SC). Third is the functions for controlling and maintaining the system which are performed by the Headquarters Controller (HQC).

1) Functions of POS

• Sign On/Off

Sign On function is used when the cashiers want to access to the transaction register function or perform sales activity. The cashiers have to key-in their password before beginning sales activity. On the other hand, Sign Off is the opposite function of Sign On. It is used when the cashiers wish to quit the system. These functions will register the business transaction performed by the cashiers.

- Sale by Bar-code

This function is used for products with bar-codes being sold. The cashiers will use the electronic scanner to scan the bar-code then the product's description and price will automatically appear on the monitor.

- Sale by PMA Code

This function is used for products without bar-codes. The cashiers have to key-in two digits of PMA (Product Movement Analysis) code which is labeled on the product's package and the price will appear on the monitor.

- Sale by One-Touch Key

This function is used for certain kinds of products without bar-codes, but sales frequency is high. This kind of product will be assigned to the button of the keyboard one by one. The cashier can sell the product by pushing this key one time per product.

- Sale by Price Look Up

This function will be used in many cases for products that do not have the price label or/and a bar-code. The cashiers will push this function key and all the product description and prices will be listed. The cashiers can then look from the list and sell the product. The list can be sorted by the name or code depending on the cashiers.

- Sale by Mix & Match

Mix & Match is one type of promotional sell. The different products which are purchased together will be discounted. For example, if the total price of soft drinks with a burger is 30 baht and is set in the mix & match promotion, then the total price will be discounted to 25 baht. For POS, the cashiers can sell by normal procedure and the price will be discounted automatically at the end of the transaction.

- Sale by Multi-Pack

Some products may be sold by single pack and multi packs. The price per piece when sold by multi-packs is cheaper than a single pack. This function will automatically be discounted when the cashiers sell the product through the normal procedure.

- End of Transaction

At the end of a transaction, the cashiers have to key the type of customer before receiving payment. This demography information will be used for customers' analysis function.

- All Void

All void function will be used when the cashiers or the customers want to cancel the transaction. This function can be used if the customers have not made any payment.

- Line Void

Line void or item correction will be used when the cashiers want to cancel some items in that transaction. This function can be used if the customers have not made the payment.

- Item Return

Item return function will be used when the customer wants to return some items that have been purchased. This function will be done under the authorization of the Assistant Store Manager, who holds a special key. Before performing this transaction, the authorized person has to unlock the keyboard by a special key and the keyboard will be returned to the normal status after operating this function.

- All Return

All return function will be used when the customer wants to return all items that have been purchased. This function can be operated for the purchase within the same day because this function will still recall the invoice of the transaction being returned, and cancel it. The transaction will be kept on a daily basis. This function will be done under the authorization of the Assistant Store Manager who holds a special key. Before doing this function, the authorized person has to unlock the keyboard by his special key. The keyboard will return to its normal status after operating this function.

- Suspend

This is used when the cashiers want to suspend an invoice in case the customers are not ready to pay. After suspending, the cashiers can operate other transactions for other customers.

- Resume

This is used when the customer is ready to make a payment after the suspension. The cashiers are able to recall the suspended invoice by using the resume function.

- Payment Register

There are three types of payment that can be used for purchasing the products in the store as cash, supplier coupon, and corporate coupon. Cash is the normal payment type which is usually used in the store. Supplier coupon is the coupon issued by the supplier of the firm and can be used for purchasing some products noted in that coupon and corporate coupon is a coupon issued by the firm and can be used for purchasing some products noted in that coupon.

- Security

The system is controlled by using a password and physical key in order to have security and to keep track of the users of the system. Every user will be

assigned with a password which is used to access into the system and the physical keys are used by the authorized users. The level of authorization are shown in figure 4.1.
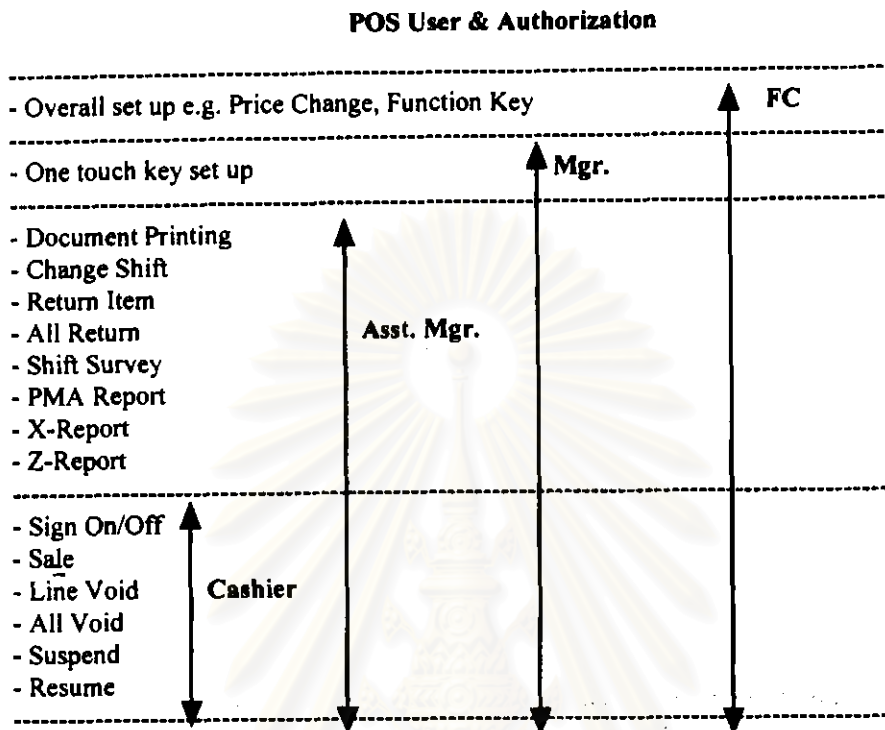
POS User & Authorization

Figure 4.1 POS User and Authorization

- Shift Survey Report

This report will be printed when the Asst. Mgr. or Mgr. wants to audit cash in order to control the operation at the store. It will report on how much cash there should be, and the auditor will count the bank-notes and coins.

- PMA Report

This report will be printed in order to list the sales by PMA.

- X-Report

This report will be printed at the end of the shift in order to check the status before changing the cashiers.

- Z-Report

This report will be printed at the end of the day in order to summarize the status of the day.

2) *Functions of SC*

A Store Controller (SC) is the computer in the back room. Its function is to control and back up the POS. Furthermore, many analysis will be printed or displayed at the SC. The functions of the SC are listed as follows:

- Initial POS

The data for initial POS (Point of Sales) is prepared and sent to the POS from the SC. Examples of initial data are product information file, users' password, one-touch keyboard layout, etc..

- Upload/Download File

At the end of each shift by the end of the day, the POS will be connected to the SC and download all transactions to the SC. Then the updated information will be uploaded to the POS. By this process, most functions at the POS are set up automatically by the SC.

- Back Up the POS

Every transaction which is operated at the POS will be sent to the SC and will be kept for a period of time. Back up files will be sent to the POS and operated once again should any errors occur at the POS.

- Sales Analysis Reports

The sales information will be reprocessed at the SC. The outputs of this function are sales analysis reports performed in any required format.

3) Functions of the HQC

The Headquarters Controller (HQC) will prepare the information at the Headquarters before sending it to the SC. Furthermore, in case of an error in the SC, the technical support person at the HQ will use HQC to perform maintenance job. The main functions of HQC are the following:

• Update Keyboard Layout

The keyboard layout is prepared by the HQC and sent to the SC through a modem line. This will reduce workload and man made error of the staff, and it is easy to control the keyboard layout.

• Convert Data

The data in the HQ will be converted to the required format before sending it to the SC.
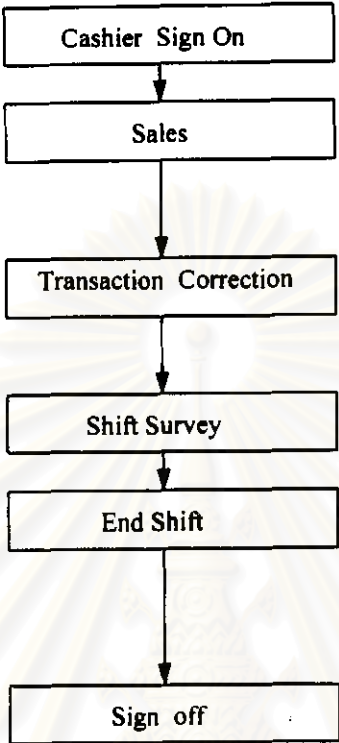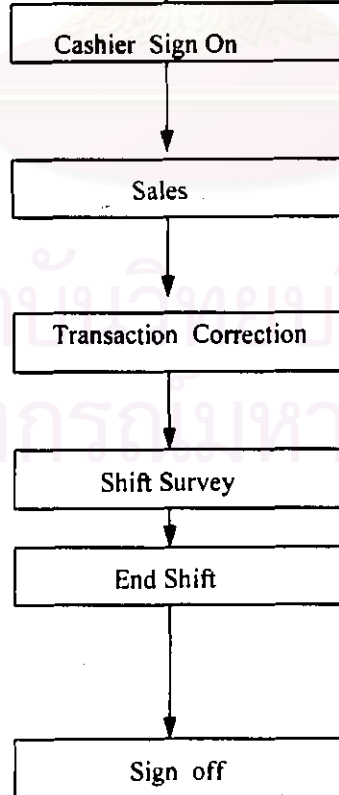
• Remote Access to the SC

If any errors occur at the SC, the first maintenance method can be done by using remote access program. This means that the technical support person will sit at the front of the HQC and connect to the SC through the modem. After connecting to the SC, the technician can operate anything at the HQC similar to that at the SC. If it is a software error, it may be solved by this function.

4.4.4 Work Flow and Procedures

To document the work flow and working procedures, the project team which consisted of the operation support person has to review the work flow and working procedures in order to ensure that they are realistic. During this process, questions like "Why the users have to do this step?" and "Are there any better ways to do this step?" are always raised. The purpose of these questions is to remind the project team that every step is essential and valuable. After writing the work flow and work procedures, the staff of the project team

are assigned to follow those steps which are modified in order to handle any problems that may arise. The final operation work flow is shown in figure 4.2.

Work Flow

shift	System	Flow	Function
1 st Shift		Cashier Sign On ↓ Sales ↓ Transaction Correction ↓ Shift Survey ↓ End Shift ↓ Sign off	- Bar code Price Look Up, PMA code, Mix & Match, One - touch, Multi Pack - All Void, Item Return Line Void, All Return Suspend, Resume - Print PMA Report - Print X - Report - Cash Counting - Send Data to SC
2 nd Shift	POS	Cashier Sign On ↓ Sales ↓ Transaction Correction ↓ Shift Survey ↓ End Shift ↓ Sign off	- Bar code Price Look Up, PMA Code, Mix & Match, One - touch, Multi Pack - All Void, Item Return Line Void, All Return Suspend, Resume - Print PMA Report - Print X - Report - Cash Counting - Send Data to SC

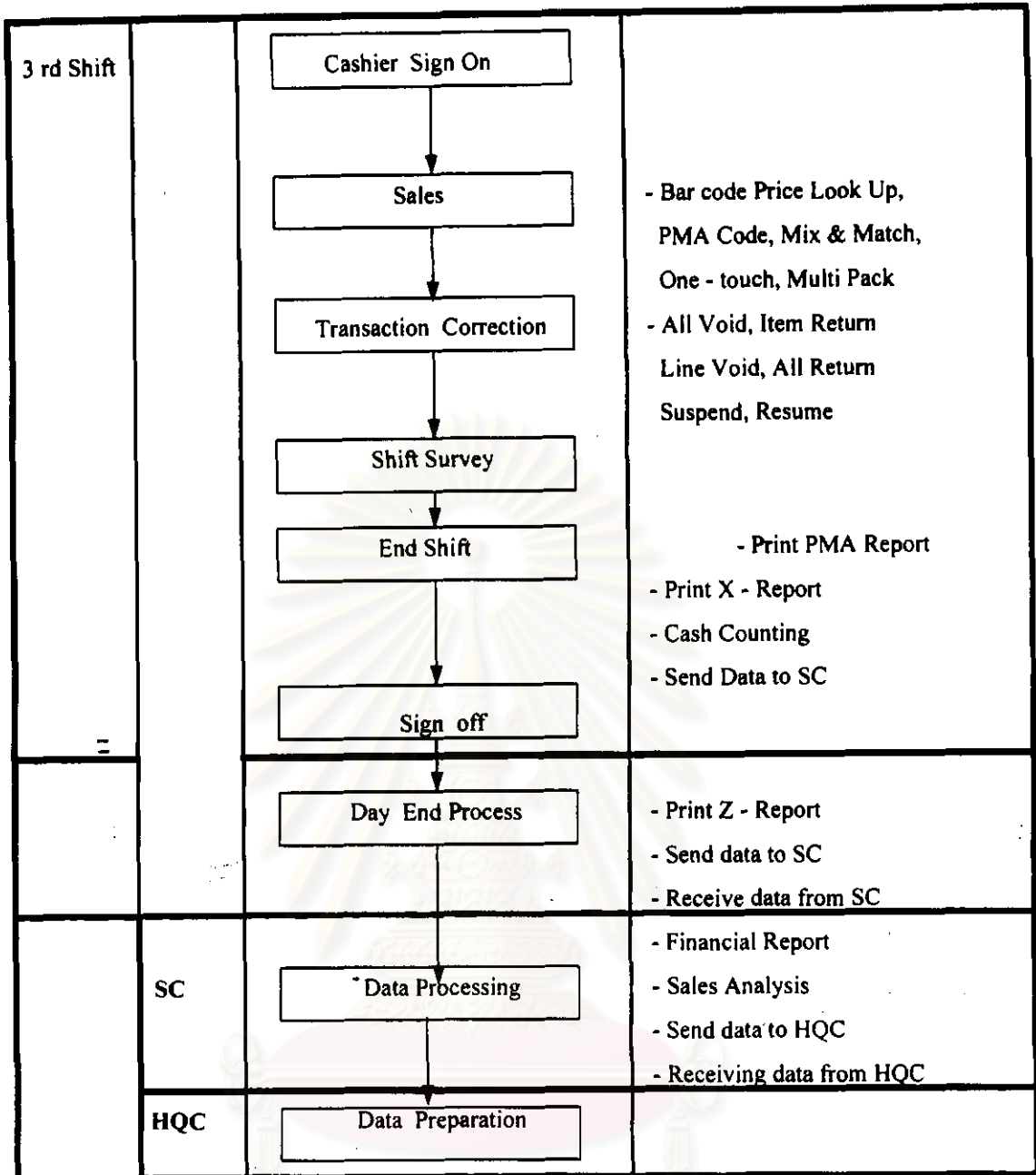Figure 4.2 Operation Work Flow

4.4.5 Retail Information Flow

In order to clarify the process of information flow, retail information flow is written as shown in figure 4.3. This flow will be used whenever incomplete information arises at any point. Furthermore, it will allow the users to understand the importance of information flow in order to alert them to follow the procedures strictly.
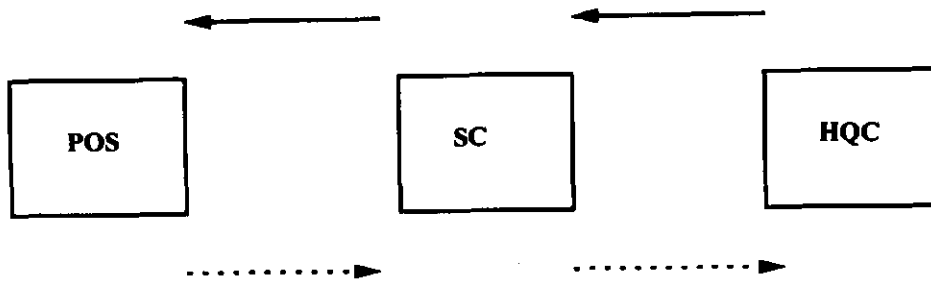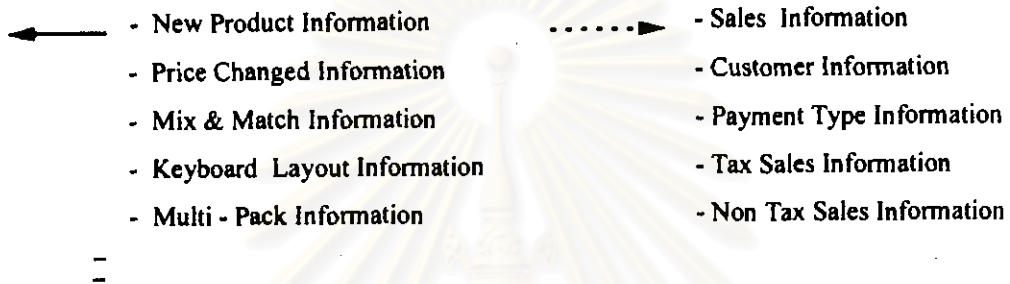
Retail Information Flow

Figure 4.3 Retail Information Flow

⟵ - New Product Information
- Price Changed Information
- Mix & Match Information
- Keyboard Layout Information
- Multi - Pack Information

⋯▶ - Sales Information
- Customer Information
- Payment Type Information
- Tax Sales Information
- Non Tax Sales Information

4.5 Programming, Testing, and Conversion

During the step of collecting users' requirements and system design, some basic functions such as sign on/off can be programmed and then integrated into the system. In order to shorten the period of programming and testing, these two tasks are conducted in parallel. It means the software is coded and submitted to the testers function by function. Program coding is the responsibility of the vendor and will not be mentioned in details in this chapter. The task of the project team is program testing.

The vendor for this case study has experienced working with the software and hardware as well as working closely with the project team. He is assigned to perform his task at the case study's site in order to shorten communication time and reduce communication errors. However, the schedule is delayed for some functions but the project team still follow the test procedures and not abbreviating it to make up for lost time.

The test team consists of both the person from the technical support and the operation support who fully understand the operation environment (Operation support person is selected from the store managers who have high operation's performance.). They are aware that it is better to be late than to accept defective components that will cause operational problems in the future. The example list of testing are shown in figure 4.4.

Testing list for POS

Item	Description	Done	Problem	Remarks
1	Target Function			
1.1	Sign on/off			
1.2	New clerk registering			
1.3	Sale by bar - code			
1.4	Sale by one touch			
1.5	Sale by price look up			
1.6	Sale by multiple			
1.7	Sale by company coupon			
1.8	Sale by supplier coupon			
1.9	Return cash			
1.10	Return company coupon			
1.11	Return supplier coupon			
1.12	Void ,all void			
1.13	No sale			
1.14	Paid in/out			
1.15	Suspend selling			
1.16	Information in receipt			
1.17	TAX, VAT Non Tax calculation			
2	Related Features			
2.1	Timing of drawer opening and closing			
2.2	Timing of printing receipt			
2.3	Timing of integrated process			
2.4	Journal printing			
2.5	Key controlling			
2.6	Operation while changing paper of journal			
2.7	Drawer sensor			
2.8	Printer sensor			
2.9	Keyboard sensor			

2.10	Bar-code sensor			
2.11	Operation when electricity has fallen or gone out			
2.12	Recovery			
2.13	Fault tolerance against monkey operation			
3	Require statistic information			
3.1	Customer type			
3.2	Grand Total(GT.),Gross sales(GS)			
3.3	Cash register number			
3.4	Difference between GS and actual amount			
3.5	Transaction data			
4	Accuracy of Reports			
4.1	X - report			
4.2	Z - report			
4.3	Shift recap report			
4.4	Day - end report			
5	Other functions for testing			
5.1	Set button for new product			
5.2	Clear data			
5.3	Transaction data inquiry			
5.4	Floppy information inquiry			
5.5	Interface from/to existing system such as master data, sales data			
5.6	Lock screen			
5.7	Transmit sales data from POS to serve without using FD			

Figure 4.4 List of Testing

After the vendor studies the users' requirements, they perform the required data structure and submit them to the information system support person who is responsible for converting the company's existing data to those required format. After converting the data, the project team verified them and found two important errors. One is the technical error and the other an error

from the incomplete database. The technical problem is solved by the information system support person. For incomplete database, the project team puts a lot of effort to correct it. The major incomplete product information is the bar-code of the product. This field has been in the database of a company for a long time but never used by any other departments, so it is never maintained or verified. The project team has to survey around two thousand items to update the bar-code. It is a time-consuming and labor intensive task. From this point, the team foresees the problems associated with the quality of information and tries to prevent this problem in the future by establishing the procedures for data entry and data verification. More details will be reported in chapter 5.

Integrating and testing the system as a unit is performed before the system is installed in the operational environment. All software packages, customized applications, and existing programs of the case study are included in the new system and have to be tested to ensure that they are compatible. The team runs the system in a simulated environment using simulated data. From this simulated test, the team finds an error and omits the end-user and design specification. Amendments have to be executed during this period before running the system at the pilot store.

4.6 System Implementation

The system implementation step concerns many supporting tasks. The new system is implemented to three pilot stores in order to study the impacts of the system to store operations. Furthermore, it will limit the potential damages of a defective system. Although the project team has the experience of system implementation, this new system is not easy to implement. Other previous systems the team has used, concern the internal working. For this system, POS is concerned with service quality and has impacts on the image of the firm. Proper selection, preparation and training are essential in order to ensure the success of the implementation.

4.6.1 Pilot Site

1) Site Selection

Pilot site selection can be the factor of success or failure of implementation. Each store in the chain has it's own unique profile. In order to reduce the bias from operational environments for the first site, the team has to consider many criteria as follows :

Sales per Day

Customer per Day

Sales per Customer

Number of Stock Day

Operational Performance

Location

The first store selected has medium sales volume, medium number of customers and medium sales per customer. In order to test the performance of the system, it examines whether the throughput and response time for processing are adequate to meet a normal workload. Furthermore, it is located not far from the headquarters for ease of support.

For the next two pilot stores, the team selects the pilot sites by the same criteria but selects the sites which have different profile in order to cover the most problems that will occur depending on the differences between the store's profiles.

2) Site Preparation

After selecting the pilot sites, the project team has to prepare and complete it before installation date. The issues that must be addressed are:

- Store Layout and Furniture

The new system requires the space at the store for POS and SC. POS can be placed instead of ECR set by set. The space for SC requires a location that has a suitable environment for the store staff to perform their jobs. For the first

store, we select the space under the stairs but closed to the sales area. The reason for selecting this location is that this space is not appropriate for displaying products, and it has a suitable environment for the store's staff to perform their jobs as shown in Appendix F (figure F.1).

There is also a private room for the staff to generate reports. The space shown in Appendix F (figure F.2) is modified to be a store controller room by using the partition and hanging the label "Staff Only".

- Shelf Layout

The size of the proposed POS equipment is larger than the size of ECR, so it needs more space. Therefore, candy shelf which used to be placed in front of ECR as shown in Appendix F (figure F.3) has to be moved to another place. Appendix F (figure F.4) shows POS without a candy shelf.

- Electrical Outlets

A sufficient number of electrical outlets have to be prepared and located close to the installation points. For POS, it does not need to increase the number of electrical outlets because we use the same number as ECR. The additional electrical outlets are needed for SC as shown in Appendix F (figure F.5).

- Cabling

The communication between POS and SC has to be done through LAN cable. The cable is prepared and has to be decorated in order to have an appropriate store environment as shown in Appendix F(figure F.6).

- Telephone Access

The communication between SC and HQ has to be done through a telephone line. The telephone line is installed by the same procedure as LAN cable. Both the telephone line and LAN cable are prepared as shown in Appendix F(figure F.7).

- Lighting

Lighting will be considered if we decide to put SC in the back room. For this situation, SC is in the sales area which has enough light to operate. Appendix F (figure F.8) shows the environment after installing the system.

3) *Staff Preparation*

The current situation of employee turnover rate of the case study is quite high. This impacts on the new system implementation. If there are many new staff in the pilot store, they can not concentrate on the system because they have to learn many other store functions. The way we prepare staff for the pilot store is not to allow operation manager to move the staff in the pilot store during the testing period. Furthermore, the pilot store should have a sufficient number of staff.

4.6.2 Manual Preparation

Before preparing a user's manual, the project team must recognize the educational background of store's staff. An effective manual should be simplified for easy understanding. For this system, the user's manual should consist of more pictures than text such as pictures of equipment, pictures of displays, pictures of working steps, etc.. Furthermore, the final chapter should consist of a troubleshooting guide which can be used as a guide for correcting potential problems of the store. The manual is prepared in Thai language which is appropriate for the case study's staff ; however, it is not attached in this report.

4.6.3 End-User Training

One of the most important steps for the new system implementation is training. For this case study, the project is driven by the firm's staff while the application is developed by the vendor. End-user may not be familiar with computer equipment. Even if there is an existing computer at the store, it is usually used by the store manager. Furthermore the end-user or the cashier, is not familiar with training from external trainers. For these reasons, the project

team decides to train the store's staff by an internal user who understands the business operations and are familiar with the end-user requirements.

1) Training Courses

The implementation plan is designed to install at the store at a time. The end-user for each installation is planned at around ten persons. It consists of one store manager, three assistant store managers, and six cashiers. From this situation, the following issues are considered in order to provide an appropriate training course.

- Method

The training plan for ten persons per course can be provided by two different methods. First is one-on-one training and the second is workshops. Both of them have advantages and disadvantages. The advantage of one-on-one training is that it can be brief and very effective because the trainer can personalize the training to each user. However, one-on-one training may be too expensive in some situation. The second method, workshops, where a group of users is trained in a classroom which has one or two trainers and some assistants. Workshops costs less expensive than one-on-one training but may be less effective.

After careful consideration, the team decides to provide workshops based on several reasons. The pilot project is being implemented to a few number of stores and the proposed system is not so complicated ; thus, it may not be worth the cost to provide one-on-one training. Furthermore, we believe that the workshops can be an effective training tool if the setting and the suitable factors such as timing of training, period of training, training equipment, etc. are available.

- Timing

The suitable timing to provide workshops is the week before system installation. The reason is that the cashier who is the end-user of the new system

is the same person who operates the existing system. The operating procedures of the two systems are different. If the training is provided before system installation for too long, the users will be confused because they have to operate the existing system for a period of time before operating the new system.

- Period

Considering operation work flow, the training period should not be more than four hours. If the training takes too long, in my opinion, our proposed system may be too complicated and required more time for training. The training schedule is 8.30-12.30 AM. for the first group and 2.30-6.30 PM. for the second group. The two courses are provided because all the staff can not attend at the same time. Since there should be some staff operating the existing system at the store.

- Trainer

At first, the training course was taught by the vendor. However after studying the operation's environment of the case study, the vendor and the project team agree that it is not easy for the vendor to perform as an effective trainer. This is because the vendor does not have the background to really understand the business operation of the case study. He understands only the scope of the proposed system, but this system is also concerned with other operations of the store. Finally, the trainers are the persons from the case study who are involved in this project as the tester of operation and used to be the store managers who have good performance.

- Place

There are two different alternatives for training places. One is at the HQ (Headquarters) and the other is at the store. The advantage of training at the store is that it is convenient for the trainees and provides real operation environment. The disadvantage is that it hard to set up the facilities for training. If we train in the back room, the space may not be enough and the temperature may be too high. If we train in the front room or sales area it will disrupt the

existing sales activity. For these reasons, the training courses are provided at the HQ which has full facilities for training. The classroom is performed in the case study meeting room which has an air conditioner, good lighting, white board, and comfortable tables, and chairs.

- Topics

The topics of training cover both the theory and practice parts. It consists of ;

Introduction

Hardware Configuration

Work Flow and Work Procedure

Workshops

Question and Answer

Examination

The introduction session gives an overview of the reasons for implementing the system. It mentions the background and objectives of the project as well as the advantages of the system. This session is provided in order to motivate the operators to participate in implementing the new system.

2) Documentation and Training Materials

- Documentation

The documents for training are prepared in Thai and are considered confidential so they can not be attached in this report. It consists of the following documents ;

User's Manual   The user's manual (as described in Manual Preparation Topic) is provided one copy for one trainee.

Shift Survey Sheet   It is the paper used for auditing cash.

Shift Worksheet   It is the paper for recording cash status and cash address

Examination Paper

- **Training materials**

Training materials consist of the following :

POS   Three sets of POS are set up for one classroom.

SC   One set of SC is set up and will be used by the store manager and the assistants.

HQC One set of HQC is provided even if it is not the hardware for the store. It is used for information transfer demonstration.

Sample Products   The sample products are provided as the materials for the user to practice performing sales activity.

3) On the Job Training

On the job training is one method of training. Although workshops training is provided, on the job training is essential. The training is provided because this system requires skills and experiences of operators. At the beginning, operators who have attended workshops may be unable to operate the system smoothly. The objectives of on the job training are to reduce the errors that occur because of inexperienced operators and reduce the time required for workshops. At first, the project team decided to provide one project staff to standby at the pilot store for every working shift for a week. After implementing the system, we found that the operators can operate by themselves without requests for help in one day. It means in day two, the operators can sign on, perform sales activity, and sign off by themselves. The major task of the project staff becomes the problems survey and correction. So we use three persons for three shifts for a three day period. By providing on the job training, the learning curve of operators is shorter. Furthermore the trainer will be able to monitor and correct the problem of system implementation.

4.6.4. System Installation Procedure

System installation is a task, which needs to be well planned and managed. Many tasks are performed at this step. In order to have the completed installation, many installation procedures are planned and executed properly.

1) Final System and Equipment Inspection

Final system and equipment inspection procedures are written in order to protect against incomplete systems and equipment. The procedures of this job is listed as follows :

- Simulate Store Operation

After receiving the hardware from vendor, it needs to be unpacked, assembled, connected, and tested. It is simulated at the store where POS, SC, and HQC are connected together. After all the equipment are assembled and connected, final inspection is performed.

- Hardware Testing

To test the hardware, we operate the system at the store by scanning the products, plugging and unplugging immediately, turning on and turning off, stand by the hardware overnight, and etc. in order to pre-test the durability, security and reliability of the hardware.

- Software Testing

The software is tested by simulating sales activity used by various types of operations. The software is accepted if no unacceptable errors are found.

- Database Verification

The database is verified in order to ensure that it is the correct and updated database.

- Interface Testing

Interface testing is accomplished by performing information and file transfer between POS and SC through LAN cable, and between SC and HQC through a telephone line.

- Packing

The packing process seems to be a simple task. However, it requires proper planning because the sets of POS have their own serial numbers and are registered at the Revenue Department. Tax identification numbers of each set are assigned and can not be used by the other. To avoid the mistake, each set of POS should be packed together or labeled for correct assembly.

- Transfer to Pilot Store

The hardware should be transferred to the pilot store before the installation day. This is to avoid traffic problems which may lead to delay in installation.

2) Initial Set Up

Before the system is run, it needs to be initialized during set up. The type of set up such as transferring previous historical data existing in the store's computer to SC, setting up users' password and authorization, setting up initial amount of cash, setting up keyboard layout, and etc.. Some tasks of initial set up can be pre-set at the HQ such as setting up keyboard layout while some tasks have to be set up at the store. The information system support person should plan this task effectively in order to reduce the time for initial set up at the store.

3) Mixed Strategy of System Implementation

According to the *National Association of Convenience Stores (NACS) 1995*, there are four major styles of systems installation namely parallel, phased, pilot, and plunge. During the parallel installation, the new system runs alongside with the old system until the new one has proven effective and reliable. For the

phase installation, only a portion of the system is installed for the entire operation. If all goes well, additional portions are installed until either a problem is encountered or the installation is completed. During the pilot installation, the new system is implemented in just one or two stores at a time and operated until all the problems appeared to be solved. When the pilot testing is completed and working smoothly, the system is installed throughout the organization, either simultaneously or in stages. The final major style of system implementation is the plunge installation, which stops the old system, and initiate the new system.

The installation style will affect the limitations of potential damages of a defective system. In order to be suitable for the case study, the team decided to use a mixed strategy in selecting the advantages of each installation style. As previously described, this project will be implemented at three pilot stores in order to study the potential problems before implementing the total system suggested by the consultant. The *pilot installation* is the main implementation strategy of this installation.

At the pilot stores, the existing system uses two ECRs (Electronic Cash Register) to support sales activity. To install the POS system, the issue is how to install the system without stopping sales activity of the store. On the other hand, this implementation tries to avoid the *plunge installation* strategy which is exceedingly dangerous. If the proposed system does not work perfectly, then the store will be closed for a period of time in order to set up back to the old system. This causes the store to lose in sales opportunity and store image.

The solution of this issue is using the *parallel installation* to avoid shutting down all systems. The procedure begins at the end of the third shift of ECR#2, validating cash and performing day end process. After ECR#2 has completed its day end process, it will be cut off and POS#2 is installed. POS#2 will be operated instead of ECR#2 for a period of time parallel with ECR#1. The length of this period depends on how smooth the new system runs. If

POS#2 runs smoothly without any errors (hardware, software, database), and the operator is able to run the sales activity at the acceptable speed, ECR#1 will then be used to perform at the end of the third shift and day end process. POS#1 will later be installed. For this case study, POS#2 runs for an hour before installing POS#1 and cutting off the ECR system.

Furthermore, we also use the *phased installation* due to our application on the system. The system is first installed in order to replace the ECR. While running the system to allow the operators to perform their skills, the team have to develop sales analysis application and install it in the second phase.

In conclusion, the mixed installation strategy used for this system consists of three implementation styles namely the *pilot installation* at the pilot stores, the *parallel installation* initiating with the proposed system, and the *phase installation* for application implementation.

4.7 System Maintenance

System maintenance is the final task before evaluating this project. After running the system at the pilot store in a live operation environment, performing real sales activity takes place. This will examine the performance of the system, performance of processing during peak loads, human engineering, method and procedure, back up and recovery. With this result, the tasks of the project team are to correct the problems and update the system.

4.7.1 Problem Correction

After the proposed system is implemented to the store's operation, failures due to software error, hardware error, interface error, and misuse may arise from time to time. The project team and the vendor staff must work with the end users to identify the causes and effects of such errors and make necessary changes to the system. Problem corrections are done case by case.

- Hardware Problems

To solve this problem, the team spares the most potential down parts. This plan is based on the historical data of the system implementation at other sites.

- Interface and Software Problems

When the interface and software problems arise, they result in an aborted program or loss of data. The backup files or data will be reinstalled. The programmer will identify the causes and in some cases the programs have to be rewritten.

- Database Problems

Database problems usually occur because some fields such as a bar-code has never been used by any systems. The project team found the error and correct it by updating the database frequently. Furthermore, in order to protect this problem, the team sets up database procedure maintenance and announces throughout the organization.

- Misuse Problems

This kind of problems occurs from both the operators and the system complication. In order to correct this problem, the trainers have to re-train the users and the programmers, or request the developers to enhance the system.

4.7.2 System Updates or Enhancements

One of the most effective ways to correct the problem is to prevent it. The ideas for enhancements are usually generated from this situation. The proposed system for this case study is updated several times. The objective of system updates or enhancements is to adapt the system to the new requirements found during running the system in the real operation environment. From this pilot project, the system enhancements occur from these following issues ;

- System Performance

The performance of the proposed system has to meet the normal workload. If not, the enhancements are required in order to support this requirement. For this case study, the proposed system has an adequate performance to support the normal workload.

- Peak Workload Processing Performance

The peak workload processing performance is essential in order to prevent opportunity loss during peak periods. For the case study, peak load is usually in the second shift. For the first version of this proposed system, we found that in the second shift the processing time for each transaction is longer. This is due to the software problems. The programmers have to rewrite the program and update the new version to the system. At this moment, this problem has disappeared.

- Human Engineering Performance

The human engineering performance of the proposed system itself is not the issue for this case study since the team always consult the users together with the work study methods during the design phase. However this issue seems to be the problem at the beginning of the implementation because the operators are not familiar with the system and may be confused with the POS and the ECR system. The problem, however disappeared when the operators run the POS system without the ECR system for a period of time. Furthermore for new employees who have never operated the ECR system, training them to use the POS is easier than training them to use the ECR.

- Methods and Procedures

Some methods or procedures of the proposed system are modified in order to fit to the case study's operation environment. Some effective procedures are suggested by the store's staff. However in order to improve the procedures, the project team is working closely with the store's staff with good

relationship. This makes the store's staff more willing to suggest appropriate procedures while the project team knows the actual problems.

- Backup and Recovery

The backup system may become an issue if it is not logical. For the proposed system, the backup files are kept both in the POS itself and in the SC. Now the recovery can be performed by the staff of the project team and the vendor. In the near future we will design a procedure to maintain this issue first by the store's staff.

Even many problems were solved and system updates or enhancements were continually done during a year running the pilot project, there are still many points that require improvements. Chapter 6 on Conclusion and Suggestion will mention about the conclusion of the project together with suggestions for improvements.