Information Technology : A Comparative Analysis of Purchasing and Shipment Processes at Thailand Tobacco Monopoly : A Case study

By

Mr. Mahaysak Kanignan

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
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Academic Year	1998

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

This comparative analysis project presents the implementation of Information Technology (IT) based on Thailand Tobacco Monopoly, in the process of purchasing and shipment at Petchaboon Tobacco Office, as a case study. The implementation of -Information Technology is divided in 3 phases as follows:

Phase I : The first stage in which no Information Technology was implemented.

Phase II : The next stage in which the implementation of Information Technology with computer system was carried out.

Phase III : The implementation of Information Technology with a computer system and digital scales.

This project report consists of eight parts: the first is the introduction to project background, the project's objectives and the scope of the entire study. Part two explains the background information which is necessary for Information Technology implementation. Part three describes the history of Thailand Tobacco Monopoly and the implementation of information system with Information Technology. Part four shows the details of the domestic tobacco supply and shipment process and then specifies the details of purchasing and shipment process, and another necessary data is presented in part five. After we have collected data in part five then an analysis and evaluation in parts six and seven is done respectively. The last part contains the project summary and the future of Information Technology implementation in Thailand Tobacco Monopoly.

ACKNOWLEDGENIENTS

I am indebted to the following people and organizations. Without them, this project would not have been possible.

I wish to express sincere gratitude to my project advisor, Mr. Smith Tungkasmit, who has given freely of his time to assist, support, guide, and constantly encourage my project.

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1. INTRODUCTION

1.1 Description of p roject

In the current economic situation, the strategy of survival of an organization is to increase the serviceability towards the customers and reduce the cost. So Information Technology (IT) is the way to solve that problem.

This project aims to illustrate how Information Technology can reduce cost and improve performance through studying the site Teference at Thailand Tobacco Monopoly in purchasing and shipment from the branch office in Petchaboon province to the head office in Bangkok.

The study of this project is a comparison between the current system of Thailand Tobacco Monopoly, which uses Information Technology in purchasing and shipment, and the previous system, which was not implemented with Information Technology.

1.2 Project background

In the present day, computers play important roles in information systems in any organization. The organization has to collect much data, and translate data to serve as information for decisions. Thailand Tobacco Monopoly is one of those organizations, where the executives have foreseen the importance of information technology to support management and operations, so Thailand Tobacco Monopoly established the Information System since 1991. The Information System structure is centralized and linked to each division by telephone lines using modem connections.

Thailand Tobacco Monopoly implemented Information Technology in head its office in Bangkok, branch offices and stations around the country, with 14 systems to support the information system. The purchasing and shipment system is one of the many unites that uses Information Technology. Because this process is clear and is impacted upon by Information Technology, so it is very interesting to analyze and evaluate this system.

1.3 Project objectives

The objectives of this project are as follows:

To study and analyze the implementation of Information Technology and the Information System in Thailand Tobacco Monopoly.

To study and analyze the process of purchasing and shipment in Thailand Tobacco Monopoly.

To study, analyze, compare and evaluate the implementation of Informa;on Technblogy in each phase of the implementation of the purchasing and shipment process.

To indicate the result in the implementation of Information Technology which helps the organization to reduce the cost.

To show the result in the implementation of Information Technology that helps the organization increase the performance.

1.4 Scope of the project

This project focuses on the implementation of Information Technology from the site reference, Petchaboon Tobacco Office, in the process of purchasing and shipment. The project evaluates and summarizes the results of Information Technology implementation concentrating on financial data such as hiring costs or paper expenses.

The project also analyzes and evaluates how Information Technology affects the organization such as the performance of working process, as etc.

1.5 Project plan

The project plan outline can be defined into topics as follows:

1) Finding the title of topic, waiting for advisor's approval

2) Planning the project

3) Collecting information and survey activity
   - Interviewing staff
   - Studying documents

4) Analyzing
   - System without IT
   - The implementation of IT
   - The current system

5) Compare and evaluate each phase of Information Technology implementation

Summarizing the result and drawing a conclusion from the project

7) Document the project report

2. Background Information

2.1 Information Technology

Information

Information is a stimulus that has meaning in some context for its receiver. Some (if not all) kinds of information can be converted into data and passed on to another receiver. Relative to the computer, we can say that: Information is made into data, put into the computer where it is stored and processed as data, and then put out as data in some form that can be perceived as information.

Computer

A computer is a device that accepts information (in the form of digital data) and manipulates it for some result based on a program or sequence of instructions on how data is to be processed. In another word, computers are used extensively to turn data into information. Complex computers also include the means for storing data (including the program, which is also a form of data) for some necessary duration. A program may be invariable and built into the computer (and called logic circuitry as it is on microprocessors) or different programs may be provided to the computer (loaded into its storage and then started by an administrator or user). Today's computers have both kinds of programming.

Information Technology

Information Technology (IT) is a term for encompassing all forms of technology used to create, store, exchange, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived). Among other uses, Information Technology includes both telephony and *computer technology* in the same word:

Most information management questions asked in any organization today can be classified as problems of planning, organization and control. The table below lists some of the recurring management questions that originated in the DP era but still recur today. More contemporary questions representative of;the IT era are also listed. In addition, of course, there are important questions which are inherently technological. These are not our concern at this stage, but can be thought of as a fourth aspect of information management.

Table 2.1 Information management questions

Activity	Recurring questions	New questions
Planning	What systems should we develop next?	What information systems do our current business strategies demand?
	Which of our many applications needs have priority?	What strategic opportunities are presented by IT?
	What is the next hardware step?	Do we need a telecommunications policy?
Organization	Should DP be centralized or not?	How will IT affect our organization structure?
	How do we improve user-specialist Relations?	How can we find more IT personnel?
	How can we secure top management support?	Should we have an IT director?

Table 2.1 Thibrmation management questions (continuo.)

Activity	Recurring questions	New questions
Control	How much should we be spending on DP? Are we getting value for money from DP? Should we charge out all DP services?	How much are we spending on IT? How can you evaluate IT proposals? Flow can we manage large IT projects?

Centralization and decentralization of IT

There are many arguments for both centralization and decentralization of IT activities. Hardware economies of scale, communication need, common-systems, core transaction processing infrastructure, scarce human resources and critical mass, synergies from integration, hard control over resource allocation and, above all, a centralized host organization can point to centralization of some or all IT resources. Serving different business needs, giving resource allocation control to business management, the dispersion of the technologies, communication and coordination costs, IS responsiveness, availability of IT service in the market place, ease of adding and spinning off business units, and, above all, a decentralized host organization can point to devolving IT activities. However, not only do all these — and more — factors have to be weighed up, but the IT function, or IT resources, are not a homogeneous activity. At the infrastructure level, there are computing, communications, data, and core transaction systems. At another level, there is the crucial activity of development — analyzing, designing and implementing IT applications. There is also the matter of overall direction — strategy formulation and policy-setting, involving questions of planning and control.

As IT advances and information management understanding matures, there are oNanizatibnal choices at all these levels.

The table below summarizes the most important factors to be considered and which way they point in the centralization versus decentralization argument. The contents have been influenced by McFarlan and McKenney, Tricker, and Feeny *et al.* respectively. Three levels of analysis are proposed: operations, development and direction. It can be readily appreciated that, with this variety of factors to consider, the choice between centralization and decentralization will vary from organization to organization and over time. Furthermore, extreme positions will be the rarest, many organizations are looking for the right balance at the right time.

Table 2.2 Structuring IT activities

Level of analysis	Towards centralizing	Towards decentralizing
Direction	Giving funding boosts	Removing bureaucratic controls
	Tight or directional resource allocation	Autonomous or business-led resource allocation
	Pushing initiatives	Facilitating innovation and responsiveness
	Optimizing suppliers and costs	Recognizing diverse needs and preferences
	Formulating and policing technical policies	Formulating and implementing IS strategies
	Attending to group and corporate needs	Responding to local needs
	Centralized host. organization	Decentralized host organization

Table 2.2 Structuring IT activities (continue)

Level of analysis	Towards centralizing	Towards decentralizing
Development	Serving group, corporate functional needs	Dissatisfied with centralized service
	Attending to architecture needs	Integrating user and specialist staff
	Attracting and keeping staff needs for common systems or data	Simplifying IS approaches and delivery
	Specialist teams required	Exploiting specific technologies
	Centralized host organization	Decentralized host organization
Operations	Manageable geographical spread	Dispersed geographical spread
	Professional service levels	User control and local responsiveness
	Scale economies of some technologies	Reduced communications costs and easier computing
	Attracting and keeping technical staff	Opening up career paths
	Availability of corporate or common data	Local data needs
	Integrated or common systems	Local system needs
	Centralized host organization	Decentralized host organization

Increasingly, hov, ever, dispersion of technology, decentralization of corporations, and the desire to identify and deliver business-led IT applications are moving organizations to devolve at least some of their IT activities. When this happens, it is important to ask what should nevertheless remain centralized. In other words, what reserved powers should be vested in a central or corporate body?

2.2 An impact of Information System

Infoi utation Technology is the one component of Infot illation System that is implemented in the organization. So we first need to explain how organizations affect technology and system. Organizations have an impact on Information System through the decisions made by managers and employees. Managers make decisions about the design of systems, they also use Information Technology. Managers decide who will build and operate systems, and ultimately it is managers who provide the rationale for building systems. There are four important questions to consider in studying this issue:

How have organizations actually used Information Systems?

- How has the organizational role of Information Systems changed?
- Who operates Information Systems?
- Why do organizations adopt Information Systems in the first place?

The answers to these questions are:

Decisions about the role of Information Systems

Organizations have direct impact on Information Technology by making decisions about how the technology will be used and what role it will play in the organization. Supporting this changing role have been changes in the technical and organizational configuration of systems that have brought computing power and data much closer to the ultimate end users.

Isolated electronic accounting machines with limited functions in the 1950s gave way to large, centralized mainframe computers that served corporate headquarters and a few remote sites in the 1960s. In the 1970s, midsized minicomputers located in individual departments or divisions of the organization were networked to large centralized computers. Desktop microcomputers first were used independently and then were linked to minicomputers and large computer in the 1980s.

In 1990s, the architecture for a fully networked organization emerged. In this new architecture, the large central mainframe computer stores information (like a library) and coordinates information flowing among desktops and perhaps among hundreds of smaller local networks. It operates much like a telephone system. Infounation System have become integral, on-line, interactive tools deeply involved in the minute-to-minute operations and decision making of large organizations. Organizations now arc critically dependent on systems and could not survive even occasional breakdowns: In most large organizations the entire cash flow is linked to Information Systems.

Decisions about the computer package: *who delivers Information Technology services?*

A second way in which organizations affect Information Technology is through decisions about who will design, build, and operate the technology within the organization. Computer technology is similar to other kinds of technology, including automotive technology. In order to use automobiles, a society needs highways, mechanics, gas stations, engine designers, police, and parts manufacturers. The automobile is a package of services, organizations, and people. Likewise, Information Systems require specialized organizational subunits, information specialists, and host of other supportive groups. Managers (and organizations in general) make the key decisions about the computer package: These decisions determine how technology services will be delivered, and by whom, how, and when.

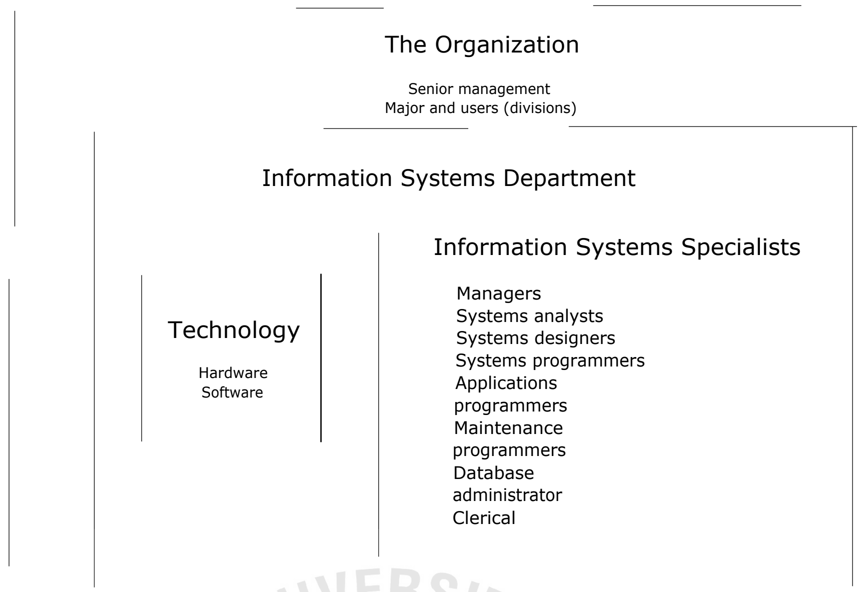

Figure 2.1 Computer package

The computer package is composed of three distinct entities. The first is a formal organizational unit or function called an Information System Department. The second consists of Information System specialists such as programmers, systems analysts, project leaders, and Information Systems managers. Also, external specialists such as hardware vendors and manufacturers, software firms, and consultants frequently participate in the day-to-day operations and long-term planning of Information Systems. A third element of the Information Systems package is the technology itself, both hardware and software.

Today the Information Systems group often acts as a powerful change agent in the organization, suggesting new business strategies and new information-based products and coordinating both the development of technology and the planned changes in the organization.

The size of the Information System Department can vary greatly, depending on the role of Information Systems in the organization and on the organization's size. In most medium to large firms, the Information Systems group is composed of 100 to 400 people. The size of the Information Systems group and the total expenditures on computer and Information Systems are largest in service organizations, where Information Systems can consume over 40 percent of gross revenues.

In the early years of the computer, when the role of Information Systems was limited, the Information Systems group was composed mostly of programmers, highly trained technical specialists who wrote the software instructions for the computer. Today, in most information groups, a growing proportion of staff members are system analysts. Systems analysts constitute the principal liaison between the Information System group and the rest of the organization. It is the system analyst's job to translate business problems and requirements into information requirements and systems.

Information systems managers are leaders of teams of programmers and analysts, project managers, physical facility managers, telecommunications managers, heads of office automation groups, and finally, managers of computer operations and data entry staff.

End users are representatives of departments outside of the Information System group for whom applications are developed. These users are playing an increasingly large role in the design and development of Information Systems.

Decisions about why Information System are built

Managers provide the public and private rationales for building Information Systems. Managers can choose to use systems primarily to achieve economies, or to provide better service, or to provide a better workplace. The impact of computers in any organization depends in part on how managers make decisions.

At first glance, the answer to the question, "Why do organizations adopt Information Systems?" seems very simple. Obviously, organizations adopt Information Systems to become more efficient, to save money, and to reduce the work force. Although this response may have been generally true in the past, it no longer comprises the only or even the primary reason for adopting systems.

Systems today are, of course, built with efficiency in mind, but they have become vitally important simply for staying in business. Information Systems are as vital as are capital improvements such as modern buildings or corporate headquarters. Improvements in decision making (speed-, accuracy, comprehensiveness), serving ever higher customer and client expectations, coordinating dispersed groups in an organization, complying with governmental reporting regulations, and exercising tighter control over personnel and expenditures have become important reasons for building systems.

More recently, organizations have been seeking the competitive benefits of systems. Hence, what seems like an easy question to answer "Why do organizations adopt systems?" is really quite complex. Some organizations are simply more innovative than others. They have values that encourage any kind of innovation, regardless of its direct economic benefit to the company. In other cases, Information Systems are built because of the ambitions of various groups within an organization and the anticipated effect on existing organizational conflicts.

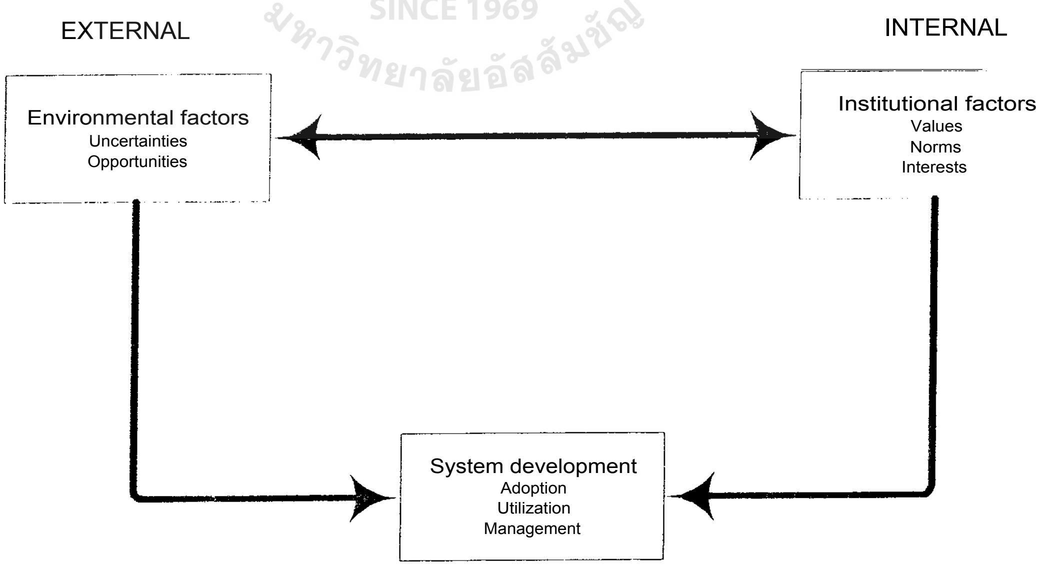

Figure 2.2 The system development process

In the figure above, a model of the *systems development process* that *includes* many factors other than economic considerations in presented. This model divides the explanations for why organizations adopt systems into two groups: external environmental factors and internal institutional factors.

Environmental factors are factors that are external to the organization and that influence the adoption and design of Information Systems. Some external environmental factors are rising costs of labor or other resources; the competitive actions of other organizations; and changes in government regulations. In general,, these can be thought of as environmental constraints: at the same time, the environment also provides organizations with opportunities; new technologies, new sources of capital, the development of new production processes, the demise of a competitor, or a new government program that increases the demand for certain products.

Institutional factors are factors internal to the organization that influence the adoption and design of Information Systems. They include values, norms, and vital interests that govern matters of strategic importance to the organization. For instance, the top management of a corporation can decide that it needs to exercise much stronger control over the inventory process and therefore decides to develop an inventory Information System. The resulting system is adopted, developed, and operated for purely internal, institutional reasons.

2.3 Importance of the Information System

For most organizations the computerized Information System has become one of the most important and critical functional areas within the firm. Almost all forms of organizations are dependent on digital computer technology to process information. Firms ranging in size from sole proprietorships to massive multinational conglomerates have become dependent on computers. The activities of the firms using computers cover a broad spectrum including manufacturing, service, government, education, retail sales, and many other economic functions too numerous to list. In addition, the areas of application of computer technology within each firm are widespread and continually expanding.

One of the reasons for this growth rate is the dramatic increase in the cost / performance ratio of all types of computer technology. This decrease in cost has made computer procession economical for more and more firms. Also, it makes the use of computing feasible for more functions within a given firm.

The computer is no longer just a sophisticated accounting machine or a super-fast scientific number cruncher. Computers now control entire manufacturing operations, including functions such as ordering and paying for raw materials, manufacturing the goods, accepting and filling orders, and billing the customer. In addition, the decision - waking and communications areas have been heavily influenced by computers. Executives can quickly obtain and analyze information using the Information System. Then they can easily communicate decisions by using word processing and electronic mail services.

With the tremendous advances in microcomputers, office automation, robotics, telecommunications, and computer aided manufacture and design, computer technology is affecting almost all aspects of business. The role of the computer will continue to grow as these technologies continue to mature and the price / performance ratio of computer hardware continues to decrease. Computers have become so important to some firms that the successful administration of the Information System can mean life or death for the organization. Some examples of computerized tasks are shown in the following figure.

Table 2.3 Examples of computerized tasks

FUNCTIONAL AREA	COMPUTERIZED TASKS
Production	Inventory Control
	Manufacturing Scheduling
	Material Requirements
	Computer Aided Manufacturing
Marketing	Order Entry
	Sales Tracking
	Market Analysis
Research and Development	Specialized Engineering Functions
	Computer Aided Design
	Experimental Design and Analysis
Accounting and Finance	Financial Statement compilation
	Accounts Payable
	Accounts Receivable
	Payroll
	Portfolio Analysis
	Fixed Assets control
	Budgeting
Personnel	Employee Tracking
	Employee Evaluation
	Recruiting
	Government Reports
High Level Management	Summary Reports
	Ad Hoc Queries
	Long-range Planning

When computers are properly managed, they can substantially increase productivity. However, when mismanaged they can lead to disaster. These factors make the various activities involved in the management of an Information System very important. In many firms these management functions are scattered throughout the firm. While the major focal point in the Information System is usually the management of computer resources. Since computers are present in all aspects of business, people generally considered outside the traditional realm of data processing are involved in managing computer resources. These people must also concerned with issues such as computer security, backup, system compatibility, data integrity, and issues that are usually associated only with data processing professionals.

For example, the marketing research department may have its own distributed minicomputer. The manager of the marketing research department may actually have to manage a center that is substantially smaller than the centralized system, but one that has many of the same types of problems. With the widespread use of microcomputers, every individual responsible for a micro must be concerned with the proper management of the computer technology under their control. The size and cost of the equipment for the Information System under consideration should not determine whether good management principles are to be applied. Mismanagement of any system can adversely affect an organization. However, the general rule is that the magnitude of the damage is usually (but not always) greater for large systems.

Fortunately, the principles of sound Information System management can be successfully applied to all levels of the Information System. In most cases, applying these principles will consume fewer resources and demand less formal structure in a smaller system than in its larger counterpart. Since the distinction between different size systems is usually unclear.

For example, protection of corporate data is an extremely important function. Saving backup copies of the file can be done to help restore lost or damaged data files. On the centralized, mainframe-oriented system, data backup is a very formal process. A determination must be made of which files are to be backed up and how often the backup should be done. The backup schedule will affect the availability of the system since users will not be allowed to alter a file while it is being backed up

On the other hand, for a personal workstation the backup process may be as informal as having the primary user copy files from the hard disk to a floppy disk as needed. In either case, improper backup may cause the loss of important data. In the small system case, this could affect only a single user, while for the centralized system this could affect hundreds of even thousands of users.

Understanding the principles of Information System Management in the complex centralized environment should allow an individual to apply these same principles selectively to smaller systems. For this reason it will concentrate on managing large system. Of course, where appropriate we will discuss issues involved in managing department and personal systems.

While most managers will have some responsibility for computer technology, the manager of the centralized computer system will have the most responsibility for the proper management of computer facilities. The manager of Information Systems (or vice-president of Information System or manager of data processing or whatever the chief of computer technology is titled) must not only administer the resources under the control of the Information Systems area, but must also provide leadership, advice, and direction to others involved in managing computer resources. These factors make the position of manager of Information Systems of strategic importance.

The manager of Information Systems is a challenging position with a substantial amount of responsibility. The dynamic nature of computer technology and complexity of most Information Systems makes the manager's job quite demanding. The manager must deal with all forms of users ranging from the sophisticated technically oriented user to the casual native user. In addition, the manager must supervise and plan computer operations and development involving large investments of the firm's capital and extremely complex technology. These activities demand that the manager possess a wide range of job skills including a sound business background, a technical computer background, managerial competence, and a good does of ordinary common sense.

2.4 The Systems Development Life Cycle

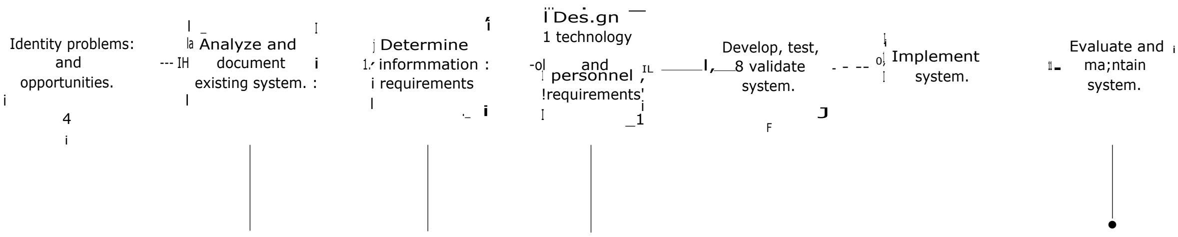

Figure 2.3 Systems development life cycle overview

The figure above provides a basic model of the steps involved in the systems development. The steps in the cycle are not completely discrete, one-time processes. Rather, the systems development cycle is iterative and evolutionary. They do, however, retain a basic sequential flow from the point of origin to "identify new problem and opportunities." Each step represents a major checkpoint, or milestone, and has identifiable deliverables that symbolize completion. At any step in the cycle, previously unidentified problems and/or opportunities may be discovered. In such cases, it is important to ensure proper integration of a solution to the new problem and/or new opportunity.

Making even a minor change to a system without proper consideration of what has been previously established can cause unanticipated and undesirable rippling effects. These effects can seriously damage the operation of the system. Therefore, as the figure above shows, all steps of the systems development cycle allow return to the point of origin at any time. This feature causes the life cycle to exhibit a "spiraling" or "whirlpool" characteristic rather than a purely sequential or "waterfall" characteristic.

The "waterfall" model as the figure below, the traditional life cycle model, has come under increasing criticism for being too inflexible to respond to today's changing business climate. With its natural movement "downward" it implies that returning " upward" to previous steps is unnatural, undesirable, and to be avoided. The rapid pace of business change, however, suggests a model that facilitates if not encourages revisiting previous steps to ensure system viability and reduce subsequent changes downstream.

The time required to complete the cycle for a given problem or opportunity may range from a few hours to many years, depending on the complexity of the task.

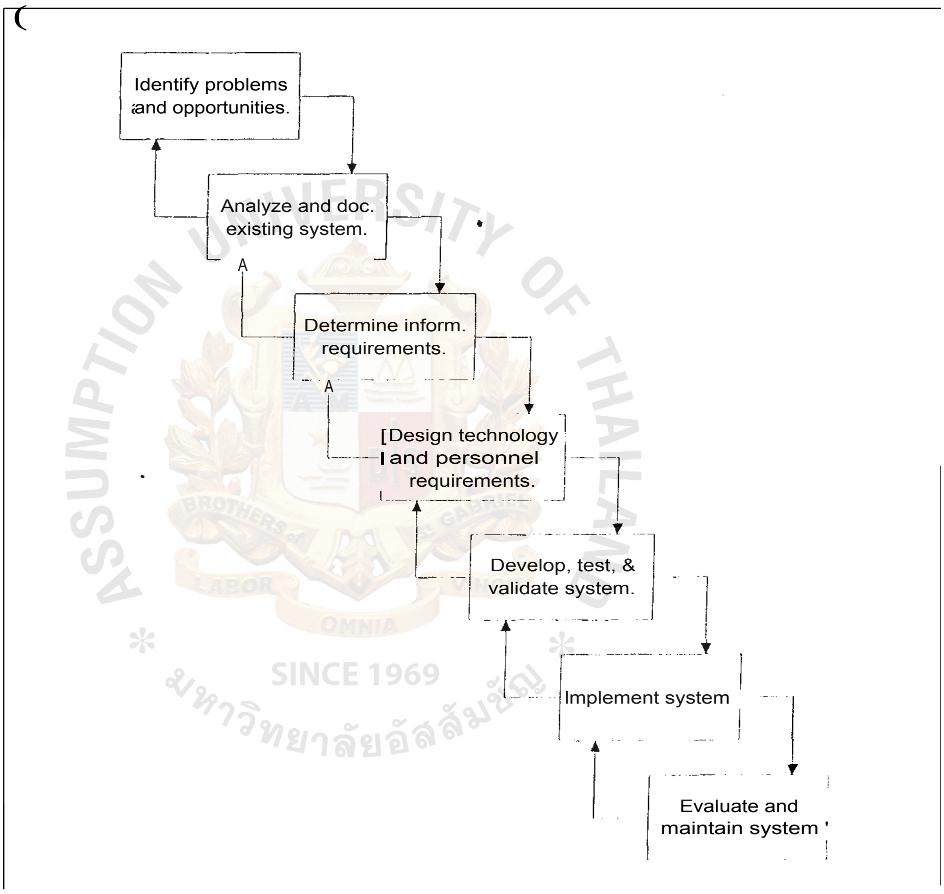

Figure 2.4 Waterfall system development life cycle model

STEP 1: Identify Problems and Opportunities

In the first step we start with recognizing problems and opportunities. But before a problem or an opportunity can be analyzed, it must clearly be identified and defined. We will explore first, therefore, concepts pertinent to identifying and defining problems and opportunities. Following the conceptual issues, we will discuss how to define problems, conduct feasibility studies, and form a project team.

Concepts

Reaction and opportunistic surveillance. Managers can take one of two basic approaches to surveillance that are relevant to defining problems and opportunities. These two approaches are called reaction and opportunistic surveillance.

> Reaction surveillance involves addressing problems as they arise — a management by exception approach. It is the easiest and most commonly employed technique. For example, if customers begin to complain about the tardiness of order processing, management might react by attempting to resolve the problem. Otherwise, management "leaves well enough alone." In other words, "If it ain't broke, don't fix it."
>
> Opportunistic surveillance continually seeks opportunities that might be beneficial to the organization. Rather than leaving well enough alone, management seeks continual improvement. This is a much more aggressive posture, and it can pay considerable dividends. For example, management may see an opportunity to gain more customers by implementing a new order-processing system that will provide customer deliveries in a way that is superior to that of competitors. Here it might be said, "If it ain't broke, there's still time to 'fix' it."

Object system and information system. The distinction between an object system and an information system is sometimes subtle but nevertheless important. An object system is the physical process of achieving one or more organizational goals. Examples of object systems include manufacturing products and selling merchandise. An infoimation system is a physical process that supports an object system in achieving organizational goals. An information system may run parallel to the object system in order to provide both documentation and information for decision making pertinent to the management and operation of the object system. In some instances (for example, with military command and control systems and industrial design systems), the object system is merged with the information system. In a manufacturing plant, work orders may be used to document the work flow and production schedules may be used to plan the work flow. In a retail store, sales can be documented by being entered into cash registers or retail terminals, and sales information is used for merchandising decisions.

A helpful and important way to differentiate between object systems and information systems is to keep in mind that without an object system there is no need for an information system. The purpose of an information system is to facilitate the operation of an object system. Indeed, the cost of operating an information system should be offset by the benefits realized when the object system is more efficiently and effectively managed.

Frameworks for studying problems and opportunities. There is a tendency simply to automate old processes rather than to be truly innovative and come up with creative applications of technology. Three high-level, strategic frameworks for recognizing problems and opportunities — competitive strategy, customer resource life cycle (CRLC), and future perfect. These are powerful tools that should be used by the project team to explore innovative opportunities in the use of technology. In other words, they are not just useful for strategic planning; they should be reused for more detailed analysis during the actual systems development process. A day or two of brainstorming within these frameworks can flesh out a strategic idea into an operational concept.

Defining problems and opportunities

Usually, it is not difficult to identify broad problem areas or possible opportunities. Generally, it is more difficult to define, with specificity, the different dimensions or various cause-and-effect relationships that are creating problems or preventing opportunities. For instance, customer demand for faster delivery of orders may be identified as a problem. On the surface, this may appear to be a performance problem related to response time. However, there are many potential causes of the problem.

1. Salespersons fail to turn in customer orders promptly.
2. The order processing department is managed incompetently.
3. Data entry operators give too low a priority to the orders (e.g., they may give higher priority to payroll transactions).
4. The order processing department has a morale problem.
5. There is an insufficient number of data entry operators.
6. Computer programs that process orders have several "bugs" in them, resulting in some orders being processed incorrectly.
7. Computer capacity is sufficient to handle the workload.
8. Information on inventory fluctuations is not timely enough to prevent frequent stock-outs due to poor routing.
9. The inventory manager is not aware of late deliveries because this information is not reported.
10. The credit department does not review customer credit checks until just before orders are to be shipped. Therefore, an order has to be held if any credit questions arise.

Which of these items cause the problem? The preceding list suggests that to ascertain the cause of a problem fully (or the prevention of an opportunity) requires a thorough understanding of both the object system and the information system.

Causality. The actual cause of a problem can be quite elusive. An inexperienced manager often confuses symptoms with problems. Just because something precedes something else chronologically does not mean that the former caused the latter. For example, a crowing rooster precedes a sunrise, but the rooster does not cause the sun to rise.

Similarly, in addressing information systems symptoms, great care has to be taken to identify the real cause of the problem. For example, when a new infolination system is implemented within an organization, a number of problems may occur and the organization may incorrectly conclude that the information system caused the problems. It may well be, however, that the information system merely revealed problems (like a crowing rooster signals the sunrise) of which the organization was previously unaware.

Magnitude of problems or opportunities. Problems and opportunities vary in complexity. In many cases, concerns can be addressed with minimal difficulty and time. This usually occurs when the existing system is well understood and problems are rather glaring. Consequently, the appropriate solution is apparent. For example, if the cause is late processing of customer orders due to new salespersons failing to turn in orders promptly, then the problem could be easy to resolve. Management may simply write a memo to the sales manager, explaining the importance of turning in orders promptly and requesting that appropriate action be taken.

More complex problems and opportunities, however, require more comprehensive analysis. For example, if an information system is not providing necessary information or the technology used in an information system is obsolete, problem resolution requires considerably more effort. In such cases, problem resolution or opportunity achievement requires a major overhaul of an existing system or the development of a new one. Major changes, however, may not always be feasible with available organizational resources.

Feasibility Studies

When complex problems and opportunities are to be defined, it is generally desirable to conduct a preliminary investigation called a feasibility study. It provides an overview of the problem and generally assesses whether feasible solutions exist — prior to committing substantial resources. During a feasibility study, the project team works with representatives from the departments expected to benefit from the solution. The primary objective of the study is to assess three types of feasibility.

I. Technical. Can a solution be supported with existing technology?

2. Economic. Is existing technology cost effective (i.e., will the costs be offset by the benefits)?

3. Operational. Will the solution work within the organization if implemented?

By intent, the feasibility study is a very rough analysis of the viability of a project. It is also an important checkpoint that should be completed before committing more resources. The feasibility study answers a basic question: is it realistic to address the problem or opportunity under consideration'?

The final product of a successful feasibility study is a project proposal for management. The contents of this report may include, but are not restricted to, the following items.

1. Project name.
2. Problem or opportunity definition.
3. Project description.
4. Expected benefits.
5. Consequences of rejection.
6. Resource requirements.
7. Alternatives.

S. Other considerations.

9. Request for authorization. a

Justifying systems. A key part of getting a proposal accepted is justifying it to management. With all of the publicity surrounding the use of information technology for opportunistic or competitive-advantage applications, most information systems professionals are experiencing a combination of excitement and paranoia as they contemplate how to respond. Now that the pressure is on, how exactly should they go about promoting competitive-advantage information systems to top management.

One obstacle is that some systems analysts are shackled by early-1970s thinking, believing that all computing applications have to be cost justified. Cost justification involves demonstrating that savings or revenue generated by a new system more than offsets the cost of developing it. Common methods of cost justification include return on investment (ROI) and break-even analysis. ROI is the percentage return computed by ROI = net return ÷ investment. Break-even analysis is concerned with the point in time at which revenue or savings from investment equals start-up cost. In other words, break-even analysis indicates when the original investment is recouped by additional revenue.

Unfortunately, as precise as the formula's for computing break-even analysis and ROE are, considerable judgment is required to come up with these numbers - especially benefit numbers — which always makes the analysis somewhat suspect. For example, we generally feel that getting an education is cost justified. But generating the actual costs (including the income foregone while attending school) and benefits (including intangibles such as greater meaning to life) are extremely hard to quantify.

Cost justification of information systems became popular in the late 1960s, when many companies were severely disappointed (and rightly so) with their investments in computer systems. Hard-nosed cost justification was employed to put the brakes on runaway information technology budgets; unfortunately, it also created an infertile environment for future innovation. Enhancements to the way a company operates, such as using systems for competitive advantage, are brought on by entrepreneurial, imaginative thinking that should not be dominated by premature preoccupation with exact cost and benefit justification.

With cost justification clearly lacking as a singular, effective way to promote competitive-advantage applications, it is necessary to develop a framework for successfully promoting such applications. One approach involves a three-phase program that can be likened to a political campaign.

1. Selecting the candidate. During this stage, a good idea must be developed and thoroughly refined. One approach is to conduct a retreat where users and systems designers go off together for a weekend or so to address the subject without distraction. At such a retreat, it might help to include some customers, and a facilitator who will make sure the focus remains on the competitive-advantage issues.

   If one or more visionary concepts come out of such a session, the battle is half over. If the concepts can be readily cost justified as well, so much the better; but remember that this aspect should not be the only criterion. The concepts selected for further development should be expressed in a crisp, succinct phrase, almost like a campaign slogan. For example, "We are going to be the first car rental company to sell our used cars through an on-line order entry system — instead of just advertising them in the newspaper."

2. Establishing support. Management backing and grassroots support are established during this stage. As in a political campaign, differences in opinion on strategic and logistical specifics should be worked out in small groups "behind closed doors" rather than in public. Adjustments, even significant compromises, may be required to gain the constituency necessary for the concept's acceptance.

3. Inaugurating the winner. The final stage of promoting competitive applications involves the formal presentation with all appropriate fanfare. Ideally, an initial prototype of the system should be available to demonstrate. By now, it should be said, the system has been informally "wired" for acceptance. Now the time is finally at hand for actual systems development and implementation to begin.

The project team

If the project proposal is approved, management generally organizes a project team and assigns project responsibility to it. The specific personnel or type of personnel to be included on the project team should be defined under a resource requirements section of the project proposal.

Careful organization of a project team is a prerequisite to good systems analysis. Different types of expertise are required to consider all system variables thoroughly; a system analyst provides primarily computer technology-oriented skills, and representatives from various departments affected by the information system provide the dimensions of their needs and requirements. Project team participants should be given sufficient release time from their normal duties to contribute the necessary level of participation to the project. However, release time should be provided only for the duration of the project; upon project completion, the participants should return to their normal duties.

An interesting debate about project teams pertains to who should be the project leader. Some managers contend that systems analyst should provide the leadership, while others say that this role is better filled by a management-level representative from the departments that will use the system. Projects tend to be completed faster when a systems analyst is in charge, but users are generally more committed to, and more satisfied with, the results of projects when they are directly responsible. When a systems analyst is in charge, users have a tendency to give her too much latitude in designing the system (often because users do not understand much of the technology) and then decide whether or not they like the system after it is completed. Unfortunately, the systems analyst may design a system that works but that is not the right system; it does not adequately satisfy the users' information requirements.

STEP 2: Analyze and Document Existing Information Systems

System analysis is the process of separating a whole into its parts to allow examination of the parts; this leads to an understanding of their nature, function, and interrelationships. Considerable effort is required to conduct the analysis of an information system. This section discusses how to gather the information necessary for analysis — reviewing the object system, defining the decision making associated with the object system, isolating the deficiencies of the object system, and documenting the analysis.

Information-gathering Activities for Systems Analysis

The four basic activities used to gather information about an object system and its information system are listed in table and discussed in more depth next.

Table 2.4 Information Gathering Activities

Activity	Explanation
Documentation review	This consists of reviewing recorded specifications that describe the objectives, procedures, reports produced, equipment used, and so on, in an information system.
Observation	This consists of watching the object system and/or the information system in process to note and record facts and events about their operations.
Interviews	This consists of meeting with individuals or groups to ask questions about their roles in and their use of an information system.

Table 2.4 Information Gathering Activities (continue)

Activity	Explanation
Questionnaires	This consists of submitting questions in printed form to individuals to gather information on their roles in and use of an information system.

Documentation and observation. A review of available documentation is a logical starting point when seeking insight into a system. The documentation review allows project team members involved in systems analysis to attain some knowledge of a system before they impose upon other people's time. Unfortunately, documentation seldom completely describes a system, and often it is not up to date. The current operation of the system may differ significantly from how it is described. Therefore, after a review of available documentation, the next logical step is to observe the operation of the system (unless one does not yet exist). Observation provides a more tangible perspective on what is described in the documentation. It also brings to light aspects of the documentation that are incomplete or outdated.

Interviews and questionnaires. After a review of available documentation, those involved in systems analysis can then use interviews or questionnaires to gather additional information. Interviewing techniques and questionnaire design are topics for extensive study. However, a few key concepts should be noted here.

Interviews are generally preferable to questionnaires for information gathering because they allow direct interaction, through questioning, and unlimited discussion. Salient issues can be immediately identified (sometimes through "body language") for further questioning. In an interview, not all questions have to be determined *in* advance (as they do in a questionnaire). However, when information from a large number of people has to be gathered and tabulated, questionnaires are usually preferable for reasons of efficiency.

Two basic formats for questioning are categorized as open-ended and closed-ended. The difference between the two types of questioning is similar to the difference between essay and multiple-choice exams. Open-ended questions allow latitude to the persons responding. Consequently, information gathered from open-ended questions may be creative and rich in content. Examples of open-ended questions are the following.

1. Are there areas of dissatisfaction with the existing information system? If so, what are these areas?
2. Do you have suggestions for improvements if a new system is designed? If so, what are your suggestions?

Structured interviews, with closed-ended questions, are more restrictive in the latitude allowed to a respondent. The respondent must select an answer from available choices. The major advantage of closed-ended questions is that responses are easily quantified for tabulation, which greatly expedites analysis. The most common application of closed-ended questioning involves scaling techniques. Responses are categorized on a scale between two extremes.

Techniques of documentation, observation, interviews, and questionnaires are used in varying degrees during the following steps of analyzing the existing system.

1. Review the object system.
2. Define decision making associated with the object system.
3. Isolate deficiencies in the information system.
4. Document and analyze existing information systems.

Review object system

During this step, project team members have the opportunity to develop a working knowledge of the physical processes associated with the object system under consideration. A clear understanding of the purpose of the object system and of the means used to achieve it should be developed. The project team should develop a thorough understanding of the players and the roles they play. The project team should also make a special effort to become familiar with the vocabulary associated with the object system, minimizing communication problems as the systems analysis progresses.

Some type of procedures manual describing the operation of the object system is usually available. A copy of this manual should be requested from the managers who are responsible for the object system. After the manual has been reviewed, arrange a tour that allows initial observation of the object system in operation. Interviews and, if necessary, questionnaires can be used to complete the review.

Define decision making associated with object system

After acquiring an operating knowledge of the object system, the next logical step is to define the decision making associated with managing the object system. A definition of the decision-making system (also known as the decision system) provides the framework for determining what information is required. This is one of the most neglected aspects of systems analysis. Since the utility of information is its ability to improve decision making, such negligence is somewhat surprising.

Managers are frequently asked what information they would like to have, or they are offered copies of reports that are currently being produced or will be produced for other managers. This approach tends to encourage managers to ask for more information than they need. Research in the area of decision making and the use of information indicates the following.

1. Decision makers tend to ask for and feel most comfortable with more detailed information than they really need. Moreover, they appear to make better decisions with summarized information and exception reporting.
2. The less knowledgeable decision makers are about the decisions required to manage a process properly, the more information they tend to request

(presumably, hoping to find something of value). However, much of the information they request is irrelevant to their decision making.

By basing information requests on the decisions they have to make, managers can be more discriminating in their requests. This reduces the tendency of managers to demand more data than they need. Such overloads are both dysfunctional and expensive.

Difficulty in defining decision system. Defining the decision system is a desirable step of systems analysis, and it is not a trivial one. Considerable discipline and effort on the part of managers may be required to define such a system. Managers often make decisions so routinely that it seldom occurs to them how often they make decisions and what types of decisions they make. Consequently, they are understandably tempted to take a "shotgun" approach to defining their information requirements, rather than a more time-consuming but more specific "rifle" approach.

Decision centers. Decisions made in an organization tend to be clustered into decision centers. A decision center generally consists of a decision maker, decision procedures, and the activities for which decisions must be made. Accordingly, decisions made in a decision center tend to pertain to the management of a particular organizational process.

Viewing the organization in terms of decision centers is particularly useful in systems analysis. Decision centers are potential areas where organizational processes may be improved by the provision of more relevant, timely, accurate information. In organizational terms, a decision center combined with an activity center constitutes a functional unit or department.

Another advantage of defining decision centers and major decisions is that the overall profile of decision making and decision-making location often reveals discrepancies. For example, if sales persons are under the impression that they can commit inventory, but they really cannot, this discrepancy should be cleared up. Otherwise, inventory may be promised to the wrong customers.

If the same decision is being made by two or more decision centers, this, too, should be resolved. Consider, for instance, a situation where all orders must be approved for credit by the credit department before they are sent to the order processing department. However the order processing department is unaware of this procedure so a second credit check is made, using an exact copy of the credit rating report used by the credit department. Such duplication of effort is not uncommon in organizations. It may go on, unnoticed, until identified by someone aware of what both departments are doing. Requiring that information received by a department be justified for decision making should expose discrepancies and duplications.

Isolating deficiencies in existing information system

After defining the decision making associated with managing the object system, the next step is to isolate the deficiencies in the existing information system. This sets the stage for reengineering the process. After the object system has been thoroughly studied through documentation, interview, or questionnaires, it may appear that defining deficiencies is simply a matter of logically subtracting the decision making information needed from the object system information provided. But, as pointed out previously, identifying true problems and causes is not always linear and/or easy to do; correctly isolating information deficiencies demands both objectivity and persistence.

Information systems development analysts must always bear in mind the inescapable reality of change. An object system is most likely being upgraded or improved even as the analyst is interviewing personnel and reviewing the object system. Similarly, organizational decision-making requirements are constantly undergoing change as the world around the organization (and personnel) changes. Therefore, a simple, linear subtraction of "what we want" from "what we've got" is often hindered because two changing, moving entities are being considered. In this case, the best route may be to establish some common point in the future upon which to extrapolate (not without risk) "what will be needed" and "what will be there" — in order to identify the projected deficiencies the new information system will address.

Documenting existing systems

Once the information required from the new system is defined, the next step is to document thoroughly the existing system and the analysis to date—the fourth phase of step two in the overall development life cycle.

Some form of documentation of the existing information system is generally available, and this is the logical starting point for analysis. Narrative documentation is usually to vague and imprecise to ensure that project personnel will accurately understand the system. Therefore, graphical documentation is preferred. To illustrate, when receiving complex directions to a geographic location, do you generally prefer verbal directions or a map? The most useful forms of documentation for reviewing an information system are data flow diagrams, flowcharts, and presentation graphics using icons — all of which are structured techniques.

STEP 3:Determine Information Requirements

Determining information requirements, the third step in the system development life cycle, is a critical stage because it concerns whether or not the "right" system is to be developed. Subsequent stages of systems development are concerned with making the system "work right." If the "wrong" system is defined during requirements determination, subsequent efforts are in vain. The system will not be fully utilized, or it will require expensive, time-consuming modification after installation.

There are four general problems in determining information requirements: single-function system, information ignorance, individual interviews, and unstructured interviews. These problems and their solutions will be discussed, along with actual cases highlighting solution techniques.

Single-function systems. The first mistake that has historically been made in determining information requirements for information systems is that most systems are viewed as being unifunctional as opposed to cross- or multifunctional. This single-function system perspective is far too narrow for most organizations and can create dysfunctional "islands" of systems and information. For example, when developing a new budgeting system, it is easy to focus on what information is needed by the budget managers or budgeting staff members. The problem is that people other than the budgeting staff also use budgeting information. Unfortunately, if the budget department is designing the system, it will likely carry a very strong control orientation as opposed to a general management reporting orientation. This result in budgeting systems that end up being used much like a banking statement simply to reconcile finances. Similarly, many department managers keep their departmental budgets on a departmental computer and simply reconcile them with the "control" statement they receive from the budget department. Due to this phenomenon, up to 60 percent of the data entered into company computers are keyed from reports generated from other computers in the same organization.

Another way to illustrate the need to develop systems cross-functionally is to consider a business process such as order processing. To process orders, salespeople have to decide which customers to call on, what to sell them, and what is available to sell. Credit personnel must decide which customers can have credit and how much, which customers need past-due notices, and which customers' credit should be discontinued. The warehouse must decide what and how much inventory to stock, when to reorder, when to unload slow moving inventory, and to which customers to allocate limited inventory. Shipping must decide such things as what merchandise to send to which customers, what orders can be shipped together to save delivery costs, and when trucks should depart. In developing a new system, information should be provided so that all decisions can be supported.

In trying to improve the quality of the decision, factors such as the following should be considered.

- How important is each customer to the business?
- How promptly does each customer need delivery of the order?
- What is the profitability of each order?
- What is the credit status of each customer?
- What is the shipping schedule for delivery to each customer?

Has the customer recently been upset because a previous order was late?

Note that the information needed to improve decision making in the ordering department comes from outside the department. For example, customer need, importance, and profitability would come from sales, credit worthiness would come from credit, and the shipping schedule would come from shipping.

This is a very important concept of information management: most of the information needed to improve decision making within a function will come from outside the function. This is why it is so important for an organization to share information if it wants to improve productivity and design information systems that are multifunctional. When an organization learns to share information cross-functionally, employees are empowered to make better and more productive decisions for the organization. The bottom line is that in order to develop a new information system, it is necessary to be aware of all functions that are touched by the information system and be sensitive to their decision-making requirements. Then, a system can be developed that allows information to flow cross-functionally to improve decision making.

As straightforward as the concept of cross-functional systems is, many system analysts attempting to develop them complain that employees are very proprietary about "their" functional information and are often unwilling to participate in a system that will "share" information. Recognizing that information is power, employees are not always interested in sharing power — an attitude that is totally dysfunctional. Since information is power, the idea is to empower decision makers by giving them the best information possible. An organization that does not share information cross-functionally ends up with the left hand not knowing what the right hand is doing.

To solve the problem, top management needs to use its leadership and influence to achieve cross-functional design. When a new system design is being undertaken, those functions that are transcended by the new system must have management participation.

Information ignorance. How do many system analysts go about determining what information managers want from their computer system? Unfortunately, they sometimes simply ask, "What information do you want from the new system?"

A second problem in determining information requirements has to do with the fact that most managers do not know what information they need and end up asking for too much. They give it their best attempt, assuming brilliant computer wizards will sort things out for them. Several months and millions of dollars later, however, when the system is delivered, managers quickly discover that it does not give them the information they need and does give too much of what they don't need. Managers then ask for changes, and the system analyst goes into shock. The costs and time needed to change a system after it is complete are 50 to 100 times higher than making those same changes during the systems design phase. For a custom-built house, for example consider the cost of adding a bathroom after the house is complete versus the cost of adding a bathroom during the blueprint or design stage. This is one reason why so many needed information system revisions are never implemented, and why, consequently, resulting systems are often a disappointment. A disappointing system can range from a system that only partially fulfills management's requirements (with or without expensive revisions) to one that is totally abandoned, resulting in a million dollar write-off.

Having been victims of management's inability to define information requirements properly, many systems analysts go to Plan B — the "user sign-off." This approach involves asking managers what information they want from a system and then requiring them to sign a document aimed at contractually obligating them to accept the system when they get it. User sign-offs have only marginal political value when systems analysts are battling with management about system revisions, and they do not solve the functional problem that managers do not know what information they need. A user sign-off is a powerless piece of paper when matched against the fury of top management. _ .

Plan C, sometimes used by systems analysts, is to use the "catalog" approach to information requirements determination. This approach involves showing a manager a wide variety of reports, perhaps requested by other managers or available from a commercial software package. As the manager reviews these reports, he or she select the ones believed to be needed. This may seem like a good idea, but it does not work; managers tend to think that all reports will be useful.

Individual interviews. A third mistake commonly made in determining infoi requirements occurs when the system design team interviews managers individually rather than in groups, also know as joint application design (JAD). The individual interviewing process places cognitive stress on a manager, stress that hinders his ability to respond adequately to questions.

Consider this scenario: a group of strangers come to you and ask you to tell 10 jokes. Even though you probably know 10 jokes, you might have difficulty recalling them, as most people would. But what if a group of you and your friends are asked together to generate jokes? Very likely you and your friends could generate 80,90, or even 100 jokes. In other words, each person really knows a great deal of jokes, but when asked to come up with them off the top of his head, he would likely have difficulty recalling them. The moral is that group or collective experiences and memory are essential in recalling information. When managers are asked what information they need, they generally mention things they needed recently, not everything they need. Therefore, one reason that the requirements determination should be done as a group or in a joint process is so that the memory of each manager can be pooled to do a more job of recalling key requirements.

A second reason for a joint application design is that, when it comes to developing a new information system, different functional areas of an organization have different agendas. For example, consider the order processing system, each decision center would likely emphasize different design criteria. Sales may view the primary importance of order processing as ensuring prompt and correct delivery of orders to customers. If we were to think of purpose of order processing from a group perspective, we would likely end p with design criteria that would focus on improving prompt, correct delivery of orders to customers while ensuring credit integrity and facilitating good inventory management, good routing and scheduling of shipments, and so on.

Unstructured interviews. A fourth problem determining information requirements is that designers usually ask the wrong question: "What information do you need from the new system?" Though this is the obvious question, it is not at all helpful to managers who don't know what they need. Many systems analysts assume managers know what they need, while many executives assume systems analysts know what executives need. The problem is that this unstructured interview technique is akin to a psychoanalyst talking to a patient lying on a couch and asking, "What type of therapy do you need?" Or a salesperson being an order taker (rather than a problem solver) who asks, "What features do you want?" If patients or customers don't know how to look out for themselves, they are unlikely to get satisfactory solutions.

Information Requirements interview techniques

Straightforward, useful approaches to determining information requirements have *been* developed through research. Three of such techniques, summarized in the table below are business systems planning (BSP), critical success factors (CSF), and ends/means (E/M) analysis. These techniques were discussed as information requirement gathering techniques. By combining these three different methodologies, a comprehensive, reliable determination of conceptual information requirements can be achieved.

Table 2.5 Comprehensive Interview Approaches

Approach	Information system implementation
Specify problems and decisions.	The executive interview portion of business systems planning (BSP).
Specify critical factors.	Critical success factors (CSF).
Specify effectiveness criteria for outputs and efficiency criteria for processes used to generate outputs.	Ends/means analysis (E/M analysis).

A basic model for determining information requirements using these approaches is portrayed in the figure. The key is to focus on issues that "back into" information requirements. Specific questions asked under each approach will be discussed as the summary of structured interview sample questions table below.

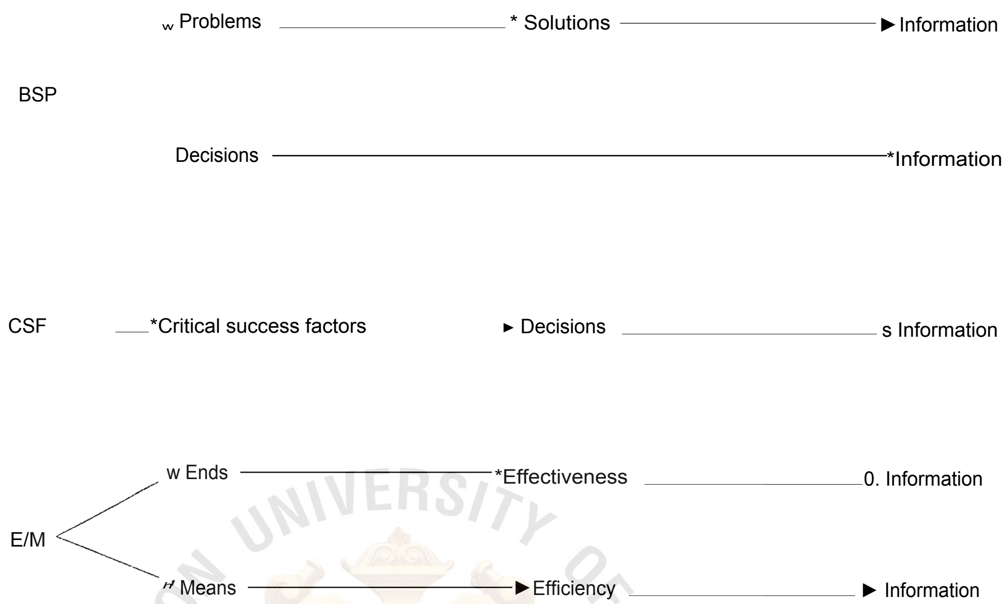

Figure 2.5 Framework for information requirements interviews

Table 2.6 Summary of Structured Interview Sample Questions

Method	Sample interview questions
Business system planning (BSP)	What are the major problems encountered in accomplishing the purposes of the organizational unit you manage? What are good solutions to those problems? How can information play a role in any of those solutions? What are the major decisions associated with your management responsibilities? What improvements in information could result in better decisions?
Critical success factors (CSF)	What are the critical success factors of the organizational unit you manage? What actions or decisions are key to achieving these CSFs?

Table 2.6 Summary of Structured Interview Sample Questions (continue)

Method	Sample interview questions
	What information is needed to ensure that critical success factors are under control? How do you measure the specific CSFs?
Ends/means (E/M) analysis	What is the good or service provided by the business process? What makes these goods or services valuable to recipients or customers? What information is needed to evaluate this value? What are the key means or processes used to generate or provide goods or services? What constitutes efficiency in providing these *goods* or services? What information is needed to evaluate this efficiency?

Define information categories and map interviews in to them

Results of interviews need to be converted into information categories. The process of defining information categories from the cross-functional, joint application design interviews is a straightforward process based on entity/attribute analysis. Entities are defined as persons, places, or things about which information is stored. Attributes are the characteristics of these entities.

Customer address is an attribute of customers. We determine entities and attributes by evaluating the information compiled from BSP, CSF, and E/M analysis.

STEP 4:Design Technology and Personnel Requirements

Information structuring during information system design is the main focus of this section. Infoimation systems structure refers to the structure of information in the databases (e.g., logical data structure, data elements, input definitions), the process structure (e.g., business rules, logic definitions, algorithms, computation rules), the presentation mode (e.g., text, graphical, animation, sound, video),--the presentation style (e.g., menus, windows, interactive, real time, configurable, natural language), and the output requirements (e.g., the context and meaning of the infoimation as presented to the user). For most information system users, structuring the information has the greatest impact on system utility and their jobs..

When structuring information for an information system, a systems designer may not know what specific hardware and software will be best suited to support the system. The degree of uncertainty about the hardware and software platform depends on a number of factors including the scope of the system, the radicalness of the design, and the degree of divergence from the established information technology architecture.

The degree of stability in the technological platform also influences the types of development tools that can be used. Increasingly, development tools are tied to a particular architecture of the technology platform. Thus, if a new technological platform is required, the development team and project management must factor in time for searching, selecting, and learning new tools. The bottom line is that tools and technologies are related — and decisions about development tools and about technologies are more and more interdependent.

System design techniques and technologies

In general, system design techniques should be as independent of hardware and software as possible, allowing systems specifications to be implemented using whatever hardware and software turns out to be most cost-effective in supporting the information structure. To the degree that design tools and techniques are hardware and software independent, the developer and the business can be less mindful of the interdependencies between the design specification and the ultimate hardware-software environment in which the information system will operate. Moreover, the systems analyst in then less constrained by concerns over types of development tools and can more fully concentrate on developing a design that best satisfies the client's requirements and has the highest fidelity in delivering business results.

A number of sophisticated techniques and technologies are covered. Though organizations may have system design procedures and computer-aided software engineering (CASE) technologies, differ from the procedures presented will generally be cosmetic rather than conceptual in nature.

Before tackling the several sophisticated techniques and technologies, it is helpful to have an understanding of the outcomes or deliverables from the systems design phase of the systems development life cycle. System design should generate the following deliverables.

1. Input definitions describe input documents and input screens.
2. Output definitions describe the printed reports or terminal displays provided by the system. Outputs can be categorized as formal and predefined or informal and ad hoc; the latter requires good anticipation of requirements through the data modeling techniques.
3. Logical data structures use data modeling to define the various entities, attributes, and relationships within the database designed to support the information system.
4. Data dictionaries define all the data elements that are inputted, computed, stored, and reported in the information system. This includes the source of each data element, validation logic, processing or computation logic, where each data element is used, and where it is stored.

5. Logic definitions graphically define complex processing rules necessary for input, computation, processing, and data storage. Techniques include decision tables and decision trees.

6. System presentation graphics portray, in a macro sense, how the overall system is put together. These graphics illustrate information flow, reporting, files, and so forth.

The various design specifications (with the exception of presentation graphics) are linked together as illustrated in the figure such that the input, computation, logical processing, storage, and reporting *of* each item of information can be traced forward or backward from its point of origin to its final use. As shown in the figure, the data dictionary is the core of design specifications. On completion, the specifications should provide sufficient documentation to guide the generation of software required to operate the system.

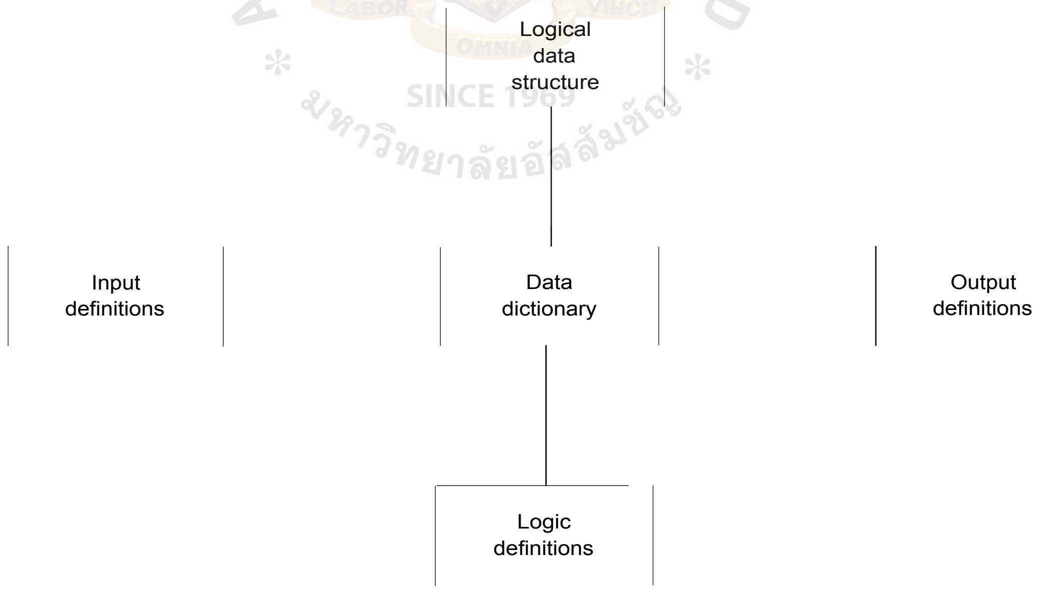

Figure 2.6 System design specifications

The outputs of any system deteimine the inputs and processes necessary to support the system. Once the output requirements are determined, the system designer can determine what to include in the system and how to structure it so that outputs can be provided. The process of translating output requirements to determine information inclusion and structure is a two-phase process consisting of a conceptual or logical phase and a detailed phase.

STEP 5: Develop, Test, and Validate the New System

Once system design and design documentation are complete, systems development can proceed. Systems development refers to structuring hardware and software to achieve affective and efficient processing of an information system. Since hardware is increasingly available for off-the-shelf acquisition and interconnection, development most often encompasses the structuring or programming of application software that will "command" the hardware. Off-the-self software applications are becoming increasingly available that need relatively minor adjustments or configuring to fulfill most, if not all, of the documented information systems requirements. The following discussion, however, assumes that application software (and not individual pieces of hardware) must be created and tested.

Assembling an information system is a major step in the overall systems development process because something tangible must be built tbr developers, users, and corporate sponsors. Up to the point of actually constructing software and hardware, products of labor have been mostly mental — conceptual models and specifications documented in data files, diagrams, and text. System construction, unfortunately, can be too important an event. When the demand for a system is especially great, it can be very tempting — in spite of enormous risks — simply to skip SDLC steps 1-4 and start constructing something in step 5. Users can be clamoring for computer-based solutions, management can be chafing at the pace and cost of analysis and design, and developers can be overly eager to apply new technology (and perhaps justify their corporate existence). Like houses and office buildings, hOwever, information systems that are well designed before major construction begins are much more likely to be delivered on time, within budget, and useful.

On the other hand, as we saw in the discussion of prototyping and heuristic design, it is usually beneficial to_do some constniction_and testing in order to refine requirements determination and design. Therein lies the difference between "traditional" development and emerging development approaches.

The basic premise underlying traditional development approaches is that a system should be thoroughly and exactly specified — through a combination of narratives, diagrams, and formal specification languages — prior to software coding. Traditional development approaches evolved from an era of mainframe technology where computers were accessible only to professionals. Since coding with programming languages was time-and labor-intensive, significant effort was spent creating detailed specifications to ensure that coders had unambiguous and complete requirements from which they could code the business logic and necessary algorithms. Many development organizations and development professionals are now rethinking the traditional development model in view of new technologies, growing user computer literacy, and new organizational demands for faster, more productive, and cheaper development practices.

Newer development approaches are usually based on an Information Technology environment that is layered and that supports cooperative processing — taking advantage of increasing, levels of computer power and distributed databases. In contrast to the traditional approach, the emerging development approaches emphasize development speed, inherent self-documentation, high-level programming languages, reusable software components, and an "open" (or common, standardized) systems orientation for compatibility in multivendor environments. Quality and control over the project process and outcomes are created through an emphasis on excellence in executing selected development techniques. These are combined with organizational structures that emphasize small empowered teams that are accountable for organizational or business outcomes, rather than simply system outcomes.

Emerging tool sets for constructing information systems

As usual, good tools always help, especially with prototyping and the incremental evolution of the prototype into a production system. Under this approach, the end user and the organizational sponsor of a system are literally involved in physically prototyping and developing a system. Emerging development tools can be classified into three types:

1. Integrated CASE tools support prototyping and reusable systems components, including component repositories and automatic computer code generation. The latest I-CASE tools are actually hybrids that blend traditional development approaches, however, they are often less flexible in supporting rapid prototyping when compared to loosely-coupled tool sets and object-oriented development environments.
2. Loosely-coupled tool sets represent one of the fastest growing and most popular of the new approaches to development tools. Loosely-coupled tool sets are independent tools, developed by different tool vendors, to support one or more information systems architecture layers. Under this scenario, a developer benefits from the best tools for each layer and then assembles and develops components for each layer that are subsequently "hooked" together to produce an operational prototyping is well supported, and development proceeds rapidly with significant client interaction using a prototype to test viability.
3. The object-oriented development paradigm is a significant departure from the past and a tool approach that significantly changes the way development is accomplished. First, object-oriented development is much more than a

programming language or a tool set — it is a perspective or paradigm, a new view of the application domain. Second, successful object-oriented development efforts use an object-oriented development environment that includes an object-oriented programming language (e.g., Smalltalk), a layered object architecture, an object class library that includes a collection of object classes for each layer of the architecture, search tools (e.g., browsers), debuggers, operating system interfaces, and interfaces to other languages and systems.

Testing — a critical stage

During program development, computer program modules are steadily tested by the coder as part of the writing process — sometimes line by line. As the programs are integrated into a total information system software package, overall testing of the system becomes possible. When individual modules or programs are tested independently, it is called a unit test; when all programs are tested together, it is called a systems or an integrative test.

Although unit testing is important, integrative testing is a critical stage of the systems development cycle. Integrative testing is the major checkpoint prior to actual implementation or delivery of a system. The consequences of system malfunctions are minimized when they are discovered during integrative testing rather than during or after implementation. In virtually all programs — especially large ones — coding mistakes are an inevitable part of human activity. To that end, testers are expected to find mistakes — not simply rubber-stamp the product as "okay."

Good testing actually begins before coding begins — by using the design documentation to design a test plan. This is especially important with large programs containing hundreds, if not thousands, of logic branches where mistakes can easily occur. Unfortunately, very large programs may be physically impossible to test fully mainly because of the number of possible branching permutations; testing tools may be needed to test all possible branches or at least the most critical ones. The testing tools and test data management tools provided by CASE and a programmer's workbench greatly enhance the ability to do high-quality testing in an efficient manner.

The major system processes tested are the following.

1. Clerical processing. Data-collection and preparation procedures are performed correctly.
2. Input processing. Transactions are checked for errors and applied to the right records in the right files.
3. Computational processing. The proper variables are computed, using proper arithmetic.
4. Logic processing. Decision rules are executed, using the correct sequencing and branching.
5. Data accessing. Data are stored in, and retrieved from, the right locations.
6. Output processing. The correct variables are printed in the right places on printouts and displays.

Testing these processes can be accomplished by processing real or fabricated transactions that represent normal and abnormal conditions. Outputs from transaction processing can be tested by simply checking to see if they are correct. For example, the amount due on a loan can be computed on a calculator and compared to a corresponding output provided by the information system.

An information system must be able to handle exceptions (i.e., abnormal transactions). To test this aspect of the system, transactions that deviate from normal transaction form should be prepared and processed. For example, payroll transactions with invalid department codes, missing social security numbers, pay rates below the minimum wage rate, or hours-worked that exceed the allowable limit should be tested. A properly developed information system should detect such errors and report them.

Debugging. Correcting system malfunctions is called debugging. The source of a malfunction can exist anywhere in an information system — during data collection or preparation, during input processing, in the computational or logical processes of one or more computer programs, or at any other point. To debug a malfunction, therefore, its origin must be isolated before the problem can be resolved. The specific location of the malfunction can be isolated by working backward from the output to the input or forward from the input to the output. Once isolated, a system malfunction can be resolved, say, by a change in program code, data collection procedure, or data entry procedure.

Validation. Validation ensures that the system meets documented and approved system requirements established during the design stage. This is quite different from testing the system; testing establishes whether the system works, while validation establishes whether it does the right work when it does work. A software program may not do what it was intended to do even though it executes flawlessly.

Validation should not be done by the testers but rather by analysts who were involved in the design or users who were involved in determining the requirements. It is also sometimes done by independent workers — perhaps by contractors. It is also sometimes done by independent workers — perhaps by contractors — who can be objective and give stakeholders an honest evaluation prior to system distribution and implementation.

STEP 6: Implement the New System

The next-to-final step in developing an information system is implementation — putting the developed system into operation. Implementation is not nearly as easy as "plug it in and start it up"; there are serious implementation issues such as conversion strategy and sequence, and user training.

Implementation planning

Unfortunately, one of the least understood and most overlooked issues in information systems development is implementation. Often the biggest error made is postponing implementation planning until it is time to switch from the old system to the new. To postpone a thorough assessment of the feasibility of implementing a system until after it is designed and developed can cause unfortunate — perhaps unforgiving — consequences.

Allowing system users to experience a new system prior to implementation helps uncover problems before the system becomes set in concrete. Given that implementation issues should be continuously reviewed during system development, the next issue is preparing for, and actually converting to, the new system. There are two key dimensions to this: conversion strategy and user training.

Conversion strategy

Conversion is the process of changing from the old system to the new system, and it requires careful planning. Conversion methodology can be defined in terms of continuum ranging from parallel operation to direct cutover (also called "cold turkey"). In a parallel conversion, both the old and new systems are concurrently processed until the new system stabilizes, confirming the reliability of the new system prior to abandoning the old one. In a direct cutover conversion, however, using the new system immediately terminates the old system. In practice, the conversion approach used may fall somewhere between parallel and cutover. For example, transactions processed on the old system can be collected for a week and then reprocessed on the new system over the weekend. In this example, parallel processing applies to the transactions processed but not to the timeframe in which they are processed.

Parallel processing reduces the risk of implementing a new — but faulty — system; but it has sonic disadvantages. First, parallel processing is expensive — additional personnel (or overtime) and equipment are often required. For some systems, it is virtually impossible to conduct parallel processing. For example, it is not plausible to parallel process two on-line airline reservation systems.

In direct cutover conversion, rigorous testing of the new system is critical prior to implementation. Where parallel processing is possible, value judgments must be made to assess the trade-offs between risks and costs. Cutover requires much more planning and testing up front — with the users who will suddenly shift from one system to another. Savings from avoiding parallel operations can quickly be eclipsed by losses from cutover to a malfunctioning system or one that users don't understand.

A different dimension to the conversion issue concerns the scope of implementation, whether done in parallel or by cutover. The pilot conversion approach converts one unit of the business first for a "shake down" before other units are converted. A phased conversion approach is an incremental conversion whereby different business units are brought on-line in a stepped sequence. For example, the inventory module of an order processing system can be phased in, followed by accounts receivable, and, finally, order entry.

In implementing a new information system, it is also important to detei wine the sequence in which system segments are converted, generally a function of the following variables.

- Organizational functions: different departments, branches, plants, or other logical breakdowns.
- Organizational cycles: normal cycles of organizational activities within organizational functions (e.g., accounting or billing cycles).

It is generally advisable to begin conversion with those segments of the system that appear to offer the least difficulty. For example, the conversion may start with the best-managed and best-organized functions with the shortest cycles. This enhances the probability of initial success, which in turn enhances the credibility and momentum of the new system and its subsequent implementation. Even so, management should attempt to minimize any additional internal or external requirements on department undergoing conversion. A department is generally disrupted enough during conversion without having to handle the complications of additional disturbances.

The final task of conversion sequence is to define what will signify the complete implementation of the new system. This definition may vary; but whatever the definition of implementation, it should be agreed upon in advance by organizational members. When the defined implementation has been achieved, the system should be formally approved and accepted, and implementation should be considered complete.

User training

Thorough user training is critical to implementing and information system successfully. User training requirements for a new information system can be categorized as either clerical or managerial. Clefical users must be instructed in how to process transactions. Managers must be informed as to the format and content of reports and workstation displays, as well as how to request reports or make on-line in-quires. Managers also need to understand how programmed decisions are made and how to use any decision-support capabilities.

It is usually advantageous to have representatives (possibly project team members) from the different departments participate in developing user documentation (e.g., user procedures manuals) and in actually training users on the system. Clerical and managerial personnel are often less intimidated by computer technology if a new information system is explained to them and documented for them by someone from their own department rather than by an outside computer technician.

User training frequently overlaps program development, since much of the required training can be accomplished without the use of an actual system. Also, systems tend to be implemented in a modular fashion (e.g., the inventory module of an order processing system may be operational before the order entry module). This allows operational training to be staggered in the sequence in which modules are operationalized. If an early start on user training is possible, it is wise to proceed.

An important emerging trend in training is the concept of just-in-time training. Training in new technology is much like learning a foreign language; "If you don't use it, you lose it." Consequently, training should be scheduled as closely as possible to the time when trainees will begin to use the new system.

STEP 7: Evaluate and Maintain the New System

The final step of the systems development cycle is evaluation and maintenance. It is not a temporary stage like the others; it continues for the life of the newly developed and implemented system. In one sense, it is the perpetual repetition of all the other steps for smaller, incremental changes to the system. The system evaluated, problems or opportunities are uncovered and analyzed, alternatives are explored and evaluated, and solutions are designed, developed, and implemented — all this is known as "maintenance."

Evaluation

Like the analysis process described as step 1, evaluation provides the feedback necessary to asses the value of a system and its effects on an organization's personnel and business. This feedback serves two functions. First, it provides information about what adjustments may be necessary to the information system. Second, it provides information about what adjustments should be made in approaching future information systems development projects. Information systems should be evaluated like any other organizational function. Outside, independent evaluations are useful, but they are no substitute for an internal manager's judgment. Outside audits should assist management, not do their job.

There are three basic dimensions of information systems that should be evaluated. The first dimension, the development process, concerns whether the system was developed properly. The second look at the information being provided. The third evaluation process focuses on evaluating the system's performance.

Development evaluation. Evaluation of the development process is primarily concerned with whether the system was developed on schedule and within budget — a rather straightforward evaluation. It requires, however, that schedules and budgets be established in advance and that records are kept of actual performance and costs.

Few information systems have been developed on schedule and within budget. En fact, many information systems have been developed without any clearly defined schedules or budgets. A recent survey of 261 software development organizations concluded that about 75 percent had no formal software evaluation process 7- no measurement of what they do and no way of knowing when and where they are making mistakes. Perhaps the mystique and uncertainty associated with information systems development is to blame for its not being subjected to traditional management control procedures.

With traditional information systems development, an increasing experience base and better understanding of systems development by both technicians and managers have resulted in a greater emphasis on planning and control. With the new trend toward rapid deployment of distributed systems like client/server, however, these lessons may need to be relearned. Otherwise, maintenance costs can balloon on haphazardly designed, coded, documented, and tested systems.

Infimnation evaluation. A good information system performs properly with correct computations, efficiently processed transactions, and on-time reports. A system that merely functions properly, however, may not be a system that is proper for the needs of an organization. An information system should be evaluated in terms of the extent to which its information is relevant or not relevant to the organization's decision making.

This aspect of information system evaluation is difficult and cannot be conducted in the straightforward, quantitative manner used for development evaluations. It is practically impossible to evaluate directly an information system's support of decisions made in an organization — it must be measured indirectly. A viable approach for indirectly measuring and evaluating the information provided by an information system is based on the concept that the more frequently a decision maker's information needs are met by an information system, the more satisfied he or she tends to be with the infounation system. Conversely, the more frequently that necessary information is not available, the greater the effort (and frustration) requires to obtain the necessary information — and hence, the greater the dissatisfaction with the information system. Since satisfaction with an information system correlates with the ability of the information system to support decision making, satisfaction can be used as a surrogate to evaluate information provided by an information system.

Performance evaluation. As stated earlier, a performance evaluation is concerned with how effectively and efficiently the information system is operating.

A performance audit collects and evaluates information to answer question such as the following.

Is the staff adequately trained?

Are state-of-the-art technology and methodologies being used?

Are computing and staff resources being adequately utilized?

Is there an information system plan?

Are users satisfied with services?

Does adequate documentation exist for all systems?

Do information systems have an adequate backup and recovery plan?

Ostensibly, a performance audit tends to be an extensive question-and-answer session in which auditors use an exhaustive checklist to evaluate management of an information system and the procedures used. Performance audits are often done because either general management does not feel qualified to do them or management does not want to take the time to become familiar enough with information systems to evaluate their performance. Performance audits can also be used by IT managers to justify their budgets, their performance, or to justify charges made back to customers for services. They can also be used, on the other hand, by top managers to document poor system or IT management performance. Based on the results of evaluation, changes in the system can be made accordingly as part of system maintenance.

Maintenance

All information systems require some modification after development. This can be hardware, information, or software maintenance. Hardware maintenance is straightforward and similar to the common maintenance activities associated with cars and furniture. Information maintenance ensures that incorrect information in databases is ferreted out and corrected, obsolete data are purged, and historic data are archived. "Software maintenance" is a misleading term, however, since software coding does not inherently degrade from use like machined engine parts. But software can have mistakes that need correcting; it does degrade in terms of meeting functional requirements (as the world around it changes); and it does degrade from the accumulation of less-than-perfect modifications. Here, software maintenance means all program coding after initial deployment to correct coding errors, to enhance the functionality of the software, and to perfect the maintainability and use of the software. Although not commonly thought of as maintenance, continual education, training, and career development — "maintaining: information system users, operators, management, and the maintainers themselves" — are also essential to a system's success.

Maintenance can be categorized as either scheduled or rescue maintenance. Scheduled maintenance is anticipated and can be planned and budgeted for, such as implementing a new inventory coding scheme. Rescue or emergency maintenance refers to previously undetected malfunctions that are not anticipated but require immediate resolution. A system that is properly developed and tested should have little need for rescue maintenance.

Evaluation and maintenance activities have historically been the lion's share of system life cycle costs — between 40 and 95 percent of infoiwation system budgets. Some organizations are "maintenance-bound"; they spend all their efforts maintaining what they have, with no resources left over to develop new information systems.

3. History Overview of Thailand Tobacco Monopoly

Tobacco Monopoly of Thailand is a state enterprise under the control of the Ministry of Finance. Established in April 1939, the factory is located at 184 Rama IV Rd., Klong Toey, Bangkok, on the area of 641 Rai, with assets worth 13, 080, 990, 951.49 and its employees totaling 6,562. Apart from the factory, there are also 9 Tobacco Stations situated in other provinces namely Chieng Mai, Chieng Rai, Lam Pang, Prae, Petcha Boon, Sukothai, Nong Kai, Nakorn Panom, and Khon Kaen. In addition, there are also a Tobacco Experiment Station in Chieng Mai, and a Tobacco Baking House in Den Chai, Prae. The tobacco plantation quota is distributed to 596, 230 farmers. Total growing fields of the Factory includes the area of 240, 000 Rai.

The factory itself owns 3 tobacco manufacturing factories in the same area with the Head Office at Klong Toey where 23, 430 million rolls of cigarette are produced every year. The rest of the Head Office are other departments such as Maintenance, Engineering Service, Printing, Inventory, Research & Development etc.

The Tobacco Monopoly of Thailand is a profit-oriented state enterprise, responsible for manufacturing and distributing tobacco in order to meet the demands of people from all walks of life, as well as develop tobacco quality to meet consumers' preferences. The Tobacco Monopoly makes its income from running the tobacco industry and delivering to the government. Furthermore its responsibilities also include farmer plantation development, providing plantation quota, purchase with guaranteed price, manufacturing tobacco and distributing to wholesale suppliers.

From all the information mentioned above, the tobacco industry is considered an integrated operation. It also seeks opportunities to run other busineSses based on its potentiality and resources. Its operation and management contributes to the society, with its proceedings brought to the government for further economic and social development.

The Tobacco Monopoly or Thailand has set some policies for general operations as follows:

- Marketing: Focus on piercing both domestic and foreign markets, competing with exotic cigarettes to reduce importation.
- Improve quality and reduce costs: by improving cigarette quality to be in line with international standards and obtain acceptable and constant flavor, minimize loss in every process, increase manufacturing efficiency, and set up controlling standards in manufacturing process.
- Human resources development: by fostering loyalty, initiative, and administrative spirit among employees.
- Technological and manufacturing tool development: by providing new high-speed machinery to replace long-used machines, which may require costly maintenance.
- Development of raw material: by improving raw material, particularly the tobacco, to achieve desirable and stable quality.
- Supplying: focusing on quality, consistency, and qualification of machinery, including proper moving and storage to keep them in good condition.
- Reengineering administration and organization structure: concentrating on modifying organization structure based on performance and change management method to attacking trends.
- Business development: by taking advantage from existing asset to support tobacco operation, and also seeks opportunities for other businesses out of tobacco industry to increase revenue.
- Finance and investment: modernizing accounting and budgeting systems, foctising on investment in manufacturing power, improving quality, and invest in fast-profitable operation first.

3.1 Information Technology in Thailand Tobacco Monopoly

Thailand Tobacco Monopoly has established its Information System since 1991. In this period of time, Thailand Tobacco Monopoly implemented Information Technology with Mini Computer, PRIME model 4150 and 5320, computer peripherals, operating systems, and computer programs language. The Information System structure is centralized and linked to each division by telephone line using the modern connection as the figure on next page illustrates.

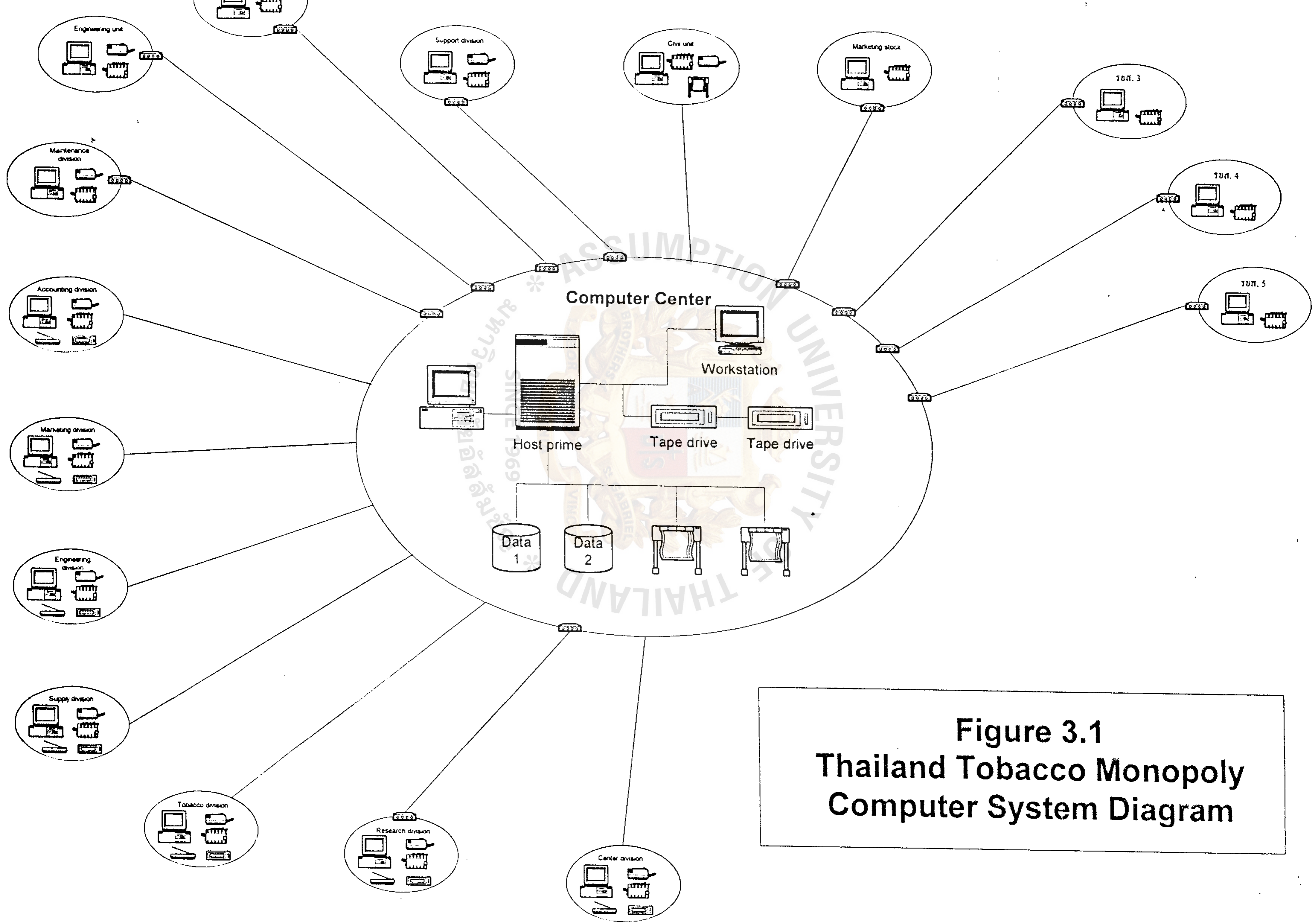

Figure 3.1
Thailand Tobacco Monopoly Computer System Diagram

Computer system history

During the years 1991 to 1998, Thailand Tobacco Monopoly implemented Information Technology according to the following table:

Table 3.1 Information Technology devices

Technology Devices	Number	Location/System	Year of implementation
1. Mini Computer - PRIME, model 4150 - RAM 16MB	1	Computer Center/ 8 Applications	2534
2. Mini Computer - PRIME, model 5320 - RAM 32MB	1	Computer Center/ 4 Applications	2537
3. Micro Computer (Terminal and Standalone)	427	Distributed by divisions /14 Applications, Word, Excell, CW and LOTUS	2534-2540
4. Dot Matrix Printer	316	Distributed by divisions	2534-2540
5. Laser Printer	58	Distributed by divisions	2534-2540
6. Inkjet Printer	25	Distributed by divisions	2534-2540
7. Line Printer	2	Computer Center	2534
8. Plotter	1	Engineering Department	2534

Table 3.1 Information Technology devices (continue)

Technology Devices	Number	Location/System	Year of implementation
9. Modern	75	Distributed by divisions	2534-2540
10. UPS	196	Distributed by divisions	2534-2540
I I . Scanner	25	Distributed by divisions	2534-2540
12. HUB	6	Distributed by divisions	2539
13. Multiplexer	6	Distributed by divisions	2539
I4. OS PROMOS and Utilities source level Debugger with EMACS	1	Computer Center	2534
IS. PRIME Inlormation	1	Computer Center	2534
16. SIMPLE	I	Computer Center	2534
17. UPS	I	Computer Center	2534

3.2 The Objectives of Information System implementation In Thailand Tobacco Monopoly

Thailand Tobacco Monopoly aims to implement the Information System to improve the time and correctness in ordinary work according to these objectives:

1. Implement new Information System instead of the previous system.
2. Efficiency to support the work in Thailand Tobacco Monopoly, which will increased in the future.
3. Thailand Tobacco Monopoly has the policy to develop Information System by implementing Information Techriology to provide information to management level with accuracy, rapidity and decision making support.
4. To service and support the computers used in each division in Thailand Tobacco Monopoly.
5. To develop through training the officer in the Information Technology.

3.3 Thailand Tobacco Monopoly Policies for Information System implementation

In the present day, computers play important roles in information systems in any organization. The organization has to collect much data, and translate data to serve as information for decisions. Thailand Tobacco Monopoly is one of those organizations where the executives foresee the importance of information technology to support management and operations. The implementation must use new and proper technology during high competitive situations such as now.

The policies in Information System implementation of Thailand Tobacco Monopoly are as follows:

1. Develop Information System by using the proper Information Technology, which benefit the image of the organization. These technologies include hardware, software, applications, communication, and office automation.
2. Implement the communication, which connects both internal and external such as, linkage to provincial office networks, Finance Ministry network and other divisions in the Finance Ministry.
3. Planning the personal development to efficiently coordinate and give data systematically.

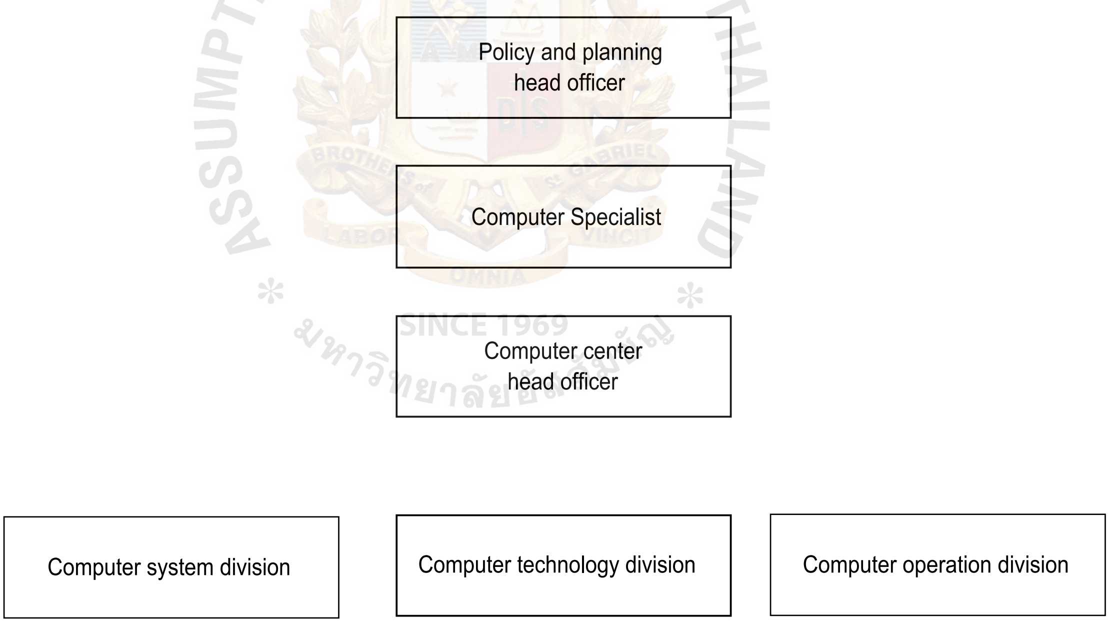

Figure 3.2 Computer department structure

3.4 Current computer system in Thailand Tobacco Monopoly

Nowadays, Thailand Tobacco Monopoly information system is divided to 14 subsystems as the following:

I. Sales system
2. Post Supplies Inventory system
3. Manufacturing system
4. Purchasing system
5. Human Resource Development system
6. Engineering and Development system
7. Accounting and Financial system — Budgeting
8. Provident Fund system
9. Performance Appraisal System
10. Analysis/Research system
I I. Domestic Tobacco Supply system
12. Administrative system
13. Statistics and Analysis system
14. External Information System

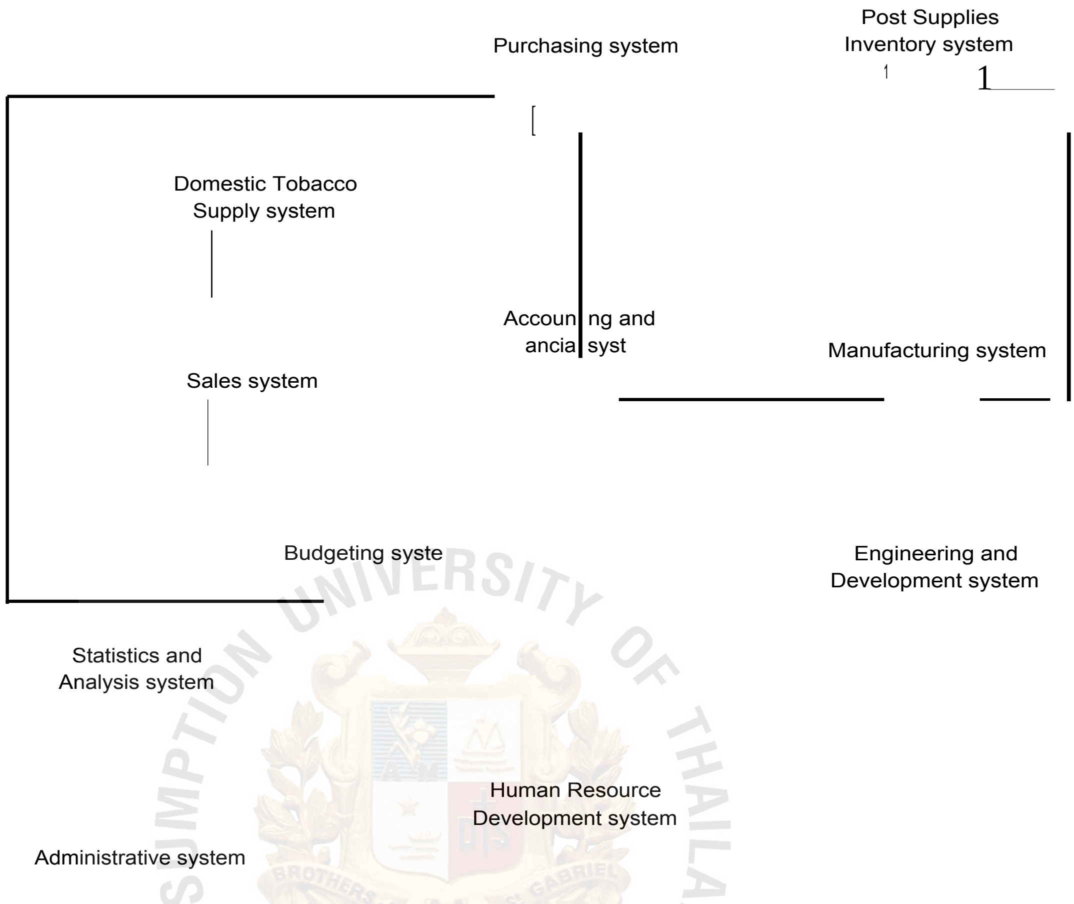

Figure 3.3 Computer System Diagram at Thailand Tobacco Monopoly

1. Sales system

- System characteristics

This Information System, the Sale system, is the system that supports marketing plans, cigarette production, and tobacco leaf use and other raw materials applications.

■ Responsible unit/division

Executive

- Marketing division

Production division

- Domestic Tobacco Supply division

■ Subsystems

Table 3.2 Subsystems in the sale system

Subsystems	Activities
Cigarette Sales in Metropolitan areas	- Cigarette sales record - Issuing purchase order Receive cigarette manufacturing expense, issuing receipt/tax invoice - Summarized sales report
Cigarette Sales in provincial areas/clubs	- Cigarette order record - Issuing tax invoice - Summarized sales report
Tobacco stock	Receive cigarette stocks from manufacturing factory - Distributing cigarette allotment from stock - Issuing daily/weekly reports

Benefits

Provide management information in sale, production and supplying.

- Using database system to estimate tobacco sales in the years later.

- The ability to forecast marketing situations.
- Support executive decisions.

2. Post Supplies Inventory system

- System characteristics

This Information System assists in planning, estimation of material purchasing such as tobacco leaves, spare-parts.

- Responsible unit/division
  - Executive
  - Domestic Tobacco Supply division
  - Engineering and development division
  - Tobacco leaves division

- Subsystems

Table 3.3 Subsystems in the post supplies inventory system

Subsystems	Activities
Manufacturing Material Domestic Tobacco Import Tobacco	- Material receiving entries - Material distributing entries - Receiving & distributing update
Domestic spare-parts Spare-part for publicizing house Miscellaneous material Stationary	- Daily/monthly report - Monthly inventory inspection

Benefits

- Supports executive decisions.

  Provides management information in supply materials and material using.

  Using database system to estimate tobacco supply in the years later.

3. Manufacturing system

" System characteristics

This Information System assists in production and sales planning.

Responsible unit/division

- Executive
- Production division
- Marketing division
- Domestic Tobacco Supply division
- Engineering and development division
- Statistics and Analysis system

Subsystems

Table 3.4 Subsystems in the manufacturing system

Subsystems	Activities
Cigarette production - Tobacco production - Cigarette rolling - Cigarette stock	- Tobacco mixture production - Tobacco mixing formula - Use of tobacco mixture for each production - Machinery efficiency record

Table 3.4 Subsystems in the manufacturing system (continue)

Subsystems	Activities
	- Daily/monthly production result - Receiving/distributing tobacco - Receiving/distributing production materials - Inventory receiving/distributing report
Belt glue mixture	- Glue mixing formula record - Glue production result record -. Receiving/distributing material for glue production mixture - Inventory receiving/distributing report
Accessories and spare-parts	- Job detail record - Wage record - Record on job materials
Cigarette package label paper	- Record on Cigarette package label paper production - Receiving/distributing manufacturing material - Inventory receiving/distributing report

Benefits

- Support executive decision.

Using database system to estimate cigarette production, tobacco supply and materials in the years later.

Using database system to estimate spare-parts and equipment price and price comparison in the years later.

4. Purchasing system

- System characteristics

This Information System assists jn tobacco leaves purchasing and production spare-parts purchasing plan to get the best quality.

- Responsible unit/division
  - Executive
  - Domestic Tobacco Supply division
  - Production division

    Engineering and developing division
  - Tobacco leaves division

- Subsystems

Table 3.5 Subsystems in the purchasing system

Subsystems	Activities
Foreign tobacco purchase	- Calculate, estimate the use of foreign tobacco purchase in previous year and remaining - Purchase requisition report - Purchase order printing
Foreign spare-parts purchase Domestic spare-parts purchase	- Calculate, estimate spare-part use - Calculate spare-part purchase price - Spare-part purchase order record - Purchase order printing - Reports
Manufacturing material purchase	- Calculate, estimate material used in the previous year - Material purchase requisition record - Purchase order printing

Benefits

- Supports executive decision.
- Using database system to compare tobacco leaves and spare-parts price.

Using database system to estimate the use of tobacco leaves and spare-parts.

5. Human Resource Development system

- System characteristics

This Information System assists in personal procurement to get quality and efficiency in the job, and assists in wage and salary and other expenses planning.

- Responsible unit/division
  - Executive
  - Personal division
  - Accounting division
  - Any other involved divisions

Subsystems

Table 3.6 Subsystems in the human resource developing system

Subsystems	Activities
Employee profile	- Record on employee and family profiles - Education records - Visiting, training and promotion records - Sick/business/annual leave records - Disciplinary action/satisfactory performance records
Salary, wage, OT payment, income tax and bonus	- Liabilities record - Record on calculating hours for leave, holidays - Calculation on salary, wage and

Table 3.6 Subsystem in human resource developing system (continue)

Subsystems	Activities
	Bonus Salary, wage slip printing - Transfer data to bank - Annual tax revenue calculation Income tax record (nil 91)

Benefits

Assistance in procuring personnel.

Planning and analyzing personal requirements.

Support in improvement of Thailand Tobacco Monopoly structure.

Assistance in setting wages and salary structures with ease to modify.

Assist in training and developing personnel.

Support the management in planning the wage, salary, OT payment, income tax and bonus.

6. Engineering and Development system

System characteristics

This Information System assists in consideration of machine performance, operating and maintenance to the most effective uses.

® Responsible unit/division

- Executive

Engineering and development division

- Production division

- Accounting division

■ Subsystems

Table 3.7 Subsystems in the engineering and development system

Subsystems	Activities
Machinery maintenance	- Machinery deployment plan - Maintenance plan - Inquiry
Inspection and repair	- Job order record - Inspection and repair record - Repair result record
Machinery history	Machinery history record - Standard manufacturing power - Report/inquiry

Benefits

Help to inspect the machinery.

- Analyze the production power for production planning.
- Support in analyzing maintenance expense.

7. Accounting and Financial systems

ɪ System characteristics

This Information System involves accounting and financial functions.

" Responsible unit/division

- Executive

All subdivisions in accounting divisions

Petrol subdivision (transportation part)

Sales management subdivision (marketing division)

Any other involved divisions

Subsystems

Table 3.8 Subsystems in the accounting and financial system

Subsystems	Activities
Inspection and distribution system	- Tobacco shipping expense inspection - Cigarette shipping expense inspection - Payment inspection according to VR - Distribute issues - Petty cash requisition - Petty cash open/clear registry
Payable and receivable system	- Receipt form record - Distribution form record - Purchase order record - Sales order record - General form record
Account purchasing system	- Balance sheet - Income statement - Closed accounts
Asset accounts system	- Record asset data - Depreciation calculation

Table 3.8 Subsystems in the accounting and financial system

Subsystems	Activities
	- Assets check report - Ledger of assets account - Inventory data record - Material average price calculation - Inventory insurance - Material insurance
Budgeting system - Operation budget - Investment budget type fl - Investment budget type 11	- Budgeting - Increase/reduce budget - Cut budget based on purchase/wage order - Transfer encumbrance wage budget - Reports

Benefits

- Improve the performance of financial and accounting management.

  Improve the accuracy of financial and accounting functions.
- Improve the time.
- Assist in planning budgets.
- Assist in the controlling the budgets.

8. Provident Fund system

® System characteristics

This Information System concerns assistance to report on employee welfare.

Responsible unit/division

- Executive
- Discipline subdivision (Personal division)

  Income subdivision (Accounting division)
- Personal management subdivision (Personal division)
- Any other involve of divisions

Subsystems

Table 3.9 Subsystems in the provident fund system

Subsystems	Activities
Permanent employee (monthly)	- Member profile
Temporary employee (by hourly ,daily wages)	- Calculation for transferring 10% of retirement allowance - Retained earning and reports - Information inquiry

Benefits

- Support in retirement allowance management.

  Provide information to management level to transfer money to provident fund.

9. Performance Appraisal System

System characteristics

This Information System assists in performance appraisal, human resource management planning.

- ■ Responsible unit/division
  - Executive
  - Financial management subdivision (Personal division)
  - Any involved divisions

a Subsystems

Table 3.10 Subsystems in the performance appraisal system

Subsystems	Activities
Appraisal for - Permanent employees - Temporary employees	- Appraisal criteria provide - Leave record - Appraisal data record - Appraisal based on criteria every 6 months - Appraisal summary/points - Report printing

Benefits

- Assists in recording the annual performance appraisal history of employees.

10. Analysis/Research system

- System characteristics

This Information System assists in the improvement the quality of cigarettes both in the chemical and the physical components.

- Responsible unit/division

  Executive
  - Research and Development division
  Production division
  - Marketing division

- Subsystems

Table 3.11 Subsystems in the analysis/research system

Subsystems	Activities
Chemical quality	- Cigarette analysis ex. CO, menthol, glucose, nicotine - Report/inquiry printing
Physical quality	- Cigarette analysis ex. Material rolling package, weight, tobacco damp, PD value
Tobacco branch quality	- Record on tobacco analysis ex. Damp value, F.P. value: Slope value, Cigarette's components - Analyze base on standard value - Report on quality - Circumstance filter PP film, width,

Table 3.11 Subsystems in the analysis/research system (continue

Subsystems	Activities
	length of package etc. - Reports

Benefits

Provide information to the management level for the consideration of improvement of the quality of cigarettes both in chemical and physical attributes.

Support the development of the cigarette package.

Share information with other divisions in Thailand Tobacco Monopoly.

11. Domestic Tobacco Supply system

- System characteristics

This Information System assists in enabling domestic tobacco to acquire good quality tobacco leaves and efficient standards in baking processes.

- Responsible unit/division
  - Executives
  - Tobacco Leaves division
  - Domestic Tobacco Supply division
  - Mixture division
  - Accounting division

Subsystems

Table 3.12 Subsystems to the domestic tobacco supply system

Subsystems	Activities
Raw tobacco supply	- Distribute tobacco in quotas for farmers - Record on tobacco purchase by farmers - Expenses, tobacco weight calculation - Reports, details, summary and inquiry - Provide raw tobacco shipment
Tobacco baking	- Record data on raw tobacco before baking - Tobacco inventory - Records on baked tobacco - Baked tobacco inventory - Reports
Baked tobacco shipment	- Records on baked tobacco shipment to stock - Records on baked tobacco shipment from stock to Bangkok - Reports

Benefits

Improve performance in tobacco supply.

Support tobacco reservation system.

- Support-in-quota the tobacco leaves for farmers.

12. Administrative System

[a] System characteristics

This Information System assists in sending/receiving documents and some commands both for internal and external control of Thailand Tobacco Monopoly.

- Responsible unit/division

Executive

Central division

Personal division

Any other involved divisions.

Subsystems

Table 3.13 Subsystems in the administrative system

Subsystems	Activities
Rules, regulations and contact orders	- Rules in Thailand Tobacco Monopoly - Internal contact orders in Thailand Tobacco Monopoly - External contact orders in Thailand Tobacco Monopoly
Agenda	- Agenda - Drawing conclusions - Meeting resolutions

Benefits

Using Information Systems to monitor the job.

Automatic sending/receiving info !nation, commands and documents between the various divisions in Thailand Tobacco Monopoly.

- Support agenda setting, conclusion drawing and meeting resolutions.
- Assisting in finding the law and rules.
- Assisting in communication between various divisions in Thailand Tobacco Monopoly.

13. Statistics and Analysis system

- System characteristics

  This Information System uses software package in statistics analysis.

- Responsible units/divisions
  - Executive
  - Marketing division
  - Production division
  - Policy and planning division

- Subsystems

Table 3.14 Subsystems in the statistics and analysis systems

Subsystems	Activities
Analyze cigarette sales data	- EXCEL application use
Analyze cigarette manufacture	- Statistics software package use

Benefits

- Support statistics analyse

14. External Information System

■ System characteristics

This Information System provides information from BISNEWS, INTERNET and the information from the Finance Ministry news which are connected directly to Thailand Tobacco Monopoly LAN system. The information is sent to the management level and supports decision making.

N Responsible units/divisions

- Division management and higher level
- Computer Center

' Subsystems

Table 3.15 Subsystems in the external information system

Subsystems	Activities
BISNEWS Information	- Economy, finance, stock, corps price, oil, etc.
INTERNET	- Foreign news communication
Finance Ministry news	- Receive/distribute letter, circular and Finance Ministry news
EIS	- Analyzes existing data

Benefits

- Management level receives both domestic and foreign information.
- Improves vision formulation.
- Supports executive decision.

4. Domestic Tobacco Supply and Shipment

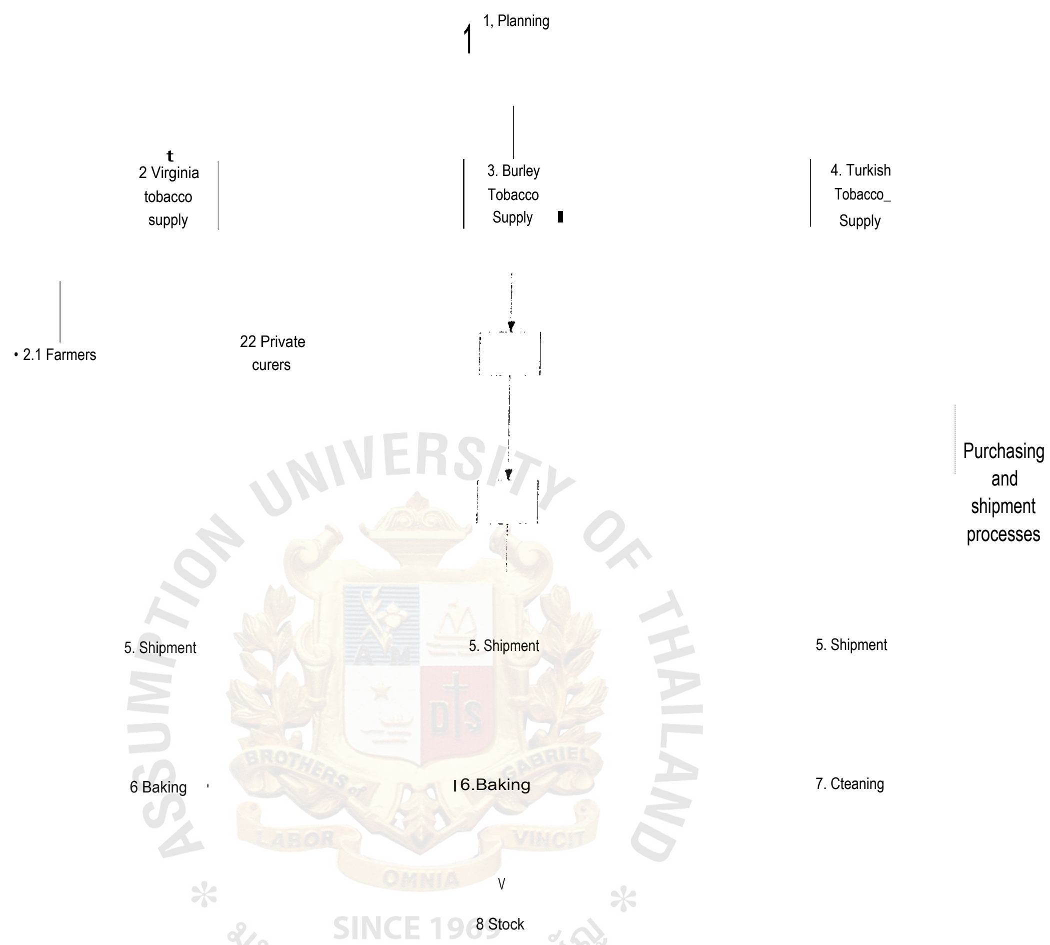

Figure 4.1 Domestic tobacco supply and shipment processes chart

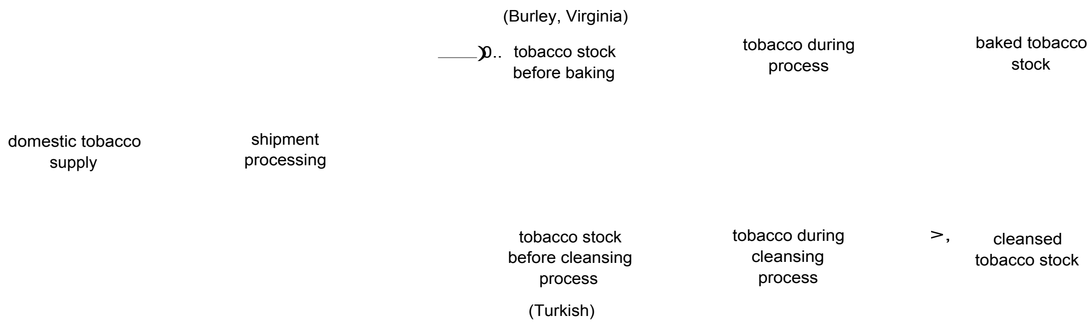

Figure 4.2 Movement Chart

1. Planning

Tobacco demand (Virginia, Burley, Turkish)

1.1 Statistics of cigarette sales so far

1.2 Anticipation of cigarette sales 5 years ahead.

1.3 Board of directors conference to make a plan for next year's supply of the 3 types of tobacco.

1.4 The Board fixes quota of domestic supply, categorized by type, amount, weight, and conditions of purchase.

1.5 Inform Tobacco Division for further implementation of Virginia tobacco from private curers, and farmers.

1.6 Inform Tobacco Division for further implementation for Burley tobacco from farriers.

1.7 Inform Tobacco Division for further implementation for Turkish tobacco from farmers.

1.8 Tobacco division fixes quota of purchase for Tobacco Offices to quota of tobacco allocation.

1.9 Virginia type: for private currers and farmers to acknowledge and take action.

1.10 Burley type: for individual farmers to acknowledge and take action.

1.11 Turkish type: for individual farmers to acknowledge and take action.

2. Virginia tobacco supply

Start: Each office allocates quota to Tobacco stations and private curers based on the previous year's quota.

2.1 Farmers

2.1.1 Tobacco stations receive quota from office and distribute to farmers based on previous quota.

2.1.2 Plant Development officer informs quota to farmers in his district and asks for approval from provincial excjse officers.

2.1.3 Supervise planting.

2.1.4 Make reports on seedbeds growing field, dried tobacco produces, and submit to Tobacco Office every 15 days.

2.1.5 -Tobacco Office gathers all reports from stations and submits to the Tobacco division every month.

Tobacco Stations

2.1.6 Make queues for dried tobacco purchase, then informs farmers and Tobacco Office.

2.1.7 Estimates cost of dried tobacco purchase for all stations 1 week ahead, sends estimation to Tobacco Office so that the Office sends resents the information to Tobacco division's Accounting department: Accounting department transfers money 1 day before purchasing happens.

2.1.8 Farmers provide tobacco packages for inspection and labeling done by Tobacco Station.

2.1.9 Package weighing, followed by weight record on 2 forms of dried tobacco purchase. Label and give sequence number to all packages.

2.1.10 Line packages by sequence number for further tobacco classification.

2.1.11 Classify tobacco based on standard classes done by:

1 purchase officer

1 purchase committee

2.1.12 Record tobacco class according to committee judgement on 2 purchase forms. Label and insert brief information label in packages.

2.1.13 Inspect and categorize tobacco weight whether its above or under the limitations, based on condition and quota of purchase. Calculate and record expenses on purchase forms.

2.1.14 Receive tobacco, record in inventory account, distribute to storehouse, and inform Tobacco Office. The office will report this to the Tobacco Division's Accounting department which will provide insurance.

2.1.15 Tobacco Station separates purchase forms of individual farmers and submits this to the Tobacco Office. The office passes the forms to Tobacco Division, Accounting department, Tobacco Accounting division, Tobacco Office's Administrative Accounting division. Tobacco Office's Supply division, and farmers (as a document for refund and collecting the sacks back). Tobacco Station keeps 2 forms.

2.1.16 Tobacco Office inspects each purchase, calculates tax deduction, and transfers surplus money back to the farmer's account on the following day.

2.1.17 50% of tobacco in quota goes to leaf-collecting process done by the Tobacco Station. The other 50% is delivered to the baking house, according to the tobacco delivery form, through the service of the Express Transport Organization (E.T.O.), for leaf collecting process done by machine, according to Tobacco Division's annual regulations (For some offices, the leaf-collecting process is 100% done at the Tobacco Station).

2.1.18 Leaves collected by the station, by others; and branches from chopping process will be included in expense account and submitted to the office and Accounting department, for further payment done every 15 days.

2.1.19 Tobacco Office submits weekly and monthly accounts on purchase order, leaf-collecting expense, tobacco pulp and branches, tobacco loss resulting from leaf-collecting process, and tobacco before leaf-collecting, to Tobacco Office's Tobacco Division and Accounting department.

2.1.20 Tobacco Station sends tobacco pulp and branches reported in the delivery form to baking house by ETO service required by the office's order.

2.2 Private curers

2.2.1 Tobacco Office allocates quota to private curers based on previous quota.

2.2.2 Tobacco Office distributes quota to individual private curers.

2.2.3 Plant Development officer supervises planting.

2.2.4 Make reports on seedbeds, growing field, fresh tobacco purchase, and dried tobacco produces, and submit the reports every 15 days.

2.2.5 Tobacco Office gathers reports from private curers and submits to Tobacco division every month.

Tobacco Office

2.2.6 Make queues for dried tobacco purchase and informs private curers.

2.2.7 Estimates cost of dried tobacco purchase 1 week ahead, sends to Tobacco division. Tobacco division reports to the Accounting department, which will transfer money 1 day before purchasing happens.

2.2.8 Private curers provide packages for inspection and labeling done by Tobacco Office.

2.2.9 Package weighing, followed by weight record on 2 forms or dried tobacco purchase. Label and give sequence numbers to all packages.

2.2.10 Line packages by sequence number for further tobacco classification.

2.2.11 Classify tobacco based on standard classes done by:

1 purchase officer

1 purchase committee

2.2.12 Record tobacco class according to committee judgement on 2 purchase forms. Label and insert brief information label in packages.

2.2.13 Inspect and categorize the tobacco weight, whether its over or under the limitations, based on condition and quota of purchase. Calculate and record expense on purchase form.

2.2.14 Receive tobacco, record in inventory account, inform Tobacco division and Accounting department who will provide insurance.

2.2.15 Tobacco Office separates purchase forms of the individual private curers and submits to Tobacco Division, Accounting department, Tobacco Accounting division, Tobacco Office's Administrative Accounting division, Tobacco Office's supply division, and private curers.

2.2.16 Tobacco Office inspects each purchase, calculates tax deduction, and transfers surplus money back to private curers' account on the following day.

2.2.17 Tobacco Office submits the tobacco delivery form by ETO service to the baking house for leaf-collecting and branch-chopping done by machine.

2.2.18 Tobacco Office submits weekly tobacco purchase order account to baking house and monthly account to Tobacco Division's Tobacco Accounting department.

<u>3. Burley Tobacco Supply</u>

Start

3.1 Responsible Tobacco Office (Petchaboon & Nakorn-Panom) allocates quota to Tobacco Stations based on previous year's quota.

3.2 Tobacco Station receives quota from Tobacco Office and distributes to individual farmers based on previous quota, and asks for approval for planting from the Provincial Excise Officer.

3.3 Plant Development officer informs quota to farmers in his district.

3.4 Supervise planting and make reports on seedbeds, growing field, dried tobacco produces, and submits to Tobacco Office every 15 days. Tobacco Office gathers all reports and Submits to Tobacco Division every month.

3.5 Tobacco Station makes queues for dried tobacco purchase and info'ins farmers.

3.6 Estimate cost of dried tobacco purchase for all stations 1 week ahead, submit the estimation to Tobacco Office and Tobacco division's Accounting department who will transfer money 1 day before purchasing happens.

3.7 Farmers provide tobacco packages for inspection and labeling done by Tobacco Station.

3.8 Package weighing, followed by weight record on 2 forms of dried tobacco purchase. Label and give sequence number to all packages.

3.9 Line packages by sequence number for further tobacco classification.

3.10 Classify tobacco based on standard classes done by:

1 purchase officer

1 purchase committee

3.11 Record tobacco class according to committee judgement on 2 purchase forms. Label and insert brief information labels in packages.

3.12 Inspect and categorize tobacco weight whether it's over or under the limitations, based on condition and quota of purchase. Calculate and record expense on purchase forms.

3.13 Receive tobacco, record in inventory account, distribute to storehouse, and inform Tobacco Office. The office will report Tobacco Division's Accounting department who will provide insurance.

3.14 Tobacco Station separates purchase form for individual farmers and submits to Tobacco Office, Tobacco Division, and Accounting Department.

Tobacco Accounting division.

- Administrative Accounting Division, Tobacco Office.
- Tobacco Supply, Tobacco Office.

- Farmers (as a document for refund and collecting sack back)

3.15 Tobacco Office inspects each purchase, calculates tax deduction, and transfers surplus money back to farmer's account on the following day.

3.16 80% of tobacco in quota goes to leaf collecting process done by Tobacco Station, the other 20% is delivered to the baking house according to the delivery form, by ETO service, for further leaf-collecting process done by machine according to Tobacco Division's annual regulations (For some Offices, the leaf collecting process is 100% done at the Tobacco Station or the baking house).

3.17 Leaves collected by the Station and by others will be included in the expense account and submitted to Tobacco Office and Accounting Department for further payment, done every 15 days.

3.18 Tobacco Office submits weekly and monthly accounts on purchase order, leaf-collecting expense, tobacco pulp and branches, tobacco loss resulting from leaf-collecting process, and tobacco before leaf-collecting, to Tobacco Office's Tobacco Division and Accounting department.

3.19 Tobacco Station sends tobacco pulp and branches reported in the delivery fonn to baking house by ETO service required by the office's order.

4. Turkish Tobacco Supply

Start

4.1 Responsible Tobacco Offices (Ban Pai & Nakorn-Panom) allocate quota to Tobacco Station based on previous year's quota.

4.2 Tobacco Station receives quota from Tobacco Office and distributes to individual farmers based on planting statistics and house labor.

4.3 Plant Development officer informs quota to farmers in his district.

4.4 Supervise planting and make reports on seedbeds, agricultural fields, dried tobacco produces, and submits to Tobacco Office every 15 days. Tobacco Office gathers all reports and Submits to Tobacco Division every month.

4.5 Tobacco Station makes queues for dried tobacco purchase and informs farmers.

4.6 Estimate cost of dried tobacco purchase for all stations 1 week ahead, submit the estimation to Tobacco Office and Tobacco division's Accounting department who will transfer money 1 day before purchasing happens.

4.7 Farmers provide tobacco packages for inspection and labeling done by Tobacco Station.

4.8 Package weighing, followed by weight record on 2 forms of dried tobacco purchase. Label and give sequence numbers to all packages.

4.9 Line packages by sequence number for further tobacco classification.

4.10 Tobacco weight inspections follow the quota of purchasing.

4.11 Classify tobacco based *on* standard classes done by:

1 purchase officer

1 purchase committee

4.12 Record tobacco class in purchase form and label packages.

4.13 Farmers receive purchase form as a document for refund.

4.14 Receive tobacco, record in inventory account, distribute to storehouse, and inform Tobacco Office, Tobacco Division, and Accounting Department for insurance process.

4.15 Tobacco Office orders Tobacco Station to send tobacco to Adams Company for cleansing procedure.

5. Tobacco Shipment System

After tobacco purchase, the shipment is issued and submitted to Den Chai baking house or International Tobacco Company.

6. Tobacco Baking

6.1 Baking house receives dried tobacco packages from Tobacco Office and Stations through ETO service, with delivery form, and keeps in stock.

6.2 Baking house issues receipt form and submits to the Accounting department and Tobacco Division, with amount of tobacco for insurance process.

6.3 Tobacco is sent to branch-separating machine and baking procedure, with banking room's receipt form issued.

6.4 Baking house bakes tobacco

- Statistics on daily tobacco branch separating.
- Statistics on daily tobacco baking.
- Report on daily tobacco branch separating.
- Report on tobacco damp before and after baking.

  Report on daily stove oil and chemical solution use.

6.5 Bring tobacco packages to baking process and pass then on to storehouse, with post delivery form.

6.6 Issue stock receipt form for each storehouse and inform Accounting Department, purchasing and cost account division, and make tobacco stock control account, then report total amount of tobacco for insurance process.

6.7 Issue dried tobacco delivery order for further shipment.

6.8 Deliver tobacco according to Tobacco division's order, to purchasing division's storehouse. At the same time, issue monthly receipt-delivery form to Tobacco Division, purchasing division, Accounting Department, Tobacco Accounting Division, and cost account division.

7. Tobacco cleaning

7.1 Tobacco Office orders Tobacco Station to send tobacco to Adams Company for cleansing procedure, with its report on tobacco class and monthly accounts on purchase order, leaf-collecting expense, tobacco pulp and branches, and tobacco loss resulting from leaf-collecting submitted to Tobacco Division's Tobacco Accounting Department.

7.2 Adams Company reports cleansing process result.

8. Tobacco Stocking

8.1 Experiment division's stock

8.1.1 Post supplies sent to Experiment division's stock, R&D Department (Alcohol and mixture)

8.1.2 Experiment division makes stock card and stock book for mixture and alcohol.

8.1.3 Manufacturing Division uses alcohol in production. Research Division and Analysis Division uses alcohol in experiment. Experiment Division uses mixture and alcohol in Thai perfume production, and then cuts stock.

8.1.4 Experiment Division produces Thai perfume and keeps in stock for factory use, and cuts stock.

8.2 Administrative division

8.2.1 Post supplies sent to Administrative Division, R&D Department.

8.2.2 Administrative Division makes stock card, chemical solution, and tools.

8.2.3 Experiment, Research and Analysis Division asks for post supplies. Administrative cuts stock.

5. Research and Data Collection

The duties of Information Technology in supporting tobacco purchasing and shipment system in Thailand Tobacco Monopoly can be categorized into 3 phases:

Phase 1: before 1993 which is the time when the IT implementation was still not *dOploy.t.‘d:*

Phase 2: from 1994-1996, the time when computer got involvedin the process.

Phase 3: from 1997 onwards, both computer system and digital scales were implemented.

This project is managed based on Petchaboon Tobacco Office's Burley tobacco purchasing system and shipment. Each phase's detailed information is provided below.

5.1 Purchasing and Shipment Process

Phase I :

ist day; weighing procedure

1. Farmers arrange tobacco.
2. Label tobacco package.
3. Weigh tobacco.
4. Officer records weight, package number, and farmer's name on 3 copies.
5. Insert brief information paper in package.

2^{nd} day; purchasing procedure

6. 3 purchase committees assign tobacco classes.
7. Record tobacco class on package and inserted paper.
8. Record tobacco class on the 3 copy of documents.
9. Inspect tobacco weight based on quota.

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10. Use recorded data for tobacco price's calculation and make reports.

A report making process is distributed to 3 teams. Each consists of 6 members performing the following steps.

- Record price.
- Record amount.
- Compare and verify data from 3 copies.
- Issue purchase fourri to farmers and make a report on quota cut.
- Make a summary report on tobacco purchase result.

11. Copy data to issue 2 shipment documents.

Phase 2 :

1st day; weighing procedure

1 Farmers arrange tobacco.
2. Label tobacco package.
3. Weigh tobacco.
4. Officer records weight, package number, and farmer's name on 2 copies.
5. Insert brief information paper in package.

2nd clay; purchasing procedure

6. 3 purchase committees assign tobacco classes.
7. Record tobacco class on package and inserted paper.
8. Record tobacco class on the 2 copy of documents.
9. Inspect tobacco weight based on quota.
10. Enter data into computer.
11. Computer displays price calculating result, issues purchase order and report on tobacco purchase result, as well as shipment documents.

Phase 3:

Purchasing and weighing process done on the same day.

1. Farmers arrange tobacco.
2. 3 purchase committees assign tobacco classes.
3. Record tobacco class on package and inserted paper.
4. Record tobacco class on the 2 copy of documents.
5. Weigh tobacco on digital scale.
6. Weight data automatically feed in (to computer)
7. Computer calculates and displays result.
8. Inspect tobacco weight based on quota which result is displayed on computer.
9. Officer records weight, package number, and farmer's name on 2 copy of documents.
10. Issue purchase form to farmers and report tobacco purchase result, and shipment document.

5.2 Officers in tobacco purchasing and shipment process

Phase 1 :

I day; weighinc; procedure

I. Scale reader : 1 officer

2. Control and quota limit : 1 officer

3. Record weight in 3 documents : 3 officers

4. Record weight in the book : 1 officer

2nd day; purchasing procedure

5. Committee : 3 officers

6. Record class in the book • : 1 officer

7. Record class in 3 documents : 3 officers

8. Check data : 3 officers

9. Price calculation and summary report 18 officers (temporary)

10. Shipment documentation : 2 officers

Phase 2 :

I^{st} clay; weighing procedure

1. Scale reader : 1 officer
2. Control and quota limit : 1 officer
3. Record weight in 2 documents : 2 officers
4. Record weight in the book : 1 officer

2 day; purchasing procedure

5. Committee : 3 officers
6. Record class on the book : 1 officer
7. Record class on 2 documents : 2 officers
8. Check data : 3 officers
9. Computer user : 2 officers

Phase 3:

Purchasing and weighing process done on the same day.

1. Committee : 3 officers
2. Record class in the book : 1 officer
3. Record class in 2 documents : 2 officers
4. Check data : 3 officers
5. Computer user : 2 officers
6. Control and quota limit : 1 officer
7. Record weight in the book : 1 officer
8. Record weight in 2 documents : 2 officers

5.3 The use of papers in tobacco purchasing and shipment process

<u>Phase 1</u>

1. The use of paper to record weight and class.

   Document A using paper (3 copies)

   Document B using paper (3 copies)

   Document C using paper (3 copies)

2. The use of paper during price calculation and report making.

   5 reports

   1 report in 2 copies

3. The use of paper while shipment document processing.

   One shipping document (2 copies)

   On one day 60 shipment documents are processed

<u>Phase 2 :</u>

1. The use of paper during weight recording and classification.

   Document A using paper (2 copies)

   Document B using paper (2 copies)

2. The use of paper during price calculation and reports making.

   5 reports

   1 report in 2 copies

3. The use of paper while shipment document processing.

   One shipping document (2 copies)

   On one day 60 shipment documents are processed

Phase 3 :

1. The use of paper during record weight and class.

   Document A uses paper for 2 copies

   Document B uses paper for 2 copies

2. The use of paper during price calculation and report making.

   5 reports

   I reports is in 2 copies

3. The use of paper while shipment document processing.

   One shipping document (2 copies)

   One day 60 shipment documents are processed

5.4 Computer System Investment in IT Implementation

The investment cost in phase 2

I. Personnel Computer 42,000 baht

- CPU 486 MHz
- RAM 4 MB
- Harddisk 200 MB

2. Printer 20,000 baht

3. UPS 18,000 baht

Total investment cost in phase 2 = 80,000 baht.

The investment cost in phase 3

1. Digital scale 250,000 baht

Total investment cost in phase 3 = 250,000 baht.

6. Systems Analysis

6.1 Wages and Salaries

Phase 1:

Regular officer salary

Table 6.1 Regular office salary in phase I

Officer	Salary (baht)	Number	Total Salary (baht)
I. Scale reader	11,000	1	11,000
2. Control and quota limiting	8,000	1	8,000
3. Recording weight on 3 documents	12,000	3	36,000
4. Recording weights in the book	8,000	1	8,000
5. Committee members	29,000	3	87,000
6. Recording class in the book	8,000	1	8,000
7. Recording class in 3 documents	12,000	3	36,000
8. Data checking	11,000	3	33,000
9. Shipment documentation	8,000	2	16,000
Total Salary		18	243,000

Total of monthly costs	= 243,000	baht
Total cost for one working season	= 243,000x6	
	= 1,458,000	baht
Total cost for one year	= 1,458,000x2	
	2,916,000	baht

Temporary officer wages

Hire 18 price calculation and summary report officers who take over all contracts in one season or 6 months at price 200,000 baht or 400,000 baht in one year.

Total number of officers in phase 1	18+18	
	= 36	
Total cost of hiring officers in phase 1	= 243,000x6 + 200,000	
	= 1,658,000	baht/season
Total cost of hiring officers in phase 1	= 1,658,000x2	
	= 3,316,000	baht/year

<u>Phase 2:</u>

Regular officer salary

Table 6.2 Regular office salary in phase 2

Officer	Salary (baht)	Number	Total Salary' (baht)
1. Scale reader	11,000	1	11,000
2. Control and quota limiting	8,000	1	8,000
3. Recording weights in 2 documents	12,000	2	24,000
4. Recording weights in the book	8,000	1	8,000
5. Committee members	29,000	3	87,000
6. Recording class in the book	8,000	1	8,000
7. Recording class in 2 documents	12,000	2	24,000
8. Data checking	11,000	3	33,000
9. Computer user	12,000	2	24,000
Total Salary		16	227,000

Total number of officers in phase 2 =16

Total cost of hiring officers in phase 2 = 227,000x6

= 1,362,000 baht/season

Total cost of hiring officers in phase 2 = 1,362,000x2

= 3,316,000 baht/year

Phase 3:

Regular officer salary

Table 6.3 Regular office salary in phase 3

Officer	Salary (baht)	Number	Total Salary (baht)
1. Committee members	29,000	3	87,000
2. Recording class in the book	8,000	1	8,000
3. Recording class in 2 documents	12,000	2	24,000
4. Data checking	11,000	3	33,000
5. Computer user	12,000	2	24,000
6. Control and quota limiting	8,000	1	8,000
7. Recording weights in the book	8,000	1	8,000
8. Recording weights in 2 documents	12,000	2	24,000
Total Salary		15	216,000

Total number of officers in phase 3 = 15

Total cost of hiring officers in phase 3 = 216,000x6

= 1,296,000 baht/season

Total cost of hiring officers in phase 3 = 1,296,000x2

= 2,592,000 bah t/year

6.2 Paper expenses

The initial data for analysis are provided as follows:

1 day tobacco from the 200 farmers is purchased.

1 month has 20 work days.

1 working season is equal to 6 months.

All document sizes are A4.

The cost of one A4 paper is 0.16 baht.

Phase 1 :

1. The use of paper while recording weight and class.

Document A is in 3 copies

Document B is in 3 copies

Document C is in 3 copies

Total paper of documents from A,B,C = 9 sheets.

The use of sheet in I working season = 9x200x20x6

= 216,000 papers

Cost of paper in 1 working season = 216,000x0.16

= 34,560 baht

The use of paper in 1 year = 216,000x2

= 432,000 papers

Cost of paper in 1 year = 432,000x0.16

= 69,120 baht

2. The use of paper during price calculation and report making.

Making 5 reports in 2 copies = 5x2

= 10 sheets

The use of paper in 1 working season = 10x20x6

= 1,200 sheets

Cost of paper in 1 working season = 1,200x0.16

= 192 baht

The use of paper in 1 year = 1,200x2

= 2,400 sheets

Cost of paper in 1 year = 2,400x0.16

= 384 baht

3. The use of paper while shipment document are processed.

One shipment document is in 2 copies

One day 60 shipment documents are processed

The use of paper in I working season = 60x2x20x6

= 14,400 sheets

The cost of paper in 1 working season = 14,400x0.16

= 2,304 baht

The use *of* paper in 1 year = 14,400x2

= 28,800 sheets

Cost of paper in 1 year = 28,800x0.16

= 4,608 baht

Total use of paper in the first phase per year = 432,000+2,400+28,800

= 463,200

Total cost of paper in the first phase per year = 463,200x0.16

= 74,112 baht

Phase 2 :

1. The use of paper while recording weight and class.

Document A is in 2 copies

Document B is in 2 copies

Total paper documents from A,B = 4 sheets.

The use of paper in 1 working season = 4x200x20x6

= 96,000 sheets

Cost of paper in 1 working season = 96,000x0.16

= 15,360 baht

The use of paper in 1 year = 96,000x2

= 192,000 sheets

Cost of paper in 1 year = 192,000x0.16

= 30,720 baht

2. The use of paper during price calculation and report making.

Making 5 reports in 2 copies = 5x2

= 10 papers

The use *of* paper in 1 working season = 10x20x6

= 1,200 sheets

Cost of paper in 1 working season = 1,200x0.16

= 192 baht

The use *of* paper in 1 year = 1,200x2

= 2,400 sheets

Cost of paper in 1 year = 2,400x0.16

= 384 baht

3. The use of paper ***in*** shipment document processing.

One shipment document is in 2 copies

One day 60 shipment documents are processed

The use of paper in 1 working season = 60x2x20x6

= 14,400 sheets

Cost of paper in 1 working season = I 4,400x0.16

= 2,304 baht

The use of paper in 1 year = 14,400x2

= 28,800 sheets

Cost of paper in 1 year = 28,800x0.16

= 4,608 baht

Total use of paper in the second phase per year = 192,000+2,400+28,800

= 223,200

Total cost of paper in the second phase per year = 223,200x0.16

= 35,712 baht

<u>Phase 3 :</u>

I. The use of paper while recording weight and class.

Document A is in 2 copies

Document B is in 2 copies

Total sheets of documents from A,B = 4 sheets.

The use of paper in I working season = 4x200x20x6

= 96,000 sheets

Cosrof paper in 1 working season = 96,000x0.16

= 15,360 baht

The use of paper in 1 year = 96,000x2

= 192,000 sheets

Cost of *paper* in 1 year = 192,000x0.16

= 30,720 baht

2. The use of paper in price calculation and report making.

Making 5 reports in 2 copies = 5x2

= 10 sheets

The use of paper in 1 working season = 10x20x6

= 1,200 sheets

Cost of paper in 1 working season = 1,200x0.16

= 192 baht

The use of *paper* in 1 year = 1,200x2

= 2,400 sheets

Cost of paper in 1 year = 2,400x0.16

= 384 baht

3. The use of paper in shipment document processing.

One shipment document is in 2 copies

On one day 60 shipment documents are processed

The use of paper in 1 working season = 60x2x20x6

= 14,400 sheets

Cost of paper in 1 working season = 14,400x0.16

= 2,304 baht

The use of paper in 1 year = 14,400x2

= 28,800 sheets

Cost of paper in 1 year = 28,800x0.16

= 4,608 baht

Total use of paper in the third phase per year = 192,000+2,400+28,800

= 223,200

Total cost of paper in the third phase per year -= 223,200x0.16

= 35,712 baht

6.3 Pay back period

Phase 2:

After implementation in the second phase, IT can reduce the expense from the first phase:

3,390,112 — 2,759,712 = 630,400 baht

The total investment of IT implementation = 80,000 baht

So the payback period = 80,000 = 630,400

= 0.1269 year or 46 days

Phase 3:

After implementation in the third phase, IT can reduce expenses from phase 2:

2,759,712 — 2,627,712 = 132,000 baht

The total investment of IT implementation = 250,000 baht

So the payback period = 250,000 = 132,000

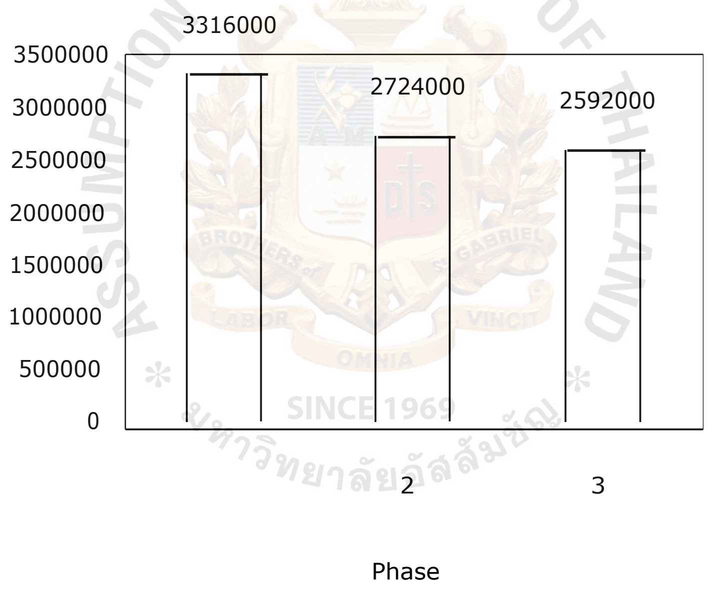
= 1.89 year or 1 year and 11 months

7. System Evaluation

<u>The reduction of cost through IT Implementation</u>

7.1 Wages and Salaries

Figure 7.1 The annual cost of wages and salaries



According to data in wages and salaries analysis, the expense of 36 officers in phase 1 can be divided into salaries for regular officers and wages for temporary officers per working season(6 months) for which the total cost per year equals 3,316,000 baht.

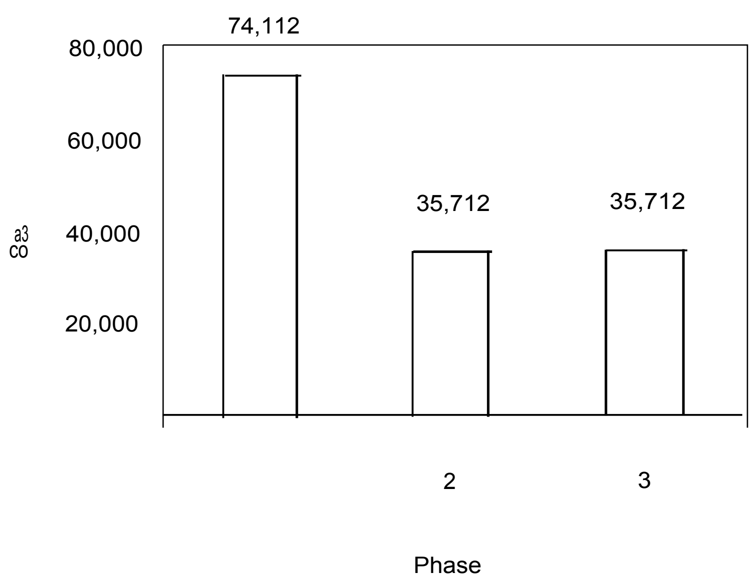
In phase 2, when IT is implemented, the cost of hiring temporary officers are eliminated after using the computer. This implementation also reduces 2 regular officers who are 2 of the record data officers in C document on 2 days and 2 of shipment documentation officers in the first phase which instead of 2 computer officers. The result of this replacement brings the total cost per year of hiring 16 officers equal to 2,724,000 baht which 592,000 baht or 17.85% reduction from the phase 1.

This implementation of IT in purchasing and shipment system is composed of one personnel computer, printer and UPS which can replace the temporary officers who carry out duties in price calculation, purchase form issue, quota cut report, report summary on tobacco purchase result, and shipment documentation.

After the digital scale which directly is connected to the computer was implemented in phase 3, the number of officers decrease by 1 (a scale reader) and the total cost per year of hiring 15 officers is 2,592,000 baht which 132,000 baht or 4.85% reduction from phase 2.

7.2 Paper expenses

Figure 7.2 The annual paper expense



According to data in the paper expenses analysis, the use of paper can be categorized into 3 steps:

1. The use of paper in weight and class tobacco record step.
2. The use of paper in calculation and report summaries.
3. The use of paper in shipment documentation.

In phase 1, the total use of paper per year is 463,200 which costs 74,112 baht.

After the IT was implemented in phase 2 with computer system, the total use of paper per year is 223,200 which costs 35,712 baht. This causes by 240,000 the reduction of using paper or 51.81% . As a result , IT in this phase can save cost of paper equalling 38,400 baht.

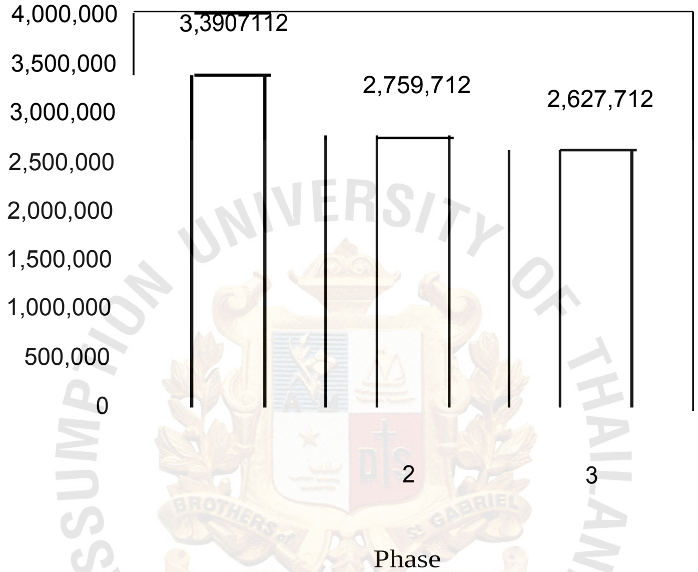
From the above data, the use of computer system in IT implementation (phase 2) can directly reduce the cost of paper in step 1, weight and class tobacco record. But in the step of calculation and report summary, and shipment documentation, the use of paper is still the same as in step 1.

In phase 3, when IT was implemented with digital scale, the total use of paper per year still is the same with phase 2 which costs 35,712 baht at 223,200 papers. As the result, the digital scale in this phase don't effect the reduction of paper use from the second phase.

7.3 Total expense of hire and paper use

Figure 7.3

The annual expense of hire and paper use



From the total expense analysis in both wage and salary, and paper expense , the total cost per year is 3,390,112 baht. After IT implementation in phase 2, the total cost per year is 2,759,712 baht which is a reduction from the first phase 630,400 baht or 18.6%.

In phase 3, the implementation of digital scale, the total cost per year is 2,627,712 baht. In this phase the reduction is 132,000 baht or 4.78% .

As a result, we can summarize that the costs of hire and paper purchase are reduced when IT was implemented.

7.4 Payback period

From the result of payback period analysis, in-Phase 2, after implementing IT as the computer system to help in purchasing and shipment, the payback time is only 46 days. This is very effective for the iinplementation of IT in phase 2. After the conclusion of the first season of tobacco purchasing, this means the investment cost disappeared.

In the implementation in phase 3, the payback period is 1 year and 11 months, so it can recover the investment cost can be recovered within 3 seasons of tobacco purchasing.

Other advantages from IT Implementation

7.5 Improve processing performance

According to data during weighing and purchasing process, IT implementation involvement provides:

In Phase 2:

I. During weight, package number and farmers' name recorded on 3 copies requiring 3 officers, the 3rd copies (C) can be withdrawn since such data will be entered by the computer.

2. During price calculation process and report on purchase result recording in Phase 1, 18 temporary' officers are called to work in 3 separate teams, each of which performs:

- Record price.
- Price calculation.
- Compare and verify data from the 3 copies.
- Issue purchase form to farmer and make a report on the quota cut.
- Make a summary report on purchase result.

It is obvious that there are too many procedures, and most of those are eliminated after IT implementation in Phase 2. After price, weight, and other data are inputted, the computer will automatically calculate, issue the purchase Form, make a report on quota cut and summary report.

3. During the shipment issue in phase 1, 2 officers are required to copy information, but after IT implementation in phase 2, this step is excluded. The computer will summarize existing data and print the shipment automatically.

In Phase3:

The digital scale in phase 3 will help reduce some steps similar in phase 2 (see above information). Anyway in phase 3, purchasing and weighing process will be combined into one day. Purchasing process is finished first, followed by weighing process. Furthermore, in phase 3 weight record on computers will be placed by digital scale working which will directly input data to computer for further calculation.

7.6 Improve accuracy

In phase 1, data entry and calculation are performed by officers who may sometime make mistakes resulting from weariness after long working hours, switching copies of information, or miscalculation. IT implementation in phase 2 can diminish those mistakes, leaving some small errors in data entry, with more accurate calculation of the result. In phase 3, IT implementation helps resolve problems in weight input by the work of digital scale inputting data directly to computer, reducing errors in keying.

7.7 Reduce working time

In phase 1, working process can be divided in to 2 steps; 1st day for weighing process, and 2nd day for purchasing process. These 2 steps require working time from 8.30-18.00. IT implementation helps shorten the length of time to 8.30-14.00 . In addition, in phase 3, the digital scale can decrease working time to just one day by combining, weighing and purchasing process in the same day requiring working time from 8.30-17.00 .

7.8 Increase efficiency in data management

In phase 1, all data are kept in the form of documentz which aggravates inspection and tracking and may contribute to documents being missed. In phase 2 and 3 when IT is implemented, information is digitized and input into the computer, as well as backed up into diskettes to Central Computer division in Thai Tobacco Monopoly to be updated in the central database. This method in keeping data, facilitates further tracking and saves papers used in document processing.

8. Conclusion

8.1 Project Summary-

From the systerri afialysis and system evaluation in tobacco purchasing and shipment based on Petchaboon Tobacco Office, we can conclude that the implementation of IT causes the reduction in cost of tobacco purchase and shipment and also increases the efficiency in purchasing and shipment processes.

This project is only based on Petchaboon Tobacco Office, but if we entirely research every office of Thailand Tobacco Monopoly which has implemented IT, a large amount of cost can be reduced and also efficiency in working process could reduce working time, influence more accuracy and increase efficiency in data management too.

8.2 Future IT Implementation

After phase 3, Thailand Tobacco Monopoly has planned to implement the next phase which connect all computer systems in each office to the central computer system in Thailand Tobacco Monopoly. This phase all of inforniation can be updated directly and real-time to the center instead of sending diskettes to the Thailand Tobacco Monopoly. But due to the economic slow down, and some other problems, this phase still has not been implemented yet.

APPENDICES

Tobacco flower

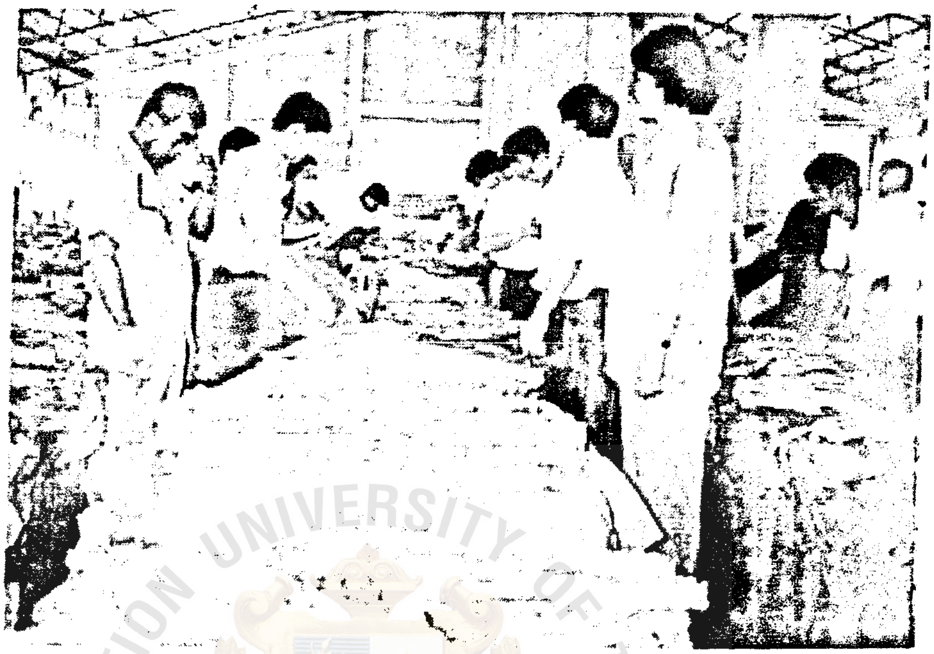
Tobacco farm

Farmers arrange tobacco

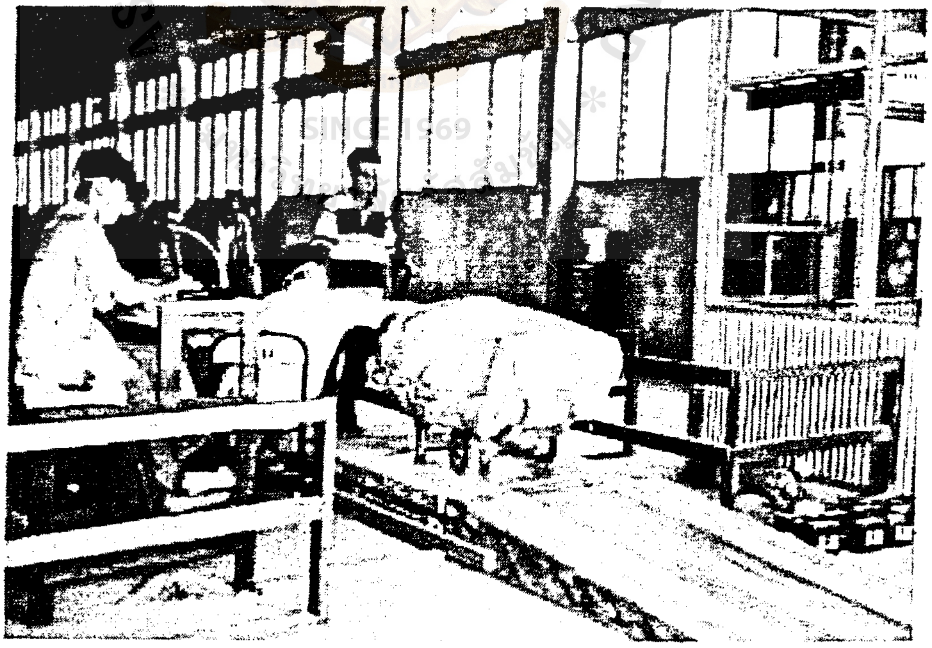
Labelling tobacco package

3 purchase committee members assign tobacco classes

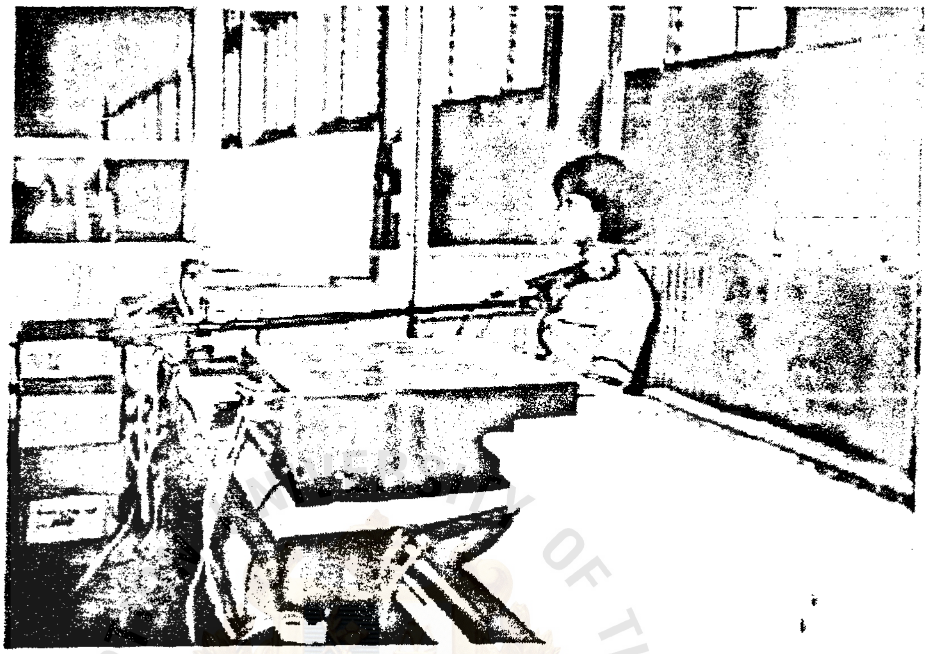
Recording tobacco class and inserting paper



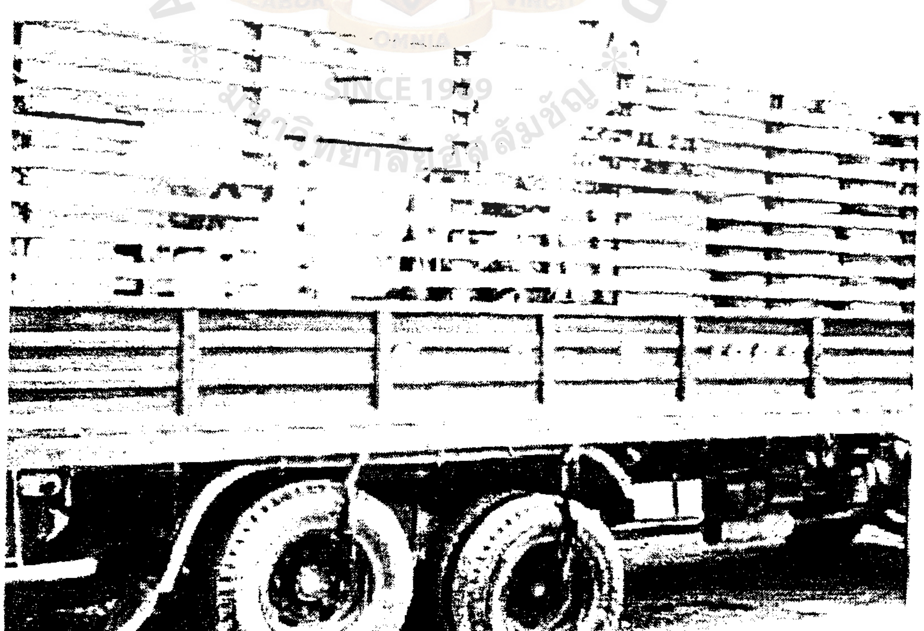
Recording tobacco classes on the same 3 copies



Weigh tobacco and record weight, package number, and farmer's name



Computer officer and control room



Shipment to Thailand Tobacco Monopoly in Bangkok

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