ANALYSIS OF THE DAILY REPLENISHMENT INFORMATION SYSTEM OF AN INTERNATIONAL COMPANY : A CASE STUDY

A THESIS
SUBMITTED TO THE DEPARTMENT OF MANAGEMENT
AND THE GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

OF
BİLKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF BUSINESS ADMINISTRATION

By
AHU YELBAŞI

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I certify that I have read this thesis and in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

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ABSTRACT

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AHU YELBAŞI

Master of Business Administration

Supervisor: Assoc. Prof. ERDAL EREL

January 1997, 58 pages

In this thesis, an implementation of Information Systems Analysis is described. As an implementation framework, the Supply & Distribution Department in the Turkish Branch of an international company is used. An analysis of the present information flow of the Daily Replenishment Information System is conducted. Recommendations to improve the existing system is developed.

Keywords : Information system, system analysis, system improvement

ÖZET

ULUSLARARASI BİR ŞİRKETİN

GÜNLÜK TEDARİK SİSTEMİNİN ANALİZİ :

BİR DURUM İNCELEMESİ

AHU YELBAŞI

Yüksek Lisans Tezi, İşletme Enstitüsü

Tez Yöneticisi: Doç. Dr. ERDAL EREL

Ocak 1997, 58 sayfa

Bu çalışmada Bilişim Sistemi Analizi uygulaması yapılmaktadır. Uygulama çerçevesi olarak uluslararası bir şirketin Türkiye ofisinin Tedarik ve Dağıtım Departmanı kullanıldı. İlgili bölümde şu anda mevcut Günlük Tedarik Sisteminin bilgi akışının analizi yapıldı. Mevcut sistemi geliştirmek için öneriler geliştirildi.

Anahtar kelimeler: Bilişim Sistemi, sistem analizi, sistem geliştirilmesi

ACKNOWLEDGMENTS

I would like to thank Assoc. Prof. Erdal Erel for his suggestions and encouragement during the completion of this thesis. I am also thankful to Assis. Prof. Serpil Sayın for her guidance during the beginning of this thesis. Without her help, I would not be able to direct myself to the related subjects.

I would also like to thank Zeki Erdem, Enver Kayıkçı and Onur Toplu for their patience and interest during my active participation to the activities of the Supply and Distribution Department of the subject company.

Without the help and intelligence of my superior Tayfun Yener Umucu, my manager Can Sungu Bakiler and my friends working in the Special Projects Department of the Production Group of Turkish Petroleum Corporation, I would not be able to perform my best.

For their patience, I would like to express my deepest gratitude and dedicate this thesis to my mother, Ayşın Yelbaşı and my father, Cengiz Yelbaşı who have always been my loyal supporters in every step of my education.

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SECTION I. INTRODUCTION

The period covering the late 1950's and the late 1980's is often referred to as the *age of information* or post-industrial society which means, that at the simplest level, more and more of what people produce is related to information rather than physical goods. Whereas, the only term used to describe 1990's by the scientists, engineers, academicians, and managers is the *age of systems thinking* or so-called *systems age.*

The marketplace - customers, suppliers, competitors - in which the goods and services are sold is rapidly changing, when compared to ten years before: computers have greater pervasivenes; due to faster pace of speed, time has become a key corporate resource; global standards and global connectivity have changed the nature of markets; new forms of organisation and management have emerged; global instead of local standards have been gradually accepted in our modern world.

As firms participate in a global marketplace, they seek a favourable position relative to their competitors - a status called competitive advantage. Competitive advantage can be achieved in many ways, such as producing high-quality products, low prices, superior service and fast delivery, but much attention currently is being focused on the use of *information.* The reasoning is logical: if the firm's managers have better information than their competitors, the managers can make better decisions than their competitors. The firms that have achieved competitive advantage have concentrated on improving information flows to and from their customers in recent years.

Information systems are one of many ways in which a company can either create competitive advantage or counteract competitors advantages, or even create new businesses. For that reason, both as business people and as people who live in our society, we need to understand information systems because it will likely be one of the most important, and the most discussed aspect of business. Other information-oriented strategies like strengthening information flows with suppliers, the financial community, the government, and competitors will most probably be added during the coming decade.

The approach used in this thesis will be as follows: First a clear description of the Information Systems, the Firm as a System, and a Structured Technique for System Analysis will be introduced. Next, the Systems Approach to Problem Solving will be explained. Then, the analysis of the Daily Replenishment Information System currently used in the Supply & Distribution Department of the company by using Data Flow Diagram will be conducted. Finally, recommendations for future use for the existing system will be presented. The open forms of the names of both the company, and industry will not be expressed both in this written report, and in presentation due to the company principles, and special requests of company managers while this study was conducted.

I.I Systems

Each day, government officials announce new applications to support the new *economic system*, politicians of the opposition parties talk about deficiencies and possible consequences of changes of the current *system,* and occasionally we hear about new *shaving systems* in advertisements, and new *manufacturing systems* by the developing technology. The word

system has become so popular that it is one of the most frequently used, but probably the least attention is paid to it, and we most likely fail to appreciate its full meaning while using in our daily language.

Before going into the details of systems thinking, the best start would be by answering the question of 'what is a system?'

> Complex whole, set of connected things or parts; organised body of material or immaterial things,
>
> Set of organs or parts in animal body of same or similar structure, or subserving the same function; animal body as a whole, such as digestion system,
>
> Department of knowledge or belief considered as an organised whole -comprehensive body of doctrines, beliefs, theories, practices etc., forming particular philosophy, religion, form of government, etc.,
>
> Group of bodies moving about one another in space under some dynamic law, such as gravitation,
>
> A set of interacting components (including organisations, people, machines, software and other systems) that operate together to accomplish a purpose (Alter, 1992)

System is a broad concept - so broad, perhaps, that it might seem impossible to find a common ground between the various definitions, however, when the definitions offered in any dictionary are examined, the two key elements of a system such that it, (1) is composed of multiple elements and (2) is intended to accomplish an objective, exist implicitly in all of them.

I.II Information Systems

Information system is defined as;

- a combination of *work practices, information, people* and *information technologies* organised to accomplish goals in an organisation (Alter, 1992),
- a particular kind of system that "run" on information (Licker, 1987).

The pictorial presentation of the elements is presented below in Figure 1.

Although goals are not a component of an information system, they do play a vital role in determining work practices as they provide criteria for deciding whether the organisation's work practices should be changed.

Work Practices. Work practices are the methods used by people and technology to perform work. They encompass not only procedures prescribed by operations manuals, but also the general ways in which people coordinate, communicate, make decisions, and perform other tasks in a business. The term *work practice* (versus *procedures*) implies that information systems include both procedure-oriented and tool-oriented systems. All arrows in Figure 1 connect to work practices to illustrate that information systems exist only in the context of things that people do in an organisation. The centrality of work practices in information systems explains a great deal about how they operate and the sources of their successes or failures.

Information. Information systems can include formatted data, text, images and sounds. By definition, data are facts, images or sounds that may or may not be pertinent or useful for a

particular task, whereas information is data whose form and contents are appropriate for particular use. Information plays a major part in coping with unpredictability in the environment. The two-way arrow between work practices and information indicates that work

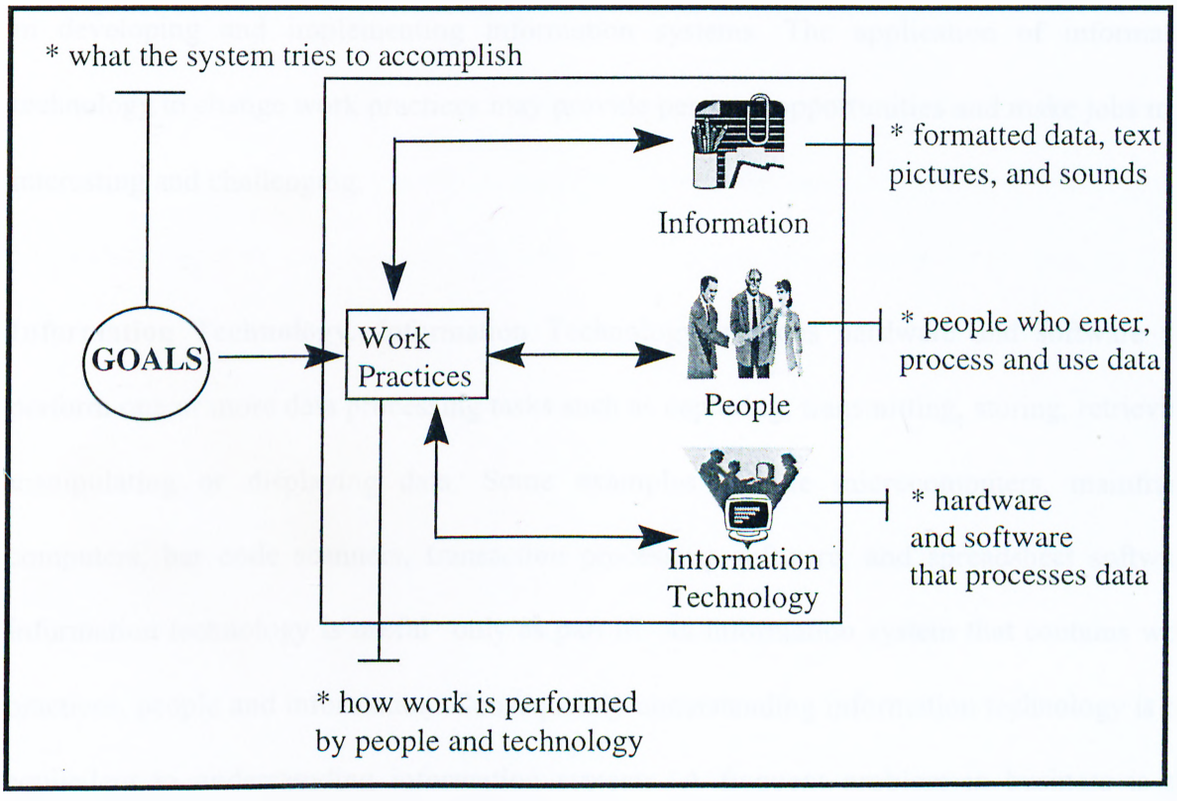

Figure 1. Elements of an Information System

Source : Alter, Steven ' Information Systems' 1992

practices determine information needs, whereas data availability determines what work practices are feasible. In the 1980's, the first computerised information systems contained only numerical data and text, current systems can use pictures and sounds in ways that once seemed beyond their scope.

People. Except when they totally automate a task, information systems must include who enter, process, or use data. The two-way arrow between work practices and people indicates that work practices affect people and that the characteristics of the people in the system determine what work practices are feasible. Managing the impacts on people is a crucial issue in developing and implementing information systems. The application of information technology to change work practices may provide personal opportunities and make jobs more interesting and challenging.

Information Technology. Information Technology includes hardware and software that perform one or more data processing tasks such as capturing, transmitting, storing, retrieving, manipulating or displaying data. Some examples include microcomputers, mainframe computers, bar code scanners, transaction processing software, and spreadsheet software. Information technology is useful only as part of an information system that contains work practices, people and information. Consequently understanding information technology is not equivalent to understanding information systems. A frequent problem in business is the tendency of the technical staff to focus on technology, while the users focus on work practices, people and information. This dichotomy hampers communication between system developers and users and is a major factor in system failures.

I.III Computer-Based Information Systems

All the business applications performed on the computer are termed the Computer-Based Information Systems (CBIS). CBIS consists of five subsystems:

Data Processing (DP) System : All firms have a data processing system. The primary purpose of a DP system is to maintain an accurate database. Most DP systems are computer-based, and consists of the firm's accounting applications with subsystems dedicated to the various applications such as payroll and inventory.

Management Information System (MIS) : is defined as the effort by the entire firm to provide all of its managers and nonmanagers with information for solving all types of problems. The firm has one MIS. The MIS can have subsystems designed to meet the needs of groups of managers within the firm, such as *marketing information systems*, *human resource information systems*, and *executive information systems*.

Decision Support Systems (DSSs) : help individual managers or small groups of manages to solve semistructured problems. Reports and simulation outputs provide the information.

Office Automation (OA) : is the use of electronic devices to communicate between people in the firm, and between people in the firm and its environment. Eight OA systems involve the computer, which are called Computer-based OA Systems. They are: word processing, electronic mail, electronic calendaring, computer conferencing, voice mail, imaging, videotex, and desktop publishing. Three OA applications which do not require a computer are facsimile transmission, audio conferencing, video conferencing, and are called Noncomputer-based OA Applications. Much of the OA appeal is due to its informal nature.

Expert Systems : can function as a consultant and enable the manager to achieve problem solutions not ordinarily expected. An expert system consists of a knowledge base that reflects the problem domain.

I.IV Resources of a Firm

A firm's information resources are a combination of hardware, software, data and information, personnel, and facilities. The four classes of computers - supercomputers, mainframes, minis, and micros which are also called personal computers (PCs) - represent the *hardware* resources. *Software* is of three types - system, application and application - development. *System software* causes the hardware to perform certain fundamental tasks required by all users, such as operating systems. *Application software* causes the hardware to perform tasks required by only certain users, and might be a custom software prepared by the firm's information specialists and users, or a prewritten software purchased from the suppliers. *Application-development software* includes personal and organisational productivity software, such as electronic spreadsheets, word processors and graphic packages.

Data and information resources describe what goes on inside the firm and in the firm's environment. *Internal data* provides the details concerning the firm's business activities. Some internal information, meaningful descriptions of the activities inside the firm, is also entered into the CBIS. The data can be converted into information, which is immediately provided to users, or it can be stored in the database for later processing.

Personnel resources consists of users and information specialists. CBIS *users* can be located inside and outside the firm. Internal users consist of managers and nonmanagers. External users consist of all the environmental elements except competitors. All the users receive information. *Information specialists* serve as intermediaries between the user and the computer as shown in the Figure 2 in an effort to communicate the user's problem to the computer so that the computer can send problem-solving information back to the user. When

the user pursues end-user computing and communicates directly with the computer, the communication paths are those shown in the Figure 2. The key intermediary is the **system analyst** who is an information specialist analysing existing systems to define the information needs and then designs and new or improved systems to meet those needs. When the system requires a change in the firm's collection of stored computer data, or database, an information specialist called a **database administrator,** or **DBA,** can be involved. Likewise, when the project involves a system that uses data communication circuits, a **network specialist** can participate. Other specialists are the well-known **programmer**, who codes and tests the program, and the **operator** who runs the job on the computer.

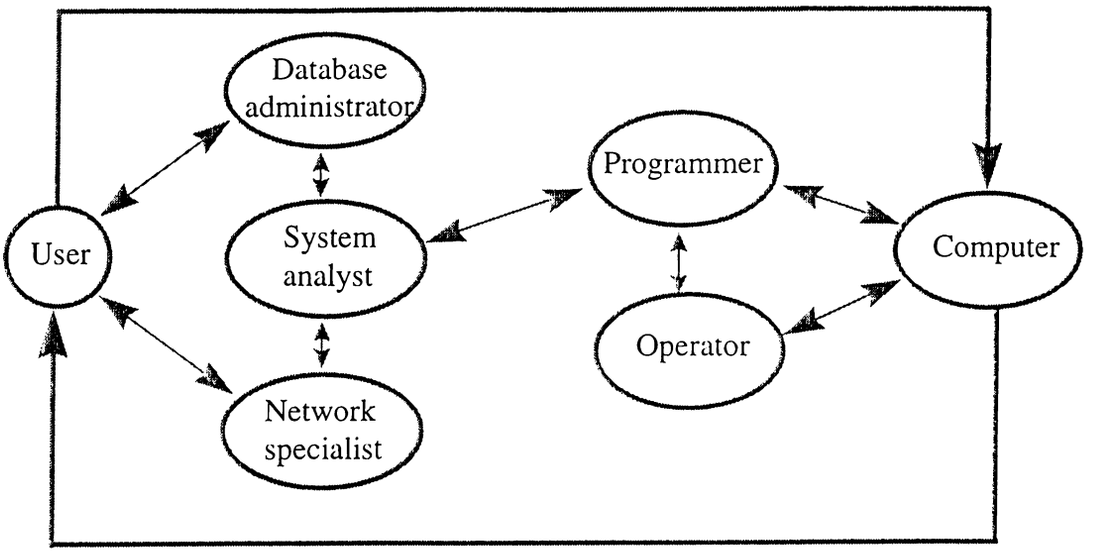

Figure 2. The Communication Chain

Source : McLeod, Jr. R. ' Systems Analysis and Design ' 1994

Problem solvers obtain information in many ways. Some use *oral media*, such as scheduled and unscheduled meetings, tours, telephone calls, and business meals. Others employ *written media,* such as letters, memos, periodicals, and the computer output. Some information is provided by *formal systems*, which operate according to a schedule or are documented in

writing. Other information is provided by *informal systems*, which function on demand to meet unexpected needs. The main concern is with the formal and informal computer-based systems.

The computer provides information to users in three basic ways reports, outputs from simulations, and communications. Reports can be *periodic* or *special* and can be *printed* or *displayed*. A periodic report is prepared according to a schedule, a special report is triggered by a request or an event. Before computers screens became common-place, reports were always printed on paper called a *hard copy*. Users use their screens to scan large volumes of information and then request hard copies of specific portions. Reports also provide information in three formats tabular, graphic, and narrative. Any representation of a business phenomenon, or entity, by means of one or more mathematical formulas is a mathematical model. The act of using such a model is called *simulation.* The model stimulates its entity. The difficulty of model building has been lessened by electronic spreadsheets. The third output form, communications, is the speciality of office automation (OA).

I.V The Value of Information

The value of information to its user depends on its four dimensions accuracy, timeliness, completeness, and relevance.

* *Accuracy* : is the degree of precision with which the information describes its subject. The computer has earned a reputation for processing data accurately and for producing accurate information.

* *Timeliness* : refers to whether the information gives the user an understanding of the subject in time to act on the information. Timeliness is the most important dimension that has to be improved most by the computer.

* *Completeness*: refers to the thoroughness with which the information describes the subject. It is important not to overload by giving more information than the user can handle, creating a condition called **information overload**. Modern systems seek to overcome the overload problem by enabling the user to specify the level of detail.

* *Relevance* : Information has relevance if it bears on the issue at hand. Systems must be flexible enough to respond to changing user needs.

I.VI The Firm As a System

Viewing the firm as a system makes it easier to identify the characteristics that are the key to successful performance. The graphic model which shows the feedback loop and control mechanism that enable the physical system to maintain a steady state is called the **general systems model of the firm** as shown in Figure 3 (McLeod, 1994). This model applies to all firms in a general way, and it illustrates the firm's operations as systems processes.

Firm's resources are transformed as they flow through the firm. This is the view taken in the late 1960`s by Richard J.Hopeman (Hopeman, 1969), a professor of production operations and management. The firm's **physical system** has the task of transforming the input physical resources, which are materials, money, machines and personnel, into forms needed by the environment. All these elements are applied so that the firm can meet the objectives such as profit, return on investment, and market share. This resource view is favoured and recognise

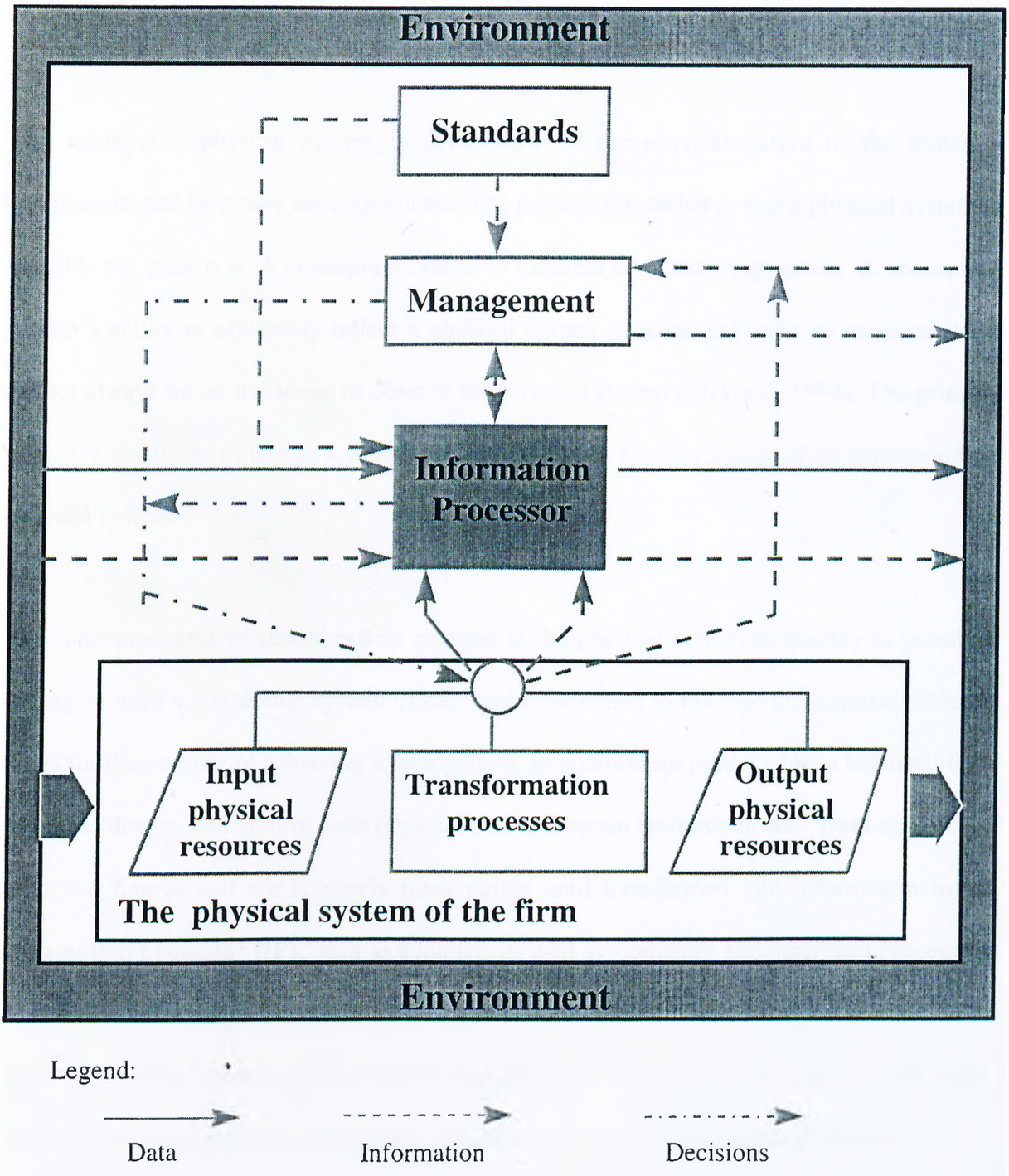

Figure 3. General Systems Model of the Firm

Source : McLeod, Jr. R. ' Systems Analysis and Design ' 1994

the need for a conceptual system to control the physical resources. The **conceptual system**, which does not exist physically, *represents* a physical system, and consists of management, an information processor, and standards of performance.

The value of a physical system is determined by the physical nature of the system's components and how they are coordinated. The point to remember is that a physical system is valuable for what it *is*. A conceptual system is valuable for what it *represents*. A conceptual system's ability to accurately reflect a physical system is of special value to managers who cannot always be on the scene to observe the physical system (McLeod, 1994). The primary objective should be to design a conceptual system that is a mirror image of its corresponding physical system.

The conceptual system should reflect changes in the physical system as quickly as possible. Managers need a conceptual system of data and information to manage the physical resource flows for the purpose of achieving a steady-state, an equilibrium produced by a balanced flow to create, directs, and control both physical and conceptual resource flows. **Data** consists of facts and figures that are relatively meaningless until transformed into information by an **information processor (IP)**, such as a human, as well as computer and other data processing device. The information processor gathers data and information describing the firm's current status from input, transformation and output elements of the physical system, and either provides the information to management immediately or stores for possible future use.

The information processor does not serve as a filter through which all of management's information must travel. Information can go directly to management from the physical system

and from the environment. The addition of the IP to the physical system enables management to get up-to-the-minute information on the physical system's resources. The data is gathered as transactions occur and is processed by the Information Processor immediately upon receipt.

Eight elements make up the firm's environment as shown in Figure 4 - individuals or organisations such as customers, suppliers, stockholders or owners, labor unions,

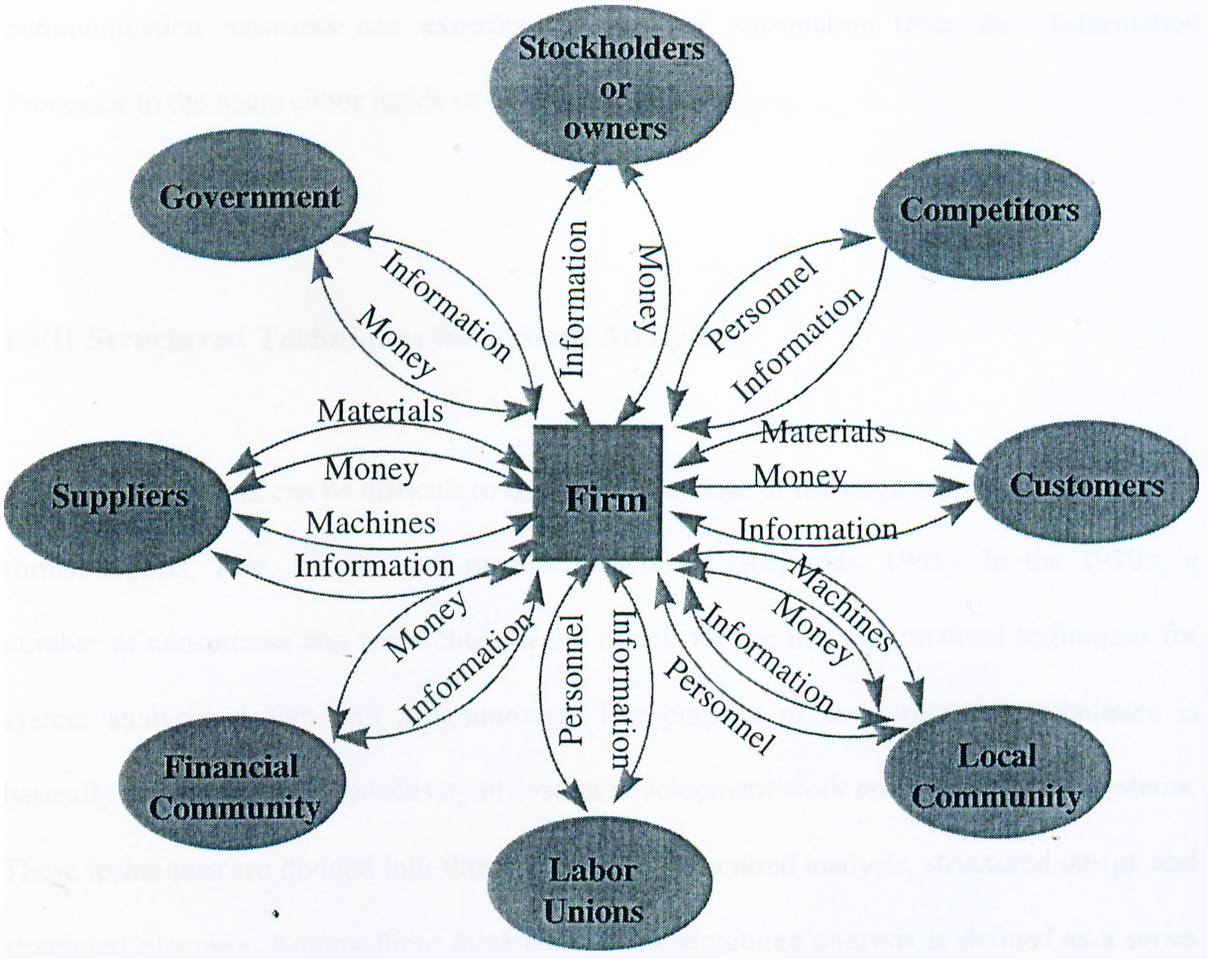

Figure 4. The Environment of the Firm

Source : McLeod, Jr. R. ' Systems Analysis and Design ' 1994

government, the financial community, the local community, and the competitors. The firm is connected to its environmental elements by flows of physical resources and conceptual resources. The manager manages the rate at which the resources flow through the firm. The conceptual resources flow between the firm and the environmental elements, and management stimulates all the flows except the outgoing flow to competitors. The manager wants data, originating inside or outside the firm, to flow to the Information Processor, such as the computer, as quickly as possible. The manager also wants data to be expedited through communication networks and expedite the flow of information from the Information Processor to the users either inside or outside the firm.

I.VII Structured Techniques for System Analysis

Information systems can be difficult to understand because of the large number of procedures, forms, reports, files, people, and machines involved (Reynolds, 1995). In the 1970's, a number of consultants and researchers began to call for the use of structured techniques for system analysis, design and programming. The purpose of the structured techniques is basically to increase the productivity of system development work and quality of the systems. These techniques are divided into three categories : structured analysis, structured design and structured planning. Among these three techniques, structured analysis is defined as a series of guidelines and diagramming tools for describing existing and proposed systems effectively for users, managers and system analysts (Alter, 1991). Data flow diagrams (DFDs) is one of the documentation tools used in structured analysis that have stimulated the most interest. Although it took a while for information specialists to get used to DFDs, they appear to be the

main process documentation tool of the future. DFDs are also well suited to the development of structured systems because they can document multiple levels of a top-down design in various levels of detail and also best suited tools for producing a logical model of the existing system.

Data Flow Diagram (DFD) is a process model - a drawing of flow of data through a system and the processing performed on the data - in which the interactions between the processes are presented as data flows between processes. Process models enable business managers to understand the essential inputs, outputs, processing, and relationships between processes.

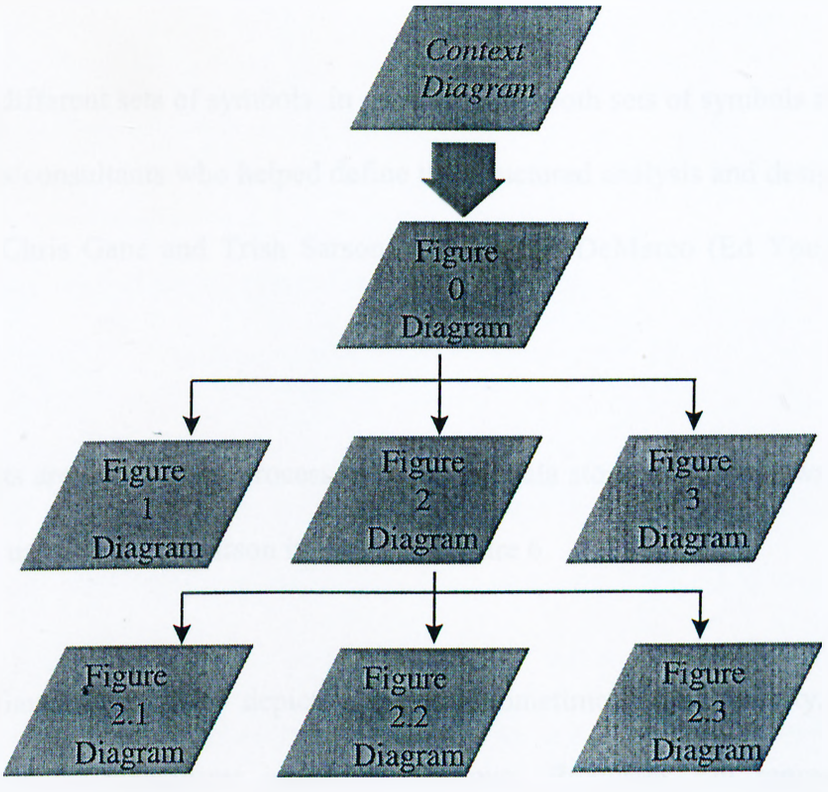

Figure 5. The Hierarchical Arrangements of DFDs

Source : McLeod, Jr. R. ' Systems Analysis and Design ' 1994

The process model, which depicts processes and how they interact or interface with one another, is much easier to understand than a written description of the system (Reynolds, 1995). DFDs typically exist in hierarchy as shown in Figure 5.

The DFD on the top level is called the **context diagram** because it describes the system in the context of its environment, and contains a single unnumbered process step. The data flow diagram on the second-highest level is the **Figure 0 diagram** as it shows the major processes of the unnumbered process step of the context diagram, and the processes are numbered beginning from 1. **Figure n DFDs and lower-level DFDs** is used until a level of detail is reached.

There are two different sets of symbols in common use. Both sets of symbols are named after pairs of authors/consultants who helped define the structured analysis and design techniques : Gane-Sarson (Chris Gane and Trish Sarson) and Yourdo-DeMarco (Ed Yourdon and Tom DeMarco).

The components are defined as : process, destination, data store and data flows. The symbols of components used by Gane-Sarson is shown in Figure 6.

Process: The Gane-Sarson DFD depicts a process, sometimes called activity, as a rounded rectangle. A process transforms inputs into outputs. Processes can represent activities performed by people, computers or machines. The details of the processing- the logic or procedure - are not shown. This allows the viewer to see the big picture without getting lost in the details. A process must have at least one incoming data flow and at least one outgoing data flow. A process is:

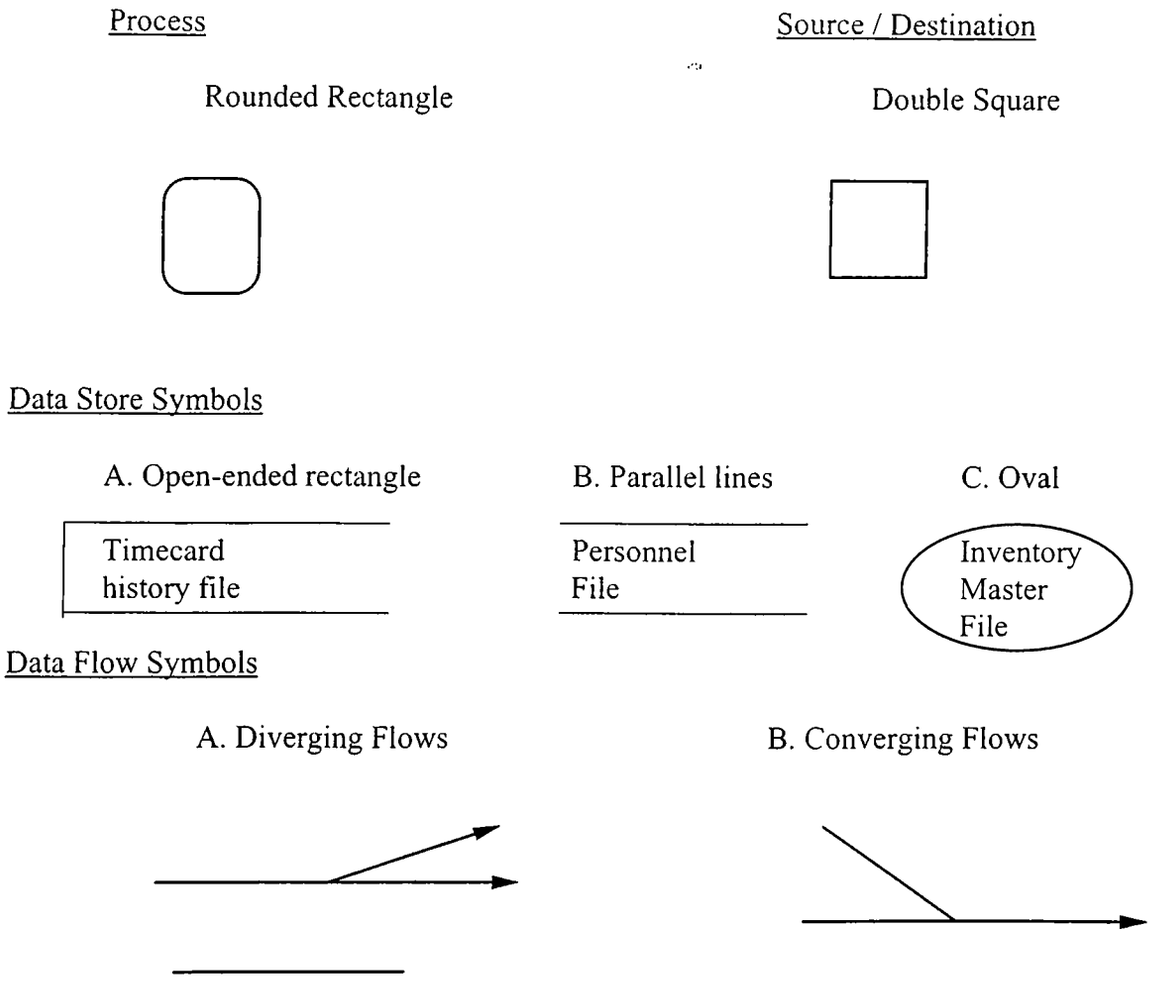

Figure 6. Symbols used in Developing a Data Flow Diagram

Source : Reynolds, G.W. , ' Information Systems for Managers ' 1995.

i) most broadly defined as an activity carried out as a series of steps, which produces a specific result or a related group of results. The steps of a business process need not be carefully defined, nor need they be consistent or carried out in particular sequence. The only critical factor is that processes they have a common purpose, and that purpose advances the business in some way. A process is generally larger than a task and thus is made up of tasks. The scope of each process is important only it should be a convenient unit to analyse, change and manage (Morris, 1994).

ii) a specific combination of machines, operators, work methods, materials, tools, and environmental factors that together convert inputs into outputs (Evans, 1993).

Source/Destination : The square identifies sources and destinations. A source provides input to the system from environment of the system under study. A destination receives output from the system. Sources and destinations may include other organisations within the firm, organisations external to the firm or other systems.

Data Source: Many systems also store data for later use. Data sources are depicted as narrow, open-ended boxes. Data stores include file cabinets, computer files, data bases, desk drawers, binders of data and so on. Data stores normally show data flows both entering and leaving (in other words, data must be created and used).

Data Flows: Finally, the arrows depict data flows. Data flows represent inputs or outputs such as reports, forms, documents, terminal displays, computer-to-computer transmission and so on. The data flow has a description of its contents written alongside it.

SECTION II. A REVIEW OF THE RELATED LITERATURE

The aim of this part is to find the related literature about the evolution of intellectual thinking about systems, recent changes in role and strategic importance of information and information systems, and their effects in organisational level.

In the book written by Derek Hitchins (Hitchins, 1992), the evolution of systems thinking is elaborated. As he mentions, most scientists and engineers are raised on the concept of reductionism as fundamental. These are based on Descartes' principles of 1637:

> Accept only what is clear and distinct as true,
>
> Divide each difficulty into as many parts as possible,
>
> Start with the simplest elements and move by an orderly procedure to the more complex,
>
> Make complete enumerations and reviews to make certain that nothing was omitted.

Systems thinking has been directed along the reductionist path since that time, which Russell Ackoff (1981) refers to as the Machine age. Now, he states, we are in the Systems Age, which needs to take a different approach. The comparison of machine-age thinking and system-age thinking is shown in Table 1.

Hitchins (1992) explains the difference by giving an example 'A machine age thinker faced with the need to explain a company would begin by considering its departments and divisions, would describe what each of them does and then would explain how they worked together to operate a company. A systems age thinker would start by identifying a system

containing the company, say the industrial system, and would then define the functions or objectives of the industrial system with reference to an even wider social system that contains it. Finally, he would explain in terms of its roles and functions in the industrial system.

Table 1. Machine-age thinking versus system-age thinking

MACHINE AGE	SYSTEMS AGE
Procedure: 1.Decompose that which is to be explained (decomposition) 2.Explain the behaviour or properties of the contained parts separately 3.Aggregate these explanations into an explanation of the whole (synthesis)	Procedure: 1.Identify a containing system of which the thing to be explained is part 2.Explain the behaviour or properties of the containing whole 3.Explain the behaviour of the thing to be explained in terms of its role(s) and function(s) within its containing whole

Evidently, analysis (reduction) and the synthesis both have their place.' The difference between machine-age analysis and systems-age synthesis is shown in Table 2.

Table 2. Machine-age analysis versus System-age synthesis

MACHINE-AGE ANALYSIS	SYSTEMS-AGE SYNTHESIS
Analysis focuses on structure; it reveals how things work	Synthesis focuses on function; it reveals why things operate as they do
Analysis yields *knowledge* Analysis enables description Analysis looks *into* things	Synthesis yields *understanding* Synthesis enables explanation Synthesis looks *out* of things

In systems design parts identified by analysis of the function(s) to be performed by the whole are not put together like unchangeable pieces of a jigsaw puzzle; they are designed to fit each other so as to work together harmoniously as well as efficiently and effectively Ackoff (1981).

As Peter F. Drucker (Drucker, 1995) states 'The corporation that is now emerging is being designed around a skeleton : *information,* both the corporation's new integrating system and its articulation' in his article 'The Information Executives Truly Need' published in HBR January-February 1995, and continues by giving a new and radically different definition of information as 'a measurement on which to base future action rather than a postmortem and a record of what has already happened.' The point that Drucker also emphasises is that the information has to be organised so that it questions and challenges a company's strategy as companies around the world transforms themselves for competition based on information.

In the book written by Raymond McLeod (McLeod 1994), the evolution of Information Management is given. As he states, the 1970's were the years in which increase in the emphasis on information prompted many firms to adopt the name MIS (Management Information System) Department for their computer units. In the 1980's, many firms not only gave the computer manager the title of vice-president but have included the person in solving strategic problems of all kinds. In late 1980's, some firms begun bestowing the title of **CIO** for **chief information officer,** on the person who manages information services.

The article published towards the end of 1995 in HBR (HBR, 1995) which gathered the perceptions of several business people about the role of information experts at the decision-making and managerial level of their organisations is a recent indicator of the emerging CIO

concept. Jonathan Newcomb, the President and CEO of Simon and Schuter, gives the job definition of Chief Information Officer (CIO) as follows: 'The Chief Information Officer directly reports to me. The CIO attends the operating reviews for all our business and works in partnership with line managers and their technology staffs to design and implement systems that best serves the Simon and Schuter's needs and most important, the needs of our customers. My CIO helps me to understand technological advances outside and inside the company and aids me in formulating priorities for technology investments.'

In the article written by Winter, Brown and Checkland in 1995 (Winter 1995), a role for soft systems methodology (SSM) in information systems development is examined. In summary, "information" is defined as data to which meaning has been attributed in a context, and it is accepted that the nature of computer-based information systems is that they serve purposeful human action which led to a concept of what is meant by the conventional phrase "an information system." The concept is shown in Figure 7. Using this model to examine some well-known IS development methodologies, it is found that they are very much focused on the system development activity, rather than on the combination of the organisation as "the system served" and the IS as the system served. It is suggested that soft systems methodology can be helpful, since it provides explicit well-established ways of modelling purposeful organisational activity. SSM-based approach to working information systems is a four part approach to the early and vulnerable stage of development process in which user needs are shaped, refined and tried out. SSM can help make a practical reality of the requirements of the IS/ISD model developed in this study.

M.Metcalfe and P.Powell (Metcalfe, 1995) in their paper published in European Journal of Information System, they attempt to synthesise the arguments for an alternative perspective

which may be particularly useful for setting information system design attitudes. It is concluded that a perceiver-concerns perspective can be beneficial in defining information since a concerned perceiver has to be present for information to exist, and this paper considers the implications of this for IS.

As managers recognise the linkage between information systems and an organisation's potential effectiveness and competitiveness, the commitment in perceiving information and systems in intellectual level, studies about alternative methodologies in Information Systems Development and changes in role of information experts in companies will continue. The most important contribution of this review to this study is that the methodology to be used is chosen in the direction of the recent trends particularly considering the notion of systems thinking.

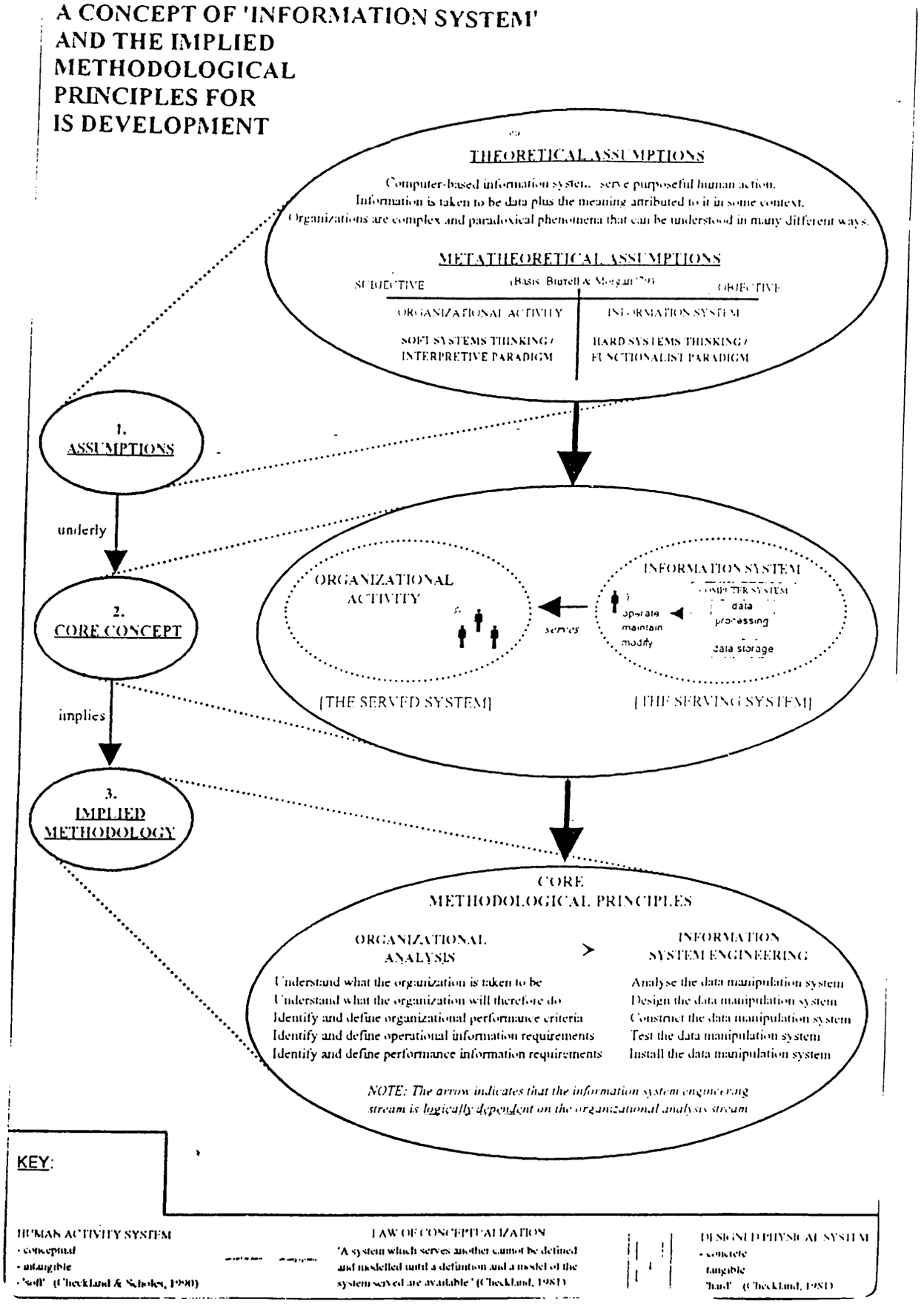

Figure 7. The Model of Information System and the Implied IS Development Methodology

Source : Winter M.C., Brown D.H., Checkland P.B. Eur. J. Inf. Systs. , 1995

SECTION III. METHODOLOGY

In this section, the methodology including the explanations of each steps is given. The reason underlying the preference of the Systems Approach to Problem Solving is that it is viewed as the basic systems methodology which can be used by anyone in analysing a system and finding solutions to systems problems.

III.I The Systems Approach to Problem Solving

In a 1960 book, Herbert A. Simon, a management scientist noted for his contributions to management theory and artificial intelligence, wrote about an approach to problem-solving that would be key to a successful career and a successful organisation (Simon, 1960). According to Simon, problem-solving involves four phases, with the problem solver making decisions in each phase:

- Intelligence Activity including the collection of data, scanning of the environment, and detection of the problems that need to be solved;
- Design Activity including the systematic study of the problem, creation of alternatives, and evaluation of outcomes;
- Choice Activity is the selection of the preferred alternative;
- Review Activity is the process of putting the decision into effect.

Simon is not the only person to describe the problem-solving process, others followed the same general approach of defining the problem to be solved, identifying and evaluating the possible alternatives, selecting and implementing the best alternative and evaluating the

performance which is an intuitively logical approach. At this stage, it would not be wrong to say that *any* problem solver can use such an approach in solving *any* type of problem.

The **systems approach** (McLeod, 1994) is the recommended procedure for the analysis and design of systems and is the tailored form of the general problem-solving approach to the solution of systems problems which can be used by managers, nonmanagers, and information specialists. The description of the systems approach consists of ten steps in three phases as illustrated in Figure 8.

III.I.I Phase I- Preparation Effort

Before solving a problem, taking a **systems view** or having a **systems orientation** is essential. Taking a systems view means engagement in the first phase of problem solving - *the preparation effort.* This phase consists of three phases:

Step 1 - View the Firm as a System In developing a system to help the firm solve a problem, it is best to view the firm as a system as illustrated with the graphic model in Figure 3 because viewing the firm as a system enables the analysts to detect and solve problems that threaten the firms ability to operate properly.

Step 2 - Recognise the Environmental System Viewing the firm as a system enables the analyst to acknowledge that the firm exists in an environment.

Step 3 - Identify the Firm's Subsystems The firm consists of subsidiary systems, or subsystems. The most obvious subsystem are the functional areas which exist in almost all firms. Less obvious are other subdivisions such as *geographic territories, product lines* and *customers. Each subsystem is a complete system*, and all the firms are arranged in a hierarchy. The systems approach can be followed on any organisational level.

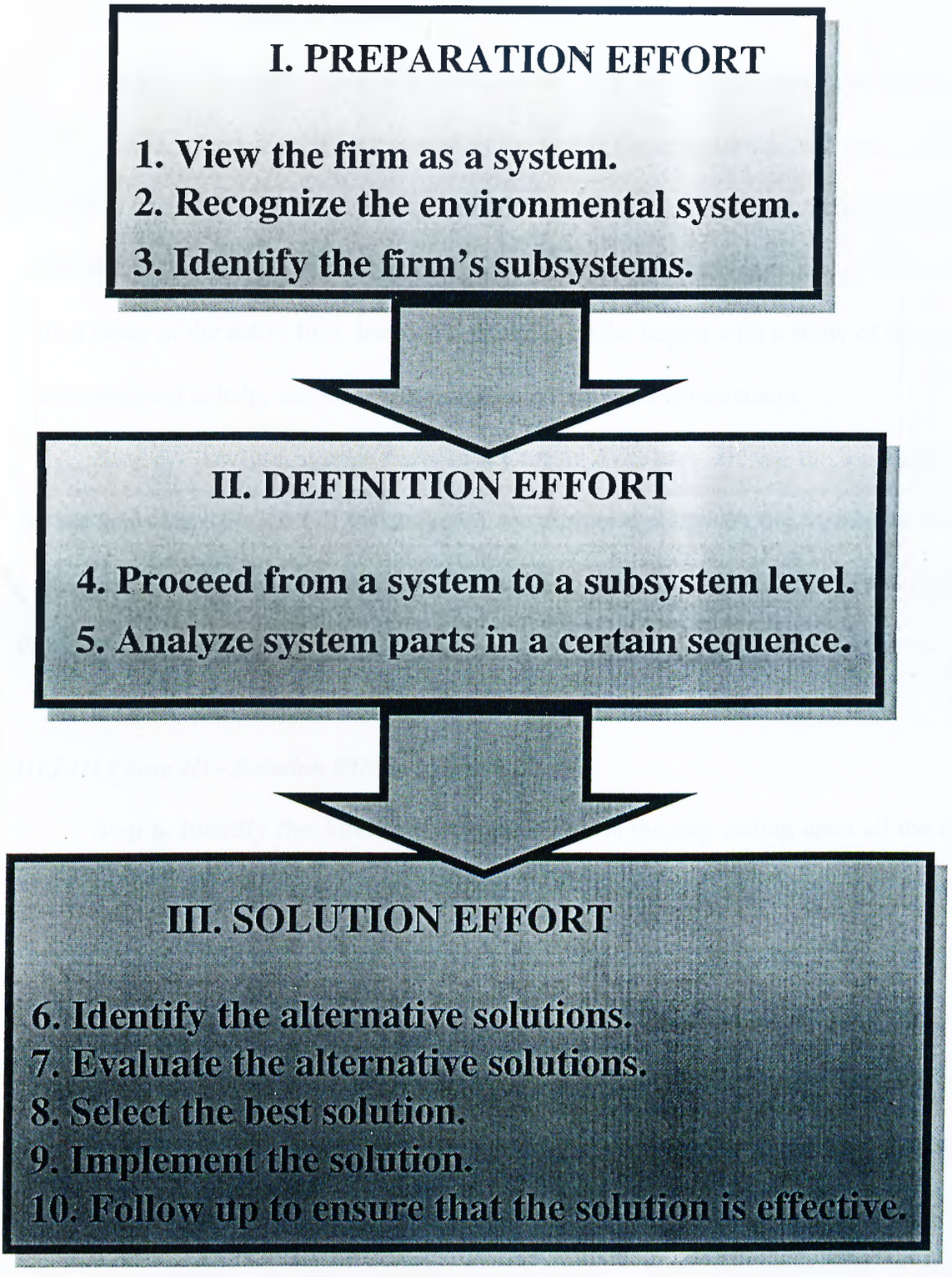

Figure 8. Steps of Systems Approach

Source : McLeod, Jr. R. ' Systems Analysis and Design ' 1994

III.I.II Phase II- Definition Effort

Step 4 - Proceed from a System Level to a Subsystem Level In defining the problem, it is always a good idea to start at the top of the organisation and work down. The top-down approach gives the advantage of understanding the big picture before trying to fill in the details, but the top-down approach does not mean that the system analyst always begin with a study of the entire firm. Instead, it means that s/he begins with a study of the unit that s/he is assigned to help, and study that unit as a system in its environment.

Step 5 - Analyse System Parts in a Certain Sequence During the top-down study, the elements *on each level* in the sequence are examined. Evaluate the Standards, Outputs, Management, Information Processor, Inputs and the Input Resources, Transformation Processes, Output Resources.

III.I.III Phase III - Solution Effort

Step 6. Identify the Alternate Solutions This is the step calling upon all the mental resources, and the most experience requiring step. Apply the system theory, and identify possible solutions for each part of the new system - the input, processing, secondary storage, and output elements.

Step 7. Evaluate the Alternate Solutions The alternatives are evaluated using certain judgement standards called **evaluation criteria.** Ideally, the evaluation involves the analysis of quantitative data.'In the absence of such data, judgement fills the gap. Bargaining, on the other hand, includes company politics, which plays a more important role in systems development than one might expect.

Step 8. Select the Best Solution The objective of the evaluation is to identify the best solution. Although the selection may consider multiple evaluation criteria, the process boils down to deciding which solution best helps the firm meet its objectives.

Step 9. Implement the Selected Solution The design that exist on paper is converted to a system that consists of hardware, software, data, and personnel, and is put into use.

Step 10. Follow Up to Ensure that the Solution is Effective Conduct audits sometime after cutover to the new system, to ensure that the system is performing as intended.

The systems approach serves as a guideline for anyone, a manager or a non-manager, a systems analyst or a systems developer. It provides the basis for all systems analysis and design work, regardless of who does it. Without such a systematic approach, a firm relies on trial and error, increasing the chances of overlooking vital information or a good alternative, but of course, it is not a foolproof recipe, instead it requires skill, knowledge, and judgement.

SECTION IV. ANALYSIS OF THE SYSTEM

IV.I Background Information about the Company

The subject company of this study is the Turkish Branch of an international company, which is one of the world's largest raw material and product companies. It was formed in the first quarter of 20th century, and headquartered in Europe. Its main activities are: exploration and production, processing, trading and transportation, and marketing the raw material and the product. The company has major operations in Europe, USA, Australasia and parts of Africa, and are expanding its presence in other regions, notably South East Asia, South America and Eastern Europe. It has been operating in Turkey since the second half of 20th century, and primarily performing in transporting, and marketing areas of the products.

The market for products is a monopoly in Turkey, because there is only one Supplier. The reason underlying this monopolistic structure is the legal and technological barriers to entry, which is also defined as the source of all monopoly power by all the economic theorists. Although the Supplier is not using a special knowledge of a low-cost productive technique, or possess unique managerial talents, the strategic distribution of Factories enabling reach all around Turkey, support of government in terms of both extent of investment essential for importing the raw material in large quantities, and building factories to process the raw material created a natural monopoly in this market (Nicholson, 1995).

The products produced by the Supplier, which will be denoted by Product A, B, C, and D throughout this study, are obtained in several proportions depending on the type of the raw material being processed. Although all of these products have been used for the same purpose, each have different characteristics appropriate for different types of equipment used. The raw material is being priced and traded in special markets. As the market demand shifts from one type of product to other due to seasonality, the Supplier makes the decisions on the

type of material to purchase after analysing the yields of the raw material, the market situation, the cost of processing and purchasing, and the sales price of the products.

The companies competing in this market are either domestic or foreign companies. As there exist only one Supplier, all of these companies purchase identical products, and market these products through the stores of the retailers which carries the logo of the companies. The price is determined by Supplier implying that none of the companies has the power of gaining advantage by applying various pricing strategies. These take to the point that, only promotion and place can be used as marketing tools by the companies to pursue their marketing objectives in the target market (Kotler, 1994).

Among the twelve companies competing, the Supplier dominates the market by having almost 60% of market share, and 66% of the total retailers distributed all around Turkey. The Turkish Branch of the international company, which will be denoted by Company X, has a market share of approximately %10, and 4% of the total retailers, and the company activities are concentrated in the north-west region of Turkey where all of its warehouses, and most of its retailers are located.

The Turkish Branch of the international company shares the same short- and long-term objectives as of the other branches in the world. The company follows the same strategy since its foundation, that is to enhance their competitive advantage and deliver high performance. The company sets new targets for a period of growth, in addition to maintaining the process of improving competitiveness through continuous cost and productivity management.

The company apparently trusts the experience, commitment and teamwork of the people who work for the company to achieve their goals. In order to encourage personal initiative and creativity, the company has been decentralising their organisation, and management processes to achieve distinctive performance from a portfolio of first-class assets. Simultaneously, they are strengthening the sharing of experience and best practice so that the company's total

competitive strength is greater than the sum of its parts. They also believe that there is still a lot more to do and commitment of the directors is essential in achieving the goals.

In 1995, the international company outsourced all its information technology operations in all of its branches around the world in an effort to cut costs, gain more flexibility, and higher-quality Information Technology (IT) resources, and focus the IT department on activities that directly improve the overall business by taking a different path to outsourcing than most companies have taken. This activity became the topic of an article written by John Cross in HBR examining the details of the steps, the decision criteria, and approach to the problem and the experiences obtained (Cross, 1995). As a consequence of this worldwide application, in the first quarter of 1995 the Turkish Branch of the company moved to a new headquarter building in which a new mainframe computer, and minicomputers for every employee and manager with the appropriate application-development softwares are located.

IV.II Phase I- Preparation Effort

IV.II.I View the Company as a System

When Company X is viewed as a system, it acts as a wholesaler. Management's task is to ensure that the physical system provides all the products to the retailers in required quantities at the right time, and places also considering the economic side of the operations. The physical resource of Company X is three warehouses. Management uses a computer network for sending and receiving electronic-mail (E-mail), direct communication by telephone and facsimile transmission between Warehouse 1, Warehouse 2 and the headquarter, and telephone, facsimile transmission between Warehouse 3, to manage the physical system. Company X does not have a fleet of delivery vehicles, instead they are chartered either on a voyage or time basis, or combination.

Merchandise is delivered to the warehouses by chartered vehicles and is stored until it is shipped by the trucks of the retailers. The *input resources* include the personnel, equipment, and warehouses that are used in providing the warehouses by the merchandise. As a wholesaler, management wants to keep the materials flowing smoothly. It also has performance standards for every manager, and employee working for the company.

IV.II.II Recognise the Environmental System

Due to the monopolistic structure in this market, the Supplier has the power to both set sales prices of each product by the support of the Government, and determine quotas of each product to be given to the operating companies. As there is no alternative of purchase, this forces all the companies to have good relations with the Supplier including Company X.

Maintaining a good relationship with the Government is also important to remain current on legal constraints, and the economic influences in the market. By incoming flows of government information would keep the firm alert to influences, and would provide the advantage to take corrective actions beforehand.

The customers of Company X are also very important. Competition for the product is keen, and very little distinguishes one retailer of a company from the other, as all of them sell the same quality products purchased from the Supplier.

As the company makes money transactions of considerable amounts through Banks while purchasing products from the Supplier, the relations with the Banks is also important.

Although the unions is not very effective in Turkey, the company takes the actions to avoid accidents, to protect people's health, to enhance the education of its employees, and to avoid damage to the environment.

Due to excess storage capacity, three of the competitor firms uses Warehouse 1 and 2 to store their own products. Company X, by this way, has information of sales operations of at least three of its competitors.

The company values its reputation as a good neighbour and corporate citizen in all of the countries in which they operate. They aim to win and retain the trust and confidence of those with whom they work -customers, governments, partners, suppliers and communities- by the education, environment and community development activities.

The communication between the firm and the environmental elements are achieved through both oral media, such as scheduled or unscheduled meetings, telephone calls, and business meals or written media such as letters and periodicals.

IV.II.III Identify the Company's Subsystems

Company X is organised into 5 main units as shown in Figure 9, each with its own vice-president except Information Processing Department. The vice-president of Finance is responsible for all financial, including the accounting and purchasing activities; the vice-president of Human Resources is responsible for staffing the organisation, appraising employee behaviour, training, development, and Office Administration Activities performed within the company; the vice-president of Retail and Supply & Distribution is responsible for all warehouses, the fleet of delivery vehicles and the product flow to the retailers; vice-president of Marketing is responsible for advertising, and sales-promotion services, customer services to evaluate complaints, requests, and suggestions related with the products; the Manager of Information Processing is responsible for the technical issues relating to computer use. The *executive committee* is composed of Vice-president of Human Resources, Finance, Marketing, and Retail and Supply & Distribution as shown by dashed lines in Figure 9.

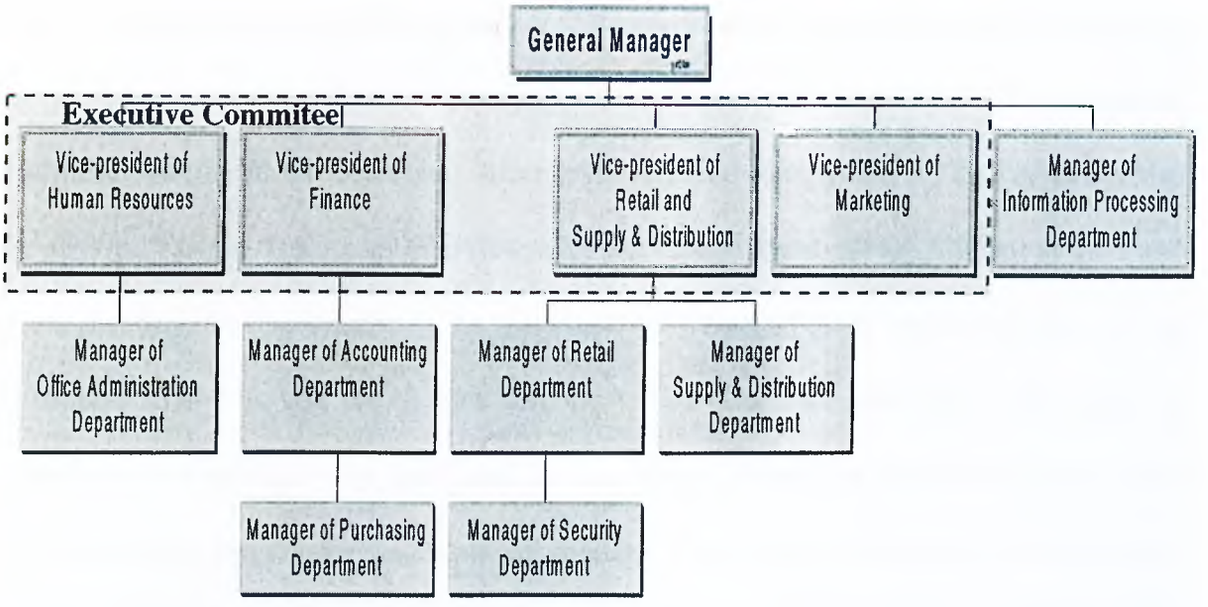

Figure 9. The Organisation Chart of Company X

IV.III Phase II - Definition Effort

IV.III.I Proceed from a System Level to a Subsystem Level

The system analysis of Company X is conducted for identifying the problems of the existing system, and make constructive recommendations to increase the effectiveness of the system, and intensify the value of information for the benefit of the employees, and to gain competitive advantage. The data gathering activities are maintained within a three month active participation in the company's operations, and mainly consist of analysing the existing system documentation, in-depth personal interviews, observation, and record search.

The first step of system analysis is to analyse the documents of the existing system. The documents show that the company meets its objectives, and standards. Managers are proud of high customer satisfaction due to the continuous availability of the products, but during

in-depth interviews, some of the managers complained about the timelessness of the reports sent about the daily merchandise replenishment activities performed by S&D Department, and inaccessibility to the additional information required for conducting further analysis of the physical system. During an interview with the Supply Manager, he said that at the times when the Supply Coordinator is on vacation, the replenishment operations can not be performed smoothly, and the system that the Coordinator had established after years of experience is a monopoly by itself, and in case of any attempt of interference, the system causes problems and creates inaccurate information. The Supply Coordinator is complaining about the increase in the number of hours worked, mentioning that he has to work overtime, even at weekends to meet the demands of the managers, and adds that he can not deal with the work and information overload. What is more, it is found out that the armature of the vehicles also has complaints about the delays of the bills paid after transportation of products which is the responsibility of the Supply Coordinator. All of these complaints direct the necessity of analysing the existing system of the Supply & Distribution Department.

The subsystems of Company X is shown in Figure 10. The Supply & Distribution (S&D) Department reports to the Retail and Supply & Distribution Manager and is composed of the Supply Manager, Supply Coordinator and Import Coordinator. The main task of the S&D Department is to coordinate the replenishment merchandise transportations, so that the warehouses are neither out of stock or overstocked. The Import Manager is responsible for coordinating the importing activities of the products on a monthly basis in case of running out of stock in the domestic market, and the economic evaluation of the importing activities considering the prices of the products. The Supply Coordinator, on the other hand, is responsible for daily replenishment activities of the products to the retailers in Turkey. As the complaints were basically related to Supply Manager and Supply Coordinator, the analysis is

concentrated on the existing system which will be called the Daily Replenishment Information System.

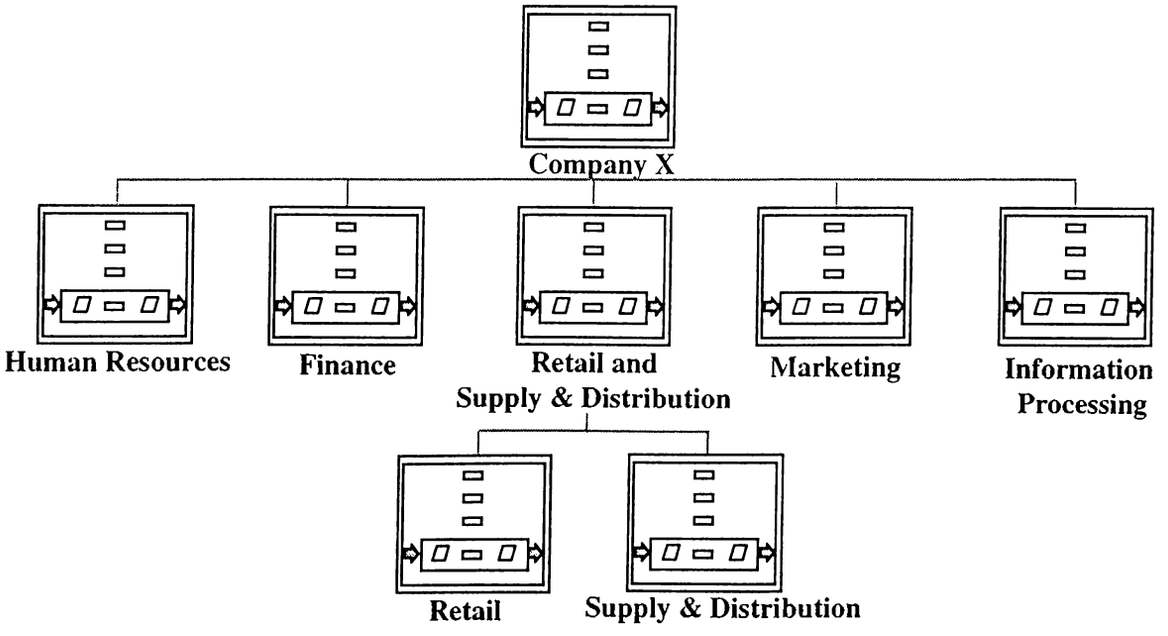

Figure 10. The Subsystems of Company X

IV.III.I.I View the Daily Replenishment Information System

The Daily Information System is the conceptual system used to monitor the physical system which is the unloading of the merchandise to the warehouses, the stocking and the distribution of the prôduct to the retailers. The Supply Manager is the manager responsible for monitoring the activities of transportation of merchandise to the warehouses, and has the authority to sign up the payments of transformations, unlike Supply Coordinator. The Supply Coordinator acts as an Information Processor, and is the only person responsible for collecting, storing, filing data and documents, preparing periodic and special reports, communicating with the environmental elements. All the jobs performed by the Supply &

Distribution Department is performed on behalf of Company X. As a result the environmental elements of the Daily Replenishment Information System (DRIS) are also the environmental elements of Company X.

IV.III.I.II The Environmental System of the Daily Replenishment Information System

At this step, the documentation of the conceptual system is achieved by using a Data Flow Diagram is made. In order to draw the Context Diagram, the environmental elements are identified. The environmental elements of the Daily Replenishment Information System are : Warehouses, Supervision Company, Supplier, Armature of Vehicles, Tenant Companies, Vice-president of Marketing Department, Vice-president of Retail and Supply & Distribution Department, and Accounting Department as shown in Figure 11.

As stated previously, Company X does not have a fleet of delivery vehicles, but instead charters vehicles which are of appropriate size, capacity, and which meet the Company Shipping, Health, Safety and Environment Principles, either on a time or a charter basis. Due to the natural restrictions of transportation, the number of possible routes is only four, and the agreements are made based on these routes.

Both time and voyage charter vehicles are hired on a yearly basis. The Company X makes constant payments to a time charter vehicle at the end of each month in TL or $, and also pays all the expenses during loading and discharging operations. On the other hand, the voyage charter vehicle is paid after each freight performed on the agreed freight price per ton of product and route. The order of transportation including the type, and quantity of the product, discharge warehouse, the target date of loading and discharge is communicated directly to the

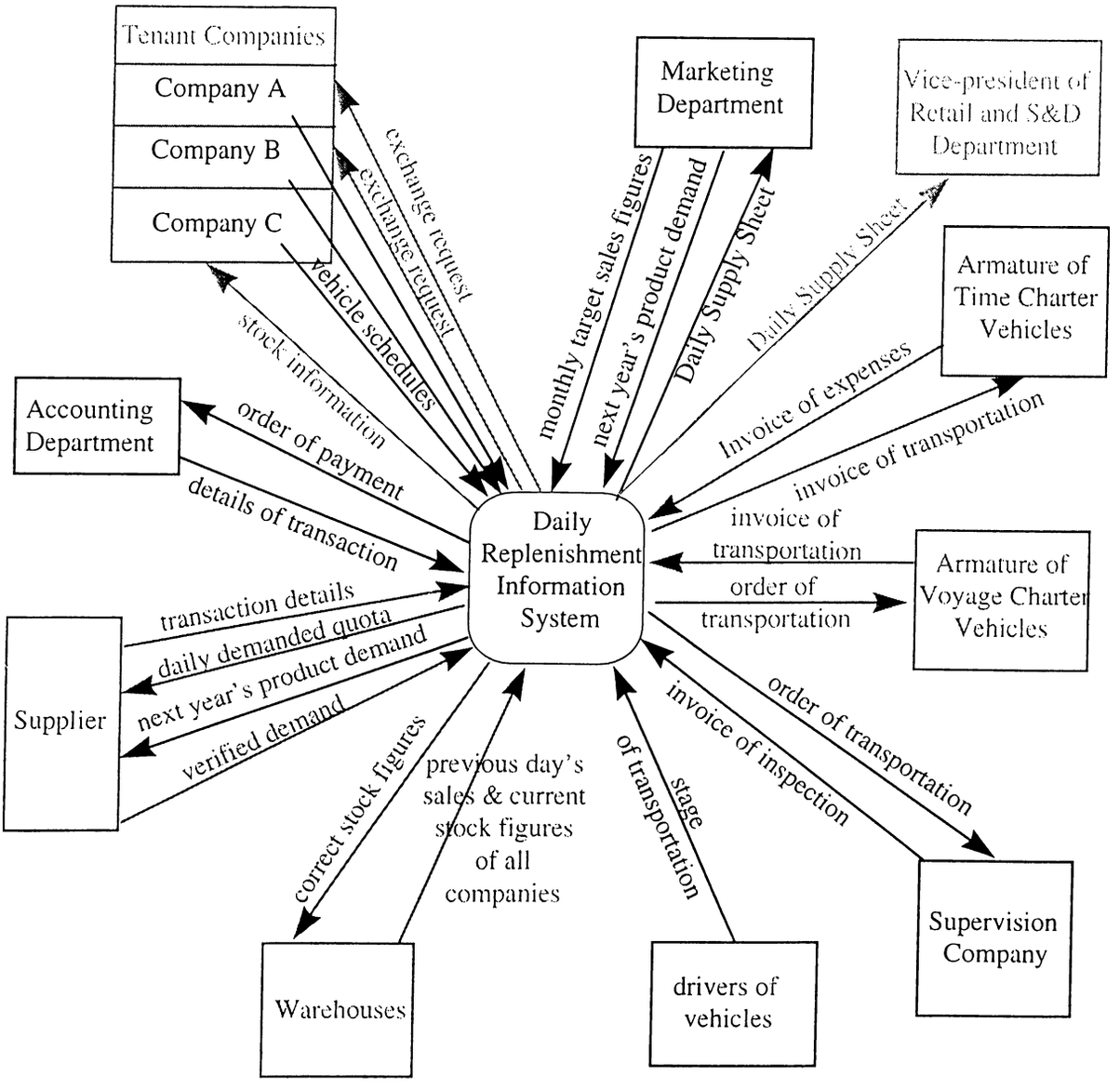

Figure 11. The Context Data Flow Diagram

Armature of Vehicles. After the voyage charter vehicle discharges its product to the directed warehouse, the armature sends the invoice for transformation. The Armature of time charter vehicles sends only the invoices of the expenses to be paid by the Company X. The drivers of the vehicles communicate with telex about the loading time, expected arrival and discharge dates.

The Supervision Company is also informed about the details of transportation. The Supervision Company supervises the operations before, during, and after loading, and discharging. After each freight, it sends the report of inspection including the data loading, and discharge quantities, exact dates of operations attached with the invoice of inspection.

Due to excess capacity in the warehouses, Company X lets three tenant companies, which are in fact the competitors, stock their own products in Warehouse 1 and 2. Company X might demand product exchange or direct purchase from the stocks of Company A, or B to close the gap between the daily quota of the company obtained from the Supplier, and the product demanded. By this way, the Company maintains control and information about the sales of three of its competitors, and also minimises the operating costs. In Warehouse 1, the stocks of Company X, A, and B are kept separate from each other. In Warehouse 2, the product sales of Company A is made from its own account, however, the product sales of Company C is made from the Company X's stock, and Company C is informed to either pay the amount of the products sold to be paid in TL to Company X, or bring merchandise to be stocked to the account of Company X. As the capacity of Warehouse 3 is just enough for

Company X, there is no tenant company. All the tenant companies, and Company X keep the records of quantities sold of each product, and has to inform the Supply Coordinator if they plan to stock products to any of the warehouses. Warehouses send the data of the previous day's sales and current stock figures of every company separately for each product, and the exact discharge amount of each transportation is communicated to the Supply Coordinator. In return, if there is a mismatch between the stock values of the Supply Coordinator and the warehouses, the correct stock values are maintained after negotiating with each other.

Company X purchases all of the products from two factories of the Supplier. The Supply Coordinator sends the estimated product demands of each product from each of the factory for the next year to the Planning and Programming Department of the Supplier by fax through the end of year so that the Supplier have time to arrange the import operations of the raw material, and the production schedule for the next year. As previously stated, the Supplier sets quotas for every company operating in the market. Every company do not have the right to demand an amount of product more than its quota which is set at the beginning of every year and communicated to the companies, so all of the companies regulate themselves according to the quotas, and calculates the daily product demand accordingly. The Supply Coordinator communicates the product demand after calculating the quota everyday. When the Supplier verifies the demand, the Supply Coordinator sends the details of transaction (bank, amount, account number) back to the Supplier.

Marketing Department basically communicates two kinds of information to the Supply Coordinator: the first one is the monthly target sales figures of each one, and the second one is yearly estimated product demands from each factory of the Supplier. The Supply Coordinator. In exchange sends the hard copy of the 'Daily Supply Sheet' which involves the data about the current situation of Supply as shown in Figure 12.

Accounting Department verifies the transaction to be made related with the purchase of daily product demands, and communicates the Supply Coordinator by telephone, in exchange, the Supply Coordinator sends the order of payment which includes the amount of payment.

DAILY SUPPLY SHEET

Date

Warehouse 1

	Product A	Product B	Product C	Product D
Daily target sales				
Prev. week actual aver. daily sales				
Previous Day Product Sales				
Company A				
Company B				
Opening Stocks				
Company A				
Company B				
Remaining Stocks				
Transportation				

Warehouse 2

	Product A	Product B	Product C	Product D
Daily target sales				
Prev. week actual aver. daily sales				
Previous Day Product Sales				
Company A				
Company C				
Opening Stocks				
Company A				
Company C				
Remaining Stocks				
Transportation				

Facility 3

	Product A	Product B	Product C	Product D
Daily target sales				
Prev. week actual aver. daily sales				
Previous Day Product Sales				
Opening Stocks				
Remaining Stocks				
Transportation				

Figure 12. Daily Supply Sheet

The Supply Coordinator sends the hard copy of 'Daily Supply Sheet' to the Vice-president of the Retail and Supply & Distribution Department. The Vice-president communicates with the Supply Coordinator either by phone or e-mail in need of different information.

IV.III.I.III Analyse the Daily Replenishment Information System

In order to elaborate the conceptual DRIS, the Figure 0 diagram as shown in Figure 13a, 13b, and 13c is drawn by identifying the processes, the flow of data, the timing and the details of the communication methods used.

First Process : Update Stock Files Every morning at 8. 30 to 9.00, except on Sundays, all the warehouses send the previous day's sales figures of each product and of each company to the Supply Coordinator. This information arrives through e-mail from Warehouse 1 and 2, and through fax from Warehouse 3 as there is not an e-mail connection between the headquarter and the warehouse. As the warehouses are closed on Sundays, and the company is in weekend holiday on Saturdays and Sundays, the sales figures of both Friday and Saturday arrives to the Supply Group on Monday mornings. As the warehouses do not have a direct access to the system, the hard copies of the e-mails are taken, and the figures are entered by hand to the corresponding master stock files. As the previous day's sales figures are entered to the related cells, the current stock figures are calculated automatically by the use of installed formulas. If there is a mismatch between the available stock figures of the warehouse, and the Coordinator, he communicates with the operator of the warehouse, and corrects the figures. The master stock files of all the warehouses are shown in Appendix A. The formulas used are also shown on the cells of the Tables.

Second Process: Update Quota File The monthly transportation master file is a file kept both in the form of a computer worksheet and manual, and holds all the data -name of the vehicle, number of travel, date and factory of loading, date and warehouse of discharge, exact loading and discharge quantities of each product- related with the transportation of vehicles. Supplier sends the monthly quota of each product at the first days of the month. The quota figures are entered to the 'Daily Quota' file once a month as shown in Table 3. As the exact loading quantities of each product is stored in the monthly transportation file, the previous day's transportation figures are obtained from the corresponding cells, and they are also entered manually to the corresponding cells, as there is no link between the spreadsheet files. The worksheet automatically calculates the daily quota of the day by using the formulas.

Third Process : Evaluate Stock After the calculation of daily quota, and the data of stock quantities, the remaining stock figures are calculated. Company X is under the obligation of keeping at least a two days stock to be on the safe side. As it owns the warehouses, it has to keep the merchandise flowing in case of any shortage of product, but also should not keep over stock cause that would increase the costs. While calculating the remaining stocks, the assumption is that if sales continue at that level, for how many days the stocks would be enough to meet the demand of the retailers.

Fourth Process : Evaluate Vehicle Schedule By calculating the remaining stocks, and the quota, the next step is to evaluate the fleet position by using the data of the monthly transportation file which shows the destination of each vehicle. As the quantity to be demanded is known by that time, the vehicle to be loaded is decided.

	A	B	C	D	E
1					
2			**DAILY QUOTA FILE**		
3					
4					
5		**Product A**	**Product B**	**Product C**	**Product D**
6					
7	Monthly Total Quantity				
8					
9	Number of Days		=B9	=B9	=B9
10					
11	Average Daily Product Quantity	=B7/B9	=C7/C9	=D7/D9	=E7/E9
12					
13	Daily Quota	=B11*F4-B28	=C11*G4-C28	=D11*H4-D28	=E11*I4-E28
14					
15					
16	***Previous Day Transportation***				
17	Vehicle 1				
18	Vehicle 2				
19	Vehicle 3				
20					
21					
22					
23	***Total transportation***				
24	Vehicle 1				
25	Vehicle 2				
26	Vehicle 3				
27		+	+	+	+
28		=SUM(B24:B26)	=SUM(C24:C26)	=SUM(D24:D26)	=SUM(E24:E26)
29					
30					

Table 3. Daily Quota File

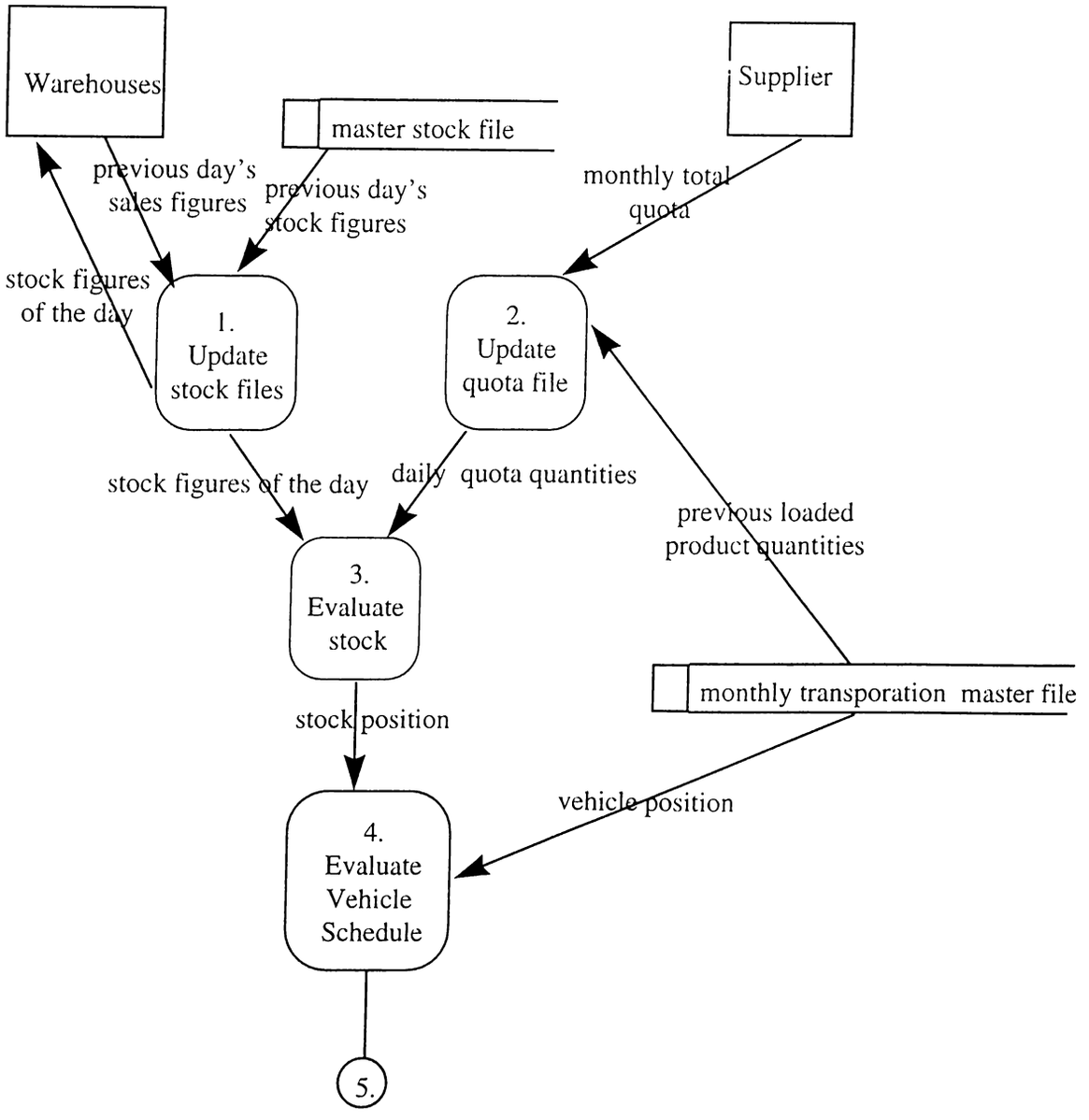

Figure 13a. Figure 0 Diagram

Fifth Process : Prepare Daily Supply Sheet The Daily Supply Sheet is a printed, tabular, and periodic (daily) report involving all the data related with the previous day's sale, stock, and target sale quantities of each product, and sent before noon. The monthly target sale quantities are send from the Marketing Department by e-mail, and the Supply Coordinator converts this to average daily target sale values by dividing the quantity into number of the

days of the month by using a calculator. This sheet forms a reference to the demanded quantities from the Supplier in accordance to the quota.

At this step, a formal meeting between 9.00 and 9.30 with the Supply Manager is conducted, and the stock, quota, and fleet situation is evaluated. As the quantity to be demanded is agreed, and approved by the Supply Manager, the next process starts.

Sixth Process : Verify Demand After completing the internal processes, the Supply Group informs the Giant Supplier about the planned transportations at 9.30 to 10. 00 AM by telephone, and waits till 10.30 AM for the proportion of the accepted demand quantities. If there is a considerable difference between the quantity demanded and the accepted, other means of supply like purchasing from another company, or borrowing some amount from the other company's stocks is investigated.

Seventh Process : Verify Amount of Payment Then the monetary amount of the accepted merchandise from the Supplier is informed to the Accounting Department by order of payment which is delivered immediately by direct contacting, and the details of further transactions is communicated to the Supply Coordinator by telephone. This process has to be completed before 12.00A.M because banks do not accept the order transactions in the afternoons. The next step is sending the fax involving the information of the date of the transportation, quantity demanded of the product, the name of the vehicle, the amount of money to be transferred to the account of the Supplier, and the name of the bank where the transactions will be made.

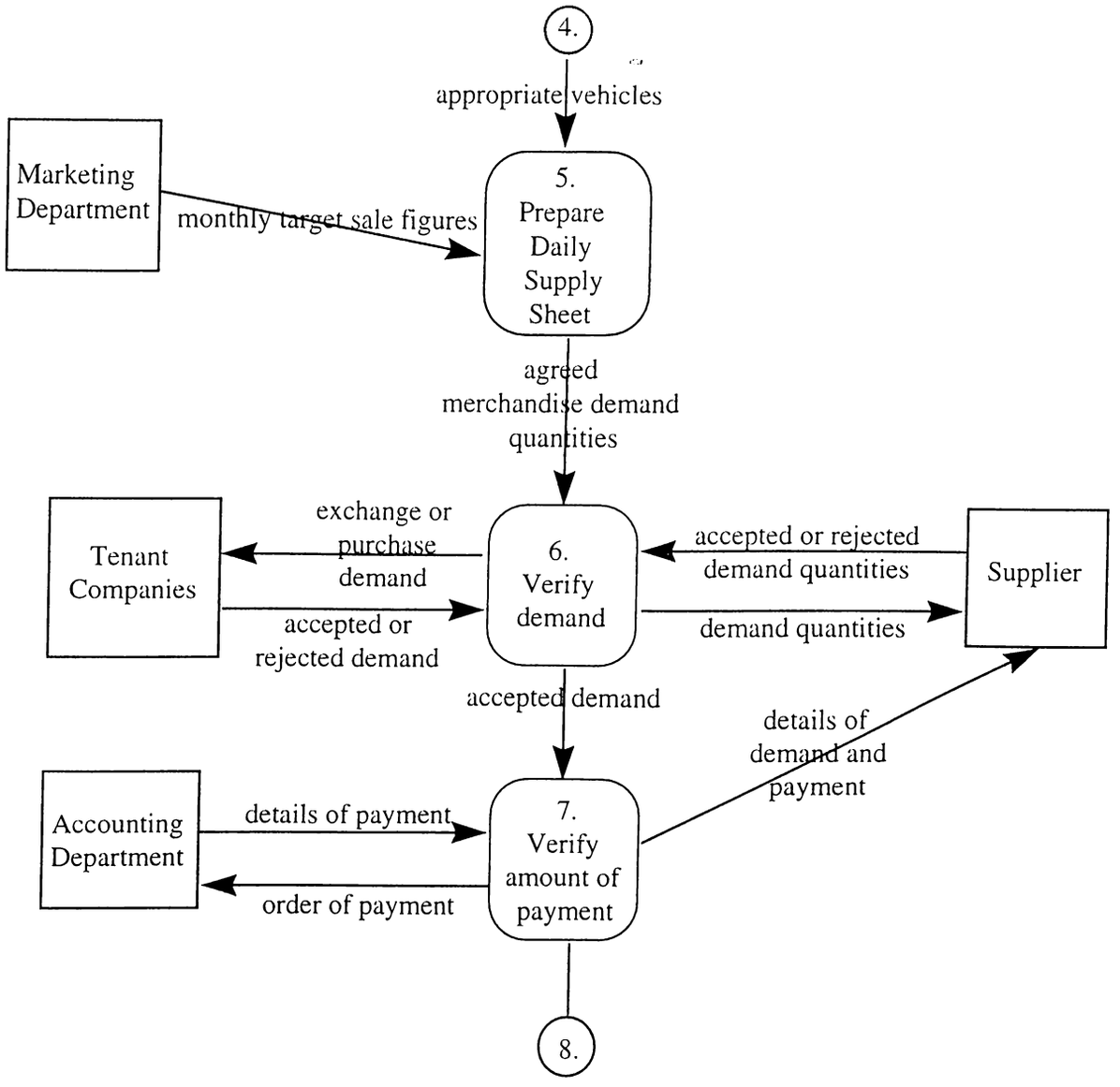

Figure 13b. Figure 0 Diagram

Eight Process : Correct Daily Supply Sheet At this step Daily Supply Sheet shown in Appendix F reaches its final form by the exact accepted quantities of merchandise, so it is send by the porter working within the company to the Marketing Department, the Vice-president of Retail and Supply & Distribution Department, and one hard copy is kept for the Group and filed in the Daily Supply Master File.

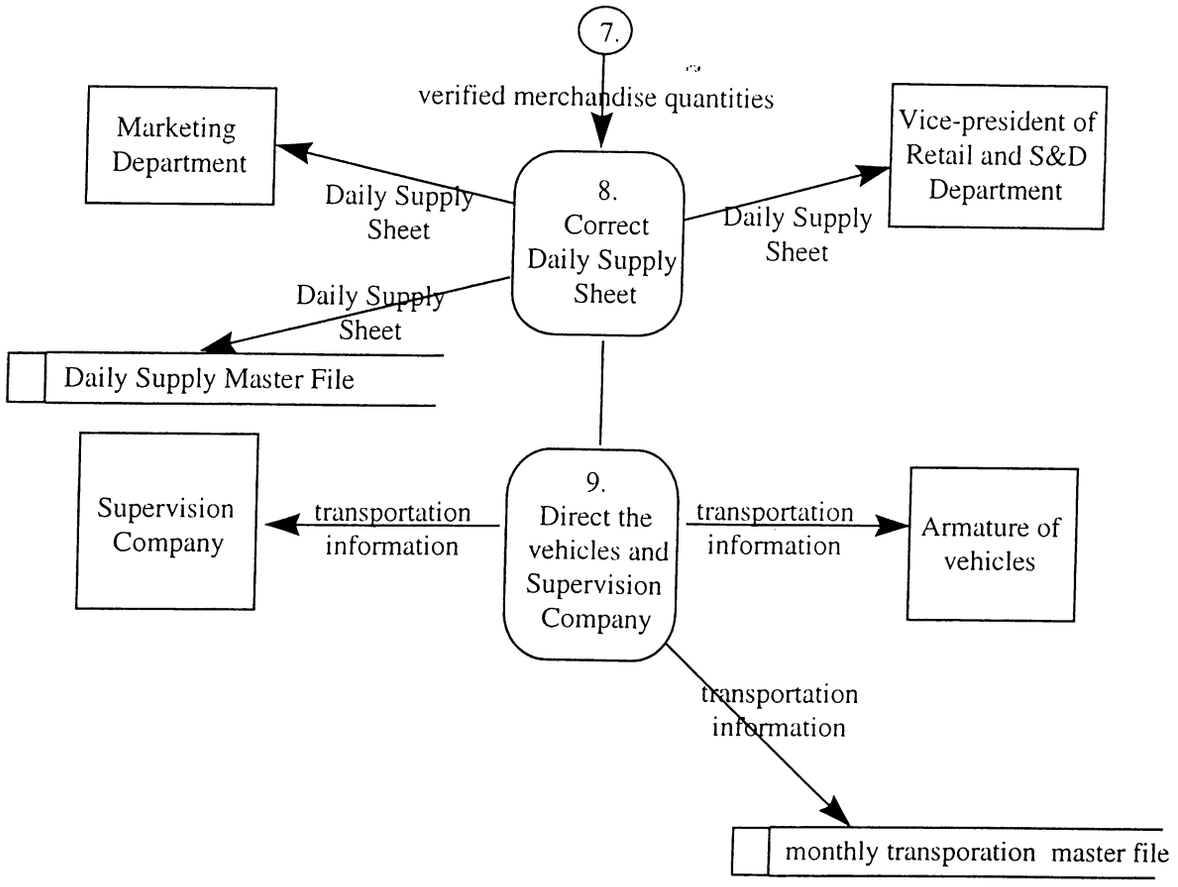

Figure 13c. Figure 0 Diagram

Ninth Process : Direct the Vehicles and Supervision Company As the exact quantities of merchandise is known, both the armature of vehicle, and the Supervision Company are informed about the loading quantity, the loading factory, the destination, and the time of expected loading and discharging. That information is also recorded in both the manual, and computer Master Monthly Transportation Files as shown in Table 4.

The Supply Coordinator creates a file for every transportation made, and keeps every document send from Supervision Company, Armature of Vehicles, and Warehouses. He also keeps the hard copies of Daily Supply Sheets in another file.

					Product A			Product B			Product C			Product D			
No. of Travel	Date of Loading	Port of Loading	Date of Discharge	Port of Discharge	Loading Quantity	Discharge Quantity	Difference	Loading Quantity	Discharge Quantity	Difference	Loading Quantity	Discharge Quantity	Difference	Loading Quantity	Discharge Quantity	Difference	Name of Vehicle

Table 4. Master Monthly Transportation File

IV.IV Phase III - Solution Effort

IV.IV.I Recommendations

Through years of experience, the Supply Coordinator has developed a half computer, half manual system in conducting his work. As the system grew in size, complexity and affected multiple organisational units, the current system began causing problems both for the Coordinator and the managers. The time limitations for most of the processes forces him to be effective and race against time, but as he is not fully trained in using the existing computer system, he can not perform as much as he has to, and can not meet the demands. Under these circumstances, to fully perform his job, he works overtime, even at weekends, and has the right to complain about the work overload. The managers also have the right to complain about not being able to monitor the physical system up-to-minute because there is not a central data repository which would provide data immediately.

This analysis shows that there exist two basic problems with the current system. The first one is related with the efficiency of the Supply Coordinator, and the other with the existing computer system in the company. The recommendations developed to find solutions to these problems are presented in the following paragraphs.

My first recommendation for increasing the efficiency of the Supply Coordinator is, conducting an education and training program which would enable him to use a computer effectively and learn more about computer usage, the system development and analysis tools. Of all the changes in computing during the past several years, end-user computing has had the most dramatic effect. For the first time, people other than information specialists are

developing their own applications. It is not sufficient for end users to simply be able to use an electronic spread sheet, which means that end users like the Supply Coordinator should have systems analysis and design capabilities and be able to use many of the same tools as the system analyst uses in developing applications. After such a program, the Supply Coordinator would learn how to benefit from the use of a computer, its speed and accuracy, will analyse systems, develop new ones and add more value to his company.

My second recommendation related with the efficiency problem is to appoint an information specialist who will establish the link between the Supply Coordinator and the computer rather than an education and training program. The information specialist would direct Supply Coordinator to the correct information resource, use them effectively, help him to maintain security, and direct him to obey the policies and standards governing computer use set by the company. In this way, the combination of the experiences of the Supply Coordinator and the information specialist would create an effective system.

The problems of the current computer system arises from the fact that there exist no central data repository which would provide data to any user about the activities of the company. A solution for this problem is to develop the database concept in the company, and supply essential the equipment and assistance to establish a database. Another solution would be to establish a computer-based Information Processor (IP) by a communication network enabling direct access between the managers. In this way, the complaints of the managers related with the timeliness of the reports, and up-to-minute information on the physical system would be eliminated. Management might also use the IP to evaluate the system performance by comparing the output of the IP which is the actual activity showing what the system is accomplishing, and the desired activity, and also might use it as a decision transmitter by a

communication network from the management to the physical systems so that changes can be made.

While developing the computer system of the subject company, it seems that the system developers have concentrated their efforts within the headquarter and ignored the environment. But it is a fact that a company can not survive if it can not establish an effective information flow between the elements of its environment. What is more, in the future representatives of multiple companies will have to work together, most likely using new technologies and tools. The alternative for establishing an effective, and faster communication might be developing network between the computer system of the Supplier, and by this way the time lost in the phone, or preparing and sending a fax would diminish. The product demanding might be made by sending the request file from the system of the Supply Coordinator to the directed receiver of the Supplier. A similar network system might be established between the warehouses and the headquarter, so that the Supply Coordinator would not lose time to get the hard copies of the previous day's sales figures, and enter the values manually into his computer files.

SECTION V. SUMMARY AND CONCLUSION

In this case study, the analysis of the Daily Replenishment Information System performed by a human Information Processor working in the Supply & Distribution Department of the Turkish Branch of an international company after a three month active participation to the operations is conducted by using the Systems Approach. After the identification of the problems, the systems approach, which is the tailored form of the general problem-solving approach to the solution of systems problems is applied. As a documentation tool in identifying the processes and the flow of information, Data Flow Diagrams are used. Recommendations related with the efficiency and timeliness of the information processor and the current computer system are developed.

This study shows that everyone is a systems analyst in a certain sense. Everyone manages a system and is expected to keep the system performing at its peak efficiency. Anyone, a manager or a non-manager, who conducts a systems analysis by using a systematic approach would decrease the chances of overlooking vital information or a good alternative, and would not rely on trial and error.

This thesis is conducted from the point of view of a manager by a non-manager, and is as much accurate as the information provided during in-depth interviews by the managers of the subject company, and the related documents searched.

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APPENDIX A

Master Stock Files of the Warehouses

	A	B	C	D	E	F	G	H	I
1									
2									
3		**WAREHOUSE 1**							
4					*Company X*				
5									
6		**Stocks**				**Sales**			
7	Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8									
9	1 - Feb								
10	2 - Feb	=B9-F9	=C9-G9	=D9-H9	=E9-I9				
11	3 - Feb	=B10-F10	=C10-G10	=D10-H10	=E10-I10				
12									
13	*Weekly Total*	*=SUM(B9:B11)*	*=SUM(C9:C11)*	*=SUM(D9:D11)*	*=SUM(E9:E11)*	*=SUM(F9:F11)*	*=SUM(G9:G11)*	*=SUM(H9:H11)*	*=SUM(I9:I11)*
14	*Weekly Average*	*=B13/3*	*=C13/3*	*=D13/3*	*=E13/3*	*=F13/3*	*=G13/3*	*=H13/3*	*=I13/3*
15									
16	5 - Feb	=B11-F11	=C11-G11	=D11-H11	=E11-I11				
17	6 - Feb	=B16-F16	=C16-G16	=D16-H16	=E16-I16				
18	7 - Feb	=B17-F17	=C17-G17	=D17-H17	=E17-I17				
19	8 - Feb	=B18-F18	=C18-G18	=D18-H18	=E18-I18				
20	9 - Feb	=B19-F19	=C19-G19	=D19-H19	=E19-I19				
21	10 - Feb	=B20-F20	=C20-G20	=D20-H20	=E20-I20				
22									
23	*Weekly Total*	*=SUM(B16:B21)*	*=SUM(C16:C21)*	*=SUM(D16:D21)*	*=SUM(E16:E21)*	*=SUM(F16:F21)*	*=SUM(G16:G21)*	*=SUM(H16:H21)*	*=SUM(I16:I21)*
24	*Weekly Average*	*=B23/6*	*=C23/6*	*=D23/6*	*=E23/6*	*=F23/6*	*=G23/6*	*=H23/6*	*=I23/6*
25									
26	12 - Feb	=B21-F21	=C21-G21	=D21-H21	=E21-I21				
27	13 - Feb	=B26-F26	=C26-G26	=D26-H26	=E26-I26				
28	14 - Feb	=B27-F27	=C27-G27	=D27-H27	=E27-I27				
29	15 - Feb	=B28-F28	=C28-G28	=D28-H28	=E28-I28				
30	16 - Feb	=B29-F29	=C29-G29	=D29-H29	=E29-I29				
31	17 - Feb	=B30-F30	=C30-G30	=D30-H30	=E30-I30				
32									
33	*Weekly Total*	*=SUM(B26:B31)*	*=SUM(C26:C31)*	*=SUM(D26:D31)*	*=SUM(E26:E31)*	*=SUM(F26:F31)*	*=SUM(G26:G31)*	*=SUM(H26:H31)*	*=SUM(I26:I31)*
34	*Weekly Average*	*=B33/6*	*=C33/6*	*=D33/6*	*=E33/6*	*=F33/6*	*=G33/6*	*=H33/6*	*=I33/6*
35									
36	19 - Feb	=B31-F31	=C31-G31	=D31-H31	=E31-I31				
37	20 - Feb	=B36-F36	=C36-G36	=D36-H36	=E36-I36				
38	21 - Feb	=B37-F37	=C37-G37	=D37-H37	=E37-I37				
39	22 - Feb	=B38-F38	=C38-G38	=D38-H38	=E38-I38				
40	23 - Feb	=B39-F39	=C39-G39	=D39-H39	=E39-I39				
41	24 - Feb	=B40-F40	=C40-G40	=D40-H40	=E40-I40				
42									
43	*Weekly Total*	*=SUM(B36:B41)*	*=SUM(C36:C41)*	*=SUM(D36:D41)*	*=SUM(E36:E41)*	*=SUM(F36:F41)*	*=SUM(G36:G41)*	*=SUM(H36:H41)*	*=SUM(I36:I41)*
44	*Weekly Average*	*=B43/6*	*=C43/6*	*=D43/6*	*=E43/6*	*=F43/6*	*=G43/6*	*=H43/6*	*=I43/6*
45									
46	26 - Feb	=B41-F41	=C41-G41	=D41-H41	=E41-I41				
47	27 - Feb	=B46-F46	=C46-G46	=D46-H46	=E46-I46				
48	28 - Feb	=B47-F47	=C47-G47	=D47-H47	=E47-I47				
49	29 - Feb	=B48-F48	=C48-G48	=D48-H48	=E48-I48				
50									
51	*Weekly Total*	*=SUM(B46:B49)*	*=SUM(C46:C49)*	*=SUM(D46:D49)*	*=SUM(E46:E49)*	*=SUM(F46:F49)*	*=SUM(G46:G50)*	*=SUM(H46:H50)*	*=SUM(I46:I49)*
52	*Weekly Average*	*=B51/4*	*=C51/4*	*=D51/4*	*=E51/4*	*=F51/4*	*=G51/4*	*=H51/4*	*=I51/4*
53	*Monthly Total*	*=B51+B43+B33+B23+B13*	*=C51+C43+C33+C23+C13*	*=D51+D43+D33+D23+D13*	*=E51+E43+E33+E23+E13*	*=F51+F43+F33+F23+F13*	*=G51+G43+G33+G23+G13*	*=H51+H43+H33+H23+H13*	*=I51+I43+I33+I23+I13*
54	*Monthly Average*	*=B53/29*	*=C53/29*	*=D53/29*	*=E53/29*	*=F53/29*	*=G53/29*	*=H53/29*	*=I53/29*
55									

Spread Sheet of Company X in Warehouse 1

	A	B	C	D	E	F	G	H	I
1									
2									
3		**WAREHOUSE 1**							
4					***Company A***				
5									
6		**Stocks**				**Sales**			
7	Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8									
9	1 - Feb								
10	2 - Feb	=B9-F9	=C9-G9	=D9-H9	=E9-I9				
11	3 - Feb	=B10-F10	=C10-G10	=D10-H10	=E10-I10				
12									
13	*Weekly Total*	*=SUM(B9:B11)*	*=SUM(C9:C11)*	*=SUM(D9:D11)*	*=SUM(E9:E11)*	*=SUM(F9:F11)*	*=SUM(G9:G11)*	*=SUM(H9:H11)*	*=SUM(I9:I11)*
14	*Weekly Average*	*=B13/3*	*=C13/3*	*=D13/3*	*=E13/3*	*=F13/3*	*=G13/3*	*=H13/3*	*=I13/3*
15									
16	5 - Feb	=B11-F11	=C11-G11	=D11-H11	=E11-I11				
17	6 - Feb	=B16-F16	=C16-G16	=D16-H16	=E16-I16				
18	7 - Feb	=B17-F17	=C17-G17	=D17-H17	=E17-I17				
19	8 - Feb	=B18-F18	=C18-G18	=D18-H18	=E18-I18				
20	9 - Feb	=B19-F19	=C19-G19	=D19-H19	=E19-I19				
21	10 - Feb	=B20-F20	=C20-G20	=D20-H20	=E20-I20				
22									
23	*Weekly Total*	*=SUM(B16:B21)*	*=SUM(C16:C21)*	*=SUM(D16:D21)*	*=SUM(E16:E21)*	*=SUM(F16:F21)*	*=SUM(G16:G21)*	*=SUM(H16:H21)*	*=SUM(I16:I21)*
24	*Weekly Average*	*=B23/6*	*=C23/6*	*=D23/6*	*=E23/6*	*=F23/6*	*=G23/6*	*=H23/6*	*=I23/6*
25									
26	12 - Feb	=B21-F21	=C21-G21	=D21-H21	=E21-I21				
27	13 - Feb	=B26-F26	=C26-G26	=D26-H26	=E26-I26				
28	14 - Feb	=B27-F27	=C27-G27	=D27-H27	=E27-I27				
29	15 - Feb	=B28-F28	=C28-G28	=D28-H28	=E28-I28				
30	16 - Feb	=B29-F29	=C29-G29	=D29-H29	=E29-I29				
31	17 - Feb	=B30-F30	=C30-G30	=D30-H30	=E30-I30				
32									
33	*Weekly Total*	*=SUM(B26:B31)*	*=SUM(C26:C31)*	*=SUM(D26:D31)*	*=SUM(E26:E31)*	*=SUM(F26:F31)*	*=SUM(G26:G31)*	*=SUM(H26:H31)*	*=SUM(I26:I31)*
34	*Weekly Average*	*=B33/6*	*=C33/6*	*=D33/6*	*=E33/6*	*=F33/6*	*=G33/6*	*=H33/6*	*=I33/6*
35									
36	19 - Feb	=B31-F31	=C31-G31	=D31-H31	=E31-I31				
37	20 - Feb	=B36-F36	=C36-G36	=D36-H36	=E36-I36				
38	21 - Feb	=B37-F37	=C37-G37	=D37-H37	=E37-I37				
39	22 - Feb	=B38-F38	=C38-G38	=D38-H38	=E38-I38				
40	23 - Feb	=B39-F39	=C39-G39	=D39-H39	=E39-I39				
41	24 - Feb	=B40-F40	=C40-G40	=D40-H40	=E40-I40				
42									
43	*Weekly Total*	*=SUM(B36:B41)*	*=SUM(C36:C41)*	*=SUM(D36:D41)*	*=SUM(E36:E41)*	*=SUM(F36:F41)*	*=SUM(G36:G41)*	*=SUM(H36:H41)*	*=SUM(I36:I41)*
44	*Weekly Average*	*=B43/6*	*=C43/6*	*=D43/6*	*=E43/6*	*=F43/6*	*=G43/6*	*=H43/6*	*=I43/6*
45									
46	26 - Feb	=B41-F41	=C41-G41	=D41-H41	=E41-I41				
47	27 - Feb	=B46-F46	=C46-G46	=D46-H46	=E46-I46				
48	28 - Feb	=B47-F47	=C47-G47	=D47-H47	=E47-I47				
49	29 - Feb	=B48-F48	=C48-G48	=D48-H48	=E48-I48				
50									
51	*Weekly Total*	*=SUM(B46:B49)*	*=SUM(C46:C49)*	*=SUM(D46:D49)*	*=SUM(E46:E49)*	*=SUM(F46:F49)*	*=SUM(G46:G50)*	*=SUM(H46:H50)*	*=SUM(I46:I49)*
52	*Weekly Average*	*=B51/4*	*=C51/4*	*=D51/4*	*=E51/4*	*=F51/4*	*=G51/4*	*=H51/4*	*=I51/4*
53	*Monthly Total*	*=B51+B43+B33+B23+B13*	*=C51+C43+C33+C23+C13*	*=D51+D43+D33+D23+D13*	*=E51+E43+E33+E23+E13*	*=F51+F43+F33+F23+F13*	*=G51+G43+G33+G23+G13*	*=H51+H43+H33+H23+H13*	*=I51+I43+I33+I23+I13*
54	*Monthly Average*	*=B53/29*	*=C53/29*	*=D53/29*	*=E53/29*	*=F53/29*	*=G53/29*	*=H53/29*	*=I53/29*
55									

Spread Sheet of Company A in Warehouse 1 (cont.)

	A	B	C	D	E	F	G	H	I
1									
2									
3		**WAREHOUSE 1**							
4				***Company B***					
5									
6		**Stocks**				**Sales**			
7	Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8									
9	1 - Feb								
10	2 - Feb	=B9-F9	=C9-G9	=D9-H9	=E9-I9				
11	3 - Feb	=B10-F10	=C10-G10	=D10-H10	=E10-I10				
12									
13	*Weekly Total*	*=SUM(B9:B11)*	*=SUM(C9:C11)*	*=SUM(D9:D11)*	*=SUM(E9:E11)*	*=SUM(F9:F11)*	*=SUM(G9:G11)*	*=SUM(H9:H11)*	*=SUM(I9:I11)*
14	*Weekly Average*	*=B13/3*	*=C13/3*	*=D13/3*	*=E13/3*	*=F13/3*	*=G13/3*	*=H13/3*	*=I13/3*
15									
16	5 - Feb	=B11-F11	=C11-G11	=D11-H11	=E11-I11				
17	6 - Feb	=B16-F16	=C16-G16	=D16-H16	=E16-I16				
18	7 - Feb	=B17-F17	=C17-G17	=D17-H17	=E17-I17				
19	8 - Feb	=B18-F18	=C18-G18	=D18-H18	=E18-I18				
20	9 - Feb	=B19-F19	=C19-G19	=D19-H19	=E19-I19				
21	10 - Feb	=B20-F20	=C20-G20	=D20-H20	=E20-I20				
22									
23	*Weekly Total*	*=SUM(B16:B21)*	*=SUM(C16:C21)*	*=SUM(D16:D21)*	*=SUM(E16:E21)*	*=SUM(F16:F21)*	*=SUM(G16:G21)*	*=SUM(H16:H21)*	*=SUM(I16:I21)*
24	*Weekly Average*	*=B23/6*	*=C23/6*	*=D23/6*	*=E23/6*	*=F23/6*	*=G23/6*	*=H23/6*	*=I23/6*
25									
26	12 - Feb	=B21-F21	=C21-G21	=D21-H21	=E21-I21				
27	13 - Feb	=B26-F26	=C26-G26	=D26-H26	=E26-I26				
28	14 - Feb	=B27-F27	=C27-G27	=D27-H27	=E27-I27				
29	15 - Feb	=B28-F28	=C28-G28	=D28-H28	=E28-I28				
30	16 - Feb	=B29-F29	=C29-G29	=D29-H29	=E29-I29				
31	17 - Feb	=B30-F30	=C30-G30	=D30-H30	=E30-I30				
32									
33	*Weekly Total*	*=SUM(B26:B31)*	*=SUM(C26:C31)*	*=SUM(D26:D31)*	*=SUM(E26:E31)*	*=SUM(F26:F31)*	*=SUM(G26:G31)*	*=SUM(H26:H31)*	*=SUM(I26:I31)*
34	*Weekly Average*	*=B33/6*	*=C33/6*	*=D33/6*	*=E33/6*	*=F33/6*	*=G33/6*	*=H33/6*	*=I33/6*
35									
36	19 - Feb	=B31-F31	=C31-G31	=D31-H31	=E31-I31				
37	20 - Feb	=B36-F36	=C36-G36	=D36-H36	=E36-I36				
38	21 - Feb	=B37-F37	=C37-G37	=D37-H37	=E37-I37				
39	22 - Feb	=B38-F38	=C38-G38	=D38-H38	=E38-I38				
40	23 - Feb	=B39-F39	=C39-G39	=D39-H39	=E39-I39				
41	24 - Feb	=B40-F40	=C40-G40	=D40-H40	=E40-I40				
42									
43	*Weekly Total*	*=SUM(B36:B41)*	*=SUM(C36:C41)*	*=SUM(D36:D41)*	*=SUM(E36:E41)*	*=SUM(F36:F41)*	*=SUM(G36:G41)*	*=SUM(H36:H41)*	*=SUM(I36:I41)*
44	*Weekly Average*	*=B43/6*	*=C43/6*	*=D43/6*	*=E43/6*	*=F43/6*	*=G43/6*	*=H43/6*	*=I43/6*
45									
46	26 - Feb	=B41-F41	=C41-G41	=D41-H41	=E41-I41				
47	27 - Feb	=B46-F46	=C46-G46	=D46-H46	=E46-I46				
48	28 - Feb	=B47-F47	=C47-G47	=D47-H47	=E47-I47				
49	29 - Feb	=B48-F48	=C48-G48	=D48-H48	=E48-I48				
50									
51	*Weekly Total*	*=SUM(B46:B49)*	*=SUM(C46:C49)*	*=SUM(D46:D49)*	*=SUM(E46:E49)*	*=SUM(F46:F49)*	*=SUM(G46:G50)*	*=SUM(H46:H50)*	*=SUM(I46:I49)*
52	*Weekly Average*	*=B51/4*	*=C51/4*	*=D51/4*	*=E51/4*	*=F51/4*	*=G51/4*	*=H51/4*	*=I51/4*
53	*Monthly Total*	*=B51+B43+B33+B23+B13*	*=C51+C43+C33+C23+C13*	*=D51+D43+D33+D23+D13*	*=E51+E43+E33+E23+E13*	*=F51+F43+F33+F23+F13*	*=G51+G43+G33+G23+G13*	*=H51+H43+H33+H23+H13*	*=I51+I43+I33+I23+I13*
54	*Monthly Average*	*=B53/29*	*=C53/29*	*=D53/29*	*=E53/29*	*=F53/29*	*=G53/29*	*=H53/29*	*=I53/29*
55									

Spread Sheet of Company B in Warehouse 1 (cont.)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3		**WAREHOUSE 2**											
4					*Company X*								*Company C*
5													
6			Stocks				Sales				Sales		
7		Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8													
9		1 - Feb											
10		2 - Feb	=B9+J9-J9	=C9-G9+K9	=D9-H9-I-9	=E9-I9-M9							
11		3 - Feb	=B10-F10-J10	=C10-G10+K10	=D10-H10-I-10	=E10-I10-M10							
12													
13		Week's Total	=SUM(B9:B11)	=SUM(C9:C11)	=SUM(D9:D11)	=SUM(E9:E11)	=SUM(F9:F11)	=SUM(G9:G11)	=SUM(H9:H11)	=SUM(I9:I11)	=SUM(J9:J11)	=SUM(K9:K11)	=SUM(L9:L11)	=SUM(M9:M11)
14		Week's Average	=B13/4	=C13/4	=D13/4	=E13/4	=F13/4	=G13/4	=H13/4	=I13/4	=J13/4	=K13/4	=L13/4	=M13/4
15														
16		5 - Feb	=B11-F11-J11	=C11-G11-K11	=D11-H11-I-11	=E11-I11-M11								
17		6 - Feb	=B16-F16-J16	=C16-G16-K16	=D16-H16-I-16	=E16-I16-M16								
18		7 - Feb	=B17-F17-J17	=C17-G17-K17	=D17-H17-I-17	=E17-I17-M17								
19		8 - Feb	=B18-F18-J18	=C18-G18-K18	=D18-H18-I-18	=E18-I18-M18								
20		9 - Feb	=B19-F19-J19	=C19-G19-K19	=D19-H19-I-19	=E19-I19-M19								
21		10 - Feb	=B20-F20-J20	=C20-G20-K20	=D20-H20-I-20	=E20-I20-M20								
22														
23		Week's Total	=SUM(B16:B21)	=SUM(C16:C21)	=SUM(D16:D21)	=SUM(E16:E21)	=SUM(F16:F21)	=SUM(G16:G21)	=SUM(H16:H21)	=SUM(I16:I21)	=SUM(J16:J21)	=SUM(K16:K21)	=SUM(L16:L21)	=SUM(M16:M21)
24		Week's Average	=B23/6	=C23/6	=D23/6	=E23/6	=F23/6	=G23/6	=H23/6	=I23/6	=J23/6	=K23/6	=L23/6	=M23/6
25														
26		12 - Feb	=B21-F21-J21	=C21-G21-K21	=D21-H21-I-21	=E21-I21-M21								
27		13 - Feb	=B26-F26-J26	=C26-G26-K26	=D26-H26-I-26	=E26-I26-M26								
28		14 - Feb	=B27-F27-J27	=C27-G27-K27	=D27-H27-I-27	=E27-I27-M27								
29		15 - Feb	=B28-F28-J28	=C28-G28-K28	=D28-H28-I-28	=E28-I28-M28								
30		16 - Feb	=B29-F29-J29	=C29-G29-K29	=D29-H29-I-29	=E29-I29-M29								
31		17 - Feb	=B30-F30-J30	=C30-G30-K30	=D30-H30-I-30	=E30-I30-M30								
32														
33		Week's Total	=SUM(B26:B31)	=SUM(C26:C31)	=SUM(D26:D31)	=SUM(E26:E31)	=SUM(F26:F31)	=SUM(G26:G31)	=SUM(H26:H31)	=SUM(I26:I31)	=SUM(J26:J31)	=SUM(K26:K31)	=SUM(L26:L31)	=SUM(M26:M31)
34		Week's Average	=B33/6	=C33/6	=D33/6	=E33/6	=F33/6	=G33/6	=H33/6	=I33/6	=J33/6	=K33/6	=L33/6	=M33/6
35														
36		19 - Feb	=B31-F31-J31	=C31-G31-K31	=D31-H31-I-31	=E31-I31								
37		20 - Feb	=B36-F36-J36	=C36-G36-K36	=D36-H36-I-36	=E36-I36								
38		21 - Feb	=B37-F37-J37	=C37-G37-K37	=D37-H37-I-37	=E37-I37								
39		22 - Feb	=B38-F38-J38	=C38-G38-K38	=D38-H38-I-38	=E38-I38								
40		23 - Feb	=B39-F39-J39	=C39-G39-K39	=D39-H39-I-39	=E39-I39								
41		24 - Feb	B40 F40 J40	C40 G40 K40	D40 H40 I-40	E40 I40								
42														
43		Week's Total	=SUM(B36:B41)	=SUM(C36:C41)	=SUM(D36:D41)	=SUM(E36:E41)	=SUM(F36:F41)	=SUM(G36:G41)	=SUM(H36:H41)	=SUM(I36:I41)	=SUM(J36:J41)	=SUM(K36:K41)	=SUM(L36:L41)	=SUM(M36:M41)
44		Week's Average	=B43/6	=C43/6	=D43/6	=E43/6	=F43/6	=G43/6	=H43/6	=I43/6	=J43/6	=K43/6	=L43/6	=M43/6
45														
46		26 - Feb	=B41-F41-J41	=C41-G41-K41	=D41-H41-I-41	=E41-I41								
47		27 - Feb	=B46-F46-J46	=C46-G46-K46	=D46-H46-I-46	=E46-I46								
48		28 - Feb	=B47-F47-J47	=C47-G47-K47	=D47-H47-I-47	=E47-I47								
49		29 - Feb	=B48-F48-J48	=C48-G48-K48	=D48-H48-I-48	=E48-I48								
50														
51		Week's Total	=SUM(B46:B49)	=SUM(C46:C49)	=SUM(D46:D49)	=SUM(E46:E49)	=SUM(F46:F49)	=SUM(G46:G49)	=SUM(H46:H49)	=SUM(I46:I49)	=SUM(J46:J49)	=SUM(K46:K49)	=SUM(L46:L49)	=SUM(M46:M49)
52		Week's Average	=B51/4	=C51/4	=D51/4	=E51/4	=F51/4	=G51/4	=H51/4	=I51/4	=J51/4	=K51/4	=L51/4	=M51/4
53		*Month's Total*	=B51+B43+B33+B23+B13	=C51+C43+C33+C23+C13	=D51+D43+D33+D23+D13	=E51+E43+E33+E23+E13	=F51+F43+F33+F23+F13	=G51+G43+G33+G23+G13	=H51+H43+H33+H23+H13	=I51+I43+I33+I23+I13	=J51+J43+J33+J23+J13	=K51+K43+K33+K23+K13	=L51+L43+L33+L23+L13	=M51+M43+M33+M23+M13
54		*Month's Average*	=B53/24	=C53/24	=D53/24	=E53/24	=F53/24	=G53/24	=H53/24	=I53/24	=J53/24	=K53/24	=L53/24	=M53/24
55														

Spread Sheet of Company C in Warehouse 2

	A	B	C	D	E	F	G	H	I
1									
2									
3		**WAREHOUSE 2**							
4					***Company A***				
5									
6		**Stocks**				**Sales**			
7	Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8									
9	1 - Feb								
10	2 - Feb	=B9-F9	=C9-G9	=D9-H9	=E9-I9				
11	3 - Feb	=B10-F10	=C10-G10	=D10-H10	=E10-I10				
12									
13	*Weekly Total*	*=SUM(B9:B11)*	*=SUM(C9:C11)*	*=SUM(D9:D11)*	*=SUM(E9:E11)*	*=SUM(F9:F11)*	*=SUM(G9:G11)*	*=SUM(H9:H11)*	*=SUM(I9:I11)*
14	*Weekly Average*	*=B13/3*	*=C13/3*	*=D13/3*	*=E13/3*	*=F13/3*	*=G13/3*	*=H13/3*	*=I13/3*
15									
16	5 - Feb	=B11-F11	=C11-G11	=D11-H11	=E11-I11				
17	6 - Feb	=B16-F16	=C16-G16	=D16-H16	=E16-I16				
18	7 - Feb	=B17-F17	=C17-G17	=D17-H17	=E17-I17				
19	8 - Feb	=B18-F18	=C18-G18	=D18-H18	=E18-I18				
20	9 - Feb	=B19-F19	=C19-G19	=D19-H19	=E19-I19				
21	10 - Feb	=B20-F20	=C20-G20	=D20-H20	=E20-I20				
22									
23	*Weekly Total*	*=SUM(B16:B21)*	*=SUM(C16:C21)*	*=SUM(D16:D21)*	*=SUM(E16:E21)*	*=SUM(F16:F21)*	*=SUM(G16:G21)*	*=SUM(H16:H21)*	*=SUM(I16:I21)*
24	*Weekly Average*	*=B23/6*	*=C23/6*	*=D23/6*	*=E23/6*	*=F23/6*	*=G23/6*	*=H23/6*	*=I23/6*
25									
26	12 - Feb	=B21-F21	=C21-G21	=D21-H21	=E21-I21				
27	13 - Feb	=B26-F26	=C26-G26	=D26-H26	=E26-I26				
28	14 - Feb	=B27-F27	=C27-G27	=D27-H27	=E27-I27				
29	15 - Feb	=B28-F28	=C28-G28	=D28-H28	=E28-I28				
30	16 - Feb	=B29-F29	=C29-G29	=D29-H29	=E29-I29				
31	17 - Feb	=B30-F30	=C30-G30	=D30-H30	=E30-I30				
32									
33	*Weekly Total*	*=SUM(B26:B31)*	*=SUM(C26:C31)*	*=SUM(D26:D31)*	*=SUM(E26:E31)*	*=SUM(F26:F31)*	*=SUM(G26:G31)*	*=SUM(H26:H31)*	*=SUM(I26:I31)*
34	*Weekly Average*	*=B33/6*	*=C33/6*	*=D33/6*	*=E33/6*	*=F33/6*	*=G33/6*	*=H33/6*	*=I33/6*
35									
36	19 - Feb	=B31-F31	=C31-G31	=D31-H31	=E31-I31				
37	20 - Feb	=B36-F36	=C36-G36	=D36-H36	=E36-I36				
38	21 - Feb	=B37-F37	=C37-G37	=D37-H37	=E37-I37				
39	22 - Feb	=B38-F38	=C38-G38	=D38-H38	=E38-I38				
40	23 - Feb	=B39-F39	=C39-G39	=D39-H39	=E39-I39				
41	24 - Feb	=B40-F40	=C40-G40	=D40-H40	=E40-I40				
42									
43	*Weekly Total*	*=SUM(B36:B41)*	*=SUM(C36:C41)*	*=SUM(D36:D41)*	*=SUM(E36:E41)*	*=SUM(F36:F41)*	*=SUM(G36:G41)*	*=SUM(H36:H41)*	*=SUM(I36:I41)*
44	*Weekly Average*	*=B43/6*	*=C43/6*	*=D43/6*	*=E43/6*	*=F43/6*	*=G43/6*	*=H43/6*	*=I43/6*
45									
46	26 - Feb	=B41-F41	=C41-G41	=D41-H41	=E41-I41				
47	27 - Feb	=B46-F46	=C46-G46	=D46-H46	=E46-I46				
48	28 - Feb	=B47-F47	=C47-G47	=D47-H47	=E47-I47				
49	29 - Feb	=B48-F48	=C48-G48	=D48-H48	=E48-I48				
50									
51	*Weekly Total*	*=SUM(B46:B49)*	*=SUM(C46:C49)*	*=SUM(D46:D49)*	*=SUM(E46:E49)*	*=SUM(F46:F49)*	*=SUM(G46:G50)*	*=SUM(H46:H50)*	*=SUM(I46:I49)*
52	*Weekly Average*	*=B51/4*	*=C51/4*	*=D51/4*	*=E51/4*	*=F51/4*	*=G51/4*	*=H51/4*	*=I51/4*
53	*Monthly Total*	*=B51+B43+B33+B23+B13*	*=C51+C43+C33+C23+C13*	*=D51+D43+D33+D23+D13*	*=E51+E43+E33+E23+E13*	*=F51+F43+F33+F23+F13*	*=G51+G43+G33+G23+G13*	*=H51+H43+H33+H23+H13*	*=I51+I43+I33+I23+I13*
54	*Monthly Average*	*=B53/29*	*=C53/29*	*=D53/29*	*=E53/29*	*=F53/29*	*=G53/29*	*=H53/29*	*=I53/29*
55									

Spread Sheet of Company A in Warehouse 2 (cont.)

	A	B	C	D	E	F	G	H	I
1									
2									
3		**WAREHOUSE 3**							
4					***Company X***				
5									
6		**Stocks**				**Sales**			
7	Date	Product A	Product B	Product C	Product D	Product A	Product B	Product C	Product D
8									
9	1 - Feb								
10	2 - Feb	=B9-F9	=C9-G9	=D9-H9	=E9-I9				
11	3 - Feb	=B10-F10	=C10-G10	=D10-H10	=E10-I10				
12									
13	*Weekly Total*	*=SUM(B9:B11)*	*=SUM(C9:C11)*	*=SUM(D9:D11)*	*=SUM(E9:E11)*	*=SUM(F9:F11)*	*=SUM(G9:G11)*	*=SUM(H9:H11)*	*=SUM(I9:I11)*
14	*Weekly Average*	*=B13/3*	*=C13/3*	*=D13/3*	*=E13/3*	*=F13/3*	*=G13/3*	*=H13/3*	*=I13/3*
15									
16	5 - Feb	=B11-F11	=C11-G11	=D11-H11	=E11-I11				
17	6 - Feb	=B16-F16	=C16-G16	=D16-H16	=E16-I16				
18	7 - Feb	=B17-F17	=C17-G17	=D17-H17	=E17-I17				
19	8 - Feb	=B18-F18	=C18-G18	=D18-H18	=E18-I18				
20	9 - Feb	=B19-F19	=C19-G19	=D19-H19	=E19-I19				
21	10 - Feb	=B20-F20	=C20-G20	=D20-H20	=E20-I20				
22									
23	*Weekly Total*	*=SUM(B16:B21)*	*=SUM(C16:C21)*	*=SUM(D16:D21)*	*=SUM(E16:E21)*	*=SUM(F16:F21)*	*=SUM(G16:G21)*	*=SUM(H16:H21)*	*=SUM(I16:I21)*
24	*Weekly Average*	*=B23/6*	*=C23/6*	*=D23/6*	*=E23/6*	*=F23/6*	*=G23/6*	*=H23/6*	*=I23/6*
25									
26	12 - Feb	=B21-F21	=C21-G21	=D21-H21	=E21-I21				
27	13 - Feb	=B26-F26	=C26-G26	=D26-H26	=E26-I26				
28	14 - Feb	=B27-F27	=C27-G27	=D27-H27	=E27-I27				
29	15 - Feb	=B28-F28	=C28-G28	=D28-H28	=E28-I28				
30	16 - Feb	=B29-F29	=C29-G29	=D29-H29	=E29-I29				
31	17 - Feb	=B30-F30	=C30-G30	=D30-H30	=E30-I30				
32									
33	*Weekly Total*	*=SUM(B26:B31)*	*=SUM(C26:C31)*	*=SUM(D26:D31)*	*=SUM(E26:E31)*	*=SUM(F26:F31)*	*=SUM(G26:G31)*	*=SUM(H26:H31)*	*=SUM(I26:I31)*
34	*Weekly Average*	*=B33/6*	*=C33/6*	*=D33/6*	*=E33/6*	*=F33/6*	*=G33/6*	*=H33/6*	*=I33/6*
35									
36	19 - Feb	=B31-F31	=C31-G31	=D31-H31	=E31-I31				
37	20 - Feb	=B36-F36	=C36-G36	=D36-H36	=E36-I36				
38	21 - Feb	=B37-F37	=C37-G37	=D37-H37	=E37-I37				
39	22 - Feb	=B38-F38	=C38-G38	=D38-H38	=E38-I38				
40	23 - Feb	=B39-F39	=C39-G39	=D39-H39	=E39-I39				
41	24 - Feb	=B40-F40	=C40-G40	=D40-H40	=E40-I40				
42									
43	*Weekly Total*	*=SUM(B36:B41)*	*=SUM(C36:C41)*	*=SUM(D36:D41)*	*=SUM(E36:E41)*	*=SUM(F36:F41)*	*=SUM(G36:G41)*	*=SUM(H36:H41)*	*=SUM(I36:I41)*
44	*Weekly Average*	*=B43/6*	*=C43/6*	*=D43/6*	*=E43/6*	*=F43/6*	*=G43/6*	*=H43/6*	*=I43/6*
45									
46	26 - Feb	=B41-F41	=C41-G41	=D41-H41	=E41-I41				
47	27 - Feb	=B46-F46	=C46-G46	=D46-H46	=E46-I46				
48	28 - Feb	=B47-F47	=C47-G47	=D47-H47	=E47-I47				
49	29 - Feb	=B48-F48	=C48-G48	=D48-H48	=E48-I48				
50									
51	*Weekly Total*	*=SUM(B46:B49)*	*=SUM(C46:C49)*	*=SUM(D46:D49)*	*=SUM(E46:E49)*	*=SUM(F46:F49)*	*=SUM(G46:G50)*	*=SUM(H46:H50)*	*=SUM(I46:I49)*
52	*Weekly Average*	*=B51/4*	*=C51/4*	*=D51/4*	*=E51/4*	*=F51/4*	*=G51/4*	*=H51/4*	*=I51/4*
53	*Weekly Total*	*=B51+B43+B33+B23+B13*	*=C51+C43+C33+C23+C13*	*=D51+D43+D33+D23+D13*	*=E51+E43+E33+E23+E13*	*=F51+F43+F33+F23+F13*	*=G51+G43+G33+G23+G13*	*=H51+H43+H33+H23+H13*	*=I51+I43+I33+I23+I13*
54	*Weekly Average*	*=B53/29*	*=C53/29*	*=D53/29*	*=E53/29*	*=F53/29*	*=G53/29*	*=H53/29*	*=I53/29*

Spread Sheet of Company X in Warehouse 3

Ahu Yelbaşı was born on 2nd of August 1971 in Ankara. After completing her secondary education at TED Ankara College, she earned her B.Sc. Degree in Petroleum Engineering at Middle East Technical University in 1994. During her under-graduate education, she worked for N.V.Turkse Shell in Diyarbakır, and Turkish Petroleum Corporation in Ankara. In 1994, she started to work for an MBA Degree at Bilkent University. She also worked for British Petroleum in İstanbul for a period of three months. She is currently employed at the Turkish Petroleum Corporation.