AN IMPLEMENTATION OF STRUCTURED SYSTEMS ANALYSIS TO AN INFORMATION TECHNOLOGY COMPANY

MBA THESIS

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AN IMPLEMENTATION OF STRUCTURED SYSTEMS ANALYSIS

TO AN INFORMATION TECHNOLOGY COMPANY

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For the Degree of

Master of Business Administration

By

Korhan Alparslan
July, 1996

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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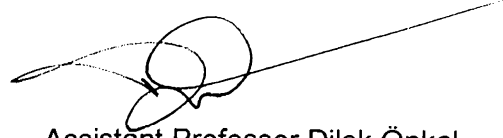
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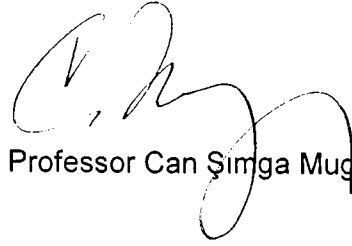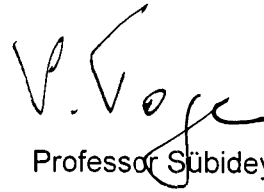
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ABSTRACT

AN IMPLEMENTATION OF STRUCTURED SYSTEMS ANALYSIS

TO AN INFORMATION TECHNOLOGY COMPANY

BY

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Systems Analysis is the process of analyzing an organization with the ultimate objective of modifying and improving it. It is a way of solving problems existing in organizations. Structured Analysis, with the aid of visual capabilities, is the most commonly applied technique of implementing systems analysis. The two major components of structured analysis are Data Flow Diagrams(DFDs) and Data Dictionary. Wide-spread usage of Computer-Aided Software Engineering(CASE) tools that support systems analysis and design made the structured analysis process easier to manage and control.

This study aims to apply structured analysis methodology to a Turkish company that operates in the information technology industry. Context diagram which is level 0 DFD is developed initially. Then the level 1 and level 2 DFDs are produced. The DFDs display the processes of each department and data flow between, in and out of departments. Each process that exists in the level 2 DFDs is explained and the data dictionary is provided in the appendices. The study concludes with a summary of recommendations that can be implemented for the improvement of the organization work flow.

Keywords: Systems Analysis, Structured Analysis, Data Flow Diagrams, CASE, Structured Analysis Implementation

ÖZET

YAPISAL SİSTEM ÇÖZÜMLEME YÖNTEMİNİN BİR BİLGİ

TEKNOLOJİSİ ŞİRKETİNE UYGULANMASI

HAZIRLAYAN

KORHAN ALPARSLAN
İŞLETME YÜKSEK LİSANS TEZİ

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Sistem Çözümleme bir organizasyonun iyileştirilmesi ve geliştirilmesi hedefini güden işlemdir. Organizasyonlarda bulunan problemleri bir çeşit çözme yöntemidir. Yapısal Çözümleme ise, görsel özelliklerinin yardımıyla, en çok başvurulan sistem çözümleme uygulama tekniğidir. Yapısal Çözümlemenin iki temel bileşeni veri akış çizgeleri(VAÇ) ve veri sözlüğüdür. Sistem çözümleme ve tasarımını destekleyen bilgasayar destekli yazılım mühendisliği (BDYM) araçlarının yaygın kullanılmaya başlanmasıyla yapısal çözümleme işlemini yönetmek ve kontrol etmek daha kolaylaşmıştır.

Bu çalışmanın amacı, yapısal sistem çözümleme metodolojisinin bilgi teknolojisi endüstrisinde faaliyet gösteren bir Türk şirketine uygulanmasıdır. İlk olarak 0 düzeyi VAÇ olan bağlam şeması oluşturulmuştur. Sonra, daha detaylı birinci ve ikinci düzey VAÇlar üretilmiştir. VAÇlar her departmanda bulunan işlemleri ve departmanlar ile işlemler arası veri akışını gösterir. İkinci düzey VAÇlarda bulunan her işlem anlatılmış ve veri sözlüğü ekte sağlanmıştır. Çalışma organizasyon iş akışını geliştirebilecek tavsiyelerin bir özetiyle sonlanmaktadır.

Anahtar Kelimeler: Sistem Çözümleme, Yapısal Çözümleme, Veri Akış Çizgeleri, BDYM, Yapısal Çözümleme Uygulaması

Acknowledgements

To my wife Zeynep

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1. INTRODUCTION

A system can be defined as a network of interrelated procedures that are joined together to perform an activity or to accomplish a specific objective (Kendall,1987). The procedures that are connected with each other form a whole which is the system itself. A procedure is a precise series of instructions. It helps to specify by whom, when, and how something has to be done.

Systems are classified as open and closed systems. Simply, a closed system controls or modifies its own operations by responding to data generated by itself. An open system, unlike a closed system, requires external control. That is, such systems get input from the environment in generating its output.

Systems analysis is simply a way of problem solving. Organizations are systems and it is the systems analysts' task to solve the problems orienting from the structure and culture of the organization. Systems analysis study is the requirements gathering, analysis, and definition stage. During this stage, the analyst who accomplishes the systems analysis study, recommends what the system is expected to do, and specifies the functional requirements. It resembles the "blueprint" stage of a construction study.

There are many systems analysis methodologies. Some of them support structured systems development techniques, some of them are unstructured. The availability of CASE (Computer Aided Software Engineering) tools starting with the common usage of computers increased the interest in structured methodologies. In this thesis, a systems analysis study is implemented with the support of a CASE tool.

With the beginning of fifties, the era of manufacturing started to decline. The percentage of labor force in the industry decreased day by day in the developed countries. Later, the labor force was directed to the service organizations. Today the trend is information. The domination of capital is currently replaced by information. The major tools of information-society is computers, data communication, electronic networking, and brain power.

It is commonly accepted that, the strategic resource in an information oriented society is knowledge. Knowledge of systems analysis and design is more important today than ever, as

computer networks are transforming the world into a global office. Internet is a good example to this fact. The capabilities of Internet allow us to make contact with other companies, governments, and other government institutions. To be competitive with others, all firms have to provide information to themselves using the features of computers.

Data that is not processed is worthless. Several tools help us in converting raw data into knowledge. Software is the most important of these tools. The effective usage of computers is only available with the suitable software. The first step in developing this software or the management information system is the systems analysis study. Therefore the systems analysis study will have great importance in the near future especially in Turkey, because most companies do not possess an integrated information system.

Computer networks make the company data available throughout the world. But properties like accuracy, availability, correctness of the information do not exist all the time. Integration in a company is essential in order to provide those properties of information. The departments of most companies work separately. This may cause data repetitions, and inconsistency. Data required for a department may not be available in time. These are the possible outcomes of working without an information system. The usage of management information systems is the key in preventing such problems. The systems analysis study is the starting point in achieving an effective information system.

Systems analysis is not a simple task to implement. Orr had stated, "Systems building is an art, and it is unlikely that this situation will change very much until we develop new methods for training systems designers and architects in the building of complex systems" (1977). Only systems analysis methodology knowledge is not enough for achieving a successful analysis. It requires the knowledge of computers, programming, basic business functions, data communications, and database concepts which are related with computer science, accounting - finance principles, and marketing related with business administration, and other subjects depending on the specific area that the systems analyst works in. Also, it is suggested to have a considerable work experience in the related area. So it is the systems analyst's responsibility to understand the functioning of an organization.

In the thesis a systems analysis study is offered for the Datakom Corporation. In the second chapter, information about the company is presented. The third chapter briefly defines

systems analysis and examines the structured systems analysis method. The fourth chapter describes the data gathering methods, CASE tools, and selected software for the study. The systems analysis study for Datakom is presented in the fifth chapter. Finally the study is concluded with a summary of recommendations that can be done in the design and implementation stages.

2. Information About the Company

2.1 Company Profile

The company is the Turkey distributor of some foreign information technology equipment manufacturers. Computer systems, hardware, and computer peripheral units are not the only product types sold. In addition software programs, technical and educational services are provided to customers.

The company, which has been founded in early seventies, has become one of the largest computer service companies in Ankara. In the early years of its life, it served special engineering projects like development of custom tailored management information systems for certain companies, geographic information systems implementations, full computer hardware and software solutions. Most of these huge studies were accomplished during the 1970s and early 1980s where there were few competitors in the sector.

Before the beginning of 1980, the company initiated an organization restructuring process. The increasing work load had made such a change necessary. It was decided to organize software production and hardware sales as different groups. The consequence of that change increased the control and coordination throughout the company because management of both groups began to deal with the projects regarding itself. The company divided into two divisions; one specializing in engineering projects such as software developments, and construction projects, the other began to deal with original equipment manufacturer(OEM) products sales, marketing, and support. Both divisions worked like separate companies until the year of 1993.

As new firms entered the computer industry the competition increased. In the past, there were relatively few firms in the market and the firm enjoyed high profit margins. But intense competition beginning with 1990s caused significant reductions in profits. Finally high losses in 1993 made some strategic changes necessary. In that year, the management of both software and hardware divisions were united forming a unique organization. This change also made some positions unnecessary. The personnel decrease caused reductions in overall costs, but this was not good enough.

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The software industry in Turkey was occupied by many small software houses. Those firms produced programs that are usable by many clients. The profit margins decreased in specialized software developments because of the economies of scale in new products. With the economic crisis in 1994, the company went to a second employment contraction by dissolving finished project groups.

The company is continuing its activities as the representative of a few peripheral unit manufacturers and a US based computer manufacturer. The sales and marketing activities are taken for those companies' products. But the bulk of sales come from computer sales: mainframes, mini, micro computers and other auxiliary devices of this brand. The engineering activities declined as a result of personnel contraction and the company focused itself on sales.

Although it is a sales oriented organization, most of the profits come from services. After selling the products to customers with a low profit margin, annual maintenance agreements are signed. The major source of income is the maintenance agreements giving great emphasis to old customers.

The customer portfolio includes mainly state organizations, universities and state economic establishments. There are also a couple of privately owned companies which have purchased company products. It is visible that most of the current customers are owned by the state.

Sales done to state organizations usually end up in a low rate of profit because of heavy competition and bidding. The profit of the company then comes from after sales services provided to those customers. The services include solving technical problems originating either from software or hardware, special trainings that are offered upon demand and periodic maintenance of the systems.

As the competition in market increased, achieving new sales became harder each day. For sustaining profit continuity the company started to be more service oriented. The ratio of income generated from services is in an increasing trend in the recent years. To keep this trend continue, service quality must be increased also. For improving service quality, the company management has initiated an information system development project which is based on the systems analysis study completed in this thesis. A positive change in service

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quickly provides an enhanced ability to compete and gain a competitive advantage in the long-run.

2.2 Organization

The company is organized as technical support, sales and marketing, finance and accounting, and trade departments.

The technical support consists of two separate divisions: Software support and hardware support. Software support deals with the problems arising from system software. System software includes the operating system, compilers, communication programs, and other system programs that have been sold with the computers. Hardware support has two functions. The first is to solve hardware problems of customers. The second is to perform periodic maintenance. Periodic maintenance is done according to service agreement contracts signed with the customers. If the customer does not have service contract, periodic maintenance is not given. In case of a failure, the customer calls the support department for serving to him.

Sales and marketing department prepares proposals to firms according to demands. Preparing a proposal to public and private establishments are quite different in style. The public proposals have to fulfill each of the written technical requirements and have to be in a predefined style.

Trade department is mostly busy with follow-ups of imports. When an order is passed to a foreign supplier, it takes long way to transport it to the customs office and taking it out of the customs office.

Finance department is responsible for finding the funds necessary for the company operations and controlling the cash flow.

Accounting department keeps compulsory accounting books and provides a basis for the reports preperation of finance department.

3. LITERATURE SURVEY

3.1 Systems Analysis Methods

3.1.1 What is Systems Analysis

Systems analysis is the process of analyzing a system with the potential goal of improving and modifying it (Fitzgerald 1987). In other words systems analysis involves the study and design of something in order to modify it.

If the term "systems analysis" is studied as separate words, analysis is the process of breaking down problems into smaller elements for study and, ultimately, finding a solution(Fitzgerald,1987). System is a set of interrelated and interacting component parts that, when put together, function to achieve a predetermined goal or objective.

The systems analysis approach to a problem differs from a trial and error approach. The trial and error approach involves identifying a number of potential solutions to the problem and then testing each until an acceptable solution is found. In the systems analysis approach, all major influences and constraints are identified and evaluated in terms of their impact on the various decision points in the system. A decision point is that point in a system at which some person or automatic mechanism reacts to make a decision (Orr 1977).

3.1.2 Common Systems Analysis Methodologies

The basic tools of systems analysis are various types of diagrams used to model an organization as an information system, the most important being the data flow diagram. The data flow diagram(DFD) portrays the system in terms of its component pieces. The flow of data between sources, sinks, processes and data stores are described by DFDs.

According to structured analysis, four step modeling should be implemented. (Fitzgerald 1987). These are the modeling of current physical, the current logical, the new logical, and the new physical system respectively (Figure 3-1). Each step should consist of a complete description of the system by DFDs, the data dictionary and mini-specifications.
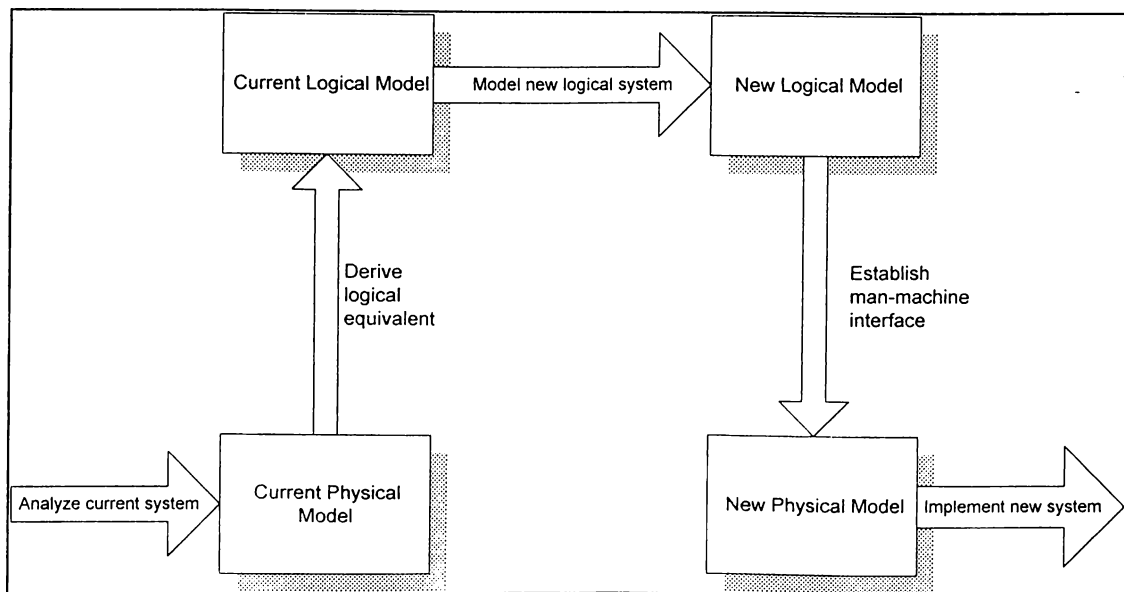
Figure 3-1 Relationship among four types of models of Structured Analysis
Source: Fitzgerald, 1987

Other than structured analysis and design, the analysis study can be implemented by a hierarchical approach. In general, it is to break down a big problem into successively smaller parts, until it is not possible to subdivide. In hierarchical analysis, the analyst asks, "how can this job be broken into a series of simpler ones?", The HIPO (Hierarchical-Input-Process-Output) methodology utilizes the hierarchical analysis in detail.

The analysis of a problem into parts is a useful process, and it is most effective if the same procedure is applied to each part of the problem. In a complete analysis this process continues until each of the pieces is so simple that there is no need to break them down further.

There are a number of drawbacks of hierarchical analysis. One is that it seems to create a lot of work, especially at the lower levels. Further, it requires that you have some idea of the top of the system and the major parts at each step. Finally hierarchical analysis poses the question: How can the system at the first place to be broken into pieces can be determined?

According to Zwass (1992), there are two major development methods, which are Systems Development Life Cycle (SDLC) and Systems Development through Prototyping.

Systems Development Life Cycle (SDLC):

This method has become a traditional method. It relies on a formally defined sequence of stages in the process of developing and maintaining an information system. Each stage has

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its own outputs and documentation. This resource-intensive process produces highly maintainable systems. It is particularly advantageous when applied to large systems; such as . those used for transaction processing.

The major stages of SDLC are systems analysis, systems design, programming and maintenance. These stages include sub-stages and at the end of each stage, either the next step studies starts or previous stage is reworked if required. This approach in SDLS has been named as waterfall model in the early 1970s. (Figure 3-2).
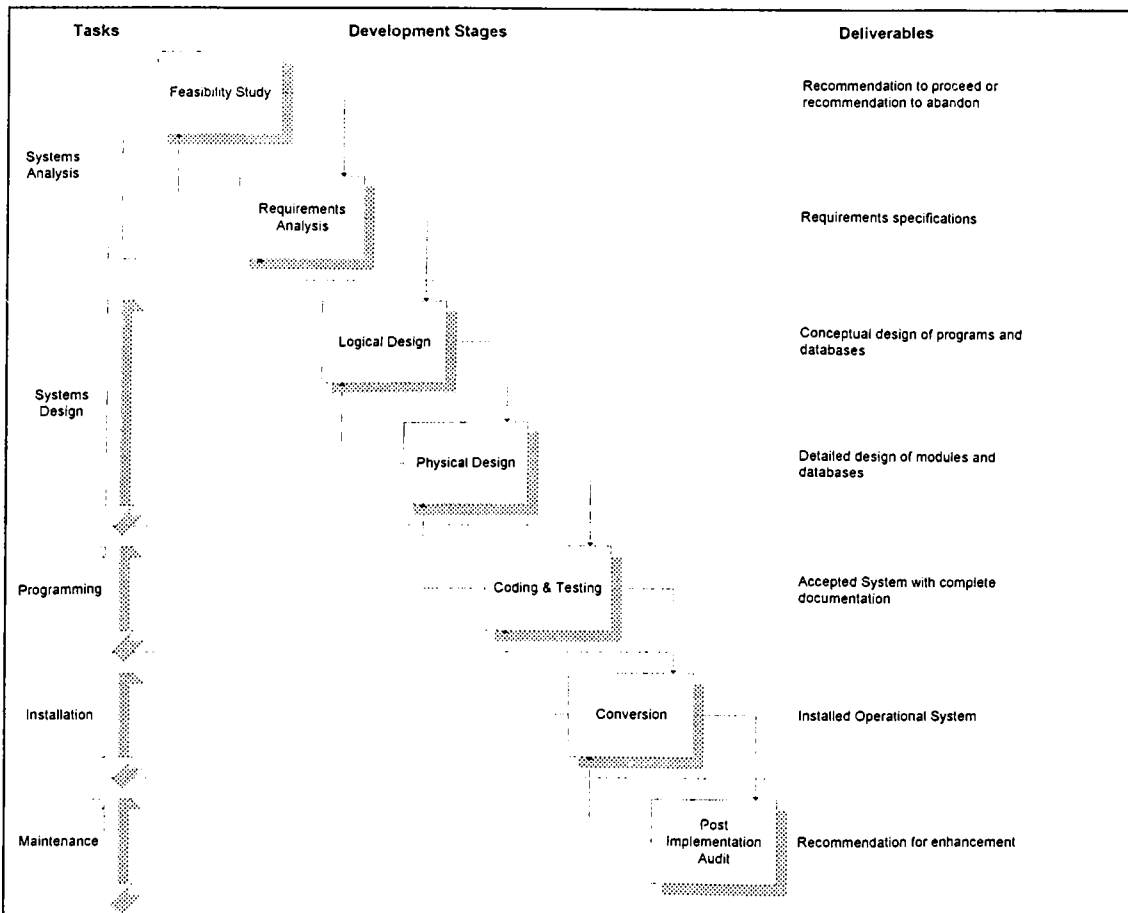
Figure 3-2 Systems Development Life Cycle (the waterfall model)
Source: Zwass, 1992

In the late 1970s, structured SDLC began to emerge. It used tools to handle the complexity of information systems development. Both systems analysis and design moved from abstract level to more detailed level with the support of techniques such as DFDs, structure charts, and data dictionary.

Systems Development Through Prototyping:

In this method, an early pilot version of the system is built, so that the future users can clarify their requirements and gain a measure of confidence in the general approach. Contrary to SDLC, there is no distinct steps for the development of the information system. A trivial software is developed, and the final system is composed of considering the complaints and advice of end users. So, there is almost no systems analysis study accomplished when this approach is employed.

Recent studies have showed that structured system development methodologies is now frequently used in systems development. In a survey of ninety-seven organizations (Necco, 1987), it was found that 69 percent used SDLC based on traditional tools (such as narratives and flowcharts) on some of their projects, and 62 percent used structured SDLC. Twice as many of the firms were considering using structured SDLC in the future. SDLC is employed by most of the firms and a significant portion of these firms are at least expecting to use structured SDLC in the future. This is a concrete evidence that structured analysis and as a result of it, structured SDLC will be the major systems development and analysis approach.

Today, in real life some systems analysts relied on personal interviews and judgment rather than applying approaches developed by theorists(Yourdon, 1989). The basis of such system developments are to do personal interviews with the key persons, conduct questionneries and to develop a narrative systems analysis study. The logical and physical systems are formed in this way and the suggested system is developed in the light of this documentation. This system, alone itself, is used rarely in real life, because it has difficulties in explaining the flow of information throughout the organization. The lack of drawings and charts is one of the reasons that make this style hard to implement.

Instead of implementing a unique method to an organization, more than one can be used. Most frequently hybrid approaches are applied. For example an analyst may start with structured analysis and support the analysis with personal interviews. This is sometimes due to the cost and time constraints of the analysis study, and sometimes the size and complexity of the organization that is analyzed is the determinant.

3.2 A Brief History of Structured Analysis

Structured analysis, like all software requirements analysis methods, is a model building activity. Structured analysis is not a single method applied consistently by all who use it. Rather, it is a mixture that has evolved over almost twenty years.

In his book on the subject, Tom DeMarco (DeMarco 1979) after understanding the failings of the analysis phase has determined the goals to be accomplished in this stage. The first goal is that, the products of analysis must be maintainable. This applies particularly to the target document. The second goal is, to deal with big and complex problems using an effective method of partitioning. The third goal suggests the use of graphical interface whenever possible, and finally the logical(essential) and physical(implementation) characteristics have to be differentiated.

After determining those goals of systems analysis, he has concluded with the requirements to accomplish these goals. These requirements are, a tool to help the designers partition the requirements and document that partitioning before specification, some means of keeping track of and evaluating interfaces, and new tools that describes the logic better than plain text.

Like many important contributions to software engineering, structured analysis was not introduced with a single landmark paper or book that was a definite treatment of the subject. Early work of analysis modeling was begun in the late sixties and early seventies, but the first appearance of the structured analysis approach was an addition to another important topic, "structured design."

Researchers needed a graphical notation for representing data and processes that transformed it. These processes would be mapped into a design architecture.

The term "structured analysis" became popular by DeMarco's methodologies. DeMarco introduced and named the key graphical symbols that would enable an analyst to create an information flow model. Data dictionary and processing narratives were introduced by him as a supplement to graphical notations. In the recent years that followed, variations of the structured analysis approach were suggested by Page-Jones, Gane and Sarson, and many others (Evergreen, 1994).

By the mid 1980s, the deficiencies of structured analysis became painfully apparent. These were mostly due to the lack of providing an adequate notation for real-time engineering problems. Real-time extensions were introduced by Word and Mellor and later by Hatley and Pirbhai (Pressman,1992). These extensions resulted in a more robust analysis method that could be applied effectively to engineering problems. Today, attempts to develop one consistent notation have been suggested.

3.3 Basic Notations of Structured Analysis

Structured Analysis is an information flow model and content modeling technique. A computer based system is represented as an information transform as shown in Figure 3-3 (Pressman, 1992). The overall function of the system is represented as a single information transform, noted as a bubble in the figure. One or more inputs originate from external entities. The input is processed in the bubble and output information passes to external entities. This model should be applied to the entire system and the software element only. The key is to represent the information fed into and produced by the transform.
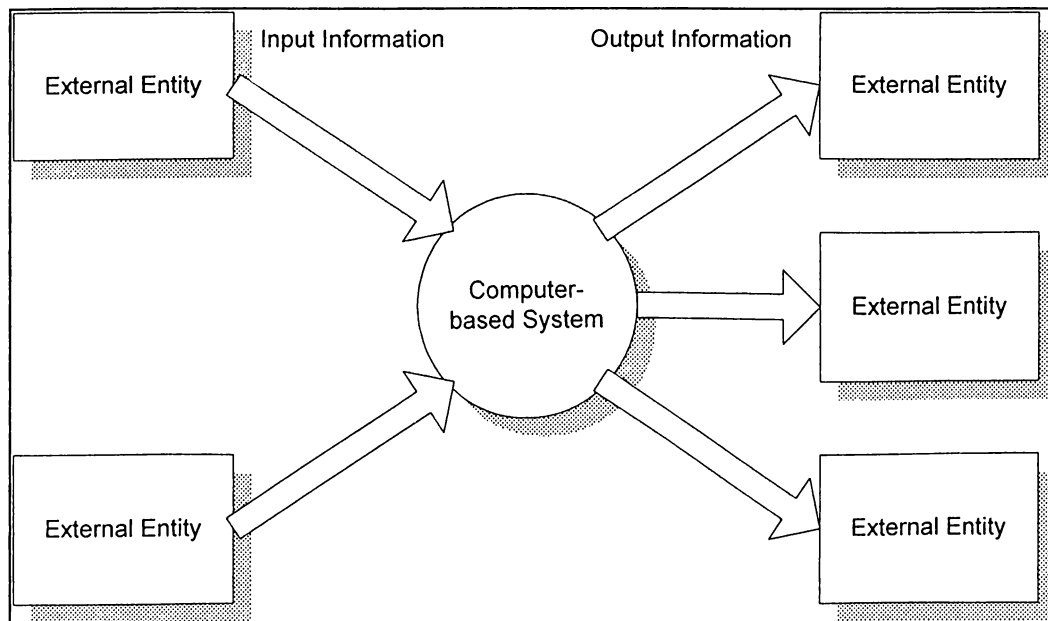
Figure 3-3 Information Flow Model
Source : Pressman 1992

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3.3.1 Data Flow Diagrams

The data flow diagram(DFD) is a graphical technique that shows information flow and the transformations that are applied as data move from input to output. The information flow model that is illustrated in Figure 3-3 is a basic data flow diagram.

Data flow diagram maybe sued to represent a system or a software at any level of abstraction. In fact, DFDs may be partitioned into levels that represent increasing information flow and functional detail. A level 0 DFD is also called a context diagram. It represents the whole software element as a single bubble with input and output data. Level 0 DFD for an organization exhibits the main function of the organization with a bubble and its relations with external environment in the form of physical input and outputs.
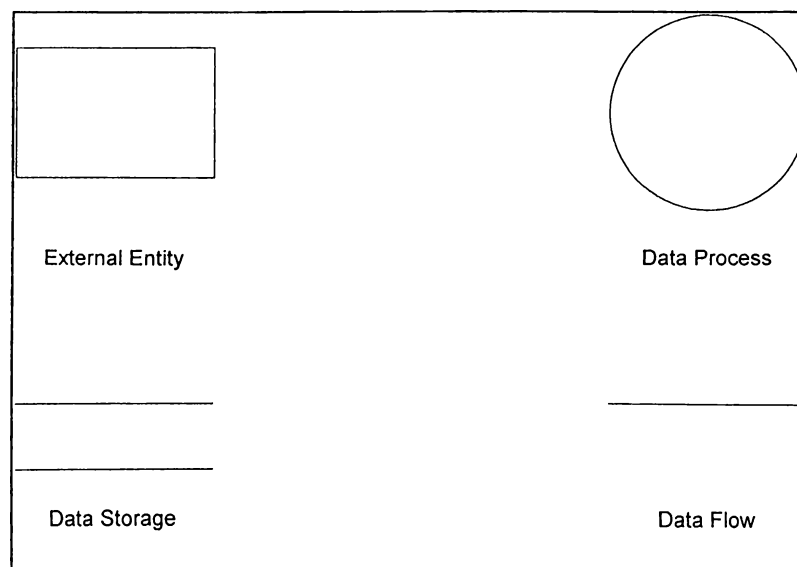
Figure 3-4 Yourdon DeMarco Data Flow Diagram

Data flow diagrams are constructed using the symbols shown in Figure 3-4. These symbols are according to the terminology of Yourdon and DeMarco. An external entity is the receiver or sender of data or information. It is any kind of entity that the organization interacts with. They may be customers, suppliers, government institutions, and so on.

A process is depicted by a circle. Processes show the transportation of the content or status of data. In other words, some sort of data processing takes place in a circle. Each process has at least one data inflow and outflow. The numbers identifying processes are unique. The number to the left of the point indicates the level (depth) of the process. Level 0 is always the

context diagram and it includes only one data process which is the main function of the organization. Other levels have more than one process circle starting with a number indicating the level of the diagram.

A data store symbol represents any kind of source in which data resides. In a manual system it can be forms, paper reports, card files, or in a computerized system it may be tapes, disks, or databases.

The fourth symbol is the data flow symbol. This symbol is used to show the flow or movement of data between process bubbles, external entities, or data stores. One end of the data flow must be connected to a process. The flows can be physical like, letters, reports, vouchers, receipts or can be in any form like telephone calls.

3.3.2 Data Dictionary

A data dictionary is a documentation that supports data flow diagrams. It contains all the terms and their definitions for data flows that relate to a specific system. The purpose of the data dictionary is to define the contents of the data flows and data stores, with the exception of processes that are defined separately. Data dictionary provides consistency. It prevents calling different data flows with same name, and same flows with different names.

Yourdon (1989) defines data dictionary as an organized listing of all data elements that are pertinent to the system, with precise definitions so that both user and analyst have a common understanding of inputs, outputs, components of stores and intermediate calculations.

The data dictionary includes the data structures defining data flows and data stores. The combinations of data elements in a data store form a data structure. Meaningful combinations of data elements are called data structures. For example, the fields on an application form compose a data structure for that particular form.

3.3.3 Data Structure Diagrams

The data structures must be organized for use. To do this, the data structures are organized into a model that shows the business objects and their relationships for all stored data in the

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system. This modeling of data structure relationship is called as data structure diagrams. They are graphic means of showing access relationships between data structures.

3.3.4 Data Access Diagrams

A data access diagram is used to picture the more detailed representation of each data structure, the corresponding relationships between data structures, and the access paths between them. The purpose of data access diagram is to show the formats of the data structures and the corresponding relationships for the system. Throughout this process the primary concern is the data; how it flows, how part of it is shown that is related to others.

3.4 Why Structured Analysis?

In the article by Bansler, and Bodker (1993), three large Danish organizations have been analyzed (A bank, utility company, and a financial institution) that have implemented systems analysis. They have concluded their study with the following findings:

• None of the organizations have chosen structured analysis out of a variety of available methods for systems analysis. Structured analysis has been perceived as the only feasible method for systems analysis in a large business environment.

• The reason underlying the selection of structured analysis has been the knowledge by designers on the subject.

• The designers have not made four different models that represent the current physical, current logical, new physical and new logical models. Even they have not distinguished between logical and physical data flow diagrams.

There is not any accepted style of the structured analysis by the designers. In all three companies different features and models of the method are used. The parts chosen not only differ from company to company but even from project to project. As a result, it can be said that the structured analysis methodology is not known by designers in detail, but it is accepted as the most correct tool for systems analysis. The findings of Necco(1987) also support this argument as more firms are considering to use structured analysis in their systems development projects.

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Yourdon has recommended in his study, the use of structured techniques in projects ranging from ten thousand to one million lines of code (Yourdon 1982). This finding would have been appropriate in the past but today programming techniques have changed dramatically. A subprogram may accomplish the features of a thousand lines of code of a past COBOL program. The inheritance property of object oriented programming[1], use of libraries[2], and 4GLs[3] allow programmers to write very short programs but do lots of work. So, today Yourdon's finding is no longer a valid criterion for applying structured analysis. It is agreeable to implement structured analysis in large and complex projects but the criteria for this complex and simple, large and small is not so certain.

In conclusion, in practice what happens is that experienced designers - instead of following rules and procedures of structured analysis - pick and choose among the various formalisms given in the method, and adapt them for their own purposes (Bansler and Bodker 1993).

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[1] *Object Oriented Programming*: A modern programming technique which uses objects rather than classical variable property of programming languages.
[2] *Programming Library:* A compiled group of procedures coded for a specific purpose which can be reusable with many programs.
[3] *Fourth Generation Languages:* A new generation of programming language which suggests the programmer to tell "what to do" rather than "how to do it."

4. DATA GATHERING AND SELECTED SOFTWARE

4.1 Data Gathering

There was no written document about the functioning of the company under study. Therefore the necessary information is collected by individual interviews. The interviewees were the company personnel who directly deal with processing in the system. Company management, department managers, sales representatives, product managers, support engineers, and finance and accounting personnel were among the employees interviewed.

During the interviews, the system functioning and the extraordinary situations are found out. The written documents used throughout the company were collected and added to the data flow diagrams as data storage. These documents are an important part of the data flow throughout the company, and therefore, they are added to the appendix in the form of data dictionary entries.(See Appendixes A-E)

4.2 CASE Tools

CASE is an acronym for Computer Aided Software Engineering. CASE is a relatively new technology. The need for automating the structured analysis, design, and data modeling methods caused the CASE technology to improve in the recent years.

The first product was introduced for usage in 1981 by STRADIS/DRAW[4]. The first tools carried only graphics capabilities that helped the analysts in diagrams. Soon after, new products were released with consistency and completeness testing facilities. The first product in that category was EXCELERATOR (1984). The success of it really established the market for CASE tools. In the recent years, the widespread use of relatively low cost, powerful computer systems increased the demand for such tools.

There are many CASE tools available to cover one or more stages of the system development life cycle including analysis, design, coding, and testing. The sophistication of the tools arises as the stages covered by a CASE tool increase. It is important to note that a CASE tool is not

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[4] The first case tool developed by Stradis Corporation.

a magical solution provider to system development. To use a CASE tool effectively, one must have an understanding of structured development methods.

The data dictionary is one of the features that makes a CASE tool so powerful. It is a collection of information about each object used on the charts in a project. Each unique object has a matching record in the data dictionary.

It is expected that CASE will do for computer software development what CAD (Computer Aided Design) has done for hardware development, that is, to enable the rapid, accurate, cost effective development of system software.

4.3 Taxanomy of Case Tools

CASE tools can be used at a variety of places regarding systems development. Here, some of their usages by function are discussed briefly (QED 1989).

They can be used as a business systems planning tool. The objective of this tool is to help understanding of information flow between organizational units.

There are CASE tools that focus on project management. But today, project management software have made them obsolete.

CASE software as support tools encompasses the activities of entire software engineering process such as quality assurance of programs, networking tools, documentation tools.

Some CASE tools support analysis and design like the one used in this study. The tool contains data and control flow, data content, process representations and other modeling representations. They assist in the creation and evaluation of the model by performing validity and consistency checks.

The programming tools provide the compiler, editor, debugger functions to the programmer.

The final group of CASE software encompass testing and maintenance tools.

4.4 Information About the Selected Software

The EasyCASE Systems Designer[5] program and documentation introduce the concepts of structured analysis, design, data modeling methods, and CASE. These concepts should in

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[5] Developed by Evergreen Case Tools, Inc.

turn help the basic knowledge of the methods and techniques required to implement full CASE solution.

EasyCASE works on personal computers under Microsoft Windows operating environment. Its graphical user interface enables a user-friendly environment. First, the user starts a new project. All written and visual materials are stored under that project directory. The main approach of the program is to form charts using the desired type and methodology. The charts are drawn usually hierarchically. This means that charts go from simple to detail. A data dictionary entry is created for every object in the charts.

The program supports several diagram types in order to implement structured analysis, design, and data modeling concepts. The diagram types are:

- Data flow diagrams (DFD)

- Data model diagrams (DMD)

- Data structure diagrams (DSD)

- Entity-relationship diagrams (ERD)

- Structure Charts (STC)

- State-transition diagrams (STD)

EasyCase produces these charts according to some methodologies and symbologies. The important ones of these methodologies are Yourdon/DeMarco, Gane & Sarson, SSADM, Jackson, Shlaer & Mellor, Chen, Martin, and IDEF1X.

There are four basic types of objects that can be used on charts:

- Symbols: A symbol represents an object on a chart. Symbols include such objects as data processes on data flow diagrams, control transforms on transformation graphs, module on structure charts, entities on entity relationship diagrams, and states on state transition diagrams.

- Connections: A link between two symbols on a chart that indicates the flow of information or resources, or the relationship between the two symbols.

- Interfaces: A connection that joins a process on one chart with an off chart entity. It is a special type of connection.

- Couples: Annotate a connection on a structure chart with data or control information passed by a call between functions or modules.
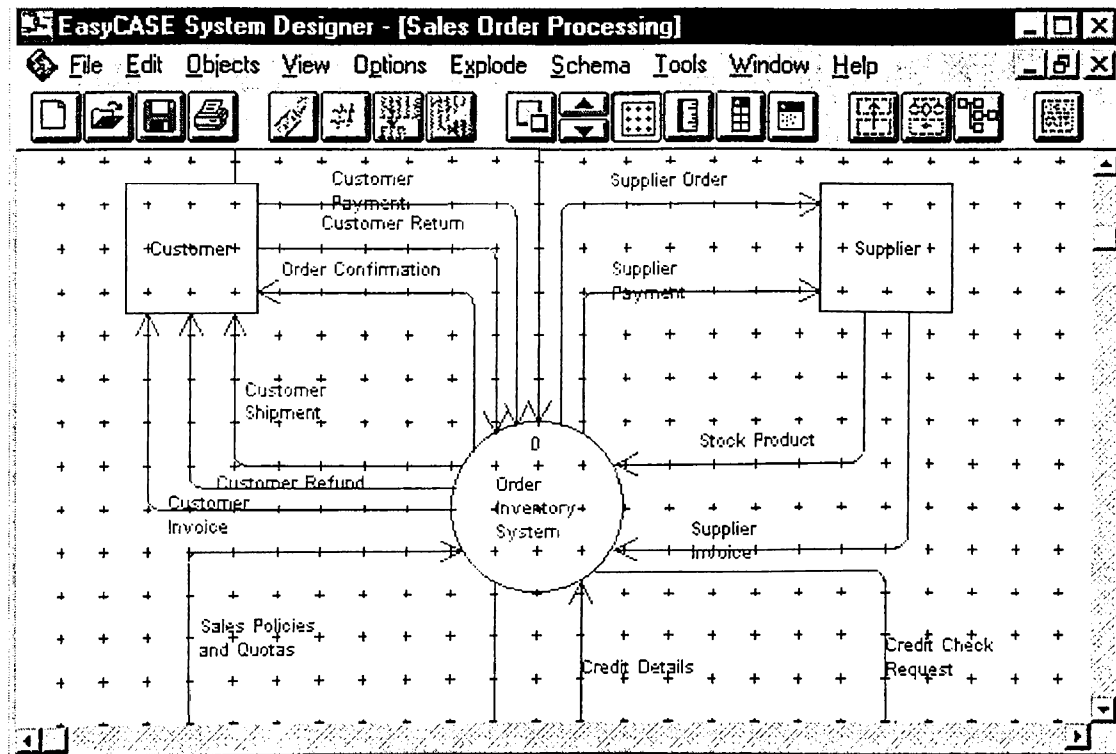
Figure 4-1 "EasyCase for Windows" Interface Sample

As structured analysis was intended to be used as a graphical descriptive technique, it requires a lot of paperwork. It was recognized that to avoid the huge paperwork of structured analysis CASE tools were the best alternative.

In this study, the DFDs with Yourdon/DeMarco method were used in developing systems analysis study. The documentation of DFD processes, data flows, and data storages were done with a text file link (that is a feature of the program) connected one to each data process symbol. After completing the study, the process explanations and data dictionary items were converted into Microsoft Word document.

5. STRUCTURED SYSTEMS ANALYSIS IMPLEMENTATION

5.1 Datakom Context Diagram

In the context diagram, there exists only one process that best explains the main purpose of the company. As Datakom aims service and sales as income generators, both terms were used in naming the process in the context diagram. That is because, the main objective of the company is to increase its market share in the Turkish computer and information technology industry by providing satisfactory service and sales activity. Besides, the circles in a DFD represent processes. So, it is better to give a name that sounds like the main function of the company.

The main external entities (square boxes) that the company interacts with and main data flows (in and out) between those entities are represented in the context diagram (See Figure 5-1: Datakom Context Diagram).

The brief explanations of these entities and information flows to and from them are explained below:

Forwarder: It is the company which is responsible for the delivery of products from the foreign vendors to customs. Trade department coordinates the contacts and studies with the forwarder firm. Data flow between the company and forwarder firm are:

Transport Communicator: The forwarder receives supplier name and address by this form. Later, he picks the orders from that address.

Fax: The forwarder firm sends the list of products picked from the vendors.

Confirmation: The fax message from the forwarder is examined and a feedback is sent to them. After the confirmation is sent, the forwarder can start transport operations.

Foreign Manufacturer/Vendor: These are the firms that their products are represented and distributed nation wide.

Foreign Firm Connections: Foreign manufacturer firms and vendors are contacted for finance and product related purposes. These contacts are usually in the form of fax messages and e-mails.

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Foreign Order: These are the order faxes passed to the firms. Every sales engineer gives the order after taking the approval of management.

Proforma: The foreign firms send a proforma invoice as a response to order faxes. Proforma includes the unit prices of ordered products.

Proforma Confirmation: If the proforma is correct, a confirmation mail or fax is sent to the vendor. Otherwise conflict(s) is resolved by negotiation.

Product Information: New product information, price lists and documents are sent from the vendor firms. A special telecommunication line is used frequently for the transmission of those materials.

Customs Commissioner: This is the firm that picks the products transported by the forwarder out of the customs. It deals with all legal operations regarding customs office.

Bank Documents: The legal documents that are required for picking the shipment out of the customs. These are original invoices, import permission, bank application petition.

Third Firms: While giving tenders to government bids, some requirements might not be met by Datakom. For meeting those needs, other firms are contacted. If they are able to meet those needs, the services or equipment are purchased from those firms.

Firm Connection: The firms that could meet the requirements are searched.

Firm Proposal: The firms pass their technical specifications and cost of their proposal to Datakom.

Social Security Organization: This is the public social security organization that all employers have to register their employees. There are a couple of periodic forms that this organization has to receive. These are new employee registry form, monthly social security and pension fund forms. The preparation of these forms are done by the accounting department.

Company H.q.: The accounting books are kept at the company headquarters which is at a different location.

Accounting Slip: Daily accounting, and cash activities are reported at a standard sheet.

Invoice/ Waybill: The invoices and waybills that Datakom is obliged to give its customers are prepared at the company's central office.

Bank: Bank is contacted for import operations. Using the bank is a legal requirement for cash transfers during import.

Bank Application: For a new import activity, an application is given to the bank with a standard document.

Import Permission: In response to the application, import permission is received in a couple of days' time. It includes the reference number unique to that import.

Customer: The real or legal person to whom the products are sold. The customer is contacted before sales for marketing activities and after sales for product support activities.

Customer Delivery: The hardware support department sets up the sold systems at the customer's site and fills out a form after accomplishing its operation.

Temporary Acceptance: After the system is shipped to the customer and ran, a document is sent to Datakom stating the temporary acceptance of those equipment.

Permanent Acceptance: After temporary acceptance, the system is tested by the customer. If it meets all the specifications, permanent acceptance of the product is done. The beginning of the warranty time and the payment is after the permanent acceptance.

Letter of Specifications: The organization which makes bidding prepares a document stating all its administrative and technical requirements. This document is named as letter of specification. Only authorized companies can obtain this document by paying a fee for it.

Tender: For entering the bidding, an appropriate tender letter is prepared considering the letter of specifications.

Training Demand: The customer may demand training related with purchased products. Training programs are generally theoretical, on-job-training is seldom employed.

Training Program: The training schedule is prepared by the Software Support Department and is sent to the customer.

Customer Call: The announcement of machine failures to Datakom from customers.

Service: The necessary services are provided to the customer that solves hardware or software related problems.

Maintenance Agreement: When the warranty time of products expire, the customer may demand a maintenance agreement which includes the free maintenance and repair of its products within a period of time.

Retailer: Some of the brands are sold to customers through retailers. Those brand products are not sold directly to customers. Retailer companies sign a contract with Datakom.

Project Customer: These are the firms for which Software Support Department works on special projects. The projects have special conditions and generally take at least 1-2 years.

Project Documents: Some messaging takes place with the project customers. There is no certain form for these messages.

Market Data: There are various resources for market data. For simplicity, those are collected in one external entity named "Market". Market data is generally used for learning new government bid dates and contents. The major written source is official gazette and IT journals.

Distributor Firm: These are other firms that are the distributors of other foreign brands in Turkey.

Domestic Order: These are the order faxes or calls given to those firms. Every sales engineer can give the order after taking the approval of management.
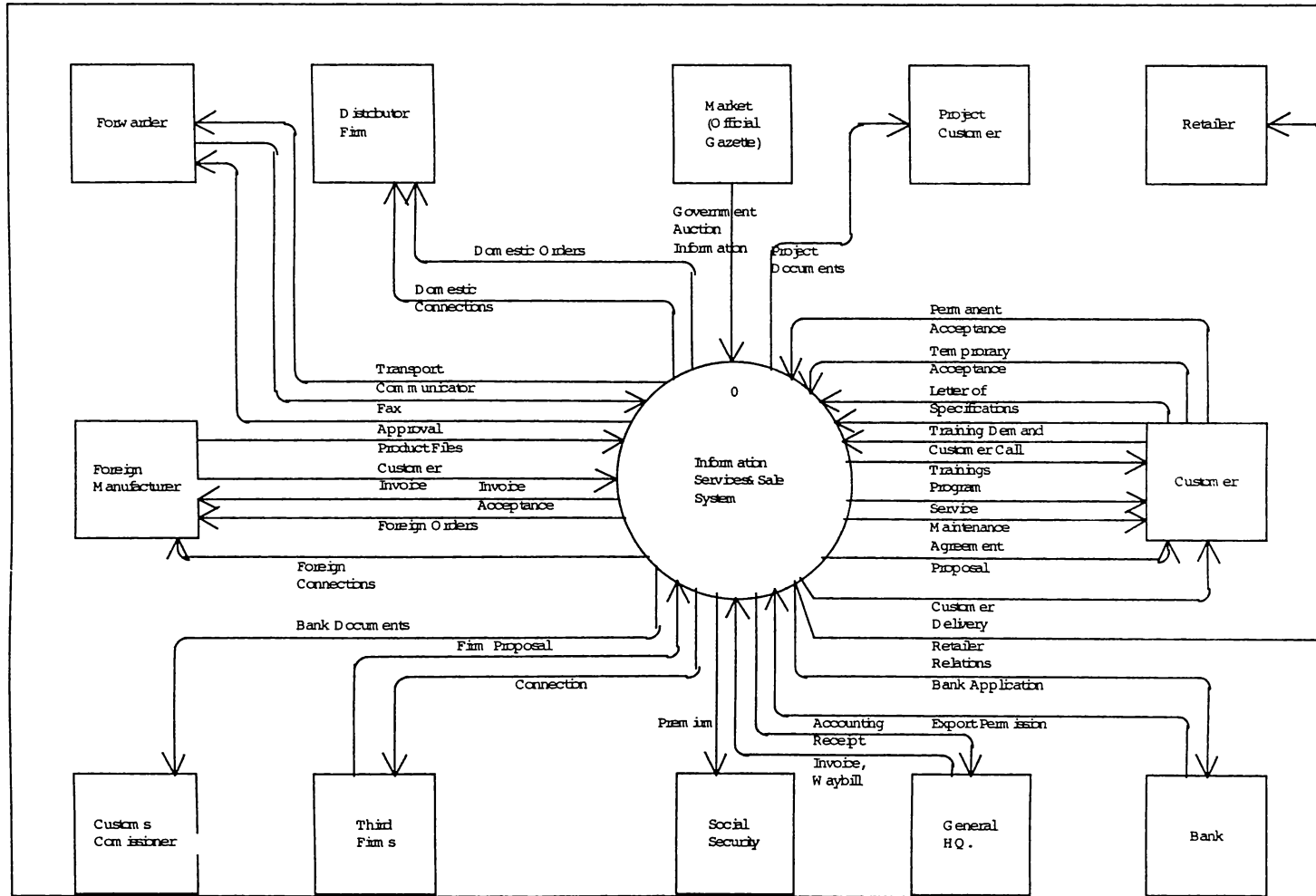
Figure 5-1: Datakom Context Diagram

5.2 Information Services and Sales Operations

5.2.1 Trade Department

Trade Department is responsible for the processes that take place during the import of products by various departments. The departments confirm foreign orders to department managers. Trade Department assumes only confirmed orders as valid ones and do not take action if they are not currently confirmed by management. Foreign vendors send a proforma invoice for each order. These invoices are examined by ordering department. The Trade Department is told to continue with the import after this examination.

Trade Department coordinates and controls the studies of picking the goods from foreign firm, transportation, and customs operations in Ankara. Many forms and documents are required for completing these steps successfully.

The department frequently contacts with finance department and three firms for its operations. Those firms are forwarder which transports the goods; customs commissioner which deals with customs bureaucracy; and insurance company which insures the products during transportation. Also, the department informs Finance Department about current and closing cash requirements like customs, freight, and insurance fees.

5.2.2 Sales and Marketing Department

Sales and Marketing Department sells computer systems by giving tenders. It prepares proposals to firms which are mostly government establishments according to their demand. Preparing a tender to public and private establishments are quite different in style. The public tenders have to fulfill each of the written technical requirements and have to be in a predefined style. Contrary to public proposals, tenders to private firms do not have a definite style.

Other group of products which are not as expensive as computer systems are sold via retailer channels. These product samples are plotters, printers, and optical readers.

The department is organized as manager, and sales support engineers. Each group of engineers work with a product manager. New products are marketed to potential customers with the leaderships of the managers. Every product manager and engineer deals only with his product range.

5.2.3 Hardware Support Department

The department deals with the hardware failures and perform periodic maintenance of the systems that were sold. Support engineers and technicians are employed for achieving these activities. It is the department manager's responsibility to arrange the schedules of his personnel. Also, the company warehouse is controlled and administered by the department. The material entrance and exit operations are controlled by the department manager.

The department generates income by providing service to customers and by selling new parts for replacing defective ones.

5.2.4 Software Support Department

Software Support Department performs support and project activities. Support activities involve the solution of software related problems of the system that are sold to customers. System support engineers work on these problems. Projects are custom software development studies that are done on a contract basis. A project team mostly consisting of engineers and programmers works on each project. The project teams are under the management of Software Support Department but the project manager has wide responsibility about the projects to customer and management. Their working place is usually the customer.

There is a company wide local area network and Internet connection. The PCs at each department use this structure. It is the Software Support Department's responsibility to keep the network running. If any problem emerges, support engineers solve it.

The training programs are scheduled and given to customers by the department. A training coordinator prepares the programs, assigns trainers and communicates with the customer. On programmed dates, courses are given to customer firm personnel at the company training room.

5.2.5 Finance Department

It is responsible for controlling the liquid assets,and providing necessary resources for the company. The cash of the company is distributed at various bank accounts both in local and foreign currencies. Everyday a small amount of cash is drawn for meeting the daily expenses. This amount is under the control of Accounting Department. Other cash in the accounts are

invested to government bonds, repo, and other funds and foreign currency. These operations are managed by Finance Department.

5.2.6 Accounting and Personnel Department

The department keeps the accounting books and personnel records that are legally required. The original accounting books are held at the company central office. So every accounting activity is recorded to accounting slips and sent to central office with original receipts and invoices. The copies are kept here for the department's own control and for reporting to management.
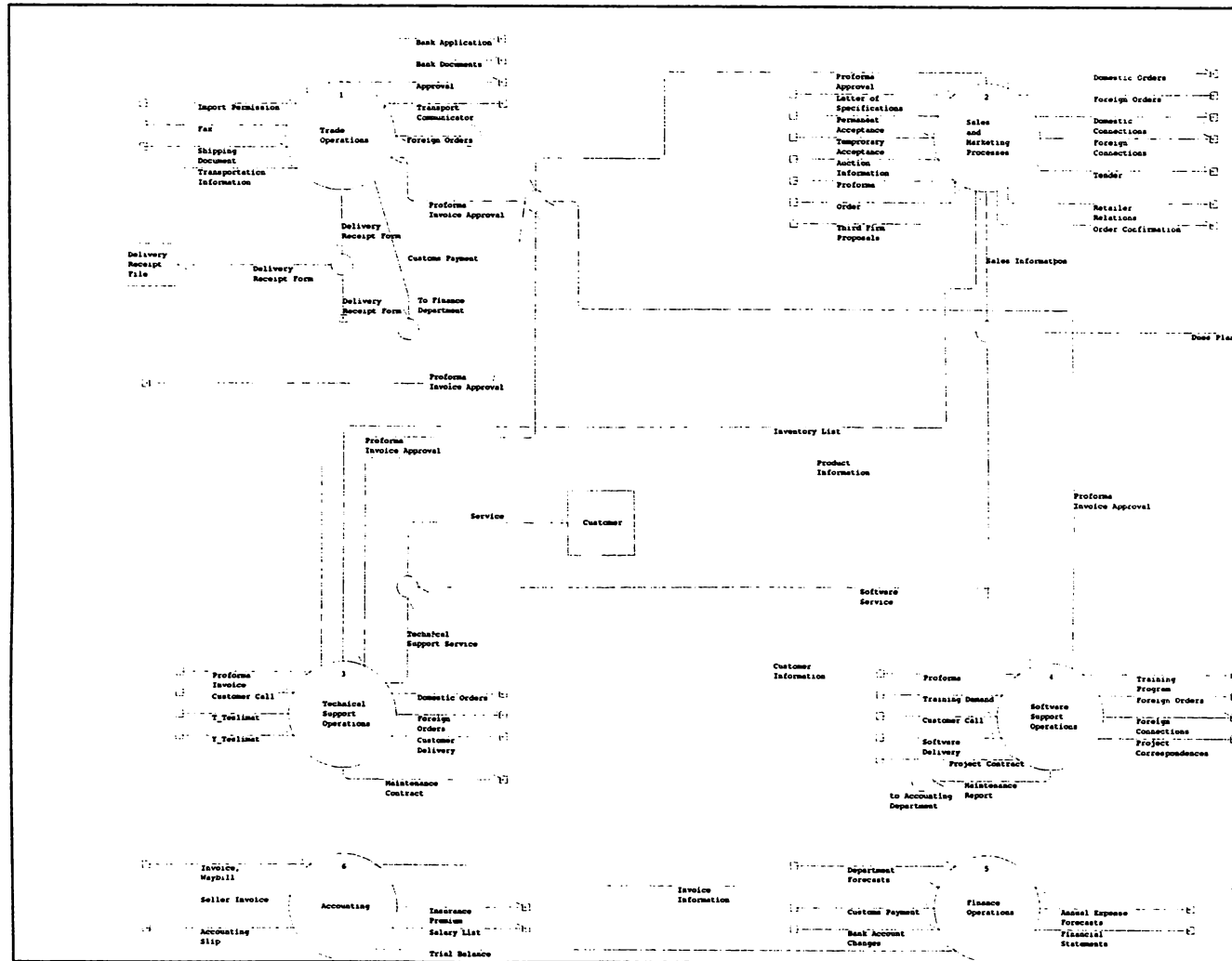
Figure 5-2: Information Services and Sales System

5.3 The Processes of Trade Department

5.3.1 Order Evaluation:

Input: Output:
Proforma Invoice Approval   Order File
Foreign Orders   Property Equivalent Transfer List

The department performs the import operations for the foreign product orders given by other departments. The order forms are confirmed by the use of proforma invoice. Copies of foreign order forms and corresponding proforma invoices come from other departments. Trade department manager fills a record for each order to "property equivalent transfer list" (See Appendix A). All legal forms and documents related to each order are collected manually in a separate document file.

5.3.2 Bank Application:

Input: Output:
Bank Application (from bank)   Import Permission (to bank)
                                     Reference Number

The trade department applies to bank for import permission with the required documents. Standard application petition, proforma invoice, import duty receipt are transmitted to the bank with the petition. The import duty receipt value changes with the import method. The bank prepares a special document named as "Import Permission G copy". The company receives this document after a few days. If required, a qualification document that is obtained from ministry of trade might be asked by the bank. The bank gives a reference number[5] for every import action. Imports continue by using this number. The reference number that stands for each order is recorded to the necessary forms.

5.3.3 Transportation Follow-up:

Input: Output:
Forwarder Fax (from forwarder)   Shipment Notification (to forwarder)
Manufacturer Fax (from manufacturer) Shipping Follow-up Update
Transportation Information   Approval (to forwarder)

---

[5]After Customs Union, the reference number began to be given by the firm, not by the bank.

The forwarder firm gets the original invoice with the goods from the seller or manufacturer abroad. The invoice is sent via fax. Invoice shows the goods that are ready for shipping. A similar fax may come from the manufacturer. The invoice fax and proforma invoice is compared in order to prevent errors. If there is no error or inconsistency, the trade department tells the forwarder to start picking up and shipping the party of goods.

After the shipping is approved, the forwarder informs how the shipping will be made. Approximate arrival date is forecasted by using this information. Trade department manager appends this data to shipping follow-up form. The manager follows expected arrivals by attaching the forms on his wall. He makes the necessary changes on these forms until the goods come into the company's warehouse. This is a method that he developed by his experience. The airway bill or plate numbers, departure dates and some other information are required for insurance.

In "total in foreign currency" column of shipping follow-up (See Appendix A) form, only the transported material's total price in USD is written. Sometimes the order is shipped in separate parties. Therefore "total in foreign currency" column's amount may be lower than the total value of the order.

5.3.4 Document Follow-up

Input: Output:
Related shipping follow-up form   Insurance Data (to insurance agent)
Insurance Policy (from insurance agent)   Insurance Policy (to customs commissioner)
Shipping Document (from forwarder)

This is the stage that starts after sending the shipping order to forwarder and ends when the goods enter the customs house.

Required data is sent to insurance agent for the insurance policy. The data is obtained from the shipping follow-up form. Airway bill or plate number, departure date, approximate arrival date are some of the data elements available in the form.

The insurance agent insures the transfer and prepares the policy in a few days.

Insurance policy is given to the customs commissioner. Customs commissioner needs that form for clearing the goods through the customs.

5.3.5 Delivery Operations

Input:
Goods Cleared from Customs
Bill of Entry
Original Invoice

Output:
Legal Documents (to customs commissioner)
Delivery Receipt Form
Customs Payment (to finance department)

The necessary documents are transferred to the customs commissioner for the goods to clear through customs. Those documents are order, bill of freight, original invoice copy, import permission "G" copy, and legal capability document if required.

Finance department should know the approximate duty tax amount. The trade department calculates duty and other expenses like transportation, and insurance. Those calculations are not exact values but the deviation is usually around 5% of the exact amount. Trade department manager demands this money to be ready before the arrival of goods to customs. Trade Department organizes meetings with Finance Department in order to inform about the incoming parties of orders.

After clearing the goods through customs, the customs commissioner hands over them adding the bill of entry, cash receipt, original invoice and his invoice to the trade manager.

Next, trade department sends the imported goods to hardware support department for routine control and tests. The part numbers and explanations of the sent goods are written in the delivery receipt form (See Appendix A).

Trade department gives copies of delivery receipt form to Hardware Support,and Accounting departments. The originals are filed in the department. Also the Sales Department orders' delivery receipt forms are sent to related sales representative. The sales department uses that form in cost analysis[6] of the sold properties.

5.3.6 Closing Bank Engagements:

Input:
Original Invoice Approved by Customs
Order file photocopies

Output:
Petition
Customs Entrance Form Copy
Customs cash receipt copy

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[6] The expenses done during import are appended to the bottom part of the delivery receipt form.

A petition is sent to the bank through which import is done. The necessary document copies are also sent with the petition letter. This operation is done for closing the bank account that was opened for import.

Proforma
Invoice Approval

1.1   1.2

Foreign Orders   Order   Bank Application   Bank
                  Evaluation   ApplicationImport Permission

                                                           Reference No

                              Reference No

                                                                  Reference No

                              Order   Reference No
                              File

                                             Property   Import
Fax   Equivalent   Notes
                                             Transfer Lst

              Forwarder Fax

      Manufacturer   Shipment
      Fax   1.3   Notification

      Transportation Transportation Shipping   Shipping
      Information   Follow-up   Follow-up   Follow-up
                                     Update   Form
      Approval
                                     1.4

Shipping   Document   Insurance Data
Document   Follow-up
                                               Insurance
      Insurance   Policy
      Policy

Customs   Delivery
Commissioner   Legal Documents   Delivery   Receipt
                                       Receipt Form   File

                              1.5
                                       Customs Entrance   Order
                              Delivery Form   Follow-up
                              Operations Original Invoice   File

      Delivery of
      Goods
Delivery   Customs Payment
Receipt Form
              Original
              invoice approved
              by customs

                              1.6
                              Closing   Copies of
                              Bank   order files
Bank   Engagement   Engagements
              closing approval

5.4 The Processes of Sales Department

5.4.1 Adjudication[7] Follow-up

Input: Output:
Bid Information (From customers and official   Bid Decision
gazette)
Letter of Specifications (From customer)
Temporary Acceptance (From customer)
Permanent Acceptance (From customer)

Information is collected about the new state adjudications from various sources. Most commonly applied resource is the official gazette, since state organizations are obliged to announce purchases in the official gazette. The specification letters of bids that the firm interested in are provided. The technical and administrative specifications of the organization are examined. If it is decided to enter the bidding process, proposal preparation (tender) studies start.

Temporary acceptance starts right after the delivery and installation of proposed systems to the customer(generally a public organization). The client firm controls the devices and uses them for a period. If every paragraph of the technical specifications are met then the customer communicates the permanent acceptance with an official letter. The temporary acceptance period varies from customer to customer. It is important to note that only after permanent acceptance the prices of the delivered systems can be paid and the warranty time can begin.

The communications with the customer continues on different subjects until the permanent acceptance of the products.

5.4.2 Tender Preparation

Input: Output:
Bid Decision   Tender (To customer)

Bid Procurement Letter (From customer)   Letter of Specifications Acceptance (To
Third Firm Proposals   customer)

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[7] A legal requirement for the state organizations that want to purchase materials from private firms. Tenders from at least three firms are received and the best tenderer is selected.

Sales price is determined considering all possible costs after winning the adjudication. For price determination, original manufacturer's price catalogs and communicators are used.

Product Communicators include price and detailed technical information about the products of manufacturer firms.

Price Catalogs are also sent from the manufacturer firms. The existing products' list prices and price changes are included in the catalogs.

A certain ratio of the determined total price is used in the acquirement of assurance letter. It is obtained from the state organization that the tender is prepared for. After obtaining assurance letter, sales engineers start preparing letter of specifications acceptance document. In that document, the solutions provided by the firm are stated (must meet the requirements written in the letter of specifications). Product communicators, brochures are used in meeting the customer's requests stated in the technical specifications.

Proposal file includes proposal and introduction letters, references, company information, personnel list, offered training program, and other standard pages and documents.

After sending the specifications acceptance and tender to the customer, the firm can enter the adjudication.

While preparing tenders to some adjudications, some additional hardware, and infrastructure requirements may be demanded from bid winner firm. These can be special printers, air conditioning systems, network cabling, etc. In the proposal, it must also be explained how to meet these requirements. Because of this, the firm may demand proposals from other firms (named as third firms) for each adjudication.

5.4.3 Project Tender Preparation

Input: Output:
Bid Decision   Tender (To customer)
Letter of Specification
Product Documents

A copy of each tender is stored at customer files. A unique project number is assigned for each tender and this number is used as a reference in future studies.

The state organization adjudications take more than one year. So, they are accepted as projects. For each adjudication, a tender which is a proposal letter, is prepared including the

list of proposed products and their prices to the customer. Since they take a long time to accomplish the initial proposed prices are modified in time. Each modification is stored at the related customer's file. Here, the project numbers are used while referring to each project.

5.4.4 Computer Component Sales

Input: Output:
Computer Component Demand (From   Proposal(To Customer)
Customer)

The existing customers can demand computer components, some other peripheral devices, and consumables. For example additional computer memories, hard disks, laser printers, or printer ribbons can be ordered. These are low price and routine sales but account for a significant portion of overall company sales income.

The proposals are sent to demanding customer and they are archived. The proposals are followed up until the shipment to customer is done.

5.4.5 Upgrade Proposal

Input: Output:
Upgrade Demand (From Customer)   Upgrade Proposal (To Customer)

Either the customers may demand for an upgrade of an existing system or sales engineers may persuade the customers for an upgrade by analyzing current configurations. A suitable upgrade equipment and price is proposed by searching the old product brochures and catalogs. The same procedure that is applied for component sales is also valid here.

5.4.6 Order Acceptance

Input: Output:
Order (From Retailer)   Order Confirmation (To Retailer)
                                               Order Form

The order faxes of retailers are received (See Appendix B). In the faxes, the explanations of the ordered products, customer address, and sales type are stated. Those faxes that come to sales department are answered in three days time. The order is confirmed by a fax to the retailer.

The order that is received by fax is copied to a form. This form shows the total of ordered products and prices. Then the approval of management is taken.

If the ordered product exists in inventory, the shipment operations start right after the approval. Otherwise the products are ordered to foreign manufacturer or distributor (See 5.4.7).

5.4.7 Give Order

Input: Output:
Order Form   Foreign Orders (To Foreign Supplier)
Proforma Invoice (From Foreign Supplier)   Proforma Approval (To Foreign Supplier)
Inventory Data (From Warehouse)

If the sold products do not currently exist in the inventory, the orders are given to foreign manufacturers or vendors. The frequently sold items are ordered when the stocks go below a certain quantity. Others(mini computers, mainframes) are ordered as a result of realized sales. As there is no currently working on-line inventory system, sales engineers control the inventory levels of products which they are responsible for.

The proforma invoice fax is confirmed by the sales engineer who has given the order or by sales manager. Sales engineers follow up the orders until they are picked by the forwarder firm. Forwarder firm picks the goods from the foreign distributor. If there is no mistake in the goods picked by forwarder, Trade Department follows the rest of the operation.

5.4.8 Cost Determination

Input: Output:
Delivery Receipt Form(From Trade dept.)   Cost Report(To Management)

The delivery receipt form (See Appendix A) includes the costs that are incurred for clearing the goods from customs. Sales engineers summarize the import costs as insurance, freight, and duty. These expenses are added and distributed proportionately to the FOB[8] prices of the goods. The costs that are found for each good are appended to the cost report and are used for the determination of sales price.

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[8] FOB: Free on board

5.4.9 Preparation of Sales Report

Input: Output:
Cost Sheet   Sales Report (To Management)
Order Form   Sales Information (To various departments)

The sales report is prepared with the help of cost sheet which is a spreadsheet document and order forms which are faxed to distributors (See Appendix B). The data regarding sales are sent to Accounting, Software Support, Hardware Support, and Finance Departments (See Appendix B). Accounting receives the data necessary for invoice and waybill preparation. Software support is informed about the programs that will be installed, hardware support is informed about which systems will be established. Finance Department requires information about payment plan and installment dates. As a result a sales operation requires tight coordination among the departments.

The money is collected from the customers in TL and converted into USD by using the Central Bank's daily exchange rate. After all payments stated in the payment plans are received sales operation is closed.

5.4.10 Retailer Discount Calculation

Input: Output:
Retailer Gross Sales Figures   Retailer Discount List

The retailers that exceed certain amounts of sales receive paybacks. The paybacks are calculated on an annual basis but they are paid at the end of each quarter. In the system in use today, the retailers that make sales after a certain amount receive sales commission. These ratios are stated in the retailer agreement and are subject to change at each renewal of retailership agreement (See Appendix B).

5.4.11 Preparation of Routine Reports

Input: Output:
Sales Files   Monthly Sales Report (To Management)
                                            Quarterly Action Report (To Management)

They are the reports that show to management, the gross sales, inventory level, and profitability of the company. There is no fixed format for those reports. Monthly report summarizes the sales of the previous month. The sales figures, payment plans, the sold

items are stated. Quarterly Action Report is more comprehensive then Monthly Report. The department manager includes his own judgment in the report. The actions on the quarter are stated, major sales are explained in detail, and realization of budgeted aims are discussed.

5.4.12 Marketing Efforts

Input: Output:
Market Information (From various resources)   Presentations, Demonstrations (To
                                                Customers)
                                                Product Brochures (To Customers)

The changes in the market conditions, customers, introduction of related new products can be accepted as market information. They do not have a definite format, since they are acquired through various resources. The colleagues working at different firms, and customers are important information resources. Also the official gazette announces public adjudications. Therefore it is a frequently applied source of data. They can be aware of new products by examining sector magazines and journals. The customers that are going to change their information systems can also be detected in those sources.

The sales engineers continuously perform presentations, demonstrations about the new products to make customers aware and provide solutions to their current and possible future needs. Also customer visits are done to keep the relations warm between the customers.
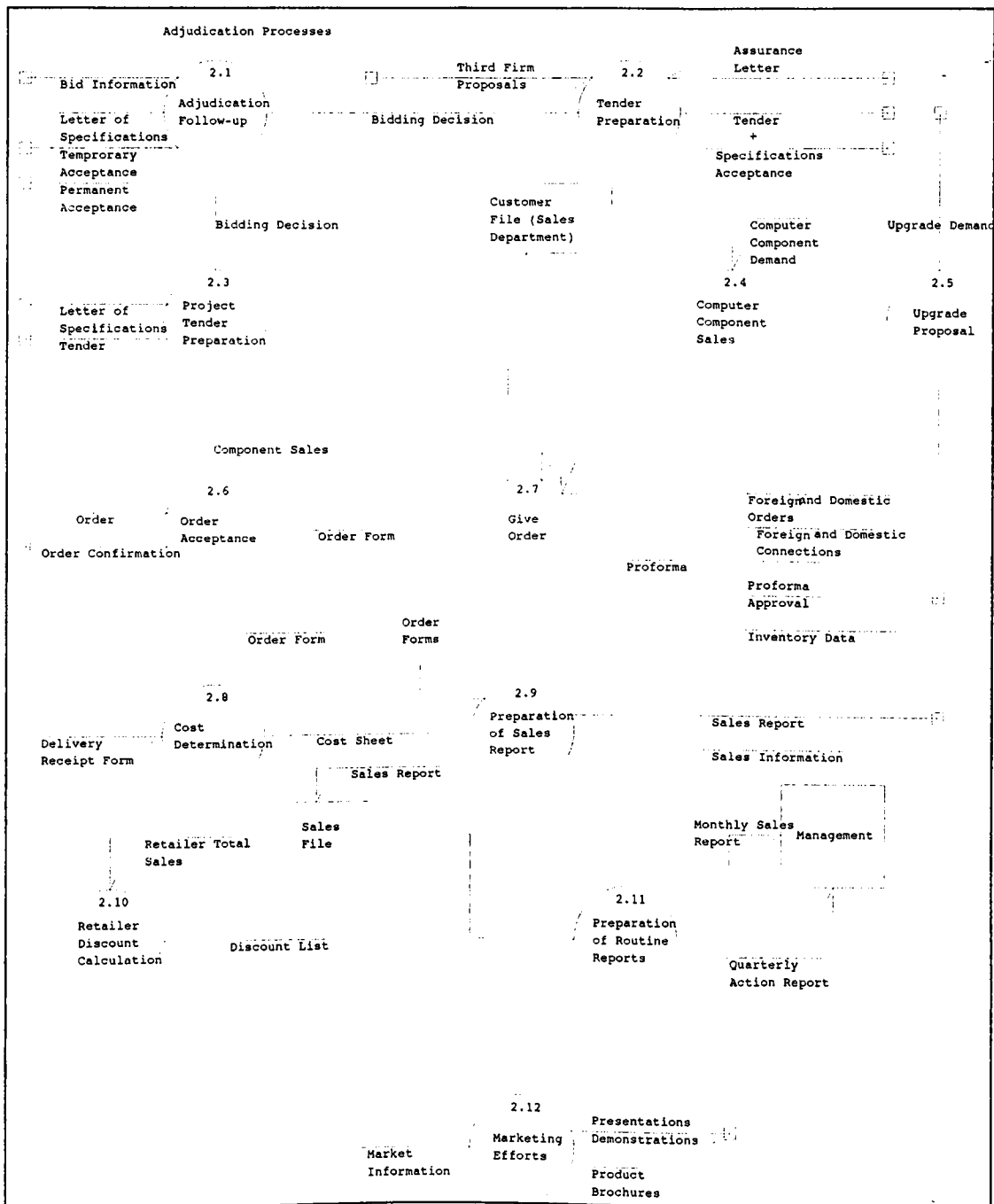
Figure 5-4: Sales Department Data Flow Diagram

5.5 The Processes of Hardware Support Department

5.5.1 Product Exit

Input: Output:
Product Information (From Sales Dept.)   Warehouse Exit Receipt
                                                Deposit Receipt
                                                Product

Necessary information about the sold materials and customer name and address arrives from Sales Department. The products are prepared for shipment according to this report. Warehouse Exit Receipt (See Appendix C) is filled for each material departure from the warehouse.

The inventory levels that physically exist in the warehouse is followed with an EXCEL document that is updated arbitrarily.

Some products may be taken from the warehouse for demonstrations or other marketing related purposes. For such departures, deposit receipt form is filled (See Appendix C). Deposit receipt form is used for temporary product usage that are enrolled to the inventory. Those products are assumed to be in inventory unless waybill or sales invoice are prepared for any of them.

The products that leave the warehouse physically are sent to customers or used in related department.

5.5.2 Preparing the System

Input: Output:
Product (From Warehouse)   Customer Delivery Form (To Customer)
                                                Product (To Customer)

The product information form that is sent from sales department includes machine configuration and installation place (At the company/customer/retailer). The stated products are carried out of the warehouse. Middle sized computer systems are generally prepared and required software is installed to the client's machines.   The machines are delivered to the customer by the delivery form. The form is signed by the responsibles of both parties.   The

delivery form that is mentioned is identical to maintenance form and is stored in the customer file that is kept in the Hardware Support Department.

5.5.3 Warehouse Entrance

Input:	Output:
Invoice (From Supplier)	Invoice (To Accounting Dept.)
Delivery Receipt Form (From Trade Dept.)	Inventory Entrance Receipt
Foreign ordered products	Update of Deposit
Domestic ordered products	Products (To Warehouse)

The products are accepted with the delivery receipt form sent from Trade Department. Warehouse responsible records the products to the inventory by filling inventory entrance receipts.

5.5.4 Call Evaluation

Input:	Output:
Customer Call (From Customer)	Record of Customer Call
	Notification to appointed personnel

Hardware Support department tries to resolve the hardware related problems that comes from the customers. The calls usually come to any engineer that the customer has previously been in touch with or directly to the department manager. The engineers try to solve the problems by themselves and inform the hardware support manager after or before solving the problem.

5.5.5 Problem Solving

Input:	Output:
Call Notification	Foreign Orders (To Foreign Supplier)
	Update of customer call records
	Domestic Orders (To Domestic Supplier)
	Maintenance Form (To Customer File)

The system failures are generally repaired in the company by hardware support engineers and technicians. The problem of the machines are recorded in a service form while they are reported by the customer. If the problem is solved at the customer, the service(maintenance) form is filled (See Appendix C), and filed in the customer file. So, the problem is closed.

If materials are required for repairing, they are taken out of the inventory. If they do not exist in the inventory, they are ordered. When the failure is repaired, the system is transported to the customer by a new service form. The delivery is done by taking the original service form as reference. Hardware support manager is informed about the failures that takes a long time to solve.

5.5.6 Preparation of Maintenance Calendar

Input: Output:
Customer Needs and Demands   Annual Maintenance Calendar

It is prepared by considering the limitations of customers. They may want services through different time intervals and hours. For example, the services may be given other than the working hours. The calendar is prepared by taking different variables of customers into considerations. The clients who sign maintenance contracts are sent a letter that informs them about the monthly service dates. An aggregate plan for all customers is also prepared.

5.5.7 Periodic Maintenance

Input: Output:
Annual Maintenance Calendar   Maintenance Form
                                               Invoice

The payment plans of periodic maintenance services differ among customers. The clients generally prefer to pay after taking the service. The invoices are taken to the customer if the payment plan is monthly.

The maintenance forms are filed to customer files (See Appendix C).

5.5.8 Preparation of Maintenance Contract

Input: Output:
Maintenance Contract Notification   Maintenance Contract (To Customer)
Maintenance Contract Approval (From
Customer)

With the end of the warranty time, maintenance contracts are signed with customers. The hardware support group follows up this date. The payment plans and amount to be paid differs among contracts. Generally, the fee of maintenance contract is a percentage of total sales price. The price to be paid by customer can also be arranged by bargaining.

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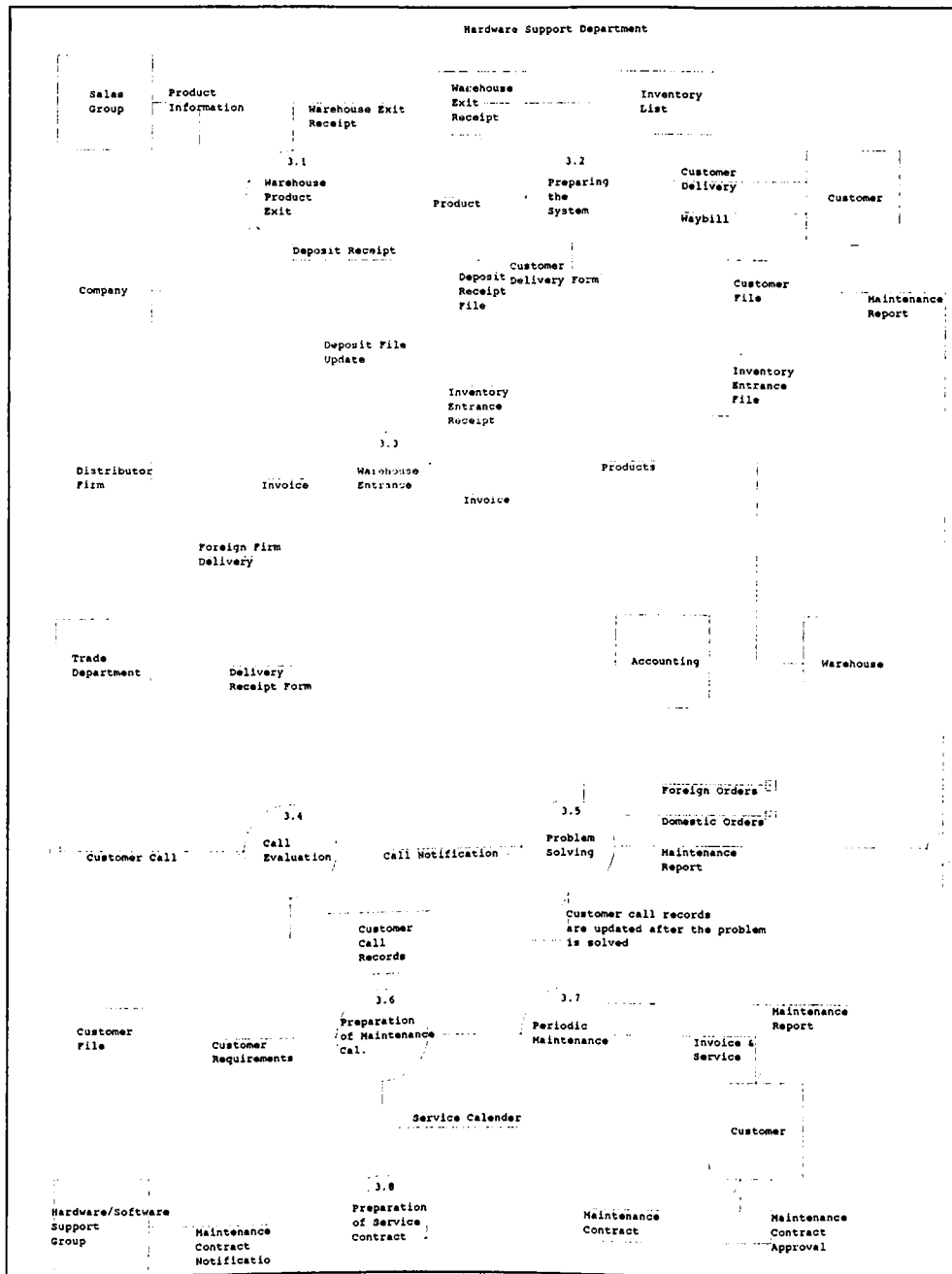
Figure 5-5: Hardware Support Department Data Flow Diagram

5.6 The Process of Software Support Department

5.6.1 Call Evaluation

Input:

Customer Call

Output:

Record of Customer Call

Notification to appointed personnel

See Part 5.5.4

5.6.2 Solving the Problem

Input:

Personnel appointment after receiving
customer call

Output:

Maintenance Report

Maintenance Form
Software Service

After the customer calls the company for a problem, a system support engineer is appointed to solve the problem. Software oriented problems can be solved inside the company by the use of networking and modem. This is generally applied when the client is far from Ankara. If it is not possible to solve the problem by remote access, the engineer goes to where the computer systems are located.

One maintenance form (See Appendix C) is filled for each service given to customer. While a copy is left with the customer, two others are filed in the company archive. If there is anything to bill out of the limits of maintenance contract, a report is sent to accounting department for the preparation of invoice.

5.6.3 Training Planning

Input:

Training Demand (From Customer)

Output:

Training Program
Training Preparation

Two kinds of training is provided. The first is, training arising from sales obligations. The company provides the client personnel the training as a part of the sales package and does not charge additional money. This has been the common application upto recent months.

In the second type, training services will be sold to existing customers and to new customers. Training will be a profit center rather than being a cost burden to the company.

Periodic training programs will be prepared and advertised to potential customers. The courses that have received enough interest will be given on stated dates.

5.6.4 Training Services

Input: Output:
Training Preparation   Training Reports (To Accounting Dep.)

Training is given to customers in the previously determined manner. The pricing is done according to number of trainees. The customer information and price data is sent to the accounting department for invoice preparation (Training reports).

5.6.5 Obtaining Software

Input: Output:
Software Demand   Domestic Connections and Orders
                                                    Foreign Connections and Orders

Software packages are ordered for internal usage or for installation to customer machines. The related distributor firms in Turkey or abroad is connected for passing the order. In foreign software purchases the products is sent via private posting firms and paid by international credit cards. This method is used for payments that are up to $1000. Other type of obtaining software uses the normal import process. Order is passed to the foreign firm. Trade department follows the rest.

The software programs come in different media; diskette, CD, various tape storage units. Especially the tape units occupy space, they are stored at a warehouse and accessed by a label number.

5.6.6 Project Studies

Input: Output:
Project Contract   Project Correspondences (To Customer)
                                                    Project Expenditures
                                                    Project File

The software projects are managed by the software support department. The projects are taken by bids and tenders. After the tender is got, the contents of the project is determined with a contract. A project team is formed. This team works within the leadership of the selected person. The expenditures, and correspondences with the customer are managed and directed by the software support department.
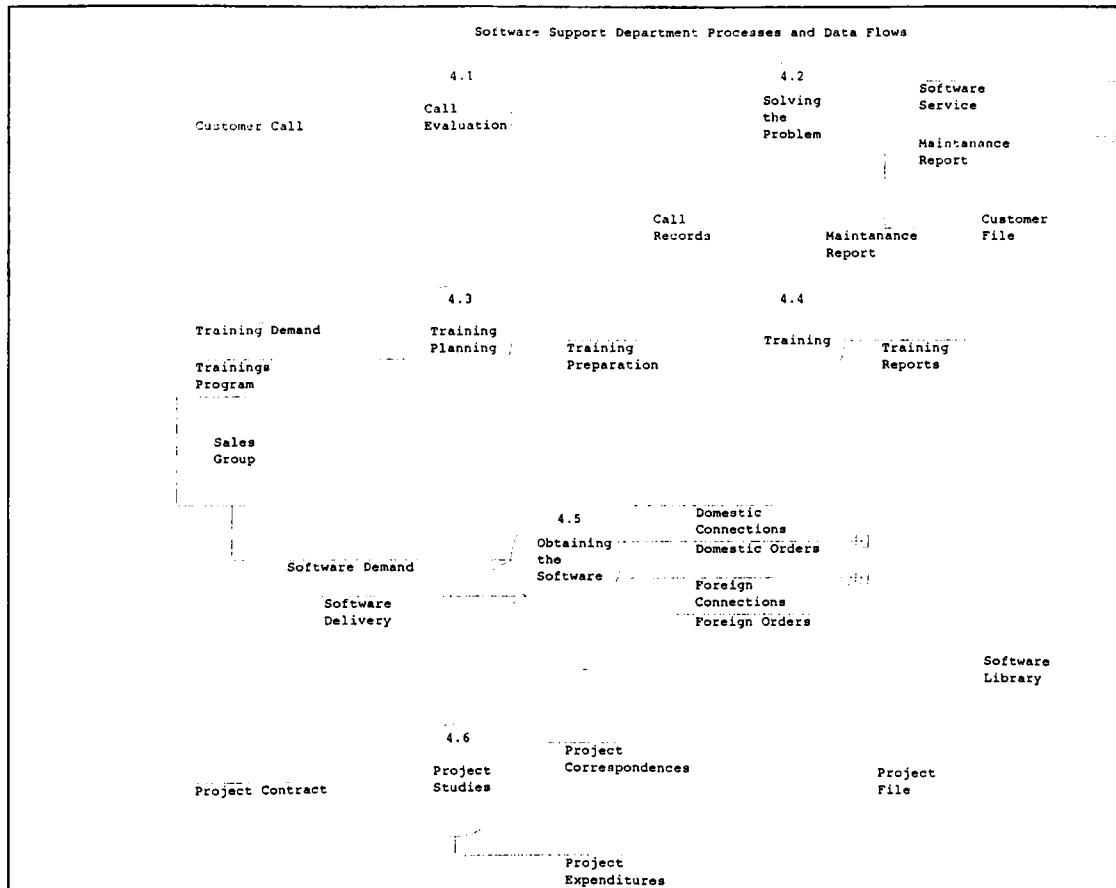
Figure 5-6: Software Support Department Data Flow Diagram

5.7 The Processes of Finance Department

5.7.1 Preparing Payments & Dues Plan

Input: Output:

Customs Payment(From Trade Department)   Payments and Dues Plan

Invoice Information (From Sales Department)

Payment Plan (From Sales Department)

Payment and Dues Plan is a report that shows the following week's payments and dues on a

table (See Appendix D). It is prepared on a weekly basis.

Foreign trade department informs about its cash requirements for the coming week. Sales

personnel also send a copy of payment plans to finance. With the addition of these data, the

reports are prepared periodically.

5.7.2 Payment Preparation

Input: Output:

Payments & Dues Plan   Monthly Expenses

Bank Sheet

The plan is prepared one week ahead of each working day. The departments may purchase

materials everyday. These orders are usually met in the following days. So, the payments are

generally confirmed one day before.

The payments that are due are confirmed from accounting manager. If the payments are

high, the required cash is collected from bank accounts by withdrawals or selling securities.

Finance Department obtains the cash and gives to Accounting Department.

5.7.3 Bank Sheet Preparation

Input: Output:

Daily bank account movements   Bank Sheet

Bank sheets are prepared at the end of every working day for following the cash flow of the

company (See Appendix D). It is prepared by using EXCEL. It is the most important

managerial accounting report that the department prepares. The daily movements are added

to the previous days sheet and by the calculations of Excel, daily sheet that shows the account

position is obtained.

It is prepared for withdrawing the cash requirements from the most suitable account.

5.7.4 Annual Budget Preparation

Input: Output:
Department Forecasts   Annual Expense Forecast Report

The department managers are expected to forecast their monthly estimates of expense and income amounts. The report of each manager is collected by finance department. They are examined and gathered at a summary file which is named as Budget Report or Annual Expense Forecast Report.

The report is sent to upper management for their approval. It is modified according to their demand.

5.7.5 Monthly Expense Calculations

Input: Output:
Monthly expense data   Monthly Expense Report
Seller Invoices for the prevailing month   Budget Realization Report

The monthly expenditures for each department is determined and grouped according to purpose of expenditure, such as transportation expenses of sales department or personnel salaries of departments. Similarly the seller invoices are grouped for each department.

The monthly expenses are found and compared with each department's estimate that was prepared at the beginning of the year. Budget realization report shows the comparison of those and they are sent to departments as feedback.
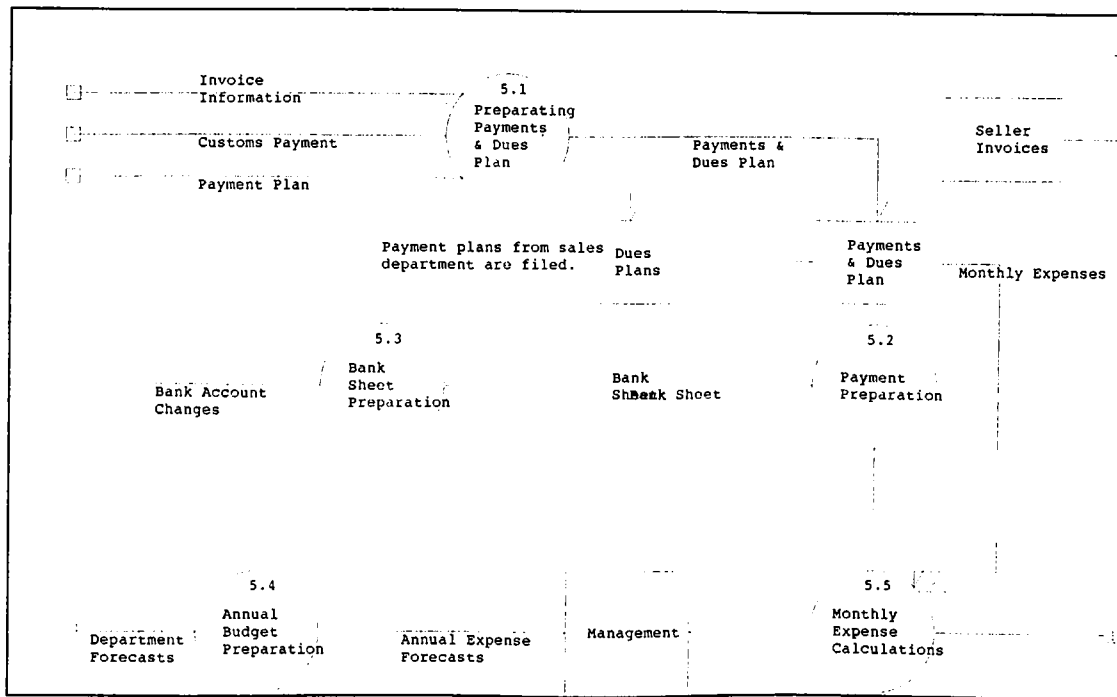
Figure 5-7: Finance Department Data Flow Diagram

5.8 The Processes of Accounting and Personnel Department

5.8.1 Invoice & Waybill Preparation

Input: Output:

Invoice, Waybill (From Company   Invoice, Waybill

Headquarters)

Customer Information (From Sales Dept.

The invoice and waybills are prepared at the company central office according to the customer

information sent from Sales Department. After they reach to Datakom, they can be distributed

to customers.

The invoice and waybills are transferred to customers through Hardware Support Department

or Sales Department employees. If the sales is done via a retailer, the invoice is prepared in

the name of the retailer.

5.8.2 Expense Evaluation

Input: Output:

Purchase Demand Form (From various   Purchase Information (To Finance

departments)   Department)

All kind of purchases for the company-wide use are done by filling purchase demand form

(See Appendix E). Whenever something is required a form is filled and approval of the

department manager is taken. The person then contacts with the firm which the purchase will

be made from. The invoice and approved purchase demand form come to the Accounting

Department attached together for processing. Accounting calculates the approximate cash

requirement and communicates this data to Finance Department.

5.8.3 Advance Payment

Input: Output:

Salary Advance Payment Demand Form   Payment Receipt (To related personnel)

(From related personnel)

Vacation Advance Payment Demand Form

(From related personnel)

Vacation Expense Form (From related

personnel)

Advance Payment Form (See Appendix E) is filled for each advance cash withdrawal. Vacation advance payments are done to personnel that travel out-of-city tasks in case of demand. At the return of vacation the expenses are documented with a summary report named vacation expense form. Related invoices and receipts are attached to this form. Those forms are stored for accounting purposes.

5.8.4 Invoice Payment

Input: Output:
Seller Invoice   Seller Invoice
                                                Payment Information
                                                Payment Receipt

The invoices come from seller firms. The payment method varies from company to company. While some of them are paid immediately, some frequently worked ones have a due date limit. The payments and other accounting activities are recorded to accounting slips (See Appendix E).

5.8.5 Accounting Slip Preparation

Input: Output:
Payment Information   Accounting Slip
Receipt

The receipts, invoice information, cash movements and all other activities regarding accounting are recorded to this form (See Appendix E). Previously, this was done manually, but since the use of an accounting software, the data is entered to computer. Instead of manually filled forms, computer print-outs are used.

The accounting slip originals were sent to company headquarters and the copies are filed in the department.

5.8.6 Accounting Reports Preparation

Input: Output:
Accounting Slips   Accounting Reports (Financial Statements)

Most of the reports are periodically prepared by the department. At the end of each month, the trial balance, balance sheet, income statement are prepared and offered to management. Sometimes, the management may demand non-routine reports other than these. In those cases, the related personnel prepares that report.

5.8.7 Personnel Follow-up

Input: Output:
Job Application Form (From Applicants)   New Employee Recruitment Form
Vacation Form (From Personnel)

The major functions of personnel are following personnel off day numbers and recruitment.

At the beginning of each year, every personnel receives a certain number of off days. This number varies according to the seniority of the person. When there is an open position the persons apply by filling a job application form. This form is filed whether the person is recruited or not. If he is recruited, this form is added to his personal file.

New Employee Recruitment Form is a standard form that all employers have to fill when they recruit a person. It is sent to state social security organization.

5.8.8 Social Security Lists Preparation

Input: Output:
Personnel Data   Monthly Premium Notification
                                Insurance Premium List

The personnel gross salary list is used in preparing the monthly premium notifications and insurance premium list. Both documents are sent to Social Security Organization. They have a definite form and style. The monthly premium notification is a list of working employees and their monthly pension fund and health insurance premium amounts are listed. Insurance premium list summarizes the totals of those values and the stated amounts are paid to the organization with this document.

5.8.9 Salary List Preparation

Input: Output:
Personnel Data   Salary List
                                Personal Salary Print-Out

Salary list is a computer print-out that shows all the employees sorted by departments and their detailed salary figures. Net paid salary, gross salary, premiums earned, social security premiums, income tax are some of those figures. At the end of each department personnel subtotals are listed. This list used in preparing monthly premium notifications and insurance premium list. Personal salary print-out is given to each employee at the end of each month which is a detailed explanation of his/her monthly earning.
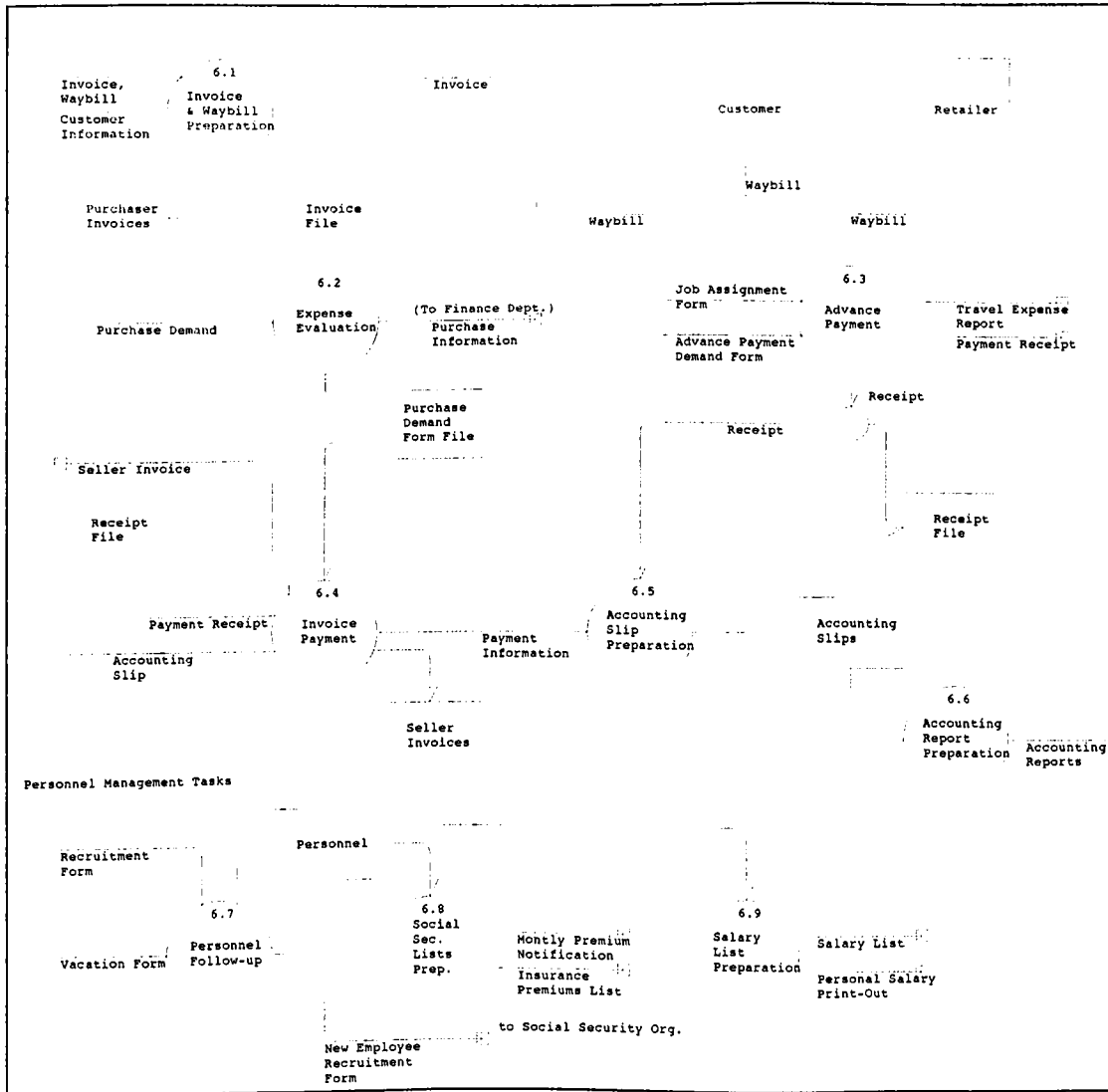

Figure 5-8: Accounting Department Data Flow Diagram

6. CONCLUSION

6.1 Main Problems Observed and Recommendations

Trade Department

- The Trade Department manager updates the shipping follow-up form manually as he becomes aware of the changes but this system is open to errors. Sometimes, all the data of a single order may come in several parties of shipment. This also makes the shipment follow-up process more complex. It is essential to use a computerized system for making this process safer and less tiring than the current form.

- Bank gives a reference number for each import operation. This reference number can be used as a unique key for each order from abroad.

- In the delivery receipt form, the Trade Department writes its own expenses for that shipment. So, all the cost data is available on that form. Because of intense competition in the market, the cost data must be kept as confidential as possible. This is only possible with a computer system with the use of user permission and access controls. In the current system, the cost data is open to everyone that handles the document.

Sales Department:

- A computerized order-processing system would be developed that best meets the requirements of the Sales Department. The department frequently receives orders from customers and these orders are dispatched to suppliers. This system would enhance the follow-up of each customer's order arrivals and deliveries. Facilitation of customer orders provides an opportunity for the strategic use of information systems. Some firms are now applying total quality improvement programs to improve the speed and accuracy of work flows between departments and many report substantial gains in efficiency by implementing order processing systems (Kotler 1994).

  A simple order database holding the order number as key, ordering sales personnel, order contents, date, customer, estimated arrival date, and prices would be used.

- The Sales Department regularly receives documents and price catalogs from foreign suppliers. In the computer industry, the prices of components change very frequently. So, the sales personnel have difficulty in following the last price of a component and

announcing their price to the customer. If the price lists are entered to a database, the response time to customers about prices decline significantly.

- An archiving system is necessary for accessing the completed project files. Those files are important for knowing the existing configuration of customers and determining their recent requirements. Also, the follow-up of existing projects is also a problem. Generally an initial Turkish Lira price is determined but the inflationary conditions require re-determination of this amount several times. The old prices are backed up and new values are entered. This process is a candidate for a computerized system.

- The salespersons give orders by fax messages but faxing each order to suppliers is a waste of time. One solution for this, is to equip each sales engineer with a fax/modem card. The drawback of this solution is, it is hard to file hard copies of order messages, and a failure in computer system may cause loss of data. A better alternative is to dedicate a server for fax messages with recovery and backup systems. By this way, each received and sent fax message can be collected at a certain location, and filed by a clerk.

- There is no on-line inventory inspection system. The inventory lists are manually kept by warehouse responsible. So, the sales engineers and product managers estimate the number of products in the inventory according to their order and sales. When the number of salespersons increase, this method may cause problems like double reservation of a product. So, an inventory system that enables on-line inspection and product reservation system is required for use by the warehouse responsible and accessible by the sales department.

- After each sale, standard documents are sent to finance, accounting, and technical support departments. This reporting process can be automated. If the sales are entered into a computer information system, the report can be generated automatically. Then, either the hard copies can be sent, or it can be mailed (by electronic mail) to related departments.

- The system can be improved to a *Sales Reporting System*. Management needs reports of current sales. Today, the executives wait varying time intervals (from hours to days) for the arrival of sales reports. The salesperson can enter the order sooner then writing to a form, and this order can immediately be accessible by the management.

- In part 5.4.10, retailer discount calculation was mentioned. This calculation is done for each retailer in an Excel® sheet. If order and sales operations are computerized; the preparation of this report can be added to that software, and this saves significant time to the product managers.

- The marketing activities are an important task of the department. A marketing-information-system(MIS) can be acquired. Some of the features of MIS is reports on orders, sales, prices, inventory levels, receivables, payables, and so on. By analyzing this information, marketing managers, and top management can spot important opportunities and problems (Kotler 1994).

Hardware Support Department:

- Customer failure calls are not recorded properly. This can cause missed or unanswered customer calls. For providing quality service, the customer calls must be answered as soon as possible. For achieving this, the failure calls may be directed to a certain phone number, and the voice may be recorded to digital media. This call is taken as the basis of future studies, and further studies are done until solving the problem.

- A failure can be given a number and all other studies and part usages can be recorded to that failure. If this system is applied it becomes easier to determine the cost of solving a problem.

- Annual maintenance contracts are signed for customers. Every month, the customer sites are visited for routine maintenance by support engineers and technicians. As the personnel is a scarce source, it is important to schedule these visits effectively. By determining the constraints and variables, the scheduling of customer visits can be prepared by a computer program. This solution contributes to better utilization of support personnel and saves time for support manager.

Software Support Department:

- There is lack of coordination between hardware and software support departments. They visit the same customers because of the same problem but collect the maintenance forms in separate files. So, a software support engineer that visits a customer does not know about the previous studies. For avoiding this problem, in the short-run, the maintenance

form copies can be collected at the secretaries of both departments, and in the long-run, the maintenance forms can be entered into a computer database and become accessible by all support personnel.

- The training programs are updated periodically. New courses can be added or existing ones can be modified. The training programs can be faxed automatically to all training customers each period.

Finance and Accounting Department:

- Weekly, Finance Department prepares payments and dues plan. If the payment plans are entered to a computer program when sales are realized, the preparation of this report becomes no longer necessary. The payments and dues plan for the following days can be taken as this software's print-out.

- The bank sheet shows the daily cash flow of the company. So, it is a very important financial report for the company management. A computer program can be developed for preparing this report. By this way, queries can be done regarding past cash movements on a bank account.

6.2 Last Word

The findings in this study are offered to company management, and resulted in the following benefits for the company:

- This study has been the first step in developing a company-wide integrated information system. The managers are convinced with the findings that showed the deficiencies of the company to themselves.

- Better understanding of the work flow would help to locate the bottlenecks and poorly functioning operations in the company. Such points would be reported to related managers, and the company would improve its internal functioning by taking the notices into consideration. The primary consequence of this, would be cost reduction by doing a job with less employees, or reducing the paperwork between departments which causes time waste and material consumption.

- It is visible that, if the company implements some of the proposed changes either by automation or modifying work flow, it can enhance its ability to compete and possibly furnish the firm with a competitive advantage in the industry (Zwass 1992).

Appendix A: Trade Department Data Dictionary Entries

			DDE No: A-1
Form Name:	Property Equivalent Transfer List		
Form Definition:			
Index Name:	Reference No		
Component Name	**Type**	**Component Name**	**Type**
Reference No Property Price Firm Actual Import Date Notes	Alphanumeric Numeric Character Date Character		

			DDE No: A-2
Form Name:	Shipping Follow-up Form		
Form Definition:	The shipments from foreign vendors are followed manually on this form. All fields are filled for each entry		
Index Name:	Order No		
Component Name	**Type**	**Component Name**	**Type**
Order No Forwarder Firm Exporter Firm Package Quantity Weight (kg)	Alphanumeric Character Character Numeric Numeric	Airway Bill/ Plate NO Departure Date Price	Alphanumeric Date Numeric

			DDE No: A-3
Form Name:	Delivery Receipt Form		
Form Definition:	The imported equipment is delivered to inventory by the trade department with this form.		
Index Name:	Reference No, Order No		
Component Name	**Type**	**Component Name**	**Type**
Reference No Order No	Alphanumeric Alphanumeric	Customer Date of Delivery	Alphanumeric Date
Product Definition Part Number Quantity	Alphanumeric Alphanumeric Numeric	Unit Price Total Price	Numeric Numeric

Appendix B: Sales and Marketing Department Data Dictionary Entries

			DDE No: B-1
Form Name:	Order Form		
Form Definition:	Retailer firms' product demand form. This form is initially filled and faxed by retailers. Later, the delivery and confirmation dates are filled out at Datakom		
Index Name:	Retailer Code, Order No		
Component Name	**Type**	**Component Name**	**Type**
Order No	Numeric	Customer Address	Alphanumeric
Retailer Code	Alphanumeric	Confirmation Date	Date
Retailer Name	Alphanumeric	Delivery Date	Date
Customer Name	Alphanumeric	Installation Choice	Numeric
Product Number	Alphanumeric	Unit Price	Numeric
Product Name	Alphanumeric	Total Price	Numeric
Quantity	Numeric		

			DDE No: B-2
Form Name:	Sales Report		
Form Definition:	It is prepared for determining the net profit amount at the end of each important sales activity The report is offered to top management.		
Index Name:	Sales No		
Component Name	**Type**	**Component Name**	**Type**
Sales No	Numeric	2. Installment Date	Date
Customer Name	Alphanumeric	2. Installment exchange rate	Numeric
Product Name	Alphanumeric	3. Installment Date	Date
Sales Channel	Retailer/Direct	3. Installment exchange rate	Numeric
Contract Amount ($)	Numeric	Contract Expenses	Numeric
Contract Amount (TL)	Numeric	Import Expenses	Numeric
Contract Date	Date	Domestic Expenses	Numeric
Exchange Rate	Numeric	Expense Total	Numeric
1. Installment Date	Date	Total Cash Collection	Numeric
1. Installment exchange rate	Numeric	Net Profit From Sales	Numeric

Form Name:	Sales Information Report		
Form Definition:	The report that include detailed information about the customer, payment method, and product installation. These data are distributed to different pages and are sent to Accounting, Finance, Hardware Suport departments respectively.		
Index Name:	Sales Number and Date		

Component Name	Type	Component Name	Type
Sales No	Numeric	Free on Board/Delivery	Numeric
Date	Date	Installation by Datacom/ Customer	Numeric
Installment Dates	Date	Customer Name	Alphanumeric
Installment Amounts	Numeric	Customer Address	Alphanumeric
Total Amount	Numeric	Related Person Name	Alphanumeric
Customer Tax Office	Alphanumeric	Phone, Fax, Notes	Alphanumeric
Customer Tax number	Alphanumeric		
Product Name	Alphanumeric	Unit Price	Numeric
Quantity	Numeric	Total Price	Numeric

Form Name:	Retailer Agreement		
Form Definition:	This is a fixed document. The retailer firm candidates receive this document and after signing it, they would distribute the related brand name's products by purchasing from Datakom.		
Index Name:			

Component Name	Type	Component Name	Type

Form Name:	Retailer Discount List		
Form Definition:	According to retailer agreement, retailers receive a kind of commission as their sales exceed a certain limit in a specified period of time. This form shows this commission amount for any retailer firm.		
Index Name:	Retailer Name		

Component Name	Type	Component Name	Type
Retailer Name	Alphanumeric	Sales after fourth quarter	Numeric
Retailer Address	Alphanumeric	Sales Discount Ratios	Numeric
Ordered Products	Alphanumeric	Quarterly Sales Disc. Commissions	Numeric
Sales after first quarter	Numeric	Annual Retailer Gross Sales Amount	Numeric
Sales aft. sec. quarter	Numeric	Annual Sales Disc. Commission	Numeric
Sales aft. third quarter	Numeric		

Appendix C: Hardware Support Department Data Dictionary Entries

Form Name:	Warehouse Exit Receipt		
Form Definition:	The products can leave the warehouse only after filling a form including the following fields.		
Index Name:	Product Number, Date		

Component Name	Type	Component Name	Type
Deliverer Name	Alphanumeric	Receiver Name	Alphanumeric
Product Number	Alphanumeric	Unit Price	Numeric
Product Name	Alphanumeric	Total Price	Numeric
Brief Usage	Alphanumeric	Date	Date
Explanation			
Quantity	Numeric		

Form Name:	Deposit Receipt		
Form Definition:	Some products are taken outside the warehouse temproraly for demonstrations or other purposes. For keeping track of these exits deposit receipt forms are filed.		
Index Name:			

Component Name	Type	Component Name	Type
Deliverer Name	Alphanumeric	Receiver Name	Alphanumeric
Product Number	Alphanumeric	Usage Explanation	Alphanumeric
Product Name	Alphanumeric	Quantity	Number
Date	Date		

Form Name:	Maintenance Form		
Form Definition:	For each customer visit by both Hardware Support and Software Support personnel one copy of this form is filled.		
Index Name:	Report Number		

Component Name	Type	Component Name	Type
Project Number	Number	Maintenance Type	Number
Customer Name	Alphanumeric	Operation Explanation	Alphanumeric
Defective Unit	Alphanumeric	Worktime on Defection	Date, Time
Defection Notification	Date, Time	Replaced Product No	Product
Solution Time	Date, Time	Replaced Product Name	Alphanumeric
Caller's Name	Alphanumeric	Quantity	Numeric
Defection Explanation	Alphanumeric	Explanation	Alphanumeric

			DDE No: C-4
Form Name:	Warehouse Entry Receipt		
Form Definition:	The products that come to the warehouse are accepted after filling this receipt.		
Index Name:	Product Number, Receive Date		
Component Name	**Type**	**Component Name**	**Type**
Receiver Name	Alphanumeric	Receive Date	Date
Product Number	Alphanumeric	Unit Price	Numeric
Product Name	Alphanumeric	Total Price	Numeric
Purchased Firm Name	Alphanumeric	Order Date	Date
Ordering Depertment	Alphanumeric	Quantity	Numeric

Appendix D: Finance Department Data Dictionary Entries

			DDE No: D-1
Form Name:	Payments and Dues Plan		
Form Definition:	The form includes the estimates of daily cash flow. It is prepared for each day of the coming week.		
Index Name:	Plan Date		
Component Name	**Type**	**Component Name**	**Type**
Plan Date	Date	Total Payments	Numeric
Total Receivables	Numeric	Daily Predicted Cash Flow	Numeric
Sum of Liquid Assets	Numeric	Day End Liquid Assets	Numeric
Receiving Firm Name	Alphanumeric	Receivable Amount	Numeric
Payable Firm Name	Alphanumeric	Payable Amount	Numeric

			DDE No: D-2
Form Name:	Bank Account Sheet		
Form Definition:	The form that shows the current liquids of the firm. Cash and bank payments are included in the sheet. The petty cash is ignored during the preparation of this report.		
Index Name:	Form Date		
Component Name	**Type**	**Component Name**	**Type**
Form Date	Date		
Bank Name	Alphanumeric	Cash Payments	Numeric
Bank Account No	Alphanumeric	Payment Explanation	Alphanumeric
Bank Acount Balance	Numeric	Cash Receivement	Numeric
Bank Accounts Total		Receivement Explanation	Alphanumeric

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Appendix E: Accounting and Personnel Department Data Dictionary Entries

			DDE No: E-1
Form Name:	Purchase Demand Form		
Form Definition:	The company personnel fill out this form for purchasing products for company-wide use. The forms have to be approved by department and top management if they exceed a certain amount.		
Index Name:	Date		
Component Name	**Type**	**Component Name**	**Type**
Date	Date	Demanding Unit	Alphanumeric
Personnel Name	Alphanumeric		
Explanatation of Purchase	Alphanumeric	Company Name	Alphanumeric
Unit Type	Numeric	Unit Price	Numeric
Total Price	Numeric		

			DDE No: E-2
Form Name:	Accounting Slip		
Form Definition:	Current accounting activities are recorded to accounting slips and are sent to company headquarters for keepiing legal accounting books and records		
Index Name:	Slip Number		
Component Name	**Type**	**Component Name**	**Type**
Slip No	Numeric	Date	Date
Account Number	Alphanumeric	Account Name	Alphanumeric
Activity Explanation	Alphanumeric	Debit	Numeric
Credit	Numeric		

			DDE No: E-3
Form Name:	Advance Payment Form		
Form Definition:	The personnel that go to business vacation may fill out this form and receive advance payment. The advance payment account is later closed by Vacation Expense Form.		
Index Name:			
Component Name	**Type**	**Component Name**	**Type**
Personnel Name	Alphanumeric	Department	Alphanumeric
Job(Project No) Name	Alphanumeric	Amount	Numeric
Vacation Place	Alphanumeric	Department Approval	
Vacation Time	Numeric	Management Approval	
Purpose	Alphanumeric	Accounting Approval	

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Form Name:	Vacation Expense Form		
Form Definition:	The personnel that go out of the city for job related purposes have to document their expenses. They fill out this form for this objective.		
Index Name:	Form Number, Date		
Component Name	**Type**	**Component Name**	**Type**
Form Number	Numeric	Date	Date
Project Number	Numeric	Vacation Subject	Alphanumeric
Vacation Place	Alphanumeric	Visiting Personnel	Alphanumeric
Start Date	Date	End Date	Date
Advances	Numeric	Transportation Expenses	Numeric
Hotel Expenses	Numeric	Other Expenses	Numeric
Transportation Expense Descriptions	Alphanumeric	Hotel Expense Descriptions	Alphanumeric
Other Expense Descriptions	Alphanumeric		

Form Name:	Job Application Form		
Form Definition:	The job applicants initially fill out this form. According to the information entered to the form the applicant is interviewed, and recruited. If the individual is recruited this form is stored in his personal file. If not recruited, the forms are stored in human resources database file.		
Index Name:	Application Number		
Component Name	**Type**	**Component Name**	**Type**
Application Number	Numeric	Name	Alphanumeric
Other Personal Information	Alphanumeric	Photograph	Image
Education Information	Alphanumeric	Foreign Language Information	Alphanumeric
Military Service	Alphanumeric	Previous Work Experience Info	Alphanumeric
Desired Position	Alphanumeric	Desired Salary	Numeric
Interviewer's Notes	Alphanumeric	Result	Alphanumeric

Form Name:	New Employee Recruitment Form		
Form Definition:	When employee is employed, th,s form has to be filled by the employer and has to be sent to the Social Security Organization within three months.		
Index Name:	Social Security Number		
Component Name	**Type**	**Component Name**	**Type**
Social Security No	Numeric	Name	Alphanumeric
Other Personal Information	Alphanumeric	Previous Working Place with Social Security Enrollment	Alphanumeric
Employment Date	Date	Employer's SSN	Numeric
Employer's Address	Alphanumeric		

Form Name:	Monthly Insurance Premium Notification		
Form Definition:	The employer has to calculate the total premium amount that he is entitked to pay to Social Security Organization. This amount and other compulsary information is written to this document and sent to the organization.		
Index Name:	Employer's Name, Date		
Component Name	**Type**	**Component Name**	**Type**
Employer's Name	Alphanumeric	Sum of Premiums	Numeric
Employer's Address	Alphanumeric	Sum of All Payments to Insured Personnel	Numeric
Workplace Id	Alphanumeric	Personnel Saving Amount (Acc. To Code 3417)	Numeric
Date	Date	Job Accidents Insurance	Numeric
Pension Fund Premium	Numeric	Motherhood Insurance	Numeric
Sum of All Premiums	Numeric	Illness Insurance	Numeric

Form Name:	Insurance Premium List		
Form Definition:			
Index Name:			
Component Name	**Type**	**Component Name**	**Type**
Employer's Name	Alphanumeric	Workplace Id	Alphanumeric
Employer's Address	Alphanumeric	Date	Date
SSNo	Alphanumeric	Total Working Days	Numeric
Name	Alphanumeric	Total Monthly Earning	Numeric
Job Entrance Date	Date	Job Leaving Date	Date

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